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Fear Reduction Under Avoidance Blocking

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FEAR REDUCTION UNDER AVOIDANCE BLOCKING

BY

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ABSTRACT

Forty-one rats were given ten minutes of exposure to the alley runway apparatus. Eleven subjects were placed in a nonshocked control group. Thirty-one subjects were trained to make an avoidance response in the alley to a criterion. Nineteen rats were divided into two experimental groups depending on their behavior demonstrated under twenty-five minutes of response blocking. Subjects demonstrating relaxed types of behavior were placed in the relaxed group. Subjects not demonstrating relaxed behavior were assigned to the nonrelaxed group. Eight avoidance trained subjects were put in a shocked control group and were not blocked. Later exposure to the apparatus demonstrated that the relaxed experimental group demonstrated more fear of the avoidance area of the alley than the nonshocked control group. The relaxed group also showed less fear than the nonrelaxed group. The nonrelaxed group showed more fear than the shocked control group. It was concluded that avoidance response blocking can lead to fear reduction. These data provide support for Stampfl's theory that effective blocking is a function of a reduction of the classically conditioned fear response.

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I

RESPONSE BLOCKING AND THE NEUROTIC AVOIDANCE RESPONSE

Interest in the extinction of avoidance responses has been, in part, due to the assumption that many forms of human psychopathology can be understood in a framework of avoidance responding. Stampfl (1966) has stated: "The defensive maneuvers and symptoms of the human patient result from attempts on his part to avoid or terminate stimuli that function as internal danger signals." Stampfl's position is in agreement with that of Maslow and Mettleman (1951) who indicate that the neurotic's symptoms and general maladaptative behavior result from anticipation or expectation of some catastrophe, and that this anticipation provides the motive force for the neurotic's symptom.

Seen in the framework of Mowrer's two factor theory of learning (1960), a classically conditioned response, triggered by a previous association with an effective aversive stimulus (UCS), generates anxiety which motivates and guides an instrumental response. This instrumental behavior, adaptative in its function of reducing unpleasant anxiety, increases in probability of occurrence because the reduction of anxiety is reinforcing.

The neurotic is one whose behavior is maladaptive and self-defeating. The result of his imagined safety from a noxious UCS is what Horney (1937) calls the vicious circle and Mowrer (1950) calls the neurotic paradox. The neurotic's behavior more or less serves to reduce the immediate anxiety, but at the same time it prolongs and increases the total anxiety because the patient never learns he has nothing to fear, that the noxious UCS is no longer following the CS. He never learns the real consequences of reality because he is never exposed to it; he avoids it. For this reason Mowrer (1950) has defined the neurotic as one who has learned how not to learn.

The blocking prevents the avoidance response (symptom) from occurring. This forces the subject to remain in the presence of the anxiety eliciting CS where the UCS no longer follows. Eventually, the classically conditioned anxiety response to the CS is diminished because it is not paired with the UCS. The weakening of the classically conditioned anxiety response removes the reinforcement for the avoidance response, which had been reducing the anxiety.

Human avoidance blocking, implosive therapy, a technique developed by Stampfl, was designed after Solomon, Kamin, and Wynne's (1953) study demonstrating that avoidance responding could be extinquished by blocking subjects (dogs) in the presence of the CS so that they could not make the avoidance response. This technique is also called flooding as it floods the animal with a full strength presentation of the fear-producing stimulus (Baum, 1966). One theoretical analysis of this procedure, based on Mowrer's two factor theory of learning, assumes that classically conditioned fear is the motive for the instrumental response, and consequently, avoidance reduction is the consequence of a weakened classically conditioned fear response occurring under blocking. That is, theoretically the implosive or blocking technique reduces the fear and therefore, the motive for the avoidance response. This assumed basis of implosive therapy has been challenged as a consequence of subhuman investigations suggesting that avoidance response reduction demonstrated under the blocking technique may not be due to reduced fear of the CS, but rather to the counter-conditioning of nonrunning responses to the fear instead of running responses (Page, 1955; Coulter, Riccio, and Page, 1969; Schiff, 1972).

Studies demonstrating that response blocking leads to a reduction of subsequent avoidance behavior are numerous (Baum, 1966, 1969A, 1970A, Black, 1958; Carlson and Black, 1959; Coulter, Riccio, and Page, 1969; Page, 1955; Page and Hall, 1953; Schiff, 1970; Stampfl and Levis, 1966; Weinberger, 1965). Some of these studies do not suggest that fear reduction of the CS is related to the avoidance reduction. The recent study by Coulter, Riccio, and Page (1969) and the earlier study by Page (1955) both indicate that while avoidance blocking led to a weakening or absence of the instrumental avoidance response, this response may not be associated with a reduction of anxiety. In the Coulter et al experiment, rats trained to avoid a CS in a shuttle box apparatus were blocked five times for 15 or 60 seconds prior to a regular extinction procedure until the subjects remained in the presence of the CS for 10 seconds on three consecutive trials. These blocked subjects subsequently stopped performing the avoidance response more quickly than a control and semi-blocked group; yet, having been deprived of food for 24 hours, blocked subjects' reentry into the avoided (90 V. shock) side of the cage to obtain food showed significantly greater latencies than a control group and a semi-blocked group which were permitted to avoid after temporary (5 sec.) blocking. This experiment was interpreted as contradicting a two factor approach based on fear reduction. An interpretation was suggested which paralleled one of Solomon, Kamin, and Wynne's (1953) and Page's (1955) contention that during blocking a new competing response, that of not avoiding, was motivated by the originally conditioned fear of the CS and subsequently reinforced. In another study, Benline and Simmel (1967) initially reduced the instrumental avoidance response to a CS by blocking for 20 second periods. Experimental subjects were blocked 8, 16, or 32 trials per day over five days depending on the group. One hundred extinction trials were subsequently run over five days (20 trials/day). Blocked experimental subjects remained in the presence of the CS longer than controls for the first two days. Gradually, the blocked subjects avoided again until there was no difference between these blocked subjects and non-blocked controls on latency to avoid the CS and number of avoidance responses. This was interpreted as evidence of residue fear after avoidance extinction. Blocking was seen as a temporary suppressor of avoidance responses only, and was considered to have no effect on the reduction of fear of the CS. In another study, Werboff, Duane, and Cohen (1964) found physiological evidence of fear of a CS (paired with a shock) in elevated heart rates of subjects with extinquished avoidance responses. These studies point to an insufficiency of Mowrer's two factor fear-reduction approach in explaining the consequences of response blocking.

