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Residual Fear of the CS as a Function of Response Prevention After Avoidance or Classical-Defensive Conditioning in the Rat

Peter M. Monti
University of Rhode Island

RESIDUAL FEAR OF THE CS AS A FUNCTION OF RESPONSE PREVENTION AFTER AVOIDANCE OR CLASSICAL-DEFENSIVE CONDITIONING IN THE RAT

BY

PETER M. MONTI

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ABSTRACT

The problems of assessing fear reduction after response prevention techniques were reviewed. After surveying the literature it was apparent that whether or not response prevention actually reduced a subject's fear to the CS was still an unanswered question. The present investigation attempted to measure fear to the CS after response prevention by employing a conditioned emotional response paradigm. The first major hypothesis was that fear of an auditory CS (conditioned in an avoidance paradigm) is reduced during response prevention. Another hypothesis considered the possibility that conditioning may occur to aspects of the conditioning environment *per se* as well as to the specific CS. The study was also interested in evaluating the effectiveness of response prevention when fear had been learned under two different conditions. One condition, avoidance conditioning, provided the animal with the opportunity to learn to actively avoid the shock UCS. The second condition, classical defensive conditioning, did not offer the animal the opportunity to avoid the UCS.

Seven groups of 10 female rats were run in the experiment. Three groups were avoidance-trained to a criterion of 10 successive avoidances. One of these groups (Condi-

tion A-B) was blocked in the shuttle box where all fear conditioning occurred. Blocking consisted of presenting a white noise CS for 15, 20-sec. periods with a variable 1 min. inter-stimulus interval. One group was nonblocked in the animals' home cage (Condition A-NBHC). The third group was nonblocked in the shuttle box (Condition A-NBSB). Two other groups were trained in a Classical-Defensive paradigm. Animals in these groups were matched to animals in Condition A-B in terms of number, order and duration of CSs and UCSs. One of these classical defensive groups was blocked (Condition CD-B). The other group was nonblocked in its home cage (Condition CD-NBHC). The remaining two groups served as control groups. A backward control group (Condition BC-NBHC) was matched to Condition A-NBHC in terms of number, order and duration of CSs and UCSs. A sensitization control group (Condition SC-NBHC) was matched to Condition A-NBHC in terms of number, order and duration of CS presentations. Each of the control conditions was nonblocked in its home cage.

The results indicated that Condition A-B showed significantly less response suppression than Condition A-NBHC. This suggested that response prevention was an effective technique in reducing the subjects' fear to a CS. Another finding was that Condition A-B did not differ from Condition A-NBSB. This suggested that conditioning of fear did occur to the conditioning environment and that this conditioned fear was subsequently blocked in Condition A-NBSB. Condition A-B showed significantly more response suppression than Condition CD-B. This suggested that the response prevention technique was more effective when fear to the CS was learned in a classical as compared to an avoidance paradigm. Theoretical implications and generalizations to Implosive Therapy were discussed.

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INTRODUCTION

Frequently, experimentally oriented clinical psychologists employ learning models to describe the development of behavior pathology and of behavior change as a function of some form of therapy. Most recently there has been a growing interest in examining the appropriateness of the analogy between certain forms of neurotic behavior and avoidance learning. Two-process theory has most often provided the framework. The development and maintenance of neurotic symptoms have been described in terms of classical conditioning of fear to stimuli and the subsequent acquisition of instrumental responses which reduce contact with these stimuli and are reinforced through fear reduction (e.g., Mowrer, 1960; Rescorla & Solomon, 1967). There are generally two components of the avoidance response thought to be changeable. The first is a classically conditioned fear response (CR) to the CS which is learned as a result of the pairing of the CS with an aversive UCS. The fear response and its afferent feedback are typically assigned motivating and rewarding properties. The increase in the sensory feedback from the fear response is postulated to instigate the instrumental component of the avoidance response. Reduction in the sensory feedback from the fear response is postulated to reward the instrumental component. Thus, the avoidance response relieves the organism of the noxious quality of the feedback from the CS. Because the instrumental avoidance response is effective in reducing the noxious classically conditioned fear, it is maintained at a high rate when the CS is presented (Solomon, Kamin & Wynne, 1953). This avoidance response has been referred to as a conditioned avoidance response or CAR.

