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The Effects of Extended Blocking,
Motivation, Chain Flooding, and Safety Testing on Approach
Measured Fear Reduction Following Response Prevention in Rats

by

Donald Spring

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Philosophy
in
Psychology

University of Rhode Island
1973

Abstract

Sixty male Wistar rats were trained to avoid a CS grid with 0.7mA(UCS) shock under food deprived and nondeprived conditions. There was no difference in deprived and non-deprived conditions in fear reduction as measured by subsequent approaches to the CS following response prevention. Response prevention varied over 3 treatments consisting of 0 response prevention for 20 subjects, response prevention until exploratory behavior occurred for 10 cumulative seconds for 20 other subjects, and response prevention until exploratory behavior occurred for 120 cumulative seconds for 20 other subjects. No differences were found between these treatments in approach measures to the CS during a 10-min. fear test.

An additional 5-hr. fear test conducted on 20 subjects revealed no differences in fear as a result of response prevention. Later exposing the subjects to the entire chain of events leading to their avoidance of the CS resulted in fear reduction. A comparison between dependent approach measures to a CS and dependent avoidance measures from a CS indicated that subjects that would not approach a CS following response prevention would not avoid the CS. The availability of safety testing, defined as a graded exposure to the CS during fear testing following response prevention led to increased approaches to the CS as compared to discrete or noncontinuous CS exposure.

The discussion suggested that response prevention was effective in reducing fear only when the entire chain leading

to the learning of the avoidance response was exposed to the subject during response prevention. The notion of individual differences in reaction to response prevention was challenged. The superiority of dependent approach measures to the CS over the traditional dependent avoidance measures was discussed. Graded exposure to the CS during fear testing was found to lead to more approaches to the CS than discrete or noncontinuous exposure to the CS.

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The Use of Response Prevention in
Reducing Fear Causing the Neurotic Avoidance
Response: The Need for More Clinically Analogous
Subhuman Studies

The similarity between some forms of neurotic behavior and avoidance learning has stimulated considerable research aimed at finding ways to eliminate an avoidance response. There are generally two components of the avoidance response thought to be changeable (Mowrer, 1950). The first is classically conditioned fear as the organism learns the association of the CS with some noxious UCS such as shock. This learned CS-UCS bond provides a signal for an operant avoidance response which relieves the organism of the noxious CS in his environment. Because the instrumental avoidance response is effective in reducing the noxious CR (conditioned fear), it is reinforced and maintained at a high degree when the CS is presented (Solomon, Kamin, and Wynne, 1953). This avoidance response will be referred to as a Conditioned Avoidance Response (CAR). This CAR may be called neurotic when it occurs in situations where the aversive UCS that previously had been paired with the CS, no longer occurs. That is, the CAR is neurotic when it occurs without serving any adaptive function, such as allowing the organism to avoid a painful stimulus.

One effective method of reducing the instrumental avoidance response has been response prevention (Solomon, Kamin, Wynne, 1953; Schiff, Smith and Prochaska, 1972). This procedure consists of restraining the subject in the presence of a feared CS it would otherwise avoid. That is, the subject is physically restrained in the presence of the feared stimulus such that an avoidance response is not possible. Solomon, Kamin, and Wynne, (1953), who first introduced this procedure trained dogs to jump over a low barrier into a goal area of a shuttle box apparatus in order to avoid a UCS shock administered through the CS grid floor. Later, when the UCS shock was turned off, the subjects still escaped the CS grid. Response prevention consisted of extending the barrier so the subject could not jump over it. This forced the subject to remain on the CS grid while the UCS shock was not delivered. Subsequently when the barrier was lowered, the subject did not jump over it to escape the CS or avoid the UCS shock. Using this analogue, Stampfl (1966), blocked avoidances and escapes from aversive words, thoughts, and ideas by having his subjects listen to, act out, and talk about unpleasant stimuli in their life. By having them imagine these noxious stimuli in a magnified form, through CS words and associations, these subjects were later able to attend to these unpleasant experiences without maladaptive (neurotic) discomfort.

While the response prevention procedure has been useful

in reducing the CAR, the mechanism underlying its effectiveness in the reduction of fear is not very well understood. Behavior therapists, using principles derived in subhuman response prevention studies, have had mixed results (Morganstern, 1973). Results from response prevention or Implosive Therapy procedures have ranged from fear reduction to fear enhancement (Hodgson and Rachman, 1970; Ayer, 1972). The lack of consistent results following response prevention procedures appears to be a function of different techniques employed by different experimenters (Bandura, 1969), a lack of rigorous experimental procedure at the human level, and a failure of subhuman studies to make conditions analogous to human ones. Many critics, noting the obvious lack of consistent data backing the assumptions about response prevention procedures, have challenged the appropriateness of its use with humans at all. Morganstern (1973) has charged advocates of Implosive Therapy with a lack of experimental rigor, indicating that "there is little evidence of systematic progress in methodological sophistication that has characterized desensitization research" (p.378). Eysenck has suggested that the "use of response prevention procedures be postponed until analogous studies have provided more detailed and reliable guides" (1968, p. 198). It is the feeling of the present author that the use of different procedures in subhuman response prevention studies, making them more analogous to the human situation, would help provide guidelines for more experimentally rigorous human studies.

For example, in assessing fear reduction under response prevention, two dependent measures have been used. The first measure is the extinction of the instrumental Conditioned Avoidance Response. This is an indirect measure and is used under the assumption that reduction of the CAR means that the classically conditioned fear response must be weakened as it is no longer motivating the instrumental avoidance response. Investigators using this measure are limited in their interpretations of fear reduction because the procedure has methodological weaknesses. Instrumental responses other than the avoidance response such as freezing, crouching, or grooming may be learned during response prevention and be negatively reinforced as the UCS does not consequent the response. These alternative responses, motivated and maintained by the same classically conditioned fear that formerly motivated the CAR, may persist after response prevention (during fear testing) such that the probabilities of CARs are decreased as the incompatible alternative response has been substituted. In this case, the reduced CARs may reflect the learning of a new response rather than a reduction of fear. The second, more clinically analogous, dependent fear measure employed is approach behavior into the CS (Page and Hall, 1953; Nelson, 1969; Spring, 1972). Approach measures eliminate the disadvantage of the CAR measures stemming from the fact that many incompatible behaviors to the CAR motivated by fear and learned under blocking may confound the CAR as a dependent measure of fear. If the organism fears the

CS, then it should not approach it. Also, if the organism has learned incompatible responses to the CAR during blocking which are motivated by fear, then again, it should not approach the CS.

In incorporating the approach measure as the dependent measure of fear, it is advantageous to also incorporate a motive for approaching the CS. If a motive for approaching is not involved, any failure of the subject to approach the CS can not be said to be maladaptive or neurotic. The use of motives can help the response prevention literature more closely approximate the human condition. Avoidance of a CS is not a problem if the CS is undesirable, and humans would not be so concerned about stopping avoidance responses if these responses were not maladaptive. Most neurotic conflicts are approach-avoidance conflicts, and successful treatment is reinforcing because the goal behind the approach behavior may be reached. Implosion therapy, for example, may be reinforcing both during and after treatment if the subject learns to attend to, discuss or experience formerly aversive but desirable CSs without anxiety. Effectiveness of most forms of human therapy is influenced by motivation (Harper, 1959; Patterson, 1966; Ford and Urban, 1963; Ayllon and Azrin, 1968), and motivation may be an important component to consider in the exploration of any effective method of treatment. The effects of motivation may have complex relationships between both the treatment's success in aiding the client to reach his goal across aversive stimuli of varying intensities and

the length of treatment necessary to deal with these stimuli.
The exploration of these relationships has obvious clinical
pertinence.

II

Experiment I

Duration of Exploratory Behavior and Degree of Motivation
As Variables in Fear Reduction Through Response Prevention

The need for more clinically analogous subhuman response prevention studies has been noted in the literature (Morganstern, 1973) and in Chapter I. In responding to this need, the dependent measures used in assessing the effectiveness of response prevention should measure the types of events humans are likely to encounter in their environment as closely as possible. Dependent approach responses toward a formerly feared CS are such measures (see Chapter I). While much of the subhuman response prevention literature has typically used the reduction of the Conditioned Avoidance Response as the dependent measure for assessment of the effectiveness of response prevention, the present study will evaluate the effects of two variables under response prevention using the approach measure.

Baum (1965) has used a box apparatus with an automated sliding platform located 6-in. above the grid floor. When

this platform was slid inside the apparatus, the subject could avoid the UCS, and escape the CS by jumping on it. Later, response prevention could be initiated by withdrawing the platform, making it unavailable to the subject for an avoidance response. Baum (1969a, 1969b) found shock intensity and length of blocking to be important variables involved in the effectiveness of response prevention as measured by the reduction of the Conditioned Avoidance Response (CAR). Baum (1971) has suggested that length of blocking is the single most important variable in blocking to reduce the CAR. Baum (1969a) reported that longer response prevention was needed to reduce the CAR when more intense shock trauma was received. While 3 to 5 minutes of response prevention was the minimum effective time for rats after receiving a mild 0.5 mA shock (UCS), 5 to 30 minutes was required for more intense 1.3 to 2.0 mA (UCS) shock. Siegel-tuch and Baum (1971) found that 30 minutes of response prevention was necessary to reduce the CAR in rats when the fear was deeply rooted through prior shock (0.5 mA). In their experiment, 30 minutes of response prevention was significantly more effective in reducing the CAR than either 5 or 15 minutes of response prevention.

Studies conducted to assess how time is most effectively used in reducing the CAR under response prevention have also been conducted. Schiff, Smith, and Prochaska (1972) subjected 15 groups of rats to either 1, 5, or 12 trials of response prevention lasting for 0.5, 10, 50, or 120 seconds

following avoidance training to a criterion of ten consecutive avoidances from a 175 V. UCS shock in a alley apparatus. These experimenters found that total response prevention time rather than massed or distributed exposure was the key variable for effective blocking. In another study, however, Berman and Katzev (1972) found that distributed response prevention (40 CS exposures) was more effective than one massed trial of response prevention with equal time after a 2.0 mA shock (UCS) in a two-way shuttle box apparatus. It should be noted that studies employing one massed CS exposure are not extinguishing responses as the process of extinction requires repeated CS exposures without the UCS until the CR is no longer elicited. When one trial is used, the term flushing is more appropriate as reduction of the CR occurs in one trial rather than over many trials (Spring, 1972).

In some studies using approach measures as dependent fear measures, enhancement of fear was found. Generally, studies reporting increased fear after response prevention blocked subjects for very short periods of time. Page and Hall(1953), using a box apparatus with a CS and a goal area, blocked rats on five trials for 15 seconds each. Page (1955), using a similar box apparatus with a mild 0.3 mA UCS shock blocked rats for five trials for 15 seconds each. Coulter, Riccio, and Page (1969), using a two-way shuttle box apparatus with a 90 V. UCS shock blocked rats

for five trials with either 0, 15, or 60 seconds per trial. Linton, Riccio, Rohrbaugh, and Page (1970), using a two-way shuttle box apparatus with a 110 V. UCS shock blocked rats for five trials for 15 seconds each. The importance of time as a variable for effective blocking has been demonstrated elsewhere (Baum, 1970b) in reducing the CAR, and it is not surprising that time seems to be a variable involved in the above studies using dependent approach measures to assess fear. One study using approach behavior as the dependent fear measure blocked longer than ten minutes and did not find enhanced fear. Rohrbaugh and Riccio (1970), employing a square box apparatus with three alley runways, blocked rats for 0, .5, 5, 15, or 50 minutes after administering unavoidable (no possible CAR) shock (85 V., 1.7 mA, UCS). The group blocked for five minutes demonstrated the most fear and was significantly different from the groups blocked for 15 and 50 minutes. The 5 min., the .5 min., and the 0 blocked groups did not differ significantly, however, so response prevention did not enhance fear when longer blocking times were incorporated. Extended blocking did not appear to reduce fear in this study as the 15 and 50 minute blocked groups were only different from the 5 minute blocked group, but not the 0 blocked group.

Reported in the literature are studies (Nelson, 1969; Spring, 1972) assessing whether or not fear could be reduced as measured by approach behavior, have found response prevention effective in reducing fear. Nelson (1969) blocked

90-120 day old albino rats in a previously avoided shock side of a Miller-Mowrer acquired drive two compartment apparatus following 150 K.Ohms, 180 V. UCS shock. Later, subjects were placed in the safe side of the apparatus and entered the shock side for food after 24-hrs. of food deprivation significantly faster than a group receiving no blocking. In another study, Spring (1972) blocked rats for 25 minutes after avoidance training in a one way alley apparatus with 150 K Ohms, 175 V. UCS. The major hypothesis in the study was that fear reduction would occur if the subjects demonstrated exploratory behavior under blocking. These investigators recorded behavior under blocking and found that 7 to 20 minutes of blocking, consisting of preventing passage to the goal end of the alley with a guillotine door, was necessary before approximately one half of their experimental subjects would demonstrate a brief 45 second period of continuous exploratory behavior during blocking. This exploratory behavior was later found to be significantly related to fear reduction when measured by approach behavior into the formerly feared CS area of the apparatus. These data are consistent with observations of Baum (1969a) who has suggested that effectiveness of blocking is related to the behavior of the organism under blocking. Baum and Gordon (1970), using a box apparatus with an automated sliding platform, found a significant relationship between fearful behavior under blocking and subsequent avoid-

ance responding. While one half of the experimental subjects in the Spring (1972) study demonstrated fear reduction after response blocking when compared to a nonblocked control, fear reduction was not demonstrated in the other experimental subjects. Additionally, complete fear reduction was not demonstrated in any experimental group when compared to controls not having undergone avoidance training (no exposure to the shock UCS). The lack of fear reduction in one half the experimental subjects, and the lack of complete fear reduction in all of the experimental subjects, raised the classic question of whether or not conditioned fear is partially irreversible (Solomon, Kamin, and Wynne, 1953).

While a relationship between behavior under response prevention and subsequent fear indicators has been demonstrated (Baum, 1969a; Baum and Gordon, 1970; and Spring, 1972) the exact nature of the association is not clear. Baum (1969a), and Baum and Gordon (1970) used the questionable CAR extinction measure as the dependent measure of fear and recorded both fearful and nonfearful activity. Spring (1972) found only a partial relationship between exploratory behavior and subsequent approach measured fear indices. At present, there is no animal literature reporting extended exploratory behavior or the use of varied amounts of exploratory behavior on fear reduction.