More recent studies by Baum (1969) and Lederhendler and Baum (1970), while not testing fear reduction, have suggested that one factor which could be used in predicting the reduction of an avoidance response after response blocking is the amount of relaxed-type behavior displayed during avoidance blocking. Baum (1970) has noted that subjects who exhibit less fearful types of behavior avoid less than other subjects. Furthermore, mechanical facilitation of relaxation activity (forced relaxed types of behavior-exploration) appeared to aid in the extinction of the avoidance response. Likewise, a social facilitation effect was found by Baum (1969) during blocking where naive and supposedly relaxed rats introduced into the presence of the rat under response prevention aided in extinction of the avoidance response. Baum (1970) has suggested, but never tested, an assumption that these results indicate that reduced avoidance activity is paralleled by fear reduction only if relaxation activity (relaxation) is concomitant with the ceased avoidance response. Baum (1970b) attributes what occurs under blocking to a combination of Pavlovian fear extinction, competing response learning, and active relaxation.

Studies indicating residue fear of the CS in the presence of reduced avoidance responding can be fit into Mowrer's two factor conceptualization if the learning of a competing response (one of not avoiding) can be said to be motivated by fear. In this case, avoidance responding could be reduced, while the fear of the CS would not necessarily be decreased. It is possible, under this theoretical framework, to assume that avoidance blocking may not necessarily lead to fear reduction. One alternate view of response blocking would suggest that avoidance blocking can lead to fear reduction. Under this assumption, studies indicating residue fear might be accounted for on the basis of inadequate blocking time for fear reduction to take place. That is, the reduction of fear may require more time than the reduction of avoidance responses, and studies suggesting residue fear may not have blocked long enough for a complete reduction of fear to occur.

The purpose of the present study was to test whether or not fear reduction can occur under extended blocking. The major hypothesis was that if blocking was extended until an organism demonstrated relaxed behavior in the presence of a conditioned aversive stimulus, then the conditioned fear would be reduced. A second hypothesis held that extended blocking with relaxed behavior occurring could lead to total reduction of the fear response.

II

METHOD

Subjects

Subjects were 40 male experimentally naive retired breeder rats of the Sprague-Dawley strain obtained from the Charles River Breeding Laboratory. The subjects weighed between 550 and 625 grams during the study. The animals were maintained on an *ad lib* schedule of food and water.

Apparatus

The apparatus consisted of a straight alley runway, 5 inches wide, 7 inches high, and 48 inches long with a Plexiglass top and aluminum sides. The alley was divided into eight six-inch zones marked off by black tape on the plexiglass top. Zones 8 and 7, the start box and part of the CS area, could be separated from the rest of the alley-way by a manually operated guillotine door. Zones 6-3 constituted the rest of the CS area. The entire CS area, Zones 8-3, were discriminable from Zones 2 and 1 by black tape which masked the walls of the CS. Zones 2 and 1, the goal box, could be separated from the rest of the alley by a manually operated guillotine door. Photocells were placed in Zone 7 and between Zones 3 and 2 to perform contact and timing functions. The apparatus was automated, using standard programming equipment. Figure 1 is a diagram of the apparatus.

The primary aversive stimulus (UCS), delivered through the grid floor, was a 175 v., A.C. shock from a matched impedence source with 150 K ohms in series with the rat. White masking noise produced by a GSC Model 901B Noise Generator through a $5\frac{1}{4}$ inch Quam Model 6A1-270736 speaker was always present.

Procedure

The procedure started by placing subjects into the start box individually and measuring general activity level in terms of distance moved for a period of ten minutes. This was done to check whether or not all groups had equal amounts of activity because activity could have effected the dependent measured of fear in subsequent phases of this study. A time sampling technique was employed to assess activity. The Zones the subjects were in were recorded at five second intervals, rendering movement scores for that five second period. Differences in Zones over consecutive periods were added, yielding a total activity level for each subject for that ten minutes. (Table 1)

Phase 1: Avoidance Training. The avoidance training phase consisted of individually placing the subjects from the experimental groups and one control group into the start box (CS) so as to break the photocell, starting the