The CAR is considered neurotic when it occurs in the absence of serving any adaptive function (e.g., allowing the organism to avoid an actual aversive stimulus situation). While the development and maintenance of neurotic symptoms have typically been described in terms of classical conditioning of fear to stimuli and the subsequent acquisition of a response which avoids or escapes contact with these stimuli, the implications of this two-process model for the elimination of maladaptive behavior seem to have been largely ignored (Riccio & Silvestri, 1973). The problem for the clinical practitioner as well as the experimentalist has been to derive effective means of eliminating or at least reducing maladaptive avoidance behavior.

Solomon, Kamin & Wynne (1953) were perhaps the first to derive an effective method of reducing non-functional avoidance behavior. After using ordinary extinction procedures which proved unsuccessful, these experimenters introduced a procedure which has since come to be called

Response Prevention. This consisted of physically preventing the avoidance response in the presence of the feared CS. In the reference experiment (Solomon, Kamin & Wynne, 1953), dogs were trained to jump over a low gate which separated the two compartments of a shuttle box. The jumping response (CR) in the presence of a buzzer (CS) enabled the animal to avoid a shock (UCS) delivered through the grid floor. After acquisition training, an extinction phase began during which UCS was not presented regardless of how long the animals remained in a given compartment without jumping. Results showed that the animals continued to escape from the presence of the CS. Another experiment was designed to test the efficacy of an extinction procedure which physically prevented the animal from jumping in the presence of the CS. This was accomplished by extending the gate so that the subject could not jump over it (blocking) thus preventing the subject from escaping the CS. Subsequently, when the gate was lowered, the subject did not jump over it to escape the CS. This response prevention procedure has served as the animal analogue model of the behavior therapy technique known as implosion.

Although numerous studies (e.g., Solomon, Kamin & Wynne, 1953; Baum, 1969a, 1969b, 1970; Berman & Katzev, 1972; Schiff, Smith & Prochaska, 1972; and Bankart & Elliott, 1974) have demonstrated that the response prevention procedure has been useful in reducing the resistance to extinction of the CAR, the mechanisms underlying its effectiveness are not clearly understood. This is reflected in the fact that several discrepancies are reported in the recent experimental literature. For example, experiments designed to study the most effective use of blocking time in reducing the CAR are somewhat at odds. Schiff, Smith and Prochaska (1972) exposed 15 groups of rats to either 1, 5, or 12 blocking trials lasting for either 0, 5, 10, 50, or 120 seconds following avoidance training of a 175 V. UCS. The animals were trained in an alley apparatus to a criterion of 10 consecutive avoidances. To determine if there was a differential effect between the number of blockings and length of blocking, three sets of groups were compared. No differences within any of the three pairs were found. These results indicated that total response prevention time, as opposed to either the number of blocked trials or the length of each blocked trial, was the critical variable for effective blocking. In another experiment, however, Berman & Katzev (1972) report that distributed blocking (40 CS exposures) was more effective than a single massed blocking trial of equal total time when rats were run in a shuttle box with a 2.0 mA UCS. It should be pointed out that the data of Berman and Katzev are easier to explain in the context of a two-process model. If fear of the CS is indeed classically conditioned during avoidance training, then it would seem that the more often the CS is presented and nonreinforced by the absence of the UCS, the less resistance to extinction would be expected.

In order to clarify the discrepancy between the Schiff _et al_. and the Berman and Katzev studies, a particular procedural difference between them deserves comment. Namely, that different apparatuses were used in the two studies. It is possible that during blocking in the shuttle box, discrete CS presentations may have a much greater effect on subsequent behavior than a prolonged exposure of comparable duration. This may be due to the fact that in this apparatus, during conditioning, the animal is required to escape the CS by running into a compartment where it was recently shocked. In the alley situation, the rat always avoids or escapes by running away from the same box, that is, away from the CS area. Pursuing this argument, we may speculate that CS onset in the Berman and Katzev study took on a greater discriminative role since it was the only consistent CS. That is, it alone was always paired with the UCS - other environmental cues (e.g., positional cues) were irrelevant. On the other hand, the white noise CS in the Schiff _et al_. study was not the only stimulus that was consistently present upon UCS presentation. Environmental-positional stimuli were also consistently paired with the UCS. If the CS onset in the Berman and Katzev study served a greater discriminative role than CS onset in the study by Schiff _et al._, then it would be reasonable that more CS onsets in blocking would be necessary in order to facilitate extinction as compared to one long CS presentation. Conversely, since CS onset played a lesser role in conditioning in the Schiff _et al._ study, differences in blocking treatments might not be expected to produce significant differences.