One important purpose of this study was to test whether or not blocking for sufficient time to allow extended explor-

atory behavior to occur would lead to total fear reduction. A second purpose was to assess the relationship between exploratory behavior and fear reduction by varying the amount of exploratory behavior occurring during blocking.

A third purpose of the present study was to assess the effect of motivation on the effectiveness of response prevention. Motivation has been demonstrated to effect the behavior of organisms toward feared stimuli (Miller, 1944), and it is likely to be an important variable influencing the effectiveness of response prevention in reducing fear. While fear or avoidance motivation has been explored through the use of different levels of shock (UCS), no one has systematically investigated the effects of approach motivation by having positive stimuli present during response prevention. Some studies (Page, 1955; Coulter, Riccio, and Page, 1969) have incorporated motivating contingencies into approach behavior in assessing fear, but this was done only in fear testing and not during blocking and was not assessed as a variable influencing the effectiveness of response prevention.

The purposes then of the present study were to assess the effects of two major variables, length of exploratory behavior under blocking and motivation on reducing fear via the response prevention procedure. The first hypothesis was that extended blocking resulting in exploratory behavior would lead to complete fear reduction. A second hypothesis was that motivation would facilitate the effect of blocking

in reducing fear. A third hypothesis replicating the author's previous study (Spring, 1972), stated that there would be a positive relationship between exploratory behavior during response prevention and subsequent fear reduction.

METHOD

Subjects

The subjects were 80 albino, male, experimentally naive rats of the Wistar strain bred and maintained at the Psychiatric Institute of the Indiana Medical Center. The animals were approximately 60 days old, weighing between 190 and 230 grams at the time of the study.

Apparatus

The apparatus consisted of a plywood box 12-in. high, 12-in. wide, and 12-in. long with a Plexiglass top. Over the Plexiglass was a black cardboard cover 13-in. high with a dark plastic viewer approximately 3-in. by 6-in. through which the inside of the apparatus could be observed. Over this hood, a second, outer black cardboard hood was placed over the side of the inner hood that the plastic viewer was on. This outer hood was 6-in. wide at the top and tapered back to the base of the inner hood at the bottom. Along the entire length of one side of the plywood wall was an automated platform capable of sliding into the box 4-in. and retracting beyond the inside of the apparatus wall. This platform was located 4-in. above the grid floor. This device is similar to the Lafayette Model #85200 Automated 1 way shuttle system. A similar device has also been described in the literature (Baum, 1965). One

quarter of an inch above this platform a 2-in. steel strip was located $\frac{1}{2}$ -in. out from the wall to prevent the subject from being pinched between the wall and the platform when the platform retracted. The platform was operated by an electric motor connected to an eccentric such that one full turn of the motor slid the platform both in and out. Time for the full cycle was 2.5 seconds. Microswitches located on both sides of the eccentric stopped and started the motor so that it moved to the desired in or out position. Two photocells located $1\frac{1}{2}$ -in. above the platform indicated when the rat had mounted the platform. A pan placed under the grid floor divided into nine 4-in. square sections was used to locate and note the subject's movement (measured by the position of the head back to the ears) in the apparatus. An aluminum feeding tray, $2\frac{1}{2}$ -in. long by 1-in. wide, was located on the opposite wall from the platform and was fastened to the apparatus wall 2-in. above the grid. This tray was wired to the nearest grid rod. A stainless steel screen with $1/16$ -in. mesh could be placed on the tray to prevent access to the inside of the tray. White masking noise generated by a Grason-Stadler #901B Noise Generator delivered ≈ 85 DB noise through a 2-in. speaker mounted on top of the apparatus wall adjacent to the food tray.

The primary aversive stimulus (UCS) was a 385V., AC, 0.7 mA. shock delivered through the grid floor from a shock generator manufactured at the Institute of Psychiatric Research, Indiana University Medical Center.

Procedure

The procedure began by randomly assigning all subjects to groups of 10. Four groups of subjects consisting of 40 animals were deprived of food for 48 hours. The remaining 40 subjects were not food deprived.

Pretraining. All subjects were run individually through the entire experimental procedure, and then immediately placed into the apparatus for 10 minutes where six 45 mg. Noyes pellets were available in the tray. During this pre-training trial in the apparatus the platform was slid out of the apparatus so that it was not visible to the subject. Rats were taken out of the apparatus after this 10 minute trial and returned to their home cages for 30 seconds, enough time for the experimenter to record the number of Noyes pellets eaten and replenish the six Noyes pellets. After this 30 second waiting period a second 10 minute pretraining trial to the apparatus was initiated. Subjects were placed on the platform which was extended into the apparatus for the whole trial. Six Noyes pellets were available during this exposure also. Time to step from the platform down onto the grid was used as a measure of the subject's approach latency to the grid and was recorded to the nearest 1/10-min. No masking noise was present during this pretraining stage.

Avoidance Training. With the masking noise present, 60 experimental subjects consisting of 30 deprived and 30 nondeprived animals from three experimental treatments (see Table 1) were trained individually to avoid the CS grid.

Initially they were placed on the floor of the apparatus so as to break the photocells, initiating the trial. Unless the subject avoided by climbing onto the platform before the end of a 10 second interval, it received a 0.7 mA. shock (UCS) until it made a successful escape response by climbing on the platform so as to open the photocell circuit. When the circuit was opened for 20 continuous seconds, the trial ended. After the trial ended, the platform automatically retracted, causing the subject to fall onto the grid floor. Then the platform advanced back into the apparatus and was available for the rat to mount, thus initiating the next trial. Experimental subjects were trained to meet a criterion of 10 successive avoidances. Two subjects not meeting the avoidance criterion before receiving either 35 trials or a total of 180 seconds of shock were discarded from the experiment. This avoidance criterion was incorporated to keep UCS shock time relatively equal. This was found to be necessary during a pilot study where one rat failed to mount the platform to escape the UCS shock for a period of over 10-min. Both subjects discarded because of this avoidance criterion were replaced with two other subjects.

Blocking. With the masking noise present, six 45 mg. Noyes pellets were placed in the food tray covered with wire screen so they were unavailable to the subject. The 60 experimental subjects received one of these blocking conditions (see Table 1). Twenty subjects received no treatment. Forty

subjects received response prevention, consisting of placing the subject in the apparatus with the platform withdrawn, inaccessible to the rat for an avoidance response. Twenty of these forty subjects received response prevention until they demonstrated exploratory behavior for a cumulative period of 10-sec. as measured by a stop watch or until they reached a 4-hr. ceiling before they explored to criterion. Twenty other subjects were blocked until they explored for a cumulative period of 120-sec. or until they reached a 4-hr. ceiling. No experimental subjects reached this 4-hr. response prevention ceiling. Twenty control subjects were placed in the apparatus until they explored for 120 cumulative seconds or reached the 4-hr. ceiling. During blocking, the subject's locomotion through the apparatus as well as his behavior were recorded. This behavior was recorded every 10-sec. on the following four point scale: 1) avoidance behavior, 2) freezing behavior, 3) grooming behavior, 4) exploratory behavior. The behavior rating assigned was that which seemed most prominent during the 10-sec. interval to the experimenter. After the subject's treatment condition was completed, the subject was placed on the platform which was retracted from under it. After 20-sec. this procedure was repeated. At the end of the 20-sec. period the subject was taken out of the apparatus and placed in its home cage.

Table 1

Outline of Design of Experiment 1
by number of subjects

Condition		Experimental Treatment			Controls
		0 Treat- ment	10-sec. Explore	120-sec. Explore	
	48 Hour Deprived Subjects	10*	10	10	10
	Non- deprived Subjects	10	10	10	10

* = number of subjects

Fear Testing. Forty five seconds after being placed in their home cages following blocking conditions, all the subjects were placed individually into the apparatus on the platform for a period of 10-min. The white masking noise was present. Six 45 mg. Noyes pellets of food were present but unavailable in the food tray covered by the screen to all groups during this stage so that counterconditioning due to the food would not be a confounding variable. Dependent measures of fear consisted of latency measures to jumping down from the platform onto the CS grid and total time on the CS grid.

RESULTS

Reliability

To evaluate the reliability of the experimenter's ratings of behavioral and activity measures, percentages of two independent raters' agreement on ratings of two randomly selected subjects were computed. The behavioral ratings consisted of the following four ratings taken during response prevention; 1) Avoidance behavior, consisting of attempts to mount the unavailable platform; 2) Freezing behavior; 3) Grooming behavior; 4) Exploratory behavior, consisting of body locomotion across activity zones. These behavioral ratings were taken as time samples every 10-sec. throughout the duration of response prevention, and indicated the behavior thought to be most prominent for that 10-sec. period. The activity rating was derived by counting the number of times the subject's head, defined as its nose back to its ears, crossed a boundary. The number of boundary lines crossed were then added, yielding a total activity number. As the activity numbers were different for each rater, the percentage of agreement was computed on the mean of the total activity numbers of the two raters combined. Then the number of raters' agreements on each of the 12 boundary lines were added. The number of agreements were then placed over the mean of the total activity ratings for a computation of percentage of agreement. In order to obtain these reliability ratings, the outside hood over the apparatus was taken off

while the two subjects used for the reliability check were run. This was done so both raters could observe the subjects.

Behavior rating. Percentage of agreement of two independent raters based on 682 behavioral ratings each was 94.6.

Activity rating. Percentage of agreement of two independent raters on activity zones entered based on a mean number of 47 zones was 83.

Pretraining Platform Latency

To assess both the subject's tendency to jump down from the platform onto the grid floor and whether or not this tendency was constant across groups, pretraining platform latency scores were recorded during the pretraining trial on the last 66 subjects run through the experiment. The first 14 subjects' pretraining platform latencies were not recorded because of the experimenter's failure to do so. The pretraining platform latency score consisted of the time it took the subject to step off the platform so that the photo-cell circuit would close, stopping the latency clock. The means and standard deviations of these data are presented in Table 2 below. Analysis of Variance conducted on parametric data throughout the study were done regardless of homogeneity of variance due to the findings of Norton (in Hays, 1963) that indicated that the Analysis of Variance is relatively

insensitive to deviations in homogeneity. Test of homogeneity of variance conducted for the Analysis of Variance statistic are presented in the Appendix with the Analysis of Variance Summary Tables. When the pretraining platform latency data were subjected to a 2-Way Analysis of Variance, the resulting F values were: $F_{1,58} < 1$, down deprived and undeprived conditions; $F_{3,58} < 1$, for blocking treatments; and $F_{3,58} < 1$, conditions times treatments. These F values were all found to be nonsignificant, indicating that there was no significant difference among the groups in approaching the CS grid prior to experimental conditions.

Table 2

Means and Standard Deviations of Pretraining Platform Latency Scores in Minutes

Condition		Treatments			Control
		0 Treat- ment	10-Sec. Explore	120-Sec. Explore	
Deprived	N	8	9	8	9
	Mean	1.85	1.33	.33	3.14
	St. Dev.	3.49	3.26	.32	4.44
Non- Deprived	N	8	9	8	7
	Mean	.21	1.81	1.82	3.01
	St. Dev.	.25	3.33	3.48	4.78

Food Eaten

During pretraining, all subjects were exposed to six 45 mg. Noyes pellets on two separate trials. Each subject could have eaten a total of 12 pellets during pretraining. The mean number of pellets groups of subjects ate are presented in Table 3 along with standard deviations. These data were not continuous and, therefore, are not appropriately subjectable to parametric statistical analysis. Nonparametric statistical consideration, like Chi Square, is also limited because too many cells in this analysis would have expected frequencies of less than five, rendering the resulting Chi Square invalid (Seigel, 1956). The necessity of any statistical computation is challengeable since a look at Table 3 indicates that subjects in deprived groups tended to eat, while subjects in nondeprived groups did not.

Table 3

Means and Standard Deviations of Food Eaten During Pretraining
Recorded in number of 45mg. Noyes pellets eaten

Condition		Treatments			Control
		0 Treat- ment	10-Sec. Explore	120-Sec. Explore	
Deprived	N	10	10	10	10
	Mean	4.10	8.50	9.60	6.20
	St. Dev.	4.53	4.01	4.20	4.37
Non- Deprived	N	10	10	10	10
	Mean	0.00	0.30	0.00	0.00
	St. Dev.	0.00	0.95	0.00	0.00

UCS Time

In assessing whether the experimental groups received equal amounts of shock during avoidance training, total time each subject was exposed to shock was cumulatively recorded in seconds. The means and standard deviations of these data are reported in Table 4. An Analysis of Variance conducted on these data yielded $F_{1,54} < 1$, down conditions; $F_{2,54} < 1$, across treatments; and $F_{2,54} < 1$, conditions times treatments. Since none of these F values are significant, groups did not significantly differ in the amount of time they were shocked during avoidance training.

Table 4

Means and Standard Deviations of UCS Shock Time in Seconds
During Avoidance Training

Conditions		Treatments		
		0 Treat- ment	10-Sec. Explore	120-Sec. Explore
Deprived	N	10	10	10
	Mean	69.80	60.30	61.60
	St. Dev.	31.54	42.80	37.91
Non- Deprived	N	10	10	10
	Mean	76.90	54.10	70.20
	St. Dev.	40.42	26.46	53.48

UCS Trials

To determine whether all experimental groups received equal trials of shock, the number of shock trials were recorded. These data are presented in mean and standard deviation form in Table 5. The Analysis of Variance conducted on these data resulted in $F_{1,54} < 1$, down deprived and nondeprived conditions; $F_{2,54} < 1$, across treatments; and $F_{2,54} < 1$, conditions times treatments. None of these F values reached significance, indicating that groups did not differ in the number of trials shocked during avoidance training.

Table 5

Means and Standard Deviations of Number of Trials Shocked During Avoidance Training

Condition		Treatments		
		0 Treat ment	10-Sec. Explore	120-Sec. Explore
Deprived	N	10	10	10
	Mean	7.30	7.30	8.00
	St. Dev.	2.41	3.95	2.91
Non- Deprived	N	10	10	10
	Mean	8.30	6.50	7.90
	St. Dev.	3.83	2.71	3.54

Total Training Trials

To determine whether or not all experimental groups had equal amounts of avoidance training, the total number of trials it took to reach the avoidance criterion of 10 successive avoidances were analyzed. The means and standard deviations of these data are reported in Table 6. An Analysis of Variance conducted on these data resulted in $F_{1,54} < 1$, down treatments; $F_{2,54} = 2.00$ across treatments; and $F_{2,54} = 2.00$ conditions times treatments. As none of these F values are significant, there is no statistically significant difference between groups on total trials it took to meet the avoidance criterion during avoidance training.