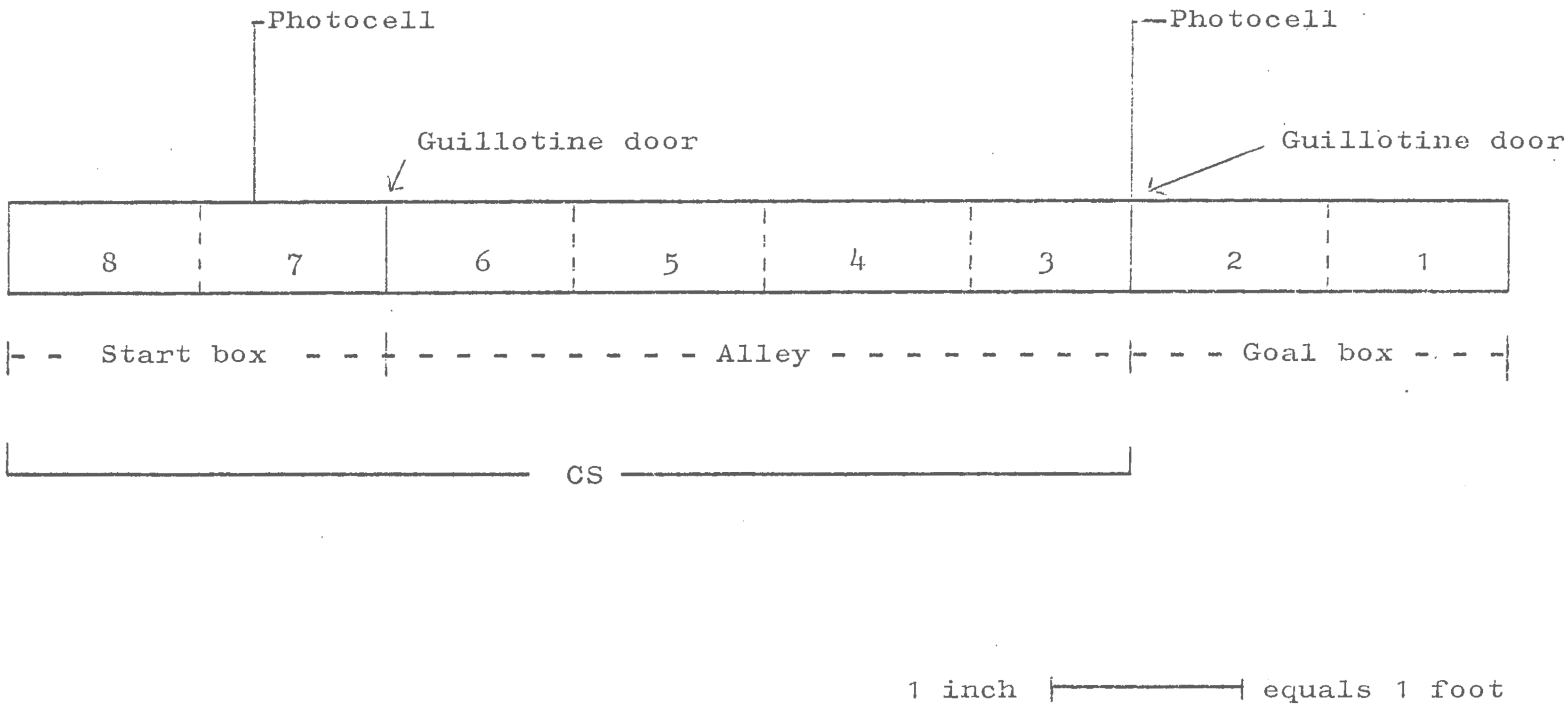

FIGURE 1: Diagram of the straight alley

TABLE 1

Procedural Outline

Premeasure	Activity Level	
	All Groups 10 Minutes	
Phase 1	Avoidance Training	No Avoidance Training
	Experimentals 21 Subjects	Non Shocked Controls 10 Subjects
	Shocked Controls 10 Subjects	
Phase 2	Response Blocking	No Response Blocking
	Experimentals Relaxed 11 Subjects	Shocked Controls 9 Subjects
	Nonrelaxed 8 Subjects	Non Shocked Controls 10 Subjects
Phase 3	Fear Reduction Measures - All Groups	
	Total Penetration Scores	
	Maximum Penetration Scores	
	CS Latency Scores	
	Total CS Time Scores	

trial. Each subject was given a 10-second period (inter stimulus interval) before the presentation of the shock (UCS) which was terminated when the subject escaped into the goal box, thereby breaking the photocell between Zones 2 and 3. The breaking of this photocell also constituted an avoidance response which was defined as the subject entering the goal box before the 10-second inter stimulus interval had elapsed.

Subjects were then taken out of the apparatus and, after a 45-second intertrial interval, placed into the start box again for the next trial. This was done until a criterion of ten successive avoidances were achieved. Each subject of a second nonshocked control group was placed in the startbox for an equal amount of time without being shocked so as to keep time in the apparatus constant. The animals in this group were placed in and taken out of the apparatus 16 times, the mean number of trials for the experimental animals, to keep the effects of handling constant.

Phase 2: Avoidance Blocking. Phase 2 of the procedure began when the experimental subjects were retained in the presence of the CS once for 25 minutes by closing the guillotine door between the CS and the goal box. The subjects' behavior was recorded using a time sampling technique where the behavior was rated on a five point scale every five seconds. The behavioral rating scale used is one similar to Baum's (1970) scale and was as follows:

1. Frantic avoidance behavior where the subject typically tried to go through the guillotine door.

2. Freezing behavior where the subject typically crouched motionless.

3. Sniffing behavior where the subject would explore with his head only, while his feet remained stationary.

4. Grooming behavior.

5. Exploratory activity. This behavior was marked by sniffing and bodily movement through the alley.

The experimental subjects were then divided into two groups on the basis of their behavior displayed under blocking. Exploratory or #5 behavior was determined to be the critical behavior demonstrated under blocking for group assignment because of its high positive correlation with low levels of emotional arousal (Hayes, 1960; Patrik, 1931). Those showing exploratory or #5 behavior for a continuous period of at least 45 seconds during blocking as determined from a pilot study with 15 subjects were put into the relaxed group category. Those not demonstrating relaxed behavior, that had exploratory or behavior #5 ratings for less than 15 consecutive seconds were placed into the nonrelaxed group. The pilot study demonstrated that equal groups of relaxed and nonrelaxed subjects would probably be produced using a 45 and 15 second criterion.