Another area of uncertainty may be found in studies conducted to determine the appropriate amount of blocking time that is necessary for effective facilitation of extinction. Baum (1969a, 1969b) has studied this problem in a series of experiments in which he employed a box apparatus with an automated sliding platform located 6 in. above a grid floor. When the platform was inserted into the box, the rat could escape the CS and avoid the UCS by jumping on it. Subsequently, response prevention could be initiated by withdrawing the platform, making it unavailable to the rat for an avoidance response. Baum found length of blocking and shock intensity to be important variables operating in the effectiveness of response prevention as measured by the reduction of the CAR.

Baum (1970) has suggested that length of blocking is the single most important variable in response prevention. In an earlier study, Baum (1969a) reported that longer response prevention was necessary to reduce the CAR when a more intense UCS was used. While 3 to 5 minutes of response prevention was the minimum effective time for rats after receiving a mild (0.5mA) UCS, 5 to 30 minutes was required for a more intense (1.3 to 2.0 mA) UCS. Siegeltuch and Baum (1971) however, report results somewhat contradictory to those of Baum (1969a). These experimenters found that 30 minutes of response prevention was necessary to reduce the CAR in rats when fear was deeply rooted through .05 mA of prior shock. In this study, 30 minutes of blocking was significantly more effective in reducing the CAR than either 5 or 15 minutes of blocking.

A problem closely allied with that of determining optimal blocking time is the problem of understanding how an animal's behavior during blocking interacts with this treatment. Bearing on this question, Baum (1969a) suggested that the effectiveness of blocking is related to the behavior of the animal during blocking. Baum and Gordon (1970), employing a box apparatus, found a significant relationship between fearful behavior under blocking and the subsequent extinction test. These experimenters measured fearful behavior during blocking by employing a time-sampling technique in which the rat was observed and the main activity of the rat (the activity consuming the most time during 5 sec. periods) was recorded. The rat's behavior was divided into four categories: (1) Abortive avoidance behavior; (2) freezing; (3) general activity; and (4) grooming. Findings from this study suggested that the more fear behavior displayed during blocking the more the animal will continue to respond in the extinction test which follows. Spring, Prochaska and Smith (1974), found exploratory behavior to be significantly related to fear reduction when measured by approach behavior into the formerly feared CS area of an alley apparatus. These studies are discrepant with some recent data (Spring, 1973) which suggest that exploratory behavior is not related to approach measured fear reduction. In these later studies Spring employed a box and platform apparatus. Although there are several procedural differences that may have contributed to these discrepant findings (e.g., alley vs. box apparatus), a more salient problem in evaluating Spring's findings is that the use of approach into the CS area as the dependent measure of fear makes for a somewhat circular argument. In the first study (Spring et al. 1974), those experimental animals that showed fear reduction were those of a subgroup (of the original experimental group) selected because they initially showed a great deal of exploratory behavior during blocking.

An area of results discrepant with those that suggest that response prevention decreases resistance to extinction is that provided by recent studies suggesting a paradoxical enhancement of fear. Studies done by Coulter, Riccio and Page (1969) and Rohrbaugh, Riccio and Arthur

(1972) have shown that with relatively short CS blocking periods there seems to be a paradoxical enhancement of fear to the CS.

While considerable caution must be exercised in extrapolating experimental data to the clinical setting, it may be instructive to point out that discrepancies among treatment results have also been frequently found with human research. Reported results from Implosive Therapy range from fear reduction to fear enhancement (Hodgson & Rachman, 1970; Ayer, 1972). Noting obvious problems, critics have challenged the appropriateness of using response prevention procedures with humans in therapy situations. Most recent among such critics, Morganstern (1973, 1974) has charged advocates of Implosive Therapy with a lack of experimental rigor. Indeed, Eysenck (1968) has called for the postponement of response prevention procedures until more detailed and reliable guides have been provided by analogous studies.