Table 6

Means and Standard Deviations of Total Trials Taken to Meet the Avoidance Criterion During Avoidance Training.

Conditions		Treatments		
		0 Treat- ment	10-Sec. Explore	120-Sec. Explore
Deprived	N	10	10	10
	Mean	22.30	21.80	24.00
	St. Dev.	5.36	4.42	5.23
Non- Dep	N	10	10	10
	Mean	23.40	21.30	24.20
	St. Dev.	7.60	6.18	5.77

Time to Explore

The time it took subjects to initiate exploratory behavior under response prevention was analyzed. These data were recorded as the first 10-sec. period during response prevention that an activity measure of 4 (exploratory behavior) was rated. All subjects explored to criterion within the 4-hr. response prevention time ceiling. The means and standard deviations for these data are given in Table 7. These data, subjected to the Analysis of Variance yielded $F_{1,54} < 1$, down deprived and nondeprived conditions; $F_{2,54} = 15.12$, across blocking treatments; and $F_{2,54} < 1$ conditions times treatments. While the F values for conditions and interaction was not significant, $F_{2,54} = 15.12$ across treatments was significant at the $P < .01$ level. This suggests that there was no difference between deprived and nondeprived groups, while there was a statistically significant difference between treatments. To further assess this significant difference between treatments a Scheffe' test was conducted. The critical value of the Scheffe' test was found to be greater than the difference between the means of the 10-sec. exploratory and the 2-min. exploratory groups, indicating that there was no significant difference between these groups. The difference between means of both the 10-sec. exploratory and the 2-min. exploratory groups from the control was greater than the critical value of 41.141, at the $P < .01$ level, indicating that the control group was significantly

different from both the 10-sec. and 2-min. exploratory groups.

Table 7

Means and Standard Deviations of Time in Minutes to Explore
Under Response Prevention

Condition		Treatments			Control
		0 Treat- ment	10-Sec. Explore	120-Sec. Explore	
Deprived	N	0	10	10	10
	Mean	-	39.08	52.68	9.68
	St. Dev.	-	23.56	48.58	25.29
Non- Deprived	N	0	10	10	10
	Mean	-	54.78	50.73	1.52
	St. Dev.	-	28.90	26.55	2.71

Time to Criterion

The time it took subjects to meet their criterion of either 10-sec. or 2-min. of exploratory behavior under response prevention was recorded. These data are reported in minutes in mean and standard deviation form in Table 8. When these data were subjected to an Analysis of Variance, the resulting F values were: $F_{1,54} < 1$ down deprived and nondeprived conditions; $F_{2,54} = 9.66$ across blocking treatments; and $F_{2,54} = 1.45$, conditions times treatments. While the F values for conditions and interaction were not significant,

$F_{2,54}=9.66$, across treatments was significant at the $P<.01$ level. This indicated that there were significant differences between treatments on total time necessary to meet the treatment criterion. Following this difference, a Scheffe' test was conducted to assess which groups were different from each other. The results of the Scheffe' test indicated that the 10-sec.and 120-sec.exploratory groups did not differ significantly. The 10-sec. exploratory group and the control group did not differ significantly either, but the 120-sec. exploratory group and the control group did differ significantly at the $P<.05$ level. This means that the 120-sec. exploratory group had significantly more response prevention time in the apparatus than the control group, while the 120-sec.and 10-sec. exploratory groups did not significantly differ.

Table 8

Means and Standard Deviations of Time in Minutes to Meet the Treatment Criterion or Total Time for Response Prevention

Condition		Treatments		Control
		10-Sec. Explore	120-Sec. Explore	
Deprived	N	10	10	10
	Mean	40.79	62.42	27.23
	St. Dev.	23.24	48.68	37.42
Non-Deprived	N	10	10	10
	Mean	57.55	61.15	9.20
	St. Dev.	27.64	33.11	8.75

Exploratory Activity

The subject's activity during response prevention, recorded as entries into the nine different 4-in. by 4-in. squares marked off on the tray beneath the grid, were assessed for exploratory activity only. Any locomotion in the apparatus during avoidance activity, marked by the subject standing on his hind legs toward the unavailable platform, was not counted. The means and standard deviations for these data are presented in Table 9. An Analysis of Variance computed on these data resulted in $F_{1,154} < 1$ down deprived and non-deprived conditions; $F_{2,54} = 36.76$, across blocking treatments, and $F_{2,54} < 1$ conditions times treatments. While the F values for conditions and interactions were not significant, $F_{2,54} = 36.76$ across treatments was significant at the $P < .01$ level. This means that there were significant differences in the exploratory activity across treatments. In further assessing this difference, a Scheffe' test was employed. The results of the Scheffe' test indicated that the 120-sec. exploratory group and the control group, that also explored for 120-sec. , did not differ. Both the 120-sec. exploratory group and the control group differed from the 10-sec. exploratory group at the $P < .01$ level. This means that both the 120-sec. exploratory group and the control group explored more than the 10-sec. exploratory group, which was probably a function of the 120-sec. or 10-sec. exploratory criterion imposed by the experimental treatments. The 120-sec. exploratory group and the

control group did not differ significantly.

Table 9

Means and Standard Deviations of Exploratory Activity in Minutes During Response Prevention

Condition		Treatments		Control
		0 Treat- ment	120-Sec. Explore	
Deprived	N	10	10	10
	Mean	9.7 0	22.6 0	26.80
	St. Dev.	3.71	8.77	9.93
Non- Deprived	N	10	10	10
	Mean	9.10	25.30	24.50
	St. Dev.	3.41	6.15	4.65

Approach Latency Measures

Approach Latency Measures, a dependent measure of fear, was the time it took the subject to come down off the platform onto the CS grid during the 10-min. fear testing period. This measure was recorded on the latency clock which stopped when the photocell circuits over the platform were both closed. The means and standard deviations of these data are reported in Table 10. These data appear to be truncated by a ceiling effect. As these data are not continuous, parametric statistics could not be appropriately used to test any group differences. A Chi Square attempted on all these data at once was likewise inappropriate because more than 20% of the cells had expected frequencies of less than 5 (Seigel, 1956).

The observed frequencies for approaching the CS grid are reported in Table 11. These data are presented as frequencies of subjects that approached during the 10-min. fear test and those that did not. The means and standard deviations of these approach latencies of subjects approaching the CS grid during fear testing are presented in Table 12. The time of approach has been omitted. A Chi Square conducted on the deprived versus nondeprived conditions alone was conducted. The resulting Chi Square of 0.33 is not significant, indicating that there was no significant difference in the approach latency between the deprived and nondeprived groups. Since the deprived and nondeprived conditions were not significantly different, the condition cells were collapsed in an effort to reduce the number of cells with small expected frequencies such that treatments could be appropriately tested. Even with condition cells collapsed, the Chi Square for all treatments violated the requirement of less than 20% of cells having expected frequencies of under 5 (Seigel, 1959). However, a Chi Square was possible between the two important groups in assessing Hypothesis 1, that extended blocking resulting in exploratory behavior will lead to complete fear reduction. A Chi Square between the 120-sec. exploratory group resulted in a value of 8.6. This is significant at the $P < .01$ level, indicating that the 120-sec. exploratory group approached the CS significantly less than the control group.

Table 10

Means and Standard Deviations of Approach Latencies in Minutes
During Dependent Fear Testing

Condition		Treatment			Control
		0 Treat- ment	10-Sec. Explore	120-Sec. Explore	
Deprived	N	10	10	10	10
	Mean	10.00	10.00	9.12	5.67
	St. Dev.	0.00	0.00	2.80	4.95
Non-Deprived	N	10	10	10	10
	Mean	10.00	10.00	8.71	3.10
	St. Dev.	0.00	0.00	3.06	4.77

Table 11

Observed Frequencies of Approaches onto the CS Grid During
Dependent Fear Testing

Condition		Treatment			Control
		0 Treat- ment	10-Sec. Explore	120-Sec. Explore	
Deprived	N	10	10	10	10
	Approach	0	0	1	5
	Non-Approach	10	10	9	5
Non-Deprived	N	10	10	10	10
	Approach	0	0	2	7
	Non-Approach	10	10	8	3

CS Time

CS time, a dependent measure of fear taken during the 10-min. fear testing stage, was recorded on a CS time clock operating when the photocell circuits over the platform were closed. The CS time clock started when the latency clock stopped and continued until the subject came back onto the platform opening the photocell circuit. If the subject later went back to the grid, the CS time clock started again without resetting, such that a cumulative CS time was recorded. As no subject came down off the platform during fear testing then went back up, CS time is the inverse of approach latency time, and as such, they are statistically identical in terms of group differences. The means and standard deviations of CS times are presented in Table 13. The means and standard deviations of CS times of subjects approaching the CS grid are presented in Table 14. No further presentations or analyses of these data were done because of the similarity to the data presented in Tables 10 and 11. The Chi Square value of 0.33 conducted on Conditions for Approach Latencies is identical to the value one would obtain for Conditions for CS Times. This indicated that there is no significant difference between the deprived and nondeprived groups in time spent on the grid during fear testing. Likewise, there is a significant difference between the 120-sec. exploratory and control groups, indicating that the controls spent more time on the CS than the 120-sec. exploratory experimentals.

Table 12

Means and Standard Deviations of Approach Latencies
in Minutes of Subjects Approaching the CS Grid During
Fear Testing

Condition		Treatment			Control
		0 Treat- ment	10-Sec. Explore	120-Sec. Explore	
Deprived	N	0	0	1	5
	Mean	.00	.00	1.16	1.33
	St. Dev.	.00	.00	.00	5.73
Non- Deprived	N	0	0	2	7
	Mean	.00	.00	2.53	.62
	St. Dev.	.00	.00	2.30	3.63

Table 13

Means and Standard Deviations of CS Time During Fear Testing

Condition		Treatments			Control
		0 Treat- ment	10-Sec. Explore	120-Sec. Explore	
Deprived	N	10	10	10	10
	Mean	0.0	0.0	.88	4.31
	St. Dev.	0.0	0.0	2.80	4.95
Non-Deprived	N	10	10	10	10
	Mean	0.0	0.0	1.30	6.90
	St. Dev.	0.0	0.0	3.07	4.77

Table 14

Means and Standard Deviations of CS Time in Minutes of
Subjects Approaching the CS Grid

Condition		Treatment			Control
		0 Treat- ment	10-Sec. Explore	120-Sec. Explore	
Deprived	N	0	0	1	5
	Mean	.00	.00	8.84	5.26
	St. Dev.	.00	.00	.00	10.07
Non-Deprived	N	0	0	2	7
	Mean	.00	.00	7.08	9.38
	St. Dev.	.00	.00	8.54	5.71

DISCUSSION

While previous research had suggested that there was a relationship between exploratory behavior during blocking and subsequent fear reduction (Spring, 1972), the results of the present study failed to replicate those earlier findings. The present study incorporated the longest cumulative exploratory time under response prevention recorded in the literature and generated no evidence that exploration time was related to approach measured fear reduction. A Chi Square conducted between the 120-sec. Exploratory Experimental and Control groups indicated that there were significant differences between these two groups ($t=8.6, P<.01$). This meant that the 120-sec. Exploratory group remained on the platform significantly longer than the Control group. The 120-sec. Exploratory group was the one group of the two groups undergoing response prevention to have any subjects approach the CS grid. If the frequencies of all subjects that were administered response prevention until they explored are taken together, only 3 out of 40 subjects from both the 10-sec. Exploratory and the 120-sec. Exploratory groups approached the CS. This was in marked contrast to 12 out of 20 Control subjects that did approach the CS. This lack of approach to the CS grid suggests that experimental subjects remained fearful of the CS grid in spite of response prevention treatment. From Table 8 it can be seen that response pre-

vention lasted mean times of 49.17 and 61.78 minutes for the 10-sec. Exploratory and 120-sec. Exploratory groups receiving this treatment. Therefore, while experimental groups received extended response prevention, fear reduction was not demonstrated.

The Approach Latency Measures collected to test Hypothesis 1 appear to be uncontaminated with other variables besides the dependent variable, fear. The treatment groups did not significantly differ in Pretraining Platform Latency Measures, indicating that groups were not different in their tendency to approach the grid before experimental manipulation. Treatment groups did differ significantly in the Time to Explore during response prevention ($F_{2,54}=12.12, P<.01$), as well as Time to Criterion during response prevention ($F_{2,54}=9.66, P<.01$). This latter difference was expected because of the difference in the treatment criterion. As the treatment groups spent significantly different amounts of time in the apparatus, habituation to novel stimuli in the apparatus may have influenced activity differences across treatment groups. As the effects of habituation have not been tested, these results should be interpreted cautiously.

Support for hypothesis 2, that motivation will facilitate the effects of blocking in reducing fear was not generated in the present study. This hypothesis, tested by depriving four groups of subjects of food for 48 hours prior to having unavailable food in the food tray during response prevention

and fear testing, was assessed with the Chi Square statistic. The resulting Chi Square value was found to be nonsignificant, indicating that deprived and nondeprived conditions did not significantly differ in Approach Latency Measures, a dependent measure of fear. Only 6 out of 40 deprived subjects approached the CS, and 9 out of 40 nondeprived subjects did so. As the frequency of the subjects approaching the CS is low for both deprived and nondeprived conditions, the fear test conducted to test the effects of motivation may not have been very reliable or valid. It is possible that the level of fear in both deprived and nondeprived groups was great enough to mask any differences due to the motivation variable. The deprived and nondeprived conditions did not differ on Time to Explore or Time to Criterion during response prevention either. The mean time for deprived subjects to initiate exploratory behavior under response prevention was 33.83 minutes as compared to 35.68 minutes for the nondeprived subjects. An Analysis of Variance conducted on these data was found to indicate nonsignificance between deprived and nondeprived groups. The time it took experimental subjects to meet their exploratory criterion of either 10-sec. or 120-sec. was an average of 43.48 minutes for deprived subjects verses 42.63 minutes for nondeprived subjects. Therefore, motivation did not facilitate the effect of response prevention in reducing fear as measured by approach behavior; it did not facilitate the effect of response prevention in leading to exploratory behavior under blocking; and it did not facilitate the effect of response prevention in leading to extended exploratory

behavior under blocking.