The shocked control subjects received no blocking, but were placed in a cage next to the apparatus for 25 minutes, and the nonshocked control subjects were placed in the blocking area of the apparatus for 25 minutes to keep the effects of time equal.

Phase 3: Fear Testing. Phase 3 of the procedure consisted of placing all groups in the goal end of the alley and leaving them for 10 minutes with both guillotine doors open. Subjects' movement through the alley was recorded using another five-second time sampling in terms of Zones the subject's head was in. These Zones were considered penetration scores down the alley. A total penetration score was determined by adding the zones the subject was in throughout the ten minutes. The maximum penetration score, the Zone entered which was furthest away from the goal box, was also recorded. Latency of the subjects' entry into the CS area in seconds was also recorded, as well as the total number of seconds subject remained in the CS area. These data were used as measures of fear to test the hypotheses, and were compared for all groups.

Measures and comparisons of the reduction of the avoidance response were not conducted as reduction of the avoidance responding has been found consistently after blocking (see references above). Also, Schiff (1972), who used the same apparatus as was employed in this study, found a significant reduction in avoidance responses following blocking.

III

RESULTS

Reliability Checks

To assess the reliability of the experimenter's ratings of activity levels, behavior under blocking, and penetration zones, percentages of rater's agreement were computed. Two raters independently rated one subject. Percentages of rater agreement were the following:

1. Percent of rater agreement of activity level, as measured in zones the subject entered through the time sample of ten minutes, with 120 ratings, was 82.5.

2. Percent of rater's agreement of behavior ratings under response blocking through the time sampled period of twenty-five minutes, with 300 ratings, was 90.7.

3. Percent of rater agreement of maximum penetration zones in the fear testing phase through a time sampled period of ten minutes, with 120 ratings, was 72.5.

Original Activity Levels

As the dependent measured used in this study involved activity, a premeasure of activity was conducted to assess whether or not pre-experimental activity was equal across groups. This premeasure, recorded as movements through zones in five-second intervals over a ten-minute period, yielded one total activity measure for each subject. All groups were then compared. Activity level means and standard deviations can be seen in Table 2. The F value of Hartley's F_{max} test of homogeneity was $F=5.98$, $df=4/10$, $P<.05$. These data do not meet the assumption of homogeneity for the analysis of variance. The necessity of having homogeneity of variance for a meaningful analysis of variance is questioned by the Norton Study's (in Hays, 1963) conclusion that the F distribution is effected much less than originally thought by deviations in homogeneity. In regards to tests of homogeneity, one is reminded of Box's (1953) analogy: "To make a preliminary test on variance is rather like putting to sea in a rowing boat to find out whether conditions are sufficiently calm for an ocean liner to leave port." (p. 219). Transformations were not conducted throughout this study on any data because of the F distribution's insensitivity to differences in the variances which are pooled into the experimental error (Winer, 1962). Following the above rationale, analyses of variance were performed throughout the paper regardless of F_{max} results.

The preliminary data, when subjected to the analysis of variance, produced non significant group differences $F=.3109$, $df=3/34$. This indicates that subjects had similar levels of activity prior to the experiment. The Analysis of Variance Summary Table is presented as Table 1 in the Appendix.

TABLE 2

Activity Levels Measured in Movements Through the Alley At Five-Second Intervals for the Ten-Minute Premeasure.

Group	Relaxed Experimental	Nonrelaxed Experimental	Shocked Controls	Nonshocked Controls
Mean	163.00	150.75	154.89	152.00
Standard Deviation	27.42	12.92	15.75	31.37

Trials to the Avoidance Criterion

To evaluate whether or not all groups had equal amounts of avoidance training, the number of trials it took the subject to meet the avoidance criterion of ten consecutive avoidances was analyzed for and between the relaxed experimental, nonrelaxed experimental, and shocked control groups. The means and standard deviations of the groups are reported in Table 3. Hartley's F_{max} test of homogeneity yields F=1.56, df=3/10. The analysis of variance used on these data yielded F=2.25, df=2/25, and is shown in summary form in Table 2 in the Appendix. There was no significant difference across groups in trials to learn the avoidance response.

TABLE 3

Means and Standard Deviations of Shocked Groups of Trials to the Successful Completion of the Avoidance Criterion.

Group	Relaxed Experimental	Nonrelaxed Experimental	Shocked Control
Mean	14.55	15.13	18.00
Standard Deviation	3.13	3.26	4.29

Nonavoided UCS Shock Trials

To assess whether or not avoidance trained groups received equal numbers of shocks, the number of trials the subjects failed to make a successful avoidance response and were consequently shocked during the avoidance learning phase was compared here. The mean number of shocks each subject received and the standard deviation is given by groups in Table 4. Hartley's test of F_{max} of homogeneity yielded $F=4.89$, $df=3/10$, $P \leqslant .01$. These data, subjected to the analysis of variance, results in $F=10.02$, $df=2/25$, $P < .01$. This can be seen in Table 3 in the Appendix in the Analysis of Variance Summary Table. These results indicate that the groups did differ in terms of the number of trials they failed to avoid and were shocked.

TABLE 4

Means and Standard Deviations of Groups on Trials of UCS Exposure

Group	Relaxed Experimental	Nonrelaxed Experimental	Shocked Control
Means	2.55	2.75	4.56
Standard Deviation	.89	.56	1.57

Further analysis of these data following a significant F ratio was done by Newman-Keuls comparison method. While the Newman-Keuls method does not require the prediction of direction, which the hypotheses in this study lend themselves to, it does handle the data in a powerful manner, while comparing all the appropriate groups. The results of the Newman-Keuls method, presented in Table 5, indicate that the shocked control group received significantly more trials with UCS exposure than the experimental groups. The relaxed experimental and nonrelaxed experimental groups did not differ.