A review of both the experimental animal studies and some clinical evidence, clearly suggests that although response prevention techniques are effective in some circumstances, they are not effective in others. Inherent in studying this obvious discrepancy of results is the problem of what to use as an appropriate measure of fear. Typically, either one of two dependent fear reduction measures has been employed. The first simply involves measuring the resistance to extinction of the instrumental CAR after avoidance conditioning and response prevention have occurred. Here, the assumption usually made is that more rapid extinction of the CAR in the blocked compared to the nonblocked groups implies that the fear response (CR to CS) has been reduced by the response prevention procedure. Unfortunately, investigators employing this measure are limited in their interpretations of fear reduction since the procedure has obvious methodological weaknesses. Several experiments (e.g., Page & Hall, 1953; Page, 1955) have suggested that reduction in this dependent fear measure may actually be a result of the learning of a new response to the still feared CS rather than a reduction of fear. For example, instrumental responses other than avoidance, such as freezing, crouching or grooming, may be learned during response prevention. These alternative responses may persist during fear testing such that the probability of occurrences of the previously trained CARs is decreased due to the presence of an incompatible but unmeasured alternative avoidance response.

A second dependent fear measure employed has been approach behavior into the CS (Page, 1955; Nelson, 1969; Spring, Prochaska & Smith, 1974). The rationale here has been that if the organism fears the CS then it should not approach it. As Spring _et al_. points out, approach measures eliminate the above mentioned problems which are characteristic of CAR extinction measures. Unfortunately, approach measures introduce special problems of their own since motivation for approaching the CS must be introduced. Although the importance of motivation is not to be underestimated, its interaction with other relevant variables (e.g., length of blocking) is as yet unknown and it would seem that the potential for undetected interaction and confounding is great. Also, it should be noted that Spring (1973) manipulated motivation through food deprivation and found that it had no apparent effect. Difficulties inherent with approach behavior as a dependent measure of fear are further complicated by recent findings which suggest, on the one hand, a correlation between exploratory behavior and fear reduction measured via CAR extinction (e.g., Baum & Gordon, 1970); and, on the other hand, only a partial relationship between exploratory behavior and subsequent approach measured fear indices (e.g., Spring, 1973).

It is apparent from the preceding review that many studies report a facilitation of extinction as a function of response prevention. However, the process by which response prevention produces this extinction is not altogether clear. This fact is emphasized by the findings (e.g., Rohrbaugh, Riccio & Arthur, 1972) which suggest a paradoxical enhancement of fear. Another major point in the review has been the importance of considering the technique which is employed in evaluating fear as a function of blocking. Also, some of the discrepancies in the literature have been discussed with particular emphasis on the differences in apparatuses employed. The above considerations have suggested that problems inherent in assessing fear reduction as a function of blocking are numerous and their implications for any theorizing as to what mechanisms might be operative in response prevention are indeed basic. Clearly, we cannot possibly understand what processes are operating in response prevention unless we have precise control of the antecedent conditions, and precise and meaningful measurement of the dependent measures of fear reduction.

After surveying the literature it was apparent that whether or not response prevention actually reduced a subject's fear to the CS was still an unanswered question. What seemed to be needed was a measure of fear unconfounded by the responses present during fear acquisition. The present study attempted to measure fear to the CS as a function of response prevention in a more precise manner than had been done previously.

Inherent in the problems of assessing fear is the more basic problem of defining one's concept of fear. This problem is not unique to the literature considered thus far. Indeed, several researchers (e.g., Brown, 1961; McAllister & McAllister, 1971) have considered the problem in great detail. Apparently there seems to be little disagreement that fear acquisition depends on classical conditioning procedures. Although fear is typically considered to be an internal response, any change in observable behavior which follows the presentation of the CS and which is the result of the pairing of the CS and noxious UCS can potentially be used to measure fear (Brown, 1961, pp. 144 ff). McAllister and McAllister (1971) point out that although the assumption underlying the direct measurement of fear is that a correlation exists between the magnitude of the observable response and the magnitude of fear, this relationship may not be known and it may differ for various response measures. They also point out that no single measure can be considered to be superior to the others in all respects and that fear cannot be defined in terms of a particular response measure. They suggest that the only characteristic which is common to all the occasions in which fear is asserted to be present is the prior pairing of neutral and noxious stimuli. The hypothetical state present upon the presentation of the CS and resulting from the prior pairing of neutral and noxious stimuli will constitute the present definition of fear. Thus, when the term fear is used henceforth, it will refer to the measured effects of the antecedent conditions of pairing neutral and noxious stimuli.