The third hypothesis, that there would be a positive relationship between exploratory behavior during response prevention and subsequent fear reduction, was tested with three levels of exploratory behavior. Experimental subjects received one of the following three exploratory behavior treatments: 0 exploratory behavior, 10-sec. exploratory behavior, or 120-sec. exploratory behavior under response prevention. From Table 11 in the Results it can be seen that none of the twenty subjects receiving 0 treatment approached the grid in the dependent fear testing stage. None of the twenty subjects receiving response prevention until they explored for 10 seconds approached the grid in the 10-min. fear testing stage. Only three out of the twenty experimental subjects that underwent response prevention until they explored for 120-sec. approached the grid. Therefore, only three out of 40 subjects that explored during response prevention approached the grid during dependent fear testing. This constitutes only $7\frac{1}{2}$ percent of the experimental subjects that explored, representing little support for Hypothesis 3.

The lack of support for the hypothesis in this study did not seem to be a function of the experimenter's inability to rate behavior and activity accurately under blocking. The percentage of agreement of two independent raters' ratings during response prevention was 94.6 for behavior and 83 for activity. The lack of support for the hypothesis was probably

not a function of differences in the subjects' tendency to come down off the platform as Pretraining Platform Latency Scores recorded on 66 subjects were not found to be significantly different for deprived and nondeprived conditions across blocking treatments, or between conditions and treatments when subjected to the Analysis of Variance. In considering whether or not any differences in the amount of food eaten could have inadvertently effected the experiment, Table 3 in the Results clearly presents data suggesting that deprived subjects tended to eat during Pretraining while nondeprived subjects did not. This difference was experimentally designed for the Motivational Hypothesis, Hypothesis 2, and indicates both that the deprived subjects were hungry (in a drive state) and ate the food (an incentive). There were no differences resulting from the avoidance training that would render any of the results suspect to experimental biases. Neither deprived nor nondeprived conditions, blocking treatments, nor interaction were found to be significantly different among groups in Total UCS Time, UCS Trials, or Total Training Trials.

While the main hypotheses in this study were not supported, some interesting data have been generated which has implications for other literature. Particularly, the results of this study are relevant to Baum's work (1966,1969a,1969b,1970a, 1970b,1971), employing a similar apparatus. The apparatus used by Baum (1965) is similar to the one used in this study except that Baum's automated platform was $2\frac{1}{2}$ in. higher off the

CS grid floor and $1\frac{1}{2}$ in. narrower than the one used in this study. Baum reports (1965) that his subjects, male hooded rats 85-125 days old, weighing an average of 297 grams, learned to avoid a 115 V. A.C. shock (UCS) with 100K Ohms delivered through the grid floor in series with the rat to a criterion of 10 consecutive avoidances after a mean number of 4.7 UCS Trials. Pilot work conducted for this study with 300 gram male Wister subjects did not replicate the quick avoidance performance noted by Baum. The initial platform used in the apparatus for the present study was 6 in. above the grid floor, lower than Baum's. It was found that the subjects could not climb up on this platform to escape UCS shocks of 0.5mA, 0.7mA, 1.0mA, 1.5mA, and 2.0mA intensity. The platform was lowered 2 in. leading to the subject's successful escape and avoidance performance. Even with this lowered platform and a cover placed over the apparatus top which was found to facilitate escape and avoidance performances, subjects in the present study received a mean of 7.55 UCS Trials to meet the avoidance criterion of 10 consecutive avoidances. This is a mean of 2.85 more UCS Trials than subjects in Baum's study received.

Similarly, the behavior of the subjects during response prevention reported by Baum (1969a, 1970a) was not replicated in the present study. Baum has reported that general activity (as opposed to avoidance activity) predominates in his subject's behavior under blocking during the second minute and grooming becomes a prominent behavior with activity after

4 minutes following a 0.5mA UCS shock. Data from this study indicate that subjects engaged in avoidance activity an average of 3.98 minutes after receiving a 0.7mA UCS shock. This was followed by an average of 25.82 minutes of freezing behavior before grooming and exploratory behavior was observed. This failure to replicate Baum's work may be due to the difference in subjects, but the apparatus, UCS shock intensity, and procedure used in the two studies are quite similar.

In addition to the unaccountable differences between the Baum studies and the present one, a further difficulty arises in assessing the relevance of Baum's work for human application. While Baum has explored many variables involved in response prevention (Baum, 1970a), he has typically used extinction of the CAR as his dependent measure. The appropriateness of this measure may be challenged on the basis of the present study. Although the response prevention procedure used in this study was more extensive than the one used by Baum, this study has failed to produce the pattern of approach measures thought to be appropriate to actual fear reduction (see Chapter I). Comparing both the dependent CAR and dependent approach measures with each other would be helpful in determining which subhuman flooding procedures are relevant for clinical theory at the human level. At the present time, the reduction of the CAR is the typical dependent measure used in assessing the effectiveness of response prevention, while the level of fear reduction to a

CS and the subject's approach to the CS is considered to be important in the treatment of humans. Using the same dependent measures across human and subhuman studies should help clarify the discrepancies between the human and subhuman literature on the response prevention procedure.

Another result of the present study not reported in the response prevention literature concerns individual differences of the subjects. Spring (1972) found that approximately one half of the experimental subjects explored in the 25 minute response prevention period and later demonstrated fear reduction. The other half of the subjects did not explore and evidenced signs of sensitization of fear when compared to a no treatment control group. Siegeltuch and Baum (1971) have also noted individual differences in subjects' behavior under blocking and later dependent measures. This experimenter noted that some subjects froze during a short 5-min. period of response prevention, while other subjects showed normal exploratory behavior during the same time. Eysenck (1968) has developed a theory to explain these differences, suggesting that there are both tendencies for extinction and for incubation in all organisms. The outcome of exposure to anxiety producing stimuli will depend on which tendency is stronger. While assessing the validity of this theory is beyond the scope of this paper, the empirical differences between subjects noted by the Spring (1972) study and Siegeltuch and Baum were not found in this study when sub-

jects were given extended periods of time. No subjects in the present study were rejected because of the 4 hour ceiling on meeting the avoidance criterion. All subjects eventually explored, indicating that response prevention may be effective in the same ways with all organisms (rats) if individual time differences are allotted for.

Summary

The present study has not found support for its three major hypotheses. Since the experimental subjects as a whole tended not to approach the CS grid, and this experiment did not replicate an earlier study suggesting that partial fear reduction following response prevention occurs in approach measures, critical examination of these results is in order. It is possible that one or more variables are operating leading to the results of the present study. These variables may be among the following: 1) the subjects were fearful of the CS following response prevention as was suggested earlier in the discussion, leading to a lack of approach responses; 2) subjects in experimental groups spending longer time in the apparatus under response prevention than Controls did not approach due to fatigue or a lack of curiosity; 3) subjects with partial fear were not given sufficient time to approach the CS during fear testing to demonstrate their partial fear reduction; 4) the response prevention procedure was not flooding the correct or entire

set of stimuli which would lead to approach measured fear reduction; and 5) the platform apparatus, different from the alley way apparatus used in the earlier study showing partial fear reduction (Spring, 1972), was a variable in influencing the approach fear reduction measures. It is the purpose of the following experiments to assess these variables.

III

Experiment II

The Effects of Extended Fear Testing, Chain Flooding,
and Avoidance Testing Following Response Prevention

The lack of evidence in Experiment I that extended blocking would lead to fear reduction raises three questions. (1) Was the 10 minute fear testing stage too short to show any differential fear reduction that might have existed in experimental subjects exploring under response blocking? (2) Was the lack of approaches to the CS grid demonstrated in the experimental subjects due to an incomplete response prevention procedure not incorporating the entire chain of events leading to the UCS shock? (3) Was the subjects' failure to approach the CS grid an indication that response prevention was not effective in reducing fear of the grid? The purpose of the present study is to test these three possibilities and to explore the relationship between dependent approach measures and dependent Conditioned Avoidance Responses (CAR) measures.

Data from Experiment I showed that 12 out of 20 control subjects approached the CS grid, but only 3 out of 40 experimental subjects undergoing response prevention did so. This seems to indicate that the experimental subjects may have been fearful of the CS grid. This assumption remains to be tested. The experimental subjects spent more time in the apparatus than the control subjects and therefore could have had less tendency to explore than the controls. If fear testing was delayed for a period after response prevention, differences in subjects' tendencies to explore would be minimized (Hall, Lowe, and Hanford, 1960). There was also the possibility that if the subjects had the opportunity to calm down after the experimental procedure, they might have habituated to the CS during the fear testing, and subsequently approached the CS. Additionally, if the subjects' fear was only partially reduced under response prevention, the 10 minute fear testing period may not have been long enough to assess whether or not there was any difference in fear between subjects that underwent response prevention and those that did not. In order to assess whether or not delayed and extended fear testing would lead to approach behavior, this study delayed and extended the fear testing, hypothesizing that delayed fear testing following response prevention would lead to fear reduction.

Experimental subjects in Experiment I were trained to make an avoidance response following a chain of events.

First, they were on a platform 4 inches off the CS grid; then the platform slid out from under them; then they dropped onto the grid floor; and then they were shocked unless they avoided by jumping back onto the repositioned platform. Being on the platform and being dropped onto the grid may be important components in learning to expect shock from the grid. Experimental subjects in Experiment I may have learned a nonfearful response to the CS grid under response prevention, such that they eventually explored on the grid. This new learning may have been very specific however, and subjects may have learned not to fear the grid when standing on the grid only. Placing the subjects back on the platform during fear testing may have provided a discriminative stimulus for the formerly learned fear of the CS grid. One of the purposes of the present study was to test the notion that being on the platform provided a discriminative stimulus for the fearful response to the grid which was not subject to new learning or modification during response prevention. A hypothesis used to assess this possibility stated that exposing subjects repeatedly to the entire chain of stimuli responsible for their avoidance behavior will lead to fear reduction.

As the relationship between dependent approach measures and dependent CAR measures had not been explored previously (see Chapter I), the present study did so. If experimental subjects that explored in the presence of a formerly feared

CS under response prevention did not approach the CS under fear testing, then avoided the CS, the avoidance of the CS would be a consistent indicator of fear. On the other hand, lack of approach behavior toward a formerly feared CS, thought to be a result of fear, would not be consistent with the subjects' failure to avoid the CS when it was possible to do so. Such inconsistencies would open questions regarding the appropriateness of either dependent measures of fear used to assess the efficacy of response prevention. As a body of literature (Page and Hall, 1953; Page, 1955; Coulter, Riccio, and Page, 1969) suggested that the reduction of the CAR may not have been related to the reduction of fear, this study tested the hypothesis that subjects showing no fear reduction of a formerly feared CS on approach measures, would show no fear of the same CS with the CAR measure.

The purpose of the present study is to test four hypotheses. Hypothesis one states that delayed fear testing following response prevention would lead to fear reduction. The second hypothesis was that extended fear testing following response prevention would lead to fear reduction. A third hypothesis stated that exposing subjects repeatedly to the entire chain of stimuli responsible for their avoidance behavior would lead to fear reduction. Hypothesis four stated that subjects showing no fear reduction of a formerly feared CS on approach measures would show no fear of the same CS with the CAR measure.

METHOD

Subjects

Subjects were 80 male rats of the Wistar strain that had been individually used 24 hours previously in Experiment I. Subjects had constant food available for at least 24 hours prior to the experiment.

Apparatus

The apparatus employed was the apparatus used in Experiment I. Six 45 mg. Noyes pellets were always unavailable in the food tray. $\approx$ 85 DB White noise was always present. No UCS shock was delivered during this experiment.

Procedure

As Experiments I and II were conducted concurrently, the procedure began by feeding all subjects in their home cages for 24 hours after they had been individually used in Experiment I.

24 Hour Platform Latency. All subjects were individually placed on the platform for a period of 10-min. Platform Latency, the time it took the subject to approach the CS grid, was recorded as well as the time the subjects spent on the CS grid. Subjects were then taken out of the apparatus.

Avoidance Testing. Immediately following the 24-hr. Platform Latency Measure, thirty subjects, 10 from the 0 Treatment Experimental group, 10 from the 120-sec. Explor-

atory Experimental group and 10 from the Control group (see Table 1) were selected randomly. Subjects were chosen from these groups because these were the critical groups necessary to evaluate the following: 1) whether or not subjects not receiving fear reduction treatment would show CARs; 2) whether or not subjects with fear reduction treatment, but not demonstrating approach measured fear reduction, would demonstrate CARs; 3) whether or not the Control group that never feared the CS would jump up on the platform, performing the CAR measured response. Five subjects were taken from the previously deprived condition and five from the previously non-deprived condition in each treatment, constituting the 10 total subjects for each treatment. Subjects were placed individually onto the CS grid in the apparatus with the platform available for an avoidance response. The photocells located over the platform recorded when the subject made an avoidance response. Following the 10-min. avoidance testing period, subjects were taken out of the apparatus and placed in their home cages.

Extended Fear Test. Immediately following the 24-hr. Platform Latency Measure, twenty subjects consisting of 10 each from both the 0 Treatment Experimental group and the 120-sec. Exploratory Experimental Treatment group were used. Five subjects from each of these two treatments were subjects used in the 10-min. Avoidance Testing procedure shown in Table 15. Subjects were selected from the 120-sec. Experimental group because it was the group most likely to show any possible

fear reduction effects with longer fear testing. The 0 Treatment group was used as a no treatment control. The regular Control group was not used as its subjects were already approaching the CS grid. The 10 subjects from each treatment were taken, 5 apiece, from both the previously deprived and nondeprived conditions (see Table 15). Subjects were individually placed on the platform. Both the approach latency and total CS times were recorded. After the 5-hr. extended fear testing period was over, subjects were placed back in their home cages.