Seconds of UCS (Shock) Exposure

In assessing whether or not all groups received equal amounts of shock as a result of not making an avoidance response in the 10-second interstimulus interval, time

TABLE 5

Results of Newman-Keuls Comparison Method of Number of UCS Exposure Trials

Groups	Relaxed Experimental	Nonrelaxed Experimental	Shocked Controls
Relaxed Experimental		.21	2.01*
Nonrelaxed Experimental			1.81*
Shocked Controls			

* $P < .05$

shocked was measured in tenths of seconds, and totaled for all groups. The means and standard deviations of groups in avoidance training are reported in seconds in Table 6. Hartley's F_{max} test of homogeneity yields F=23.72, df=3/10, $P < .01$. The summary results of the analysis of variance is seen in Table 4 in the Appendix. This analysis did not result in any significant differences across groups. This means that the groups did not differ in the total time they were shocked.

Latency Scores to Entering the CS

The latency score, one dependent measure of fear, is the number of seconds the subject took, in Phase 3, to enter the CS area. If the subject never entered the CS

TABLE 6

Means and Standard Deviations of Groups' Exposure to the UCS in Seconds.

Group	Relaxed Experimental	Nonrelaxed Experimental	Shocked Control
Mean	8.47	7.28	8.89
Standard Deviation	6.01	1.45	2.33

area, he was assigned a score of 600, the number of seconds in Phase 3. The means and standard deviations of latency scores are given in Table 7. Hartley's F_{max} test of homogeneity of these data yields F=19.52, df=4/10, $P < .01$. When the latency scores were subjected to the analysis of variance, a significant difference, F=14.85, df=3/34, $P < .01$, was found across groups. The summary table of this analysis is Table 5 in the Appendix. Further analysis of these data assessing the individual group differences by the Newman-Keuls method is reported in Table 8. From this analysis it can be seen that the nonrelaxed experimental group took longer than all other groups to enter the CS area. Furthermore, the shocked control group was slower than the relaxed experimental group and the nonshocked control group. There was no difference between the relaxed experimental group and the nonshocked control group.

TABLE 7

Means and Standard Deviations in Seconds of Groups' Entry Into the CS in the Fear Testing Phase of the Experiment.

Group	Relaxed Experimental	Nonrelaxed Experimental	Shocked Control	Nonshocked Control
Mean	33.36	508.13	317.22	56.00
Standard Deviation	52.59	195.62	256.89	115.64

TABLE 8

Results of Newman-Keuls Group Comparison Method on Latency Scores

Group	Relaxed Experimental	Nonshocked Control	Shocked Control	Nonrelaxed Experimental
Relaxed Experimental		22.67	283.86*	474.76*
Nonshocked Control			261.22*	452.13*
Shocked Control				190.90*
Nonrelaxed Experimental				

$* \ P < .05$

Total Time in the CS Area

Total time in the CS area was measured in seconds for all groups. It was a dependent fear measure consisting of the total amount of time the subject spent in the CS during the fear testing phase, Phase 3. The means and standard deviations of this measure are presented in seconds in Table 9. Hartley's F_{max} test of homogeneity yielded $F=2.31$, $df=4/10$. The analysis of variance on these data is reported in Table 6 in the Appendix. It can be seen from this table that $F=10.63$, $df=3/34$, $P < .01$, representing a significant difference. To further analyze this difference, Newman-Keuls comparison method was employed and the results are presented in Table 10. It can be seen from this table that the nonshocked group spent more time in the CS area than any other group. The relaxed experimental group had more time in the CS than both the shocked control group and the nonrelaxed experimental group. The shocked control group and the nonrelaxed experimental group did not differ.

Total Penetration Scores

The total penetration score was the third dependent measure of fear. It was derived by adding the penetration zone of the subject at five-second intervals in Phase 3 through the time sample technique. All zone areas recorded were then added to obtain a single total penetration

TABLE 9

Means and Standard Deviations of Total Time in the CS Area During the Fear Testing Phase, Phase 3.

Group	Relaxed Experimental	Nonrelaxed Experimental	Shocked Control	Nonshocked Control
Mean	288.18	58.13	112.67	456.50
Standard Deviation	186.94	152.03	157.06	129.02

TABLE 10

Results of Newman-Keuls Group Comparison Method in Seconds of CS Time in Fear Testing Phase, Phase 3.

Group	Nonrelaxed Experimental	Shocked Control	Relaxed Experimental	Nonshocked Control
Nonrelaxed Experimental		54.43	230.06*	398.38*
Shocked Control			172.63*	340.94*
Relaxed Experimental				168.32*
Nonshocked Control				

* $P < .05$

score. The means and standard deviations of the total penetration scores are presented in Table 11. Hartley's F_{max} test of homogeneity results in $F=12.57$, $df=4/10$, $P<.01$. The results of these data, subjected to the analysis of variance technique, are presented in summary form in Table 7 in the Appendix, and are shown to be significantly different, $F=9.09$, $df=3/34$, $P<.01$, across groups. Individual differences between groups compared by the Newman-Keuls method are reported in Table 12. These later data indicate that the nonshocked control group, having the highest total penetration scores, differed from all other groups. The relaxed experimental group also differed from the nonrelaxed experimental group, which had the lowest total penetration score. The shocked control group was not different than either the nonrelaxed experimental group or the relaxed experimental group. Therefore, the nonshocked control group approached the CS more than any of the other groups, and the relaxed experimental group approached more than the nonrelaxed experimental group.

Maximum Penetration Zone

The maximum penetration zone measure was the highest zone the subject entered in the fear testing phase, Phase 3. It was a dependent measure of fear, and was simply the furthest zone reached into the CS area. The

TABLE 11

Means and Standard Deviations of Total Penetration Scores of Subjects in CS Area in Fear Testing Phase, Phase 3.