Having defined the term fear, the next concern was to adopt a precise measure of the effects of fear. A reliable and sensitive measure of the continued presence of the hypothetical state of fear and its behavioral consequences, is a conditioned emotional response (CER) paradigm (e.g., Estes & Skinner, 1941; Hoffman & Fleshler, 1961). The CER consists of the suppression of ongoing instrumental behavior in the presence of a warning signal (CS) which has preceded shock (UCS). It is generally considered that the CER procedure has provided more complete and reliable information than any of the other methods regarding the determinants of conditioned fear (Church, 1971). In the present study, the effects of fear to the CS were measured, independent of avoidance behavior, in an environment different from that in which fear was initially conditioned. The CER measure was chosen not only due to its reliability and precision but also due to its appropriateness to the clinical analogue. If maladaptive avoidance behaviors interfere with an individual's day-to-day activites then this may be analogous to the CER situation in which a suppression of ongoing behavior is observed upon the presentation of a warning signal.

The first major hypothesis to be tested in the present study was that fear of an auditory CS (conditioned in an avoidance paradigm) is reduced during response prevention. This led to the prediction that blocked experimental subjects should show significantly less response suppression in a subsequent CER test than nonblocked subjects.

Another hypothesis of the present investigation considered the possibility that conditioning may be occurring to aspects of the conditioning environment <u>per se</u>. Some evidence from pilot studies conducted by the writer suggested that animals which were supposedly nonblocked in the conditioning apparatus (shuttle box) showed little difference in subsequent CER tests when compared to blocked experimental animals. Thus, it seems that the conditioning environment *per se* was acquiring special properties. This is especially interesting since only the auditory CS has "useful informational value" for the animal. In order to evaluate the nonblocked effect that the CS-environment (compartment of the shuttle box) has on response suppression, two nonblocked groups were included. One nonblocked group was nonblocked in a compartment of the shuttle box, the other was nonblocked in the animals' home cage. The hypothesis was that the conditioning environment *per se* would acquire special CS properties which would actually be blocked even though the auditory CS did not come on during Condition A-NBSB. This led to the prediction that animals nonblocked in the shuttle box would show less suppression when compared to animals nonblocked in their home cages.

The present study was also interested in evaluating the effectiveness of the response prevention procedure when conditioned fear was learned under two different conditions. One condition, avoidance, provided the animal with the opportunity to learn to actively avoid the UCS. The second condition, classical-defensive, did not afford the animal the opportunity to avoid the UCS. No differences in response suppression were expected between these groups if two-process theory is correct; that is, if fear is learned merely as a function of CS-UCS pairings. In this case, the presence of an active response should not influence the amount of fear conditioned to the CS. The design of the study is presented in Table 1, page 21.

METHOD

Subjects

The subjects were 70 experimentally-naive female albino rats from the Charles River Breeding Laboratories. The rats were housed individually upon their arrival in the laboratory and they were fed Wayne Lab-Blox brand food pellets on an ad lib schedule. They ranged from 60 to 130 days of age when used in the study.

Apparatus

The avoidance apparatus was a modified Miller-Mowrer shuttle box, 51 cm. long, 25.5 cm. high and 16.5 cm. wide. It had metal sides, a clear Plexiglas ceiling roof and brass grids spaced 1.25 cm. apart as the floor. The box was divided by a metal wall which had a 11.5 x 9 cm. opening through which rats could pass. A black door fitted into the opening such that when present, rats could not shuttle from one side to the other.

The shuttle box was located in a small experimental laboratory room. Two house lights in the ceiling of the room provided constant light in the shuttle box through the Plexiglas ceiling. The CS was an 85 db white noise delivered through either of two speakers mounted on either end of the shuttle box. The UCS was a matched-impedance scrambled shock of 225 V. a.c. with 150-K ohm resistance, in series with the rat.

Two lever boxes, 24 cm. long, 20.5 cm. wide and 19.75 cm. high were located in a second laboratory room. They each were located in their own separate sound-deadening chamber that was illuminated by a 15-w. bulb mounted on the rear wall. The CS was delivered to the lever boxes through speakers mounted on the ceiling of each box. All experimental equipment was programmed automatically using standard electromechanical programming equipment.