Chain Flooding. Immediately following the 24-hr. Platform Latency Measure, 10 subjects from the 10-sec. Exploratory Experimental group were selected. Five subjects were randomly selected from the previously deprived condition and five were randomly taken from the previously nondeprived condition. Subjects were placed individually on the platform. Then the platform was manually retracted causing the subject to fall on the CS grid. The platform was left retracted, unavailable to the rat for 1-min. while the rat was on the grid. Then the subject was picked up, the platform was repositioned into the apparatus, and the rat was placed back on the platform. This procedure was repeated five times for all 10 subjects. When the subject was picked off the CS grid after the fifth trial, it was placed back onto the platform for a 60-min. fear test. Sixty minutes for fear testing was selected as a sufficient time to gather any fear reduction data that might have been due to the chain flooding.

Table 15

Design of Experiment II
Outline of Procedure by Frequency of Subjects

Condition			Treatments								Control	
			0 Treatment		10-Sec. Explore		120-Sec. Explore		No Avoid	Avoid		
			No Avoid	Avoid	No Avoid	Chain Flood	No Avoid	Avoid				
Exp. I Previously Deprived	24-Hr. Delayed Fear Test	Exp. III 40-50 Day Time Test	2 *	3	5	5	3	2	5	5		
			5-Hr. Extended Fear Test	3	2	0	0	2	3	0	0	
			Exp. I Previously Non- Deprived	24-Hr. Delayed Fear Test	5-Hr. Extended Fear Test	2	3	0	0	2	3	0
Totals			10	10	10	10	10	10	10	10		

* = Number of Subjects

RESULTS

24 Hour Approach Latency

The 24-hr. Approach Latency Measure was the time it took the subject to approach the CS grid from the platform in a 10-min. test conducted 24 hours after Experiment I. The Means and Standard Deviations of these data are presented in Table 16. Like the Approach Latency Data in Experiment I, these data are not continuous and do not lend themselves to parametric statistical analysis. Additionally, subjecting these data, as a whole, to Chi Square is also inappropriate due to the fact that more than 20 percent of the cells have expected frequencies of less than 5 (Seigel, 1956). When the blocking treatments were collapsed and the deprived versus nondeprived were the only cells considered, Chi Square was found to be nonsignificant, indicating that the previously deprived and nondeprived conditions did not differ in the 24-hr. Approach Latency Measure. Collapsing the Condition Cells in order to appropriately assess treatments, a Chi Square was run between the 120-sec. Exploratory group and the Control group, as was done for the 10-min. Approach Latency Test in Experiment I. The resulting Chi Square was significant at the $P < .05$ level. This indicates that the 120-sec. Exploratory group remained on the platform significantly more than the Control group. Descriptively, it can be seen that the 24-hr. Approach Latency Measures remained similar to the initial Approach

Latency Measures in Experiment I. Of the 80 subjects tested both days, only five approached the second day that did not approach on the first. Three others that did approach on the first day, failed to do so on the second. The frequencies of subjects that did not approach are presented in Table 17. For purposes of comparison, Table 17 can be seen to differ only slightly from Table 11 in Experiment I, presenting the initial Approach Latency Measures.

Table 16

Means and Standard Deviations of 24 Hour Approach Latency Measures in Minutes

Condition		Treatment			Control
		0 Treat- ment	10-Sec. Explore	120-Sec. Explore	
Deprived	N	10	10	10	10
	Mean	10.0	9.11	8.65	6.03
	St. Dev.	0.0	2.81	3.23	5.12
Non- Deprived	N	10	10	10	10
	Mean	10.0	8.76	9.25	3.66
	St. Dev.	0.0	3.16	2.38	4.59

Table 17

Frequencies of Subjects by Groups Approaching and Not Approaching the CS Grid During the 24 Hour Fear Testing Period

Condition		Treatments			Control
		0 Treat- ment	10-Sec. Explore	120-Sec. Explore	
Deprived	N	10	10	10	10
	Approach	0	2	1	4
	Did Not Approach	10	8	9	6
Non Deprived	N	10	10	10	10
	Approach	0	1	2	7
	Did not Approach	10	9	8	3

24 Hour CS Time

The 24-hr. CS Time measure was the time the subject spent on the CS grid after it came off the platform in the 24-hr. fear test lasting 10-min. As subjects did not come down onto the grid, then go back up on the platform, the CS time measure was the inverse of the 24-hr. Approach Latency Measure, and, therefore, will not be presented further here.

Avoidance Testing

The Avoidance Test Measure consisted of the time it took subjects placed on the CS grid to avoid onto the platform. This was a 10-min. measure such that any subject failing to avoid at the end of the trial was assigned a score of 10. The means and standard deviations of these data are presented in Table 18. The frequencies of subjects avoiding

and remaining on the CS grid are presented in Table 19 by groups. These groups, the 0 Treatment, the 120-sec. Exploratory, and the Control, were tested for Avoidance Measures. It can be seen from Table 19 that all but one subject from the 0 Treatment group avoided, while none avoided from the 120-sec. Exploratory and Control groups. A Chi Square test conducted on these data yielded a value of 27.70 ($P < .01$). Therefore, the 0 Treatment group was significantly different in avoidance of the CS from the 120-sec. Exploratory and Control groups.

Table 18

Means and Standard Deviations of Approach Latencies in Minutes of Subjects Approaching the CS Grid During the 24 Hour Fear Test

Condition	N	Treatment			Control
		0 Treat- ment	10-Sec. Explore	120-Sec. Explore	
	N	0	2	1	4
Deprived	Mean	0	4.34	.03	.82
	St. Dev.	0	4.93	.00	.14
<hr/>					
	N	0	1	2	7
Non-Deprived	Mean	0	.06	4.45	.92
	St. Dev.	0	.00	4.24	1.58

Table 19

Means and Standard Deviations in Minutes of Avoidance Measures
of Both Groups Receiving Avoidance Testing

	Treatment		Control
	0 Treatment	120-Sec. Explore	
N	10	10	10
Mean	1.62	10.00	10.00
St. Dev.	2.59	0.00	0.00

Table 20

Frequencies of Subjects Remaining on the CS Grid or Avoiding
Presented by Groups from Avoidance Testing Measures

	Treatments		Control
	0 Treatment	120-Sec. Explore	
Remained on CS grid	1	10	10
Avoided	9	0	0

Extended Blocking Approach Latency

The Extended Blocking Approach Latency Measure was the time it took the subject to approach the CS grid from the platform during the 5-hr. Extended Fear Testing stage. The means and standard deviations for the 20 subjects used in collecting these data are presented in Table 21 by minutes. Subjects not approaching the CS grid were assigned a score of 300. These data, broken down into frequencies of subjects that approached or remained on the platform, are presented in Table 22. From Table 22, it can be seen that four subjects approached the CS and six did not from each group. The means of the Approach Latencies of the eight total subjects approaching the CS are presented in Table 23. These data, subjected to a t test were found not to be significantly different ($t=.81$). Therefore, the 120-sec. Exploratory group did not differ from the 0 Treatment group.

Table 21

Means and Standard Deviations in Minutes of 5 Hour Extended Fear Testing Approach Latency Measures

	Treatments	
	0 Treatment	120-Sec. Explore
N	10	10
Mean	212.68	231.10
St. Dev.	101.28	110.05

Table 22

Frequencies of Subjects Approaching the CS Grid During the
5 Hour Extended Fear Testing

	Treatments	
	0 Treatment	120-Sec. Explore
N	10	10
Approached	4	4
Did not Approach	6	6

Table 23

Means and Standard Deviations of Approach Latencies and CS
Times in Minutes of Subjects Approaching the CS Grid During
Extended Fear Testing

		Treatments	
		0 Treatment	120-Sec. Explore
Approach Latencies	N	4	4
	Mean	127.85	105.25
	St. Dev.	139.82	92.78
CS Time	N	4	4
	Mean	.73	91.50
	St. Dev.	.86	145.87

Extended Fear Test CS Time

The Extended Fear Test CS Time Measure was the total amount of time the subject spent on the CS grid during the 5-hr. Fear Test. The means and standard deviations of these data are presented in Table 24. The means and standard deviations of CS times of subjects approaching the CS grid are presented in Table 23. A *t* test conducted on these data yielded $t=2.6$, ($P<.05$), indicating that the 120-sec. Exploratory group spent significantly more time on the CS than the 0 Treatment group.

Table 24

Means and Standard Deviations in Minutes of 5 Hour Extended Fear Testing CS Time

	Treatments	
	0 Treatment	120-Sec. Explore
N	10	10
Mean	.35	3.35
St. Dev.	.14	5.72

Chain Flooding Approach Latencies

The Chain Flooding Approach Latency Measure was the time it took the subject to approach the CS grid from the platform during the 60-min. Chain Flooding Fear Test following chain flooding. There was only one group, consisting of 10 subjects from the 10-sec. Exploratory group which was chain flooded. The mean approach latency of the chain flooded group was 27.39-min. and the standard deviation was 30.11-min. While there was no other chain flooded group with which to compare the 10-sec. Exploratory group, a comparison was made to the two groups which received 5-hr. Extended Fear Testing. In making this comparison, only the first 60 minutes of Extended Platform Approach Latency Measures was used. That is, any subject undergoing 5-hr. Extended Fear Testing whose latency was below 60 minutes was counted as a subject that approached. The others were not. Table 25 presents the frequencies of subjects approaching the CS grid based on a 60-min. test. It can be seen from Table 25 that 6 out of 10 subjects undergoing chain flooding approached the CS grid, while only 1 out of 20 Extended Fear Tested subjects did so. Chi Square conducted on these data resulted in a value of 11.70, ($P < .01$). This indicates that the groups are significantly different. If only subjects that were subjected to response prevention in Experiment I are considered, then 6 out of 10 chain flooded subjects approached the CS, while only 1 out of 10 did so from the Extended Fear Tested group.

The means and standard deviations of the approach latencies in minutes of subjects from these groups approaching the CS grid during fear testing are presented in Table 26. A Chi Square conducted on these two groups only, resulted in $X^2=5.52$, $P<.05$. This indicates that, of two groups previously subjected to response prevention, chain flooded subjects approached the CS grid more than subjects undergoing extended fear testing for 1-hr.

Table 25

Frequencies of Subjects Approaching the CS Grid from the Extended Fear Tested and Chain Flooded Groups Based on a 60 Minute Test

	Treatments	
	Extended Fear Test	Chain Flooded
Approached	1	6
Did not Approach	19	4

Table 26

Means and Standard Deviations in Minutes of 60 Minute Extended Fear Tested and Chain Flooded Groups Approaching the CS During Fear Testing

	Treatments	
	Extended Fear Test	Chain Flooded
N	1	6
Mean	8.40	4.76
St. Dev.	.00	6.52

DISCUSSION

Hypothesis 1, that delayed fear testing would lead to fear reduction, was rejected. A Chi Square test on Approach Latency Measures, a dependent measure of fear, from a 10-min. fear test 24-hr. after completion of Experiment I was conducted between deprived and nondeprived conditions and was found to be nonsignificant ($\chi^2=0.32$). With deprived and nondeprived condition cells collapsed, a Chi Square employed between the 120-sec. Exploratory group and the Control group was found to be significant at the $P<.05$ level ($\chi^2=4.5$). This indicates that the 120-sec. Exploratory group remained on the platform significantly more than the control group. This replication of findings from Experiment I means that the experimental subjects exploring under response prevention, but not approaching the CS during fear testing, did not remain on the platform out of habituation. Since subjects had 24 hours of rest in their home cages before delayed fear testing occurred in Experiment II, the lack of approach behavior to the CS was probably due to some other variable than habituation.

Of theoretical interest is the stability of the approach measure over time. As can be seen from Table 12 in Experiment I and Table 3 in Experiment II, there is a reliable frequency of subjects approaching the CS grid in fear testing between Experiments I and II. Whatever effects avoidance training and response prevention had on the subject, therefore, were

more than transitory. These data are consistent with earlier findings of Page (1953), who found his deprived subjects unwilling to enter a CS compartment to a two compartment box apparatus to obtain food 24 hours after being shocked and blocked in this CS compartment. A recent list of theories explaining the effects of response prevention have not indicated that stability of fear test measures would exist over time. Eysenck (1968) would expect an increase in fear over time as consolidation of learning occurs. Hodgson and Rachman (1970) have found some experimental evidence of enhanced fear over 24 hours of time. Watts (1971) has implied that a sensitization to the CS would occur in time as flooding is mainly viewed as a habituation phenomenon to him. Lader and Mathews (1968) have noted a critical stimulation level in highly aroused human subjects as measured by the GSR. If arousal occurs beyond this critical level, sensitization rather than desensitization or habituation occurs. Otherwise, habituation occurs most readily, with stimulation of low intensity, in low aroused subjects. Habituation is almost as rapid with intense stimuli in highly aroused subjects until the critical level is reached. Moderately intense stimuli in moderately aroused subjects habituate slowly. Lader and Mathews (1968) have advanced a "Maximum Habituation Theory" to explain these data, suggesting that there are two processes operating in habituation. One process works most effectively with low intensity stimulation when the general level of arousal is low. The other process is most effective

with stimulation of high intensity, particularly when the the general level of arousal is high, but not exceeding the critical level. The implications of these findings are that low aroused subjects may benefit most from treatment using low intensity stimulation such as Systematic Desensitization, while high aroused subjects may benefit most from more intense stimulation like is used with response prevention procedures or Implosive Therapy. What occurs during habituation and related processes such as extinction remains obscure, but critics are slowly narrowing down the range of possibility. While little is known about what happens under flooding and related procedures, the recognition of time has been reported in the literature. "For experimental purposes it seems wise to control the time which elapses between the termination of the treatment session (s) and the conduct of the behavioral test" (Rachman, 1969, p. 301).

The test on the occurrence of avoidance responses made after the 24 hour delayed 10 minute fear test indicated that 0 Treatment subjects avoided while Experimental and Control subjects undergoing response prevention did not. While this is consistent with the literature (Baum, 1970a), it is also misleading. If the lack of avoidance responding is interpreted somehow as fear reduction, than it would be assumed that subjects might approach the CS grid. This was clearly not the case. As has been implied by other researchers (Coulter, Riccio, Page, 1969; Poppin, 1968), dependent avoidance response measures are confusing, confounding, and misleading; and their use seems only to perpetuate the lack of clarity

pervading the flooding literature at the present time.