Group	Relaxed Experimental	Nonrelaxed Experimental	Shocked Control	Nonshocked Control
Mean	398.00	179.88	257.11	584.70
Standard Deviation	234.80	67.90	110.00	183.40

TABLE 12

Results of Newman-Keuls Group Comparison Method of Total Penetration of Subjects in CS Area in Fear Testing Phase, Phase 3.

Group	Nonrelaxed Experimental	Shocked Control	Relaxed Experimental	Nonshocked Control
Nonrelaxed Experimental		77.24	218.13*	404.83*
Shocked Control			140.89	327.59*
Relaxed Experimental				160.00*
Nonshocked Control				

* $P < .05$

means and standard deviations of these data are reported in Table 13. Hartley's F_{max} test of homogeneity yielded $F=32.28$, $df=4/10$, $P < .01$. The results of the analysis of variance employed on this data, $F=15.57$, $df=3/34$, $P < .01$, is shown in summary form in Table 8 in the Appendix. This indicates a difference across groups. Further analysis of these data by the Newman-Keuls method are reported in summary form in Table 14. It can be seen from Table 14 that the nonshocked control group, the group with the largest maximum penetration score, was significantly different from the shocked control and nonrelaxed experimental groups. The relaxed experimental group was significantly higher than the shocked control and the non-relaxed experimental groups. The shocked control group was also significantly higher than the nonrelaxed experimental group. Therefore, the nonshocked control and the relaxed experimental groups had larger maximum penetration scores than the shocked control and the nonrelaxed experimental groups.

<u>Relationship of Exploratory Activity Under Blocking to Total Penetration</u>

A further assessment of one of the dependent fear measure's relationship to relaxation was conducted through the use of a Pearson Product Moment Correlation. For this purpose, the Total Penetration Score was used as it is sensitive to both the amount of penetration into as well

TABLE 13

Means and Standard Deviations of Maximum Penetration Zone Reached in the Fear Testing Phase

Group	Relaxed Experimental	Nonrelaxed Experimental	Shocked Control	Nonshocked Control
Mean	6.91	2.00	4.33	7.20
Standard Deviation	1.51	.50	2.87	1.25

TABLE 14

Newman-Keuls Group Comparison Method of Maximum Penetration Data In the Fear Testing Phase

Group	Nonrelaxed Experimental	Shocked Control	Relaxed Experimental	Nonshocked Control
Nonrelaxed Experimental		2.33*	4.91*	5.20*
Shocked Control			2.58*	2.88*
Relaxed Experimental				.29
Nonshocked Control				

* $P < .05$

as the time spent in the CS area. The relaxed and non-relaxed experimental groups were combined (N=19) for this correlation, and subjects' respective scores on the total penetration measure were correlated with the number of exploratory activity ratings (behavioral rating #5) taken from the time sampled during blocking. The resulting correlation yields $r_{xy}=.50$, N=19, $P<.05$. The amount of exploratory behavior demonstrated under blocking is therefore significantly related to Total Penetration, a fear-dependent measure.

IV

DISCUSSION

While previous research indicates response blocking does not lead to a reduction of anxiety (Coulter, Riccio, and Page, 1969; Page and Hall, 1953; Page, 1955), the results of this study indicate that response blocking can lead to fear reduction when the subject is blocked long enough to demonstrate relaxed (exploratory) types of behavior. Support for this finding comes from the significant differences between groups in approaching or entering the CS area (latency score measures), remaining in the presence of the CS (CS time measures), and intensity of the CS exposure (maximum penetration and total penetration measures).

In approaching the CS area in the fear testing phase of the study, the relaxed experimental group entered the CS area significantly faster than the nonrelaxed experimental group. The relaxed group also spent more total time in the CS area than the nonrelaxed group, had a higher total penetration score, and a higher maximum penetration score. On all four measures, the results consistently show the relaxed group demonstrating less fear than the nonrelaxed group.

The relaxed group also demonstrated less fear than the shocked control group which received no flooding treatment on two out of four measures. The relaxed group's latency into the CS area was quicker than the shocked control's, and its total time spent in the CS area was greater than the shocked control's. The relaxed group and the shocked control group did not differ on either total or maximum penetration measures.

The relaxed experimental group's less fearful response to the CS as compared to the nonrelaxed experimental and shock control groups support Solomon, Kamin, and Wynne's (1953) original theoretical assumption that avoidance reduction under blocking may be the result of a weakened classically conditioned fear response. If the subject is blocked until less fearful responses such as exploratory behavior ensues, fear reduction can be demonstrated. Therefore, the hypothesis that when blocking is extended until the organism demonstrates relaxed behavior in the presence of a conditioned aversive stimulus, the conditioned fear as measured in Phase 3 will be reduced, is accepted. This can also be seen in the significant positive correlation between the amount of exploratory behavior and total penetration, where subjects exploring more, penetrated more. These results are consistent with Baum's (1969 B) conclusions that occurrences of nonanxious behavior in the presence of the anxiety eliciting CS determines the effectiveness of response prevention. These data also extend conclusions of Benline and Simmel (1967);

Coulter, Riccio, and Page (1969); Page (1955); Page and Hall (1953); Werboff, Duane, and Cohen (1964); and Schiff (1971); who demonstrated residue fear in subjects who were blocked sufficiently for the avoidance response to subside. Collectively, this literature favored a fear motivated competing response explanation of the avoidance reduction, suggesting that response blocking does not lead to fear reduction. The alternative theory, presented in this paper, that the avoidance reduction can be associated with a weakened classical response of fear of the CS is supported after blocking subjects longer than studies did which suggested that blocking did not reduce fear. According to behavioral data collected in this study, none of these studies suggesting residue fear after blocking continuously blocked subjects long enough for fear reduction to occur. Coulter et al blocked up to 60 seconds, Benline and Simmel for 20 seconds, Page for 15 seconds, and Schiff for 120 seconds. The behavioral observations made in the present study suggest that relaxation under blocking even with fairly mild UCS shock generally takes from 7-20 minutes, and even then the nonrelaxed experimental group may not have been blocked long enough.