Procedure

All animals were reduced to 75-80% of their pre-experimental body weight one week prior to participating in the experiment. Animals were maintained at this body weight by employing a 23-hour food deprivation schedule throughout the entire experiment. Water was continuously available in the home cages.

All animals were treated identically during Phases I and III.

Phase I - magazine and bar-press training. During session one all animals were placed in a lever box for a period of three hours. During the first hour noyes pellets were available on a CRF schedule. Also, free pellets were provided at five-min. intervals. Animals were gradually shaped to a VI 2 schedule. This part of session one and all further sessions in the lever box lasted two hours.

During sessions two to five animals were conditioned to press on a VI 2 schedule. For inclusion in the study subjects had to meet a criterion of at least 1500 responses per session for sessions three to five.

Phase II - conditioning and blocking. Each of the 70 animals was randomly assigned to one of seven groups. Approximately 24 hours after the fifth session, each animal was individually run in the shuttle box. All animals were given a five-min. adaptation period in the shuttle box during which the CS tone was not present. During this period crosses from one side of the apparatus to the other were counted and at least two crosses were required for inclusion in the study. All animals except those in the Sensitization Control Condition initially received either three unavoidable CS-UCS pairings or three unavoidable UCS-CS presentations depending on their experimental condition.

Avoidance training and blocking - Three of the seven groups were trained to avoid the UCS to a criterion of 10 successive avoidances. The CS-UCS interval was 20 sec. If the animal made the appropriate avoidance response (shuttling to the opposite side of the apparatus) during this 20-sec. interval, the 85 db white noise CS was terminated. If the animal failed to avoid during the 20-sec. CS-UCS interval, then the UCS (225 V, a.c. shock) came on until an escape response was made. Upon the completion of the escape response, both the CS and UCS terminated. Intertrial intervals were arranged according to a predetermined variable one minute schedule. Upon reaching the 10 consecutive avoidances criterion, avoidance-trained animals (A) were immediately subjected to one of three treatments: Blocked (A-B), Nonblocked-in-Home-Cage (A-NBHC), or Nonblocked-in-Shuttle-Box (A-NBSB), for a period of 20 min. Table 1 summarizes all the conditions used in the study.

Animals in the A-B group remained on the side of the box to which they last ran. The door was placed between the two sides of the box thus preventing further crossings. The CS was presented for 15, 20-sec. periods with a variable one-minute inter-stimulus interval. Animals in the A-NBSB group were treated identically to animals in the A-B group except the auditory CS was not presented. Animals in the A-NBHC group, upon reaching the avoidance criterion, were removed from the apparatus and placed in their home cages for 20 min. This was the amount of time needed for the A-B and the A-NBSB procedures. The cage remained in the laboratory room.

Classical-defensive training and blocking - Two groups were trained in a classical-defensive paradigm. The CS-UCS interval was 20 sec. One classical-defensive group (CD-B) was blocked in the shuttle box. The auditory CS was presented for 15, 20-sec. periods with a variable one minute inter-stimulus-interval. Animals in the other Classical-

TABLE 1

Design of the Study

	Avoidance Conditioning (A)	Classical Defensive Conditioning (CD)	Backward Control (BC)	Sensitization Control (SC)
Blocked (B)	A-B	CD-B[a]		
Non-Blocked in Home Cage (NBHC)	A-NBHC	CD-NBHC[a]	BC-NBHC[b]	SC-NBHC[c]
Non-Blocked in Shuttle Box (NBSB)	A-NBSB			

Note.- N of each cell = 10.

a. Subjects matched to A-B in terms of number, duration, sequence of CS, UCS exposures, as well as number of CS exposures beyond those paired with UCSs.

b. Subjects matched to A-NBHC in terms of number, duration, sequence of CS, UCS exposures, as well as number of CS exposures beyond those paired with UCSs.

c. Subjects matched to A-NBHC in terms of number, duration and sequence of CS exposures.

Defensive group (CD-NBHC) were nonblocked in their home cages for 20 min. in order to maintain timing controls. Animals in both Classical-Defensive groups were matched to subjects in the A-B group with regard to number of CS and UCS pairings, their order in the series of stimulus trials, duration of CS and UCS, as well as number of CS presentations beyond those that were paired with UCSs. These additional CS presentations were given after the appropriate number of pairings had been presented.