Hypothesis 2, that extended fear testing following response prevention would show fear reduction, was rejected. Two groups of subjects exposed to a 5-hr. fear test evidenced little fear reduction due to avoidance response prevention. The 0 Treatment group and the 120-sec. Exploratory group were not found to be significantly different ($t=.807$) in approaches to the CS. (In fact, 4 out of 10 subjects approached the CS from both groups.) Harder to analyze was the Total CS Time on the grid. The 120-sec. Exploratory group spent significantly more time ($t=2.6$, $P<.05$) on the CS than the 0 Treatment group. This means that while the same number of subjects approached the CS grid, the ones in the 0 Treatment group tended to avoid back onto the platform from the CS grid. CS Time is a dependent measure of fear and indicates the subjects willingness to expose himself to the CS.) Interpretation of this measure should be cautioned, however, because of the lack of clarity in understanding what led to the CS Time. Is the measure an indication of fear reduction or an alternative incompatible response to avoidances (freezing, etc.) motivated by fear? (While it is not clear what caused the CS Time Measure, it is clear that only 4 out of 10 subjects approaching the CS is a small percentage of what would seem to be an acceptable number of approaches from an "effective treatment".) It would seem then, that there is slight evidence of fear reduction in the 120-sec. Exploratory group, but this evidence is confusing and should be evaluated conservatively.

Hypothesis 3, that exposing subjects repeatedly to the entire chain of stimuli responsible for the avoidance behavior will lead to fear reduction, is supported and accepted. Support for this hypothesis came from a one hour comparison between fear testing following chain flooding and fear testing in subjects undergoing Extended Fear Testing. These two groups were tested with a Chi Square test. The groups were found to be significantly different, indicating that the Chain Flooded group approached the CS grid more than the other group. Furthermore, this difference is not bound to be the result of overall time in the apparatus because of the chain flooding, which took approximately 7 minutes, because the Extended Fear Test group used for this comparison consisted of subjects from the 120-sec. Exploratory group only. The mean time in the apparatus for the 120-sec. Exploratory group during response prevention in Experiment I was 12.62 minutes longer than the mean time for the 10-sec. Exploratory group which received chain flooding. The fact that the chain flooded group received its 7-min. treatment 24-hrs. after the initial avoidance training may have effected the results. The acceptance of Hypothesis 3 means that the failure to generate support for hypotheses in Experiment I may have been due to incomplete flooding procedures. This suggests the possibility that the experimental subjects exploring under response prevention during Experiment I did not approach the CS grid during fear testing because they were fearful of the CS from the platform. This possibility has been noted

elsewhere.

"It is important to note that another major line of theorizing and research which eschews two-factor theory in explaining avoidance learning also prescribes response prevention as an optimal extinction procedure. The discrimination theory holds that extinction is expedited to the degree that the subject can distinguish the change in reinforcement contingencies between acquisition training and extinction." (Wilson and Davidson, 1971, p. 11)

The fact that exposing the subjects to more stimuli in the apparatus which formerly led to their fear is effective in reducing fear is not surprising. Levis (1965) has noted the importance of exposure to the entire stimulus complex rather than the simple isolated stimulus. And before him, Stampfl has noted, "studies by Black (1958), Denny, Koons, and Mason (1959), Knapp (1965), and Weinberger (1965) indicates that extinction of a learned emotional response provides with greatest rapidity when the organism is exposed to stimulus conditions most closely approaching those which were originally associated with painful stimuli" (1965, p. 10).

Even beyond the importance that chain flooded subjects were exposed to more stimuli was the fact that they were exposed to the chain they initially conditioned with. The effectiveness of this chain in conserving fear has been noted by Levis.

"In one experiment, first a door of the shock compartment was raised, six seconds later lights flashed, then a buzzer was sounded which was, in turn, followed by

shock. During extinction trials animals quickly exited from the threatening compartment at the appearance of the first signal of danger, thus preventing re-exposure to the remaining aversive stimuli. Eventually avoidance responses to the initial cue were extinguished but the resultant contact with the second feared cue, which retained aversiveness transmitted by the primary experiences, temporarily reinstated the arousal potential of the first stimulus so that it regained its capacity to maintain avoidance behavior for some time before it was permanently neutralized. A similar, though progressively shorter, reacquisition process occurred with each stimulus in the sequence, resulting in a phenomenal amount of avoidance responding. One animal, for example, performed 921 avoidance responses to the most remote stimulus, 75 to the second fearsome cue, but only 4 to the stimulus directly associated with the painful experience." (in Bandura, 1969, p. 401-402).

While there is little written about the effects of manipulation of parts of chains, research is being done as a result of this study on extinction of parts of chains and the consequent effects when the rest of the chain is then presented. One possible interpretation of the increased approach latencies to the CS following chain flooding in the present study is that being dumped off the platform is aversive. As the platform would be associated with the dumping, it would be aversive also, and the subject may avoid the platform by approaching the grid. This is not a very plausible explanation, however, as the subjects' latencies in leaving the platform to approach the grid were quite long. This suggests that the platform was not extremely aversive. It will be noted that both desensitization and implosive

treatments use the chain concept to their advantage. Wolpe's (1958) hierarchy and Stampfl's (1965) Avoidance Serial Cue Hierarchy, although used for different reasons, are employed rigorously and seem to be at the heart of both procedures. Further research will need to be done to clarify the effects of chain flooding, but evidence from this study and from the clinical literature suggests that it will be fruitful research.

Summary

(This experiment found a stable tendency for subjects initially fearful of a CS following response prevention as measured by approach behavior to remain so after 24 hours. Subjects demonstrating fear of the CS following response prevention treatment as measured by their lack of approaches to it, did not subsequently avoid the CS (CAR) when given the opportunity to do so. This indicated the need to more closely analyze and compare the types of dependent measures used in assessing the effectiveness of response prevention. The stable fear following response prevention in subjects measured by approaches to the CS was also found in subjects placed in the apparatus 4-in. from the feared CS for 5 hours. Exposing subjects to the specific chain of events initially leading to their fear of the CS, the chain involved during avoidance training of the UCS, resulted in a reduction of fear of the CS as measured by approaches to the CS.

IV

Experiment III

The Effects of Available Safety Testing on Approaching a Formerly Avoided CS Following Response Prevention

Data from Experiments I and II presented in this paper indicate that response prevention, consisting of blocking a subject's avoidance response onto an elevated platform from a CS grid, was not effective in reducing fear as measured by approach measures back onto the CS grid from the platform. These results appear to be reliable, as neither extending the fear testing period to 5 hours nor retesting after 24 hours resulted in increased approach measures in Experiment II. The lack of support for blocking's effectiveness in Experiment I in reducing fear is not consistent with other literature on blocking (Spring, 1972). While the result of the chain flooding procedure incorporated in Experiment II suggested that the response prevention employed in Experiment I was incomplete, the fact that chain flooding did not lead to total fear reduction (as indicated by approach latencies following chain flooding) suggests that the effect

of other variables may be influencing the results of the study. It is the purpose of the present study to assess the effects of one such possible variable.

The apparatus and response prevention procedure used for Experiments I and II in the present paper were selected because of a body of literature (Baum, 1970a) reporting their effectiveness. Baum (1969a) using an automated sliding platform located above a CS grid floor in a box apparatus, has noted the effectiveness of a response prevention procedure similar to the one used in Experiment I in the present paper. This consisted of blocking the subject's availability to the platform by sliding it out of reach after the subject learned to escape the CS grid floor to avoid a USC shock. Baum employed a dependent avoidance measure, and found a positive relationship between the behavior during blocking and subsequent effectiveness of the blocking in reducing the CAR. While the response prevention procedure employed in the Baum study and Experiment I in the present paper were similar, response prevention was found to be effective only in the Baum study. The reason for these discrepant results is most likely a function of the different dependent measures. Baum found his response prevention procedure effective in reducing the CAR. This effectiveness of response prevention in reducing the CAR was replicated in Experiment II in the present paper. Therefore, it seems when dependent approach measures are used, Baum's response prevention procedure

and the one used in Experiment I are ineffective.

It was one of the findings of Experiment II that chain flooding, consisting of repeatedly placing the subjects on the platform, dropping them onto the CS grid, then blocking their response back onto the platform, was necessary for response prevention to be effective as measured by approach responses to the CS grid from the platform. The necessity of chain flooding seems to be a function of the particular apparatus and response prevention procedure employed in Experiment I in this paper. This was most likely due to the fact that the automatic platform apparatus and the procedure used with this apparatus for Experiment I involved a specific, discriminable chain of events leading to the UCS shock during avoidance training. Except for the first UCS trial, the UCS shock during avoidance training always followed being on the platform, then being dumped off onto the grid floor. Unless response blocking incorporated the flooding of this platform sequence formerly leading to the UCS shock, it was not effective, since the subject apparently learned to discriminate between when it would be shocked (when it had been on the platform and subsequently dumped onto the grid) and when it would not be (when it was placed on the grid floor and left there). According to the above rationale, when the subject was placed on the platform during fear testing, the CS grid remained an effective stimulus for fear. since being on the platform was one of the events that pre-

ceded the UCS shock earlier during avoidance training. Previously, in a different alley way apparatus a chain flooding procedure was not necessary to demonstrate the effectiveness of response prevention in reducing fear (Spring, 1972).

This was most likely due to the fact that avoidance training in that study involved one specific chain of events (being placed in the apparatus on each trial by the Experimenter), and avoidance of the UCS involved another (running down to the goal box). As fear testing consisted of placing the subject in the goal box to measure its approach to the CS, the discriminative stimuli involved during avoidance training (being placed on the CS grid by the experimenter) were not providing the subject with UCS shock cues during fear testing. Except for the apparatus and consequent procedural differences in these studies, they were similar in their use of exploratory behavior under blocking as an independent variable. Experiment I in the present paper required a longer cumulative exploratory time under response prevention and blocked the subjects from its 120-Sec. Exploratory group an average of 36.79 minutes longer than subjects in the Spring (1972) study. The UCS shock intensities and weight of the subjects were different in these two studies, but the aversiveness of the UCS, number of UCS trials, and total UCS times were not markedly dissimilar. The differences in the demonstrated effectiveness of response prevention between the Spring (1972) study and the present one are probably a result of the differences in apparatus

and response prevention procedures. The efficacy of chain flooding for the response prevention used in the apparatus in Experiment I in the present paper has been mentioned above. The possibility of another variable effecting the results of the Experiment I data but not those of the Spring (1972) study has not been explored. The present author, who was the experimenter in both studies, has noticed the (subjects' tendencies to "test" the CS following response prevention before approaching the CS. That is, the subjects in the Spring (1972) study tended to expose themselves gradually to the CS. This gradual exposure, or safety testing, may have been done by the rat because it learned during response prevention that the CS grid was safe only when it was on the grid and thwarted from making an avoidance response. Being placed in a "goal end" of an alley or on a platform may have presented a different stimulus to the rat indicating that the CS grid was not safe. Particularly in Experiment I in this paper, being on the platform proceeded being dumped onto the grid floor and then being shocked during avoidance training. Yet, the apparatus in Experiment I did not lend itself to safety testing or gradual exposure. The platform, located 4-in. above the grid floor, was too high off the grid to allow the subject to touch the CS grid while remaining on the platform. This is in contrast to the alley way apparatus employed in the Spring (1972) study where the subject could test the CS end of the alley from the goal end by simply walking to it and placing a foot on it while

remaining in the goal zone. It seems likely that the availability of safety testing, or a gradual exposure to the CS from the safe zone may be a variable influencing dependent approach measures to the CS.

The purpose of the present study is to assess whether or not the availability of safety testing of the CS from the safe part of the apparatus facilitates fear reduction as measured by approach measures to the CS following response prevention. The hypothesis under investigation states that the availability of safety testing is the important component in the demonstrated effectiveness of fear reduction following response prevention.

METHOD

Subjects

Subjects were 30 male experimentally naive rats of the Wistar strain bred and maintained at the Institute of Psychiatric Research, Indiana University Medical Center. Subjects weighed 300-360 grams at the time of experimentation, and were on a constant food and water schedule.

Apparatus

The apparatus consisted of a plywood alley way 4.75 in. wide, 22 in. long, and 9 in. high. The apparatus had a grid floor and a plexiglass top. On one end of alley two aluminum platforms mounted on tracks were capable of sliding forward 4 in. into the apparatus or back flush against the inside of the apparatus wall. These platforms were located one above the other. The lower platform, placed one inch off the grid had a 7/8 in. vertical plate on it perpendicular to the 4 in. horizontal part of the platform such that the subject could not get underneath it. The upper platform was placed 4 in. off the grid floor and had a vertical plate on it so that the subject could not get between the lower and upper platform. Two photocells, one for each platform, were located 1 in. above the top of each platform 1½ in. from the end wall. These were used to determine when the subject was on or off the platform(s). A 2 in. by 1 in. Plexiglass food

tray was located 1-in. above the grid floor on the opposite end of the alley from the platforms. A 2-in. speaker at the opposite end of the alley from the platform, located 3-in. above the food tray, delivered ≈ 85 DB continuous white noise generated from a Grason-Stadler #901B Noise Generator throughout the experiment. Standard program and recording equipment were used.

The primary aversive stimulus (UCS) was a 385 V., A.C., 0.7mA. shock delivered from a shock generator manufactured at the Institute of Psychiatric Research, Indiana University Medical Center.

Procedure

The procedure began by depriving all experimental subjects of food for a period of 48 hours.

Pretraining. All subjects in the experimental and control groups were placed individually onto the grid floor of the apparatus for a period of 15 minutes. During this time, six 45 mg. Noyes pellets of food were available in the food tray. Additionally, both platforms were slid back flush against the inside wall unavailable to the subject and white noise was present.

Avoidance Training. At the end of the 15-min. individual pretraining period, experimental subjects only were left in the apparatus for avoidance training. Any 45 mg. Noyes pellets eaten by the subject were replenished so there

were six pellets in the tray. The high or low platforms randomly assigned to each experimental subject for avoidance training was then slid out 4-in. into the apparatus, available to the experimental rat, and the photocell located 1-in. above the platform was turned on. An avoidance training circuit was then closed, giving the experimental subject 10-sec. (interstimulus interval) to avoid the CS grid by jumping on the available platform before receiving an 0.7mA UCS shock. If the subject did not avoid the shock, the shock remained on until the subject made a successful escape response onto the platform and remained there for 20 continuous seconds. When the subject made an avoidance or escape response onto the platform, it opened the photocell circuit, operating a 20-sec. platform clock for as long as the photocell circuit remained opened. When the photocell closed, the 20-sec. clock reset. When the subjects opened the photocell circuit for 20 consecutive seconds, the 20-sec. clock timed out. This timing out operated the house light over the top of the Plexiglass top, signaling to the Experimenter that the trial was over. The house light remained on until the experimenter pulled the platform back, dumping the rat on the grid floor and closing the photocell circuit which turned off the house light. The platform was then slid back 4 inches into the apparatus and the rat had a 10-sec. interstimulus interval to make an avoidance response. This avoidance training procedure continued until the experimental rat made 10 consecutive avoidances of the UCS shock. A

240-sec. maximum ceiling of total UCS shock time determined as a result of a pilot study was not reached by any subject, so no subjects were discarded from the study because of too much shock. Total UCS shock time, number of UCS trials, and total training trials were all recorded during avoidance training. Control subjects were not avoidance trained.