This 7-20 minute blocking time which seemed necessary in this study for fear reduction as measured by exploratory behavior is, as far as the author knows, the only reported continuous flooding time over five minutes in the literature besides Baum's (1969B) study where subjects were blocked for 30 minutes. Baum (1969B) did not systematically observe his subjects' behavior throughout the duration of blocking, but after three minutes of observation at the end of the 5 and 30 minute blocking periods, he has reported 5 minutes to be sufficient time for his subjects to start exploratory behavior under flooding following a 0.5 ma. UCS. Baum's 30 minute response blocked group demonstrated the efficacy of extended response prevention for reducing avoidance responses. There is good support for the notion that the inability of previous research to demonstrate fear reduction via blocking is a result of blocking for too short a period of time.

While 25 minutes blocking time was sufficient for fear reduction in the relaxed group, subjects responded differentially under equal times, as 25 minutes blocking did not lead to fear reduction in the nonrelaxed experimental group. In fact, blocking may have led to an increase in fear in the nonrelaxed group. The nonrelaxed group, a group blocked as long as the relaxed group, showed more fear on two of the fear measures, than the shocked but nonblocked control group, a group postulated as having the most fear since it received no fear reduction treatment. The shocked control's maximum penetration and latency scores were greater than the nonrelaxed experimental group's.

The nonrelaxed group's possible increase in fear may be a result of a process analogous to covert sensitization (Cautella, 1967). That is, blocking was discontinued while subjects were still in a relatively high state of anxiety, allowing the fear of the CS, the anticipatory response to punishment, to build up but never subside. The shocked control subjects were never blocked, and their anticipatory responses to punishment therefore were probably not as great as that of subjects in the nonrelaxed experimental group. Therefore, while the nonrelaxed subjects may have had an anticipatory response to punishment augmented for 25 minutes leaving them tense in readiness; the shocked control subjects did not experience this.

Whether blocking can lead to complete fear reduction was tested by a relaxed experimental to nonshocked control group comparison. Here the results are mixed. While two measures, CS latency and maximum penetration, scores are equal; two measures are different. The nonshocked controls had more CS time and a higher total penetration score. The relaxed group's fear reduction does not seem complete when compared to the fearless nonshocked control group. Consequently, the hypothesis that extended blocking with relaxed behavior occurring can lead to total reduction of the fear response, was rejected.

These results reflect diversified fear reduction potentials of blocking, and do not seem to be a function of differential UCS exposures. There was no significant differences between groups on amount (seconds) of shock received. The shocked control group did receive more shock trials than both the relaxed and nonrelaxed experimental groups, but the relaxed and nonrelaxed groups did not differ. Since all three shock groups had equal time contact with UCS, fear reduction differences were probably not a function of UCS exposure. As there were no differences in prior activity level measures, dependent fear measures were apparently not a function of the animal's inherent activity level. There were no physiological measures employed to check subjects' fear levels, even though this may have been able to add valuable data to the results.

The major finding of this study is that flooding can lead to fear reduction. This result is consistent with what a two-factor theory usually considers extinction of the classical response. While the classical response has been reduced, the term extinction is a misnomer. In extinction of a classically conditioned CR, the CS is presented without the UCS trial after trial until the CR is no longer elicited. In flooding or blocking, the procedure employs one massed trial of CS exposure without the UCS. For this procedure, the term flushing is more appropriate than the misused extinction. While the results are the same as in extinction in that the subject stops performing the CR to the CS or the CS no longer elicits the CR, the flushing procedure employs one massed CS exposure in attaining this result. What the weakening of the CS-CR bond actually results from is not certain. It may be a dissipated classical fear response, or it may be the result of a newly learned or counter conditioned classical nonfearful response to the CS which is incompatible with the fearful response (Wolpe, 1969). The fear of the CS in the relaxed group would, under counter conditioning, be replaced by the new learning of not fearing the CS. In either case, fear reduction or counter conditioning did not occur in the nonrelaxed group, and this group did not learn to not fear the CS. If we consider flushing to be a process of counter conditioning, perhaps the fear in this nonrelaxed group remained at too intense a level to allow new, nonfearful responses to occur and be paired with the CS. The relaxed group's fear of the CS was reduced sufficiently so as to allow for the new learning or counter conditioning of not fearing the CS.

Generalizing from this study and considering this rat data as representing a learning model, an analogous situation may hold true for humans. In implosive therapy, which is a human form of blocking or flooding or flushing a subject in the presence of a feared CS, fear reduction would be dependent on or associated with the subjects' relaxation during flooding. If relaxation does not occur, the fear response would not be flushed. The outcome of this incomplete blocking may lead to an increase in fear, and the result would be analogous to covert sensitization. The fact that flooding can lead to fear reduction in some sub-human subjects is evident by the relaxed group's subsequent behavior in this study, but whether or not the nonrelaxed type subject can relax and undergo flushing is not demonstrated. Until these unrelaxed type subjects are tested further, implosive therapy models cannot be said to work effectively with all subjects. Certainly, evidence from sub-human studies serving as models for human studies would suggest that implosive types of therapies should be more effective on some subjects than on others. More research may clarify the nature of the characteristics of individual organisms for which flushing procedures are effective and efficient.