Control groups - Two control groups were run: a backward conditioning control group (BC-NBHC) and a sensitization control group (SC-NBHC). Animals in both control groups were nonblocked in their home cages. This procedure was followed because it was expected that if any conditioning occurred in these control conditions it would be most observable in a condition in which the animals were nonblocked in their home cages.

Animals in the backward conditioning control group always received the UCS from 5 to 10 sec. prior to the CS onset. The ISI was determined randomly. Animals in this group were matched to animals in group A-NBHC in terms of the number of stimulus pairings, their position in the series of stimulus trials, as well as the duration of the CS and the UCS.

Animals in the sensitization control group received CS presentations only. These animals were also matched to animals in group A-NBHC in terms of the number, order and duration of CS presentations.

Phase III - CER test for fear. Immediately after completing Phase II, each animal was placed into the lever box and bar pressing was once again reinforced on a VI 2 schedule. After animals had been pressing for 4 min., a series of 24, 20-sec. auditory CS periods were presented with an inter-presentation interval of 4 min. Bar presses for each CS period, as well as for 20-sec. pre-CS periods and post-CS periods were recorded. The UCS was never presented in the lever box. Fear of the CS was measured by a "suppression-ratio" (Annau & Kamin, 1961) which contrasts the animal's pressing rate during the 20-sec. CS with its rate during the immediately preceding 20 sec. The ratio used was B/A+B, with B representing number of bar presses during the CS and A representing the number of bar presses during the 20 sec. before CS onset. Thus, a ratio of .50 represented no effect of the CS; a ratio of 0 represented complete suppression of responding during the CS; and a ratio greater than .50 represented increased pressing during the CS compared to the preceding 20 sec. This particular measure of response suppression was selected because it is well established by precedent in the literature which measures fear after avoidance conditioning (e.g., Kamin, Brimer & Black, 1963).

RESULTS

Avoidance Training

It was necessary to assess the acquisition of avoidance responding for each avoidance-trained group (Conditions A-B, A-NBHC and A-NBSB) so that the effect of blocking could be properly evaluated. Because all the groups were treated identically through training, it was expected that no differences would occur in avoidance learning. Three measures taken during avoidance training were considered. These were: (1) total number of trials; (2) total number of avoidance responses; and (3) total UCS time. Each of these measures was made from the first conditioning trial until the criterion of 10 consecutive avoidance responses was met. The means and standard deviations of these data are presented in Table 2. As illustrated in this table, these data do not differ in any systematic way nor do differences between the groups appear large.

Three One-Way Analyses of Variance were done comparing the three avoidance conditions on these three measures. Analyses of Variance Summary Tables for these analyses are presented in Tables 1, 2 and 3 of the Appendix. The first analysis considered the total number of trials. The resulting F value was 1.55 (df = 2/27). The second analysis considered the total number of avoidance responses. The resulting F value was 1.69 (df = 2/27). The third analysis considered the total amount of UCS time in sec. Here

TABLE 2

Means and Standard Deviations of Total Number of Trials, Avoidance Responses and Total UCS Time During Avoidance Training

Condition		Trials	Avoidance Responses	UCS Time (in sec.)
A-B	M	26.80	16.00	9.00
	SD	8.18	2.40	8.62
A-NBHC	M	33.40	18.10	13.44
	SD	9.81	4.24	5.94
A-NBSB	M	29.20	19.90	8.38
	SD	7.29	6.30	5.85

F = 2.19, df = 2/27. All F values were found to be non-significant. This is an indication that there were no significant differences among the avoidance-conditioned groups on the measures taken at the end of avoidance training.

Responding During First Pre-CS Period of CER Phase

It was necessary to assess the overall response rate of each group independent of the effect of CS periods so that any overall effect of blocking could be evaluated. To this end, the response rate during the first 20-sec. pre-CS period was measured for animals in each condition. The means and standard deviations of these data are presented in Table 3.

A One-Way Analysis of Variance was done comparing all conditions on this measure of overall responding. The Analysis of Variance Summary Table for this analysis is presented in Table 4 of the Appendix. The resulting F value (F = 1.21, df = 6/63) was not significant. This is an indication that the experimental conditions did not differentially influence overall rate of pre-CS responding.

CER Test for Fear