Response Prevention. When the experimental subject completed the 10th consecutive avoidance response, the avoidance training circuit was turned off and the platform was pulled back flush against the inside wall, unavailable to the rat. The subject was left in the apparatus for 90-min., a time determined by pilot work and Experiment I in the present paper to be sufficient to allow exploratory behavior to occur. The six 45 mg. Noyes pellets replenished after pretraining were still available in the food tray during this time. Control subjects were also in the apparatus.

Fear Testing. When the 90-minutes of response prevention time had elapsed, both the experimental and control subjects were individually picked up and placed on either the high or low platform for fear testing. The assignment of the high or low platforms for fear testing was randomized within the procedural outline presented in Table 27 below. That is, five experimental subjects to be assessed for fear from the high platform were avoidance trained on the high platform. Five other experimental subjects assessed for fear from the high platform were avoidance trained on the low platform. Likewise, the 10 subjects assessed for fear from the low platform consisted of five subjects each subjected to avoidance training

from the high and low platforms. The 10 control subjects were randomized within the experimental design, such that five were tested on the high and five on the low platform. Subjects were placed on their assigned platform and left for 1-hr. The photocells located over the platforms indicated when the subject was on or off the platform. Approach latencies to the CS grid floor and Total Time on the CS grid floor were recorded. These were the dependent measures of fear used to test the hypothesis.

Table 27

Procedural Outline of High or Low Platform Assignments During Avoidance Training and Fear Testing

		Fear Testing	
		High	Low
Avoidance Training	High	5 *	5
	Low	5	5
Control		5	5

* = Number of Subjects

RESULTS

UCS Trials

To assess whether or not experimental subjects receiving avoidance training were subjected to equal numbers of UCS shock trials, the number of trials of shock were compared for high and low platform avoidance trained and fear tested groups. The means and standard deviations of these numbers of UCS Trials are presented in Table 28. When these data were subjected to a two-way Analysis of Variance, $F_{1,16}=1.5$, across high and low avoidance trained groups, $F_{1,16} < 1$, down high and low platform fear tested groups, and $F_{1,16} < 1$, between avoidance trained and fear tested groups, were all nonsignificant. This means that the high and low avoidance trained groups did not significantly differ on the number of UCS Trials received. The high and low platform fear tested groups did not differ on the number of UCS Trials received. Also, there was no interaction effects between these two main effects on the number of UCS Trials received.

Total UCS Time

The total time experimental subjects received UCS shock, recorded in seconds, was added for all avoidance trials. These times were compared for both high and low platform avoidance trained and fear tested groups. The means and standard deviations of these UCS Times in seconds are presented

in Table 29. A two-way Analysis of Variance conducted between these group data resulted in $F_{1,16} < 1$, across high and low platform avoidance trained; $F_{1,16} < 1$, down high and low platform fear tested groups; and $F_{1,16} < 1$, between high and low platform avoidance trained by fear tested groups. These F values were all found to be nonsignificant. This indicates that the high and low avoidance trained groups did not significantly differ from each other on the amount of UCS time received. Additionally, there was no interaction effect between the avoidance trained and the fear tested groups.

Table 28

Means and Standard Deviations of Number of UCS Shock Trials.

			Fear Tested	
			High	Low
Avoidance Trained	High	N	5	5
		Mean	5.41	4.18
		St. Dev.	5.00	1.60
	Low	N	5	5
		Mean	3.63	4.00
		St. Dev.	3.00	4.00

Table 29

Means and Standard Deviations of Total UCS Times in Seconds

Avoidance Trained			Fear Tested	
			High	Low
		N	5	5
		Mean	85.82	72.63
	High	St. Dev.	43.91	182.74
		N	5	5
		Mean	81.18	83.15
		St. Dev.	55.34	147.10

Total Training Trials

The total number of avoidance training trials the experimental subjects required to meet the avoidance criterion of 10 successive avoidances was recorded for subjects in the high and low avoidance trained and fear tested groups. The means and standard deviations of these training trials are presented in Table 30. A two-way Analysis of Variance conducted on these data yielded $F_{1,16}=1.56$, across high and low platform avoidance trained groups; $F_{1,16}=1.06$, down high and low platform fear tested groups; and $F_{1,16} < 1$, between high and low avoidance by high and low fear tested groups. These F values were all nonsignificant, suggesting that the high and low platform avoidance groups did not differ on the total number of training trials received. The high and low platform fear tested

groups did not significantly differ on the number of training trials received, and there was no interaction between these two main effects on the number of training trials received.

Table 30

Means and Standard Deviations of Total Training Trials

			Fear Tested	
			High	Low
Avoidance Trained	High	N	5	5
		Mean	20.21	17.80
		St. Dev.	9.95	10.41
	Low	N	5	5
		Mean	17.02	15.81
		St. Dev.	9.30	4.70

Food Eaten

In order to assess whether or not subjects from high and low avoidance trained and fear tested groups ate equal amounts of food, the total number of 45 mg. Noyes pellets of food eaten was added for all experimental subjects. The total number of pellets which could be eaten was 12, six from the pretraining period and 6 from the Avoidance Training, Response Prevention, and Fear Testing periods. The means and standard deviations of the number of 45 mg. Noyes pellets eaten are presented in Table 31. When these data were subjected to a two-way Analysis of Variance Statistic, the F values were the following: $F_{1,16} < 1$, across high and low platform avoidance trained groups, $F_{1,16} < 1$, down high and low platform fear tested groups, and $F_{1,16} < 1$, avoidance trained by fear tested groups. These F ratios were all nonsignificant. This suggests that the high and low platform avoidance trained groups did not significantly differ on the number of Noyes pellets of food eaten. The high and low platform fear tested groups did not differ significantly on the number of Noyes pellets eaten. There was also no interaction effect between the main, avoidance trained and fear tested, effects.

Dependent Approach Latencies

Approach latencies to the CS, a dependent measure of fear taken from the 60 minute fear testing period consisted of time, in minutes, the subject took to leave the platform to

go down onto the CS grid floor. These measures were recorded on clocks when the photocell circuit in operation was closed as the rat moved off the platform. The frequencies of subjects approaching the CS grid from the platform are presented by groups in Table 32. The means and standard deviations of these data for all subjects are presented in Table 33 in minutes to approach the grid. Subjects not approaching the grid within the 60-min. period were assigned a score of 60. The means and standard deviations of approach latencies in minutes of those subjects only that did approach the grid are presented in Table 34. A two way Analysis of Variance conducted on these approach latency data resulted in $F_{2,24}=10.65$, $P<.01$, across high and low platform avoidance trained groups and control conditions; $F_{1,24}=4.97$, $P<.05$, down high and low platform fear tested groups; and $F_{2,24}=3.05$, for interaction of avoidance trained by fear tested groups. The $F_{2,24}=10.65$, across high and low platform avoidance trained groups was found to be significant ($P<.01$). This suggests that the avoidance trained groups and control groups differed significantly in their approaches to the CS. The $F_{1,24}=4.97$, significant at the $P<.05$ level, indicated that the high and low platform fear tested groups were significantly different in their dependent approaches to the CS grid. The $F_{2,24}=3.05$, between avoidance trained and fear tested groups was not significant, suggesting the lack of interaction effects. Further analysis of the significant F ratios found in the main effects was conducted by Dunnett's method of comparing experimental groups to controls. When the high

platform avoidance trained, high platform fear tested group was compared to the high platform control group, $t=12.4$ was found to be significant at the $P<.01$ level. This means that the high platform avoidance trained, high platform fear tested group significantly differed from the high platform control group. The low platform avoidance trained, high platform fear tested group was also significantly different from the high platform control group ($t=12.92, P<.01$). The high platform avoidance trained, low platform fear tested group was different from the low platform control group ($t=10.65, P<.01$). However, the low platform avoidance trained, low platform fear tested group was not significantly different from the low platform control group ($t=1.09$). The Dunnett comparisons are presented in table form in Table 35.

Table 31

Means and Standard Deviations of the Total Number of Noyes Pellets Eaten

			Fear Tested	
			High	Low
Avoidance Trained	High	N	5	5
		Mean	2.21	2.41
		St. Dev.	5.37	6.54
	Low	N	5	5
		Mean	3.00	3.05
		St. Dev.	6.00	7.52

Table 32

Frequencies of Subjects Approaching the CS Grid During the
60-Min Fear Test

		Fear Test	
		High	Low
Avoidance Trained	High	2	3
	Low	2	5
Control		5	5

Table 33

Means and Standard Deviations of Dependent Approach Latencies
in Minutes to the CS Grid During Fear Testing

			Fear Tested	
			High	Low
Avoidance Trained	High	N	5	5
		Mean	40.82	34.71
		St. Dev.	56.93	50.80
	Low	N	5	5
		Mean	46.51	7.50
		St. Dev.	45.14	28.62
Control		N	5	5
		Mean	2.08	1.68
		St. Dev.	4.74	3.43

Table 34

Means and Standard Deviations of Approach Latencies in
Minutes of Subjects Approaching the CS Grid
During Fear Testing

			Fear Tested	
			High	Low
Avoidance Trained	High	N	2	3
		Mean	11.10	14.47
		St. Dev.	10.39	13.78
	Low	N	2	5
		Mean	24.00	7.50
		St. Dev.	11.62	12.80
Control		N	5	5
		Mean	2.08	1.88
		St. Dev.	4.74	3.43

Table 35

Dunnett Comparisons of High and Low Platform Experimental
Group Approach Latencies to High and Low Platform Control
Group Approach Latencies

			Fear Tested	
			High	Low
Avoidance Trained	High	t=	12.41	10.75
		significance	P<01	P<01
	Low	t=	12.22	1.09
		significance	P<01	n.s.

Dependent CS Times

Total CS time, a second dependent measure of fear, consisted of the total time the subject spent off the platform on the CS during the 60 minute fear test. This was recorded on a CS time clock operating only when the photocell circuit above the platform was closed. The means and standard deviations of the CS times in minutes for the high and low avoidance trained and high and low platform fear tested groups are presented in Table 36. The means and standard deviations of CS times in minutes of only subjects that approached the CS grid are presented in Table 37. A two-way Analysis of Variance statistic conducted on these data resulted in $F_{2,24}=11.63(P<.01)$, across high and low platform avoidance trained and control conditions; $F_{1,24}=1.43$, down high and low platform fear tested groups; and $F_{2,24}=1.14$, across avoidance trained by fear tested groups. The $F_{2,24}=11.63$ was found to be significant ($P<.01$), suggesting that the avoidance trained and control conditions were different on the amount of time spent on the CS grid during fear testing. Further assessing these statistically significant results by Dunnett's method yielded the following comparisons, also shown in Table 38. Both the high avoidance trained, high fear tested group and the low avoidance trained, high fear tested group differed significantly from the high platform fear tested control ($t=12.12$, $P<.01$, and $t=16.33$, $P<.01$ respectively). Additionally, both the high and low avoidance trained, low fear tested groups differed from the low fear tested controls ($t=11.21$, $P<.01$,

and $t=8.34$, $P<.01$ respectively). This suggests that all the experimental groups spent significantly less time on the CS grid than their respective controls during fear testing.

An additional test was conducted between high and low platform fear tested experimental groups only. This analysis, conducted on all 20 experimental subjects without the control subjects, was done in spite of the fact that the overall F ratio for fear testing ($F_{1,24}=1.43$) was nonsignificant. This analysis was conducted and justified because there was an a priori interest in this comparison. Only one test, assessing the difference between two groups was conducted. This analysis, a t test, was computed between all 10 experimental high platform fear tested subjects and all experimental low platform fear tested subjects. The resulting $t=2.37$ was found to be significant ($P .05$). This suggests that the high and low platform fear tested experimental groups significantly differed on the amount of time spent on the CS grid during fear testing.

Table 36

Means and Standard Deviations of CS Time in Minutes

			Fear Tested	
			High	Low
Avoidance Trained	High	N	5	5
		Mean	19.11	21.40
		St. Dev.	54.78	48.76
	Low	N	5	5
		Mean	6.64	30.52
		St. Dev.	29.19	56.21
Control		N	5	5
		Mean	56.82	56.10
		St. Dev.	7.84	9.32

Table 37

Means and Standard Deviations of CS Time in Minutes of
Subjects Approaching the CS Grid
During Fear Testing

			Fear Tested	
			High	Low
Avoidance Trained	High	N	2	3
		Mean	47.70	35.67
		St. Dev.	16.13	36.51
	Low	N	2	5
		Mean	16.45	30.52
		St. Dev.	16.37	25.14
Control		N	5	5
		Mean	56.82	56.10
		St. Dev.	7.84	9.32

Dunnett Comparisons of High and Low Platform Experimental
Group CS Times to High and Low Platform Control CS Times

			Fear Tested	
			High	Low
Avoidance Trained	High	t=	12.12	11.21
		Significance	P<01	P<01
	Low	t=	16.33	8.34
		Significance	P<01	P<01

DISCUSSION

Support for the hypothesis under investigation, that the availability of safety testing is an important component in the demonstrated effectiveness of fear reduction following response prevention, has been generated. This support comes from both the dependent CS Approach Latency Measures and the Total CS Times compared for the high and low platform fear tested groups. The means of the Approach Latencies to the CS from the platform during fear testing of these high and low platform fear tested groups were 43.02-min. and 21.09-min. respectively.) These data, subjected to an Analysis of Variance statistic with the control groups, were found to be significantly different. When this difference was further assessed by Dunnett's procedure, the high platform fear tested groups were both found to be statistically different from the high platform control group, while only the high avoidance trained, low fear tested group differed from the low platform fear tested control. The low avoidance trained, low fear tested group was not statistically different from the low platform control. This indicates that the low platform, low avoidance trained fear tested group approached the CS more often and/or sooner than the high platform fear tested group. While 5 out of 10 subjects from the high platform fear tested group approached the CS, 7 out of 10 did so from the low platform fear tested group. Likewise, on the CS Time Measure, the means of the time spent on the CS during

fear testing of the high and low fear tested groups were 12.82-min. and 26.97-min. respectively. These groups were also found to be significantly different when subjected to a t test following a nonsignificant F statistic. This indicates that the low platform fear tested group spent more time on the CS than the high platform fear tested group. (Therefore, on both dependent measures of fear, fear tested subjects on the low platform, located 1-in. off the grid floor and low enough to enable the subject to touch or test the CS grid while remaining on the platform, demonstrated more fear reduction than the high platform fear tested group.)