APPENDIX

Analysis of Variance Summary Tables

APPENDIX

TABLE 1

Analysis of Variance Summary Table for Activity Levels of Groups

Source	Sum of Squares	d.f.	Mean Square	F
Between groups	924.69	3	308.23	.31
Within groups	30,706.39	34	991.36	
Total	33,631.08	37		

TABLE 2

Analysis of Variance Summary Table of Trials to Avoidance Criterion

Source	Sum of Squares	d.f.	Mean Square	F
Between groups	64.51	2	32.25	2.25
Within groups	357.60	25	14.30	
Total	422.11	27		

TABLE 3

Analysis of Variance Summary Table
of Number of UCS Exposed Trials

Source	Sum of Squares	d.f.	Mean Square	F
Between groups	22.80	2	11.30	10.02*
Within groups	28.45	25	1.14	
Total	51.25	27		

* $P < .05$

TABLE 4

Analysis of Variance Summary Table
of Seconds of UCS Exposure

Source	Sum of Squares	d.f.	Mean Square	F
Between groups	11.82	2	5.91	.32
Within groups	462.37	25	18.49	
Total	474.15	27		

TABLE 5

Analysis of Variance Summary Table
of Latency Scores in Seconds to CS Entry

Source	Sum of Squares	d.f.	Mean Square	F
Between groups	1,394,396.52	3	464,789.84	14.85**
Within groups	1,064,110.98	34	31,297.38	
Total	2,458,507.50	37		

** $P < .01$

TABLE 6

Analysis of Variance Summary Table of Seconds
of CS Time in Fear Testing Phase, Phase III

Source	Sum of Squares	d.f.	Mean Square	F
Between groups	897,885.82	3	299,295.272	10.63**
Within groups	957,585.23	34	28,164.27	
Total	1,855,471.05	37		

** $P < .01$

BIBLIOGRAPHY

Baum, M. Rapid extinction of an avoidance response following a period of response prevention in the avoidance apparatus. Psychological Reports, 1966, 18, 59-64.

Baum, M. Extinction of an avoidance response following response prevention: some parametric investigations. Canadian Journal of Psychology, 1969 (A), 23, 1-10.

Baum, M. Extinction of an avoidance response motivated by intense fear: social facilitation of the action of response prevention (flooding) in rats. Behavior Research and Therapy, 1969 (B), Vol. 7, 57-62.

Baum, M. Mechanical facilitation of the action of response prevention (flooding) in rats. Behavior Research and Therapy (A), 1970, Vol. 8, 43-48.

Baum, M. Extinction of avoidance responding through response prevention (flooding). Psychological Bulletin, 1970 (B), 74, (4), 276-282.

Baum, M., and Gordon, A. Effect of a loud buzzer applied during response prevention (flooding) in rats. Behavior Research and Therapy, 1970 (C), Vol. 8, 287-292.

Benline, T., and Simmel, E. Effects of blocking of the avoidance response on the elimination of the conditioned fear response. Psychonomic Science, 1967, 8, 357-358.

Black, A. The extinction of avoidance responses under curare. Journal of Comparative & Physiological Psychology, 1958, 51, 519-524.

Box, G. Non-normality and Tests on Variance. Biometrika, 1953, 40, 318-335.

Carlson, N., and Black, A. Traumatic avoidance learning: note on the effect of response prevention during extinction. Psychological Reports, 1959, 5, 409-412.

Cautela, J. R. Covert sensitization. Psychological Records, 1967, 20, 459-468.

Coulter, X., Riccio, D., and Page, H. Effects of blocking on instrumental avoidance response. Journal of Comparative and Physiological Psychology, 1969, 68, (3), 377-381.

Hays, W., Statistics, New York: Holt, Rinehart, Winston Co., 1963.

Horney, K. The Neurotic Personality of Our Time. New York: W. W. Norton & Co., 1937.

Lederhendler, I., and Baum, M. Mechanical facilitation of the action of response prevention (flooding) in rats. Behavior Research and Therapy, 1970, Vol. 8, 43-48.

Maslow, A., and Mittelman, B. Principles of Abnormal Psychology. New York: Harper and Brothers, 1951.

Mowrer, O. Learning Theory and Personality Dynamics. New York: The Ronald Press Co., 1950.

Mowrer, O. Learning Theory and Behavior. New York: Wiley, 1960.

Page, H. The facilitation of experimental extinction by response prevention as a function of the acquisition of a new response. Journal of Comparative Physiological Psychology, 1955, 48, 14-16.

Page, H., and Hall, J. Experimental extinction as a function of the prevention of a response. Journal of Comparative Physiological Psychology, 1953, 46, 33-34.

Patrick, J. R. The effect of emotional stimuli on the activity level of the white rat. Journal of Comparative Psychology, 1971, 12, 357-364.

Schiff, R. Facilitation of extinction of an avoidance response by response blocking. Journal of Comparative and Physiological Psychology. In press.

Solomon R., Kamin, L., and Wynne, L. Traumatic avoidance learning: the outcomes of several extinction procedures with dogs. Journal of Abnormal and Social Psychology, 1953, 48, (2), 291-302.

Stampfl, T., and Levis, D. Implosive therapy: the theory, the subhuman analogue, the strategy, and the technique. In Possible Use of Conditioning Therapy with Chronic Schizophrenia. Battle Creek, Michigan, Veterans Administration Publications, 1966.

Weinberger, N. Effect of detainment on extinction of avoidance responses. Journal of Comparative Physiological Psychology, 1965, 60, 135-138.

Werboff, J; Duane, D.; and Cohen, B. Extinction of conditioned avoidance and heart rate responses in rats. Journal of Psychosomatic Research, 1964, Vol. 8, 29-33.

Winer, B. J. Statistical Principles in Experimental Design. McGraw-Hill Book Co., New York, 1962.

Wolpe, J. The Practice of Behavior Therapy. Pergamon Press, New York, 1969.