These data supporting the hypothesis do not seem to be a function of differences between the high and low fear tested group's initial history of trauma associated with the CS, as subjects in both these high and low fear tested groups came equally from both the high and low avoidance trained groups. That is, the 10 fear tested subjects in each group were taken, five each, from subjects in both the high and low avoidance trained groups (see Table 27). Additionally, neither high and low platform avoidance trained nor high and low platform fear tested groups differed significantly on the number of UCS trials received, the amount of UCS time received, or the number of total training trials received. The differences in the dependent measures of fear between the high and low fear tested groups were probably not a function of the amount of motivation between the high and low fear tested

groups to go down to the CS from the platform as the amount of food eaten by the two groups was not significantly different.

(Complete reduction of fear of the CS following response prevention was not found in this study however, as the high platform fear tested experimental subjects were found to be significantly different from the high platform controls on both dependent Approach Latencies and Total CS Times.) Additionally, the low platform fear tested group receiving avoidance training on the high platform was significantly different from the low platform control group on dependent Approach Latencies, and both high and low avoidance trained, low platform fear tested groups, differed significantly from the low platform controls on the amount of CS Time spent on the CS grid during fear testing. These findings, suggesting that response prevention does not lead to complete fear reduction, are consistent with earlier findings (Solomon, Kamin, and Wynne, 1953; Spring, 1972).

The differences between the high and low platform fear tested groups were most likely due to the graded verses discrete properties of the low and high platforms during fear testing, more specifically, due, perhaps, to the availability of "safety testing" on the low platform but not on the high platform. Of course, whether or not the differences in the dependent measures of fear were due to the availability of safety testing can not be known. The low platform may have provided the rat with a CS grid stimulus closer to the CS grid stimulus operating during response prevention than the CS

grid stimulus provided by the high platform. If it can be assumed that the subject learns not to fear the CS from the CS during response prevention, as evidenced by the exploratory behavior during response prevention, then what is measured during fear testing is the rat's tendency to generalize the stimuli associated with the CS grid from the grid to the platform. The possibility that the platform provides an important conditioned stimulus associated with the CS grid seems evident from the necessity of chain flooding from the platform in Experiment II in the present paper to render response prevention effective. Therefore, what may be operating during the high and low platform fear testing is the difference in the "view" of the grid. The more the view of the CS grid approximates the view of the grid during response prevention, the more generalization may occur from learning non fearful responses of the grid from the grid to nonfearful responses of the grid from the platform. While this explanation is possible (Wilson and Davidson, 1971), it may not be completely satisfactory, even though it does explain why the low avoidance trained, low fear tested group showed less fear of the CS than the high avoidance trained, low fear tested group.

What the above interpretation can not account for is why the low platform avoidance trained, low platform fear tested group showed fear reduction at all. Subjects avoidance trained on the low platform should fear the CS grid from the low platform and should not learn otherwise during response prevention unless chain flooding is administered. In the final analysis,

it may be that both this generalization interpretation and the safety testing interpretation of the data from this experiment are important variables. Certainly, both these possibilities mask the clarity of assessing whether response prevention reduces the learned fear of a CS or not. These unclarified variables are ones of measures of fear, rather than variables of fear themselves. Hopefully, further studies will explore fear reduction with different dependent measures possessing less experimental noise. One measure which avoids the problems generated and discussed in the present experiment is conditioned suppression (Rohrbaugh, Riccio, and Arthur, 1972). In a conditioned suppression experiment, the rat may remain on the CS grid during fear assessment as a rate of bar pressing for food is cumulatively recorded. Suppression of this rate of pressing for food when the CS is presented can be used as a dependent measure of fear. A conditioned suppression study such as this one would help clarify whether the results in the present study were due to stimulus generalization from the grid to the platform or safety testing. Given the variability of the human condition, and the likeliness that feared CSs will be encountered in a wide range of situations, response prevention should be assessed with as many and as divergent dependent measures as possible.

It should be noted that the fear reduction measures obtained in this experiment are the third set of such dependent approach measures to be generated in support of the efficacy

of response prevention. Earlier, Spring (1972), found that response prevention led to partial fear reduction as measured by approaches to a CS. Later, Experiment II in the present paper, again supported the efficacy of response prevention following chain flooding as measured by approaches to the CS. Finally, the present study lent some support to response prevention's efficacy in reducing fear as measured by approaches to a formerly feared CS. These data were found in the lack of significant differences between the low platform, low platform fear tested group and the low platform fear tested control group on approaches to the formerly feared and avoided CS, while the high fear tested groups both differed significantly from the high platform fear tested control.

Summary

2 (This experiment found that subjects tested for fear of a formerly feared CS in close proximity to that CS, showed more approach measured fear reduction of the CS than subjects tested for fear further from the CS.) Discussion of these results suggested that these differences in the fear tested groups may be a result of discrete verses graded exposure to the CS during fear testing, the availability of safety testing of the CS, or the differences in discriminable cues available to the rat during fear testing from the different fear test areas. Complete fear reduction was not found in this study. This finding is consistent with other literature. 7

CONCLUSIONS

In a series of three experiments, this paper indicated that response prevention was effective in reducing approach measured fear of a CS only when the specific discriminatory chain of events initially leading to the fear was exposed to the subject during response prevention. These data are in contrast to the findings of Baum (1970a) who has suggested that response prevention is effective in reducing fear of a CS as measured by the reduction of a CAR. When subjects in the present study not demonstrating approach measured fear reduction were allowed to avoid from the CS (UCS), then response prevention was found to lead to a reduction of the CAR. The differences in these dependent measures assessing the effectiveness of response prevention have been previously reported (Page and Hall, 1953), and suggest the need for further comparisons of these measures. Another finding of the present paper is that a graded exposure to the CS during fear testing led to more approach measured fear reduction than a discrete exposure to the CS. This may have been due to the different discriminable cues in the apparatus between the graded and discrete exposure to the CS, and/or the availability of safety testing of the CS in the graded exposure condition but not in the discrete exposure condition.

Generalizing from this study, several implications can be made in regard to the use of response prevention procedures with human subjects for the treatment of conditioned fear. Generalizations such as these should be made with caution since cognitive variables like demand characteristics (Bernstein, 1973) have been found to effect human responses to feared objects (CS). However, since rat data may be used as a model in the assessment of variables influencing response prevention, the present study may offer guidelines for increasing the efficacy of response prevention.

The fact that chain flooding was required to reduce approach measured fear in spite of extended fear testing suggests that response prevention forms of therapy be conducted carefully and specifically. Unless the specific chain of events initially leading to the fear of the CS-UCS is closely replicated, response prevention may not be effective. This finding may be in contrast to Stampfl and Levis's (1967) statement that "complete accuracy is not essential since some effect, through the principle of generalization of extinction, would be expected when an approximation is presented"(p.499).

A second finding of significance in the present study is that approach and reduction of avoidance dependent measures may not be consistent. Consequently, the fact that one of these measures may be reduced does not necessitate fear reduction. Human research, like subhuman research, has

generated data employing both approach and reduction of avoidance dependent measures. As the nature of the relationship between these measures and fear reduction is not clear, the support of the efficacy of response prevention techniques in reducing fear generated by these measures is questionable.

The last finding in this study is that the availability of a graded or continuous exposure to the feared CS enhances approach behavior to the CS in comparison to discrete exposure. If a graded exposure to the CS is possible, then subjects may approach it more readily or more often than if the CS is not continuously available. Therapists taking this finding into account may advise their subjects (clients) to approach the target CS in a graded fashion in order to maximize the assessment or effect of their treatment.

APPENDIX

Table 1

Analysis of Variance Summary Table of Pretraining Platform
Latencies in Experiment I

Source	Sum of Squares	d.f.	Mean Square	F
Deprived Condition	178.82	1	178.82	.18
Blocking Treatment	2285.99	3	762.00	.75
Interaction	2272.65	3	757.55	.75
Within Cells	59139.62	58	1019.65	
Total	63877.09	65		

Homogeneity of variance tested with Bartlett's Chi Square=3.373
($P>.05$)

Table 2

Analysis of Variance Summary Table of UCS Shock Time in
Seconds During Avoidance Training in Experiment I

Source	Sum of Squares	d.f.	Mean Square	F
Deprived Condition	150.42	1	150.42	.10
Blocking Treatment	2613.43	2	1306.72	.83
Interaction	663.66	2	331.82	.21
Within Cells	85129.50	54	1576.47	
Total	88556.98	59		

Homogeneity of variance tested with Bartlett's Chi Square=2.909
($P>.05$)

Table 3

Analysis of Variance Summary Table of Number of UCS Shock Trials During Avoidance Training in Experiment I

Source	Sum of Squares	d.f.	Mean Square	F
Deprived Condition	.17	1	.17	.00
Blocking Treatment	12.90	2	6.45	.60
Interaction	8.23	2	4.18	.38
Within Cells	579.70	54	10.74	
Total	600.85	59		

Homogeneity of variance tested with Bartlett's Chi Square=3.373 (P>.05)

Table 4

Analysis of Variance Summary Table of Total Training Trials During Avoidance Training in Experiment I

Source	Sum of Squares	d.f.	Mean Square	F
Deprived Condition	1.07	1	1.07	.00
Blocking Treatment	65.03	2	32.52	2.00
Interaction	6.43	2	2.22	2.00
Within Cells	1845.88	54	34.18	
Total	1918.33	59		

Homogeneity of variance tested with Bartlett's Chi Square=2.909 (P>.05)

Table 5

Analysis of Variance Summary Table of Time to Explore
During Response Prevention in Experiment I

Source	Sum of Squares	d.f.	Mean Square	F
Deprived Condition	52.08	1	52.08	.06
Blocking Treatment	25710.94	2	12855.47	15.12**
Interaction	1532.31	2	766.16	.90
Within Cells	56218.99	54	1041.10	
Total	79361.59	59		

Homogeneity of variance tested by Bartlett's Chi Square=40.081
($P < .01$)

Table 6

Analysis of Variance Summary Table of Time to Criterion During
Response Prevention in Experiment I

Source	Sum of Squares	d.f.	Mean Square	F
Deprived Condition	10.75	1	10.75	.01
Blocking Treatment	20104.63	2	10052.32	9.66**
Interaction	3027.20	2	1513.60	1.45
Within Cells	56218.99	54	1041.09	
Total	79361.59	59		

Homogeneity of variance tested by Bartlett's Chi Square=20.749
($P < .01$)

Table 7

Analysis of Variance Summary Table of Exploratory Activity
During Response Prevention in Experiment I

Source	Sum of Squares	d.f.	Mean Square	F
Deprived Condition	.67	1	.67	.00
Blocking Treatment	3139.03	2	1519.52	36.76**
Interaction	64.63	2	32.32	.74
Within Cells	2343.60	54	43.40	
Total	5599.33	59		

Homogeneity of Variance tested with Bartlett's Chi Square=40.08
($P < .01$)

Table 8

Analysis of Variance Summary Table of Total UCS Shock Trials
During Avoidance Training in Experiment III

Source	Sum of Squares	d.f.	Mean Square	F
Avoidance Trained	5.00	1	5.00	1.50
Fear Tested	.80	1	.80	.24
Interaction	3.20	1	3.20	.96
Within Cells	53.20	16	3.33	
Total	62.20	19		

Homogeneity of variance=2.31 ($P > .05$)

Table 9

Analysis of Variance Summary Table of UCS Shock Time
During Avoidance Training in Experiment III

Source	Sum of Squares	d.f.	Mean Square	F
Avoidance Trained	45.00	1	45.00	.01
Fear Tested	156.82	1	156.82	.06
Interaction	98.85	1	98.85	.03
Within Cells	64287.64	16	4018.02	
Total	64588.29	19		
Homogeneity of variance=1.15 (P>.05)				

Table 10

Analysis of Variance Summary Table of Total Training Trials
During Avoidance Training in Experiment III

Source	Sum of Squares	d.f.	Mean Square	F
Avoidance Trained	23.80	1	23.80	1.56
Fear Tested	16.28	1	16.28	1.06
Interaction	11.83	1	11.83	.77
Within Cells	244.46	16	15.28	
Total	296.21	19		
Homogeneity of variance=2.32 (P>.05)				

Table 11

Analysis of Variance Summary Table of Number of Noyes Pellets
Eaten During Pretraining in Experiment III

Source	Sum of Squares	d.f.	Mean Square	F
Avoidance Trained	2.45	1	2.45	.26
Fear Tested	.05	1	.05	.01
Interaction	.05	1	.05	.01
Within Cells	148.05	16	9.25	
Total	150.64	19		

Homogeneity of variance=1.91 (P>.05)

Table 12

Analysis of Variance Summary Table of Dependent Approach
Latencies During Fear Testing in Experiment III

Source	Sum of Squares	d.f.	Mean Square	F
Avoidance Trained	6624.14	2	3312.07	10.65**
Fear Tested	1635.32	1	1635.32	4.97*
Interaction	2109.10	2	1054.55	3.05
Within Cells	8554.17	24	356.43	
Total	18922.68	29		

Homogeneity of variance=23.5 (P<.01)
 ** (P<.01)
 * (P<.05)

Table 13

Analysis of Variance Summary Table of Dependent Total CS
Time During Fear Testing in Experiment III

Source	Sum of Squares	d.f.	Mean Square	F
Avoidance Trained	9174.10	2	4587.05	11.61**
Fear Tested	565.03	1	565.03	1.43
Interaction	899.10	2	899.10	1.14
Within Cells	9487.21	24	395.37	
Total	20125.48	29		
Homogeneity of variance=15.4. (P<.01)				
**(P<.01)				

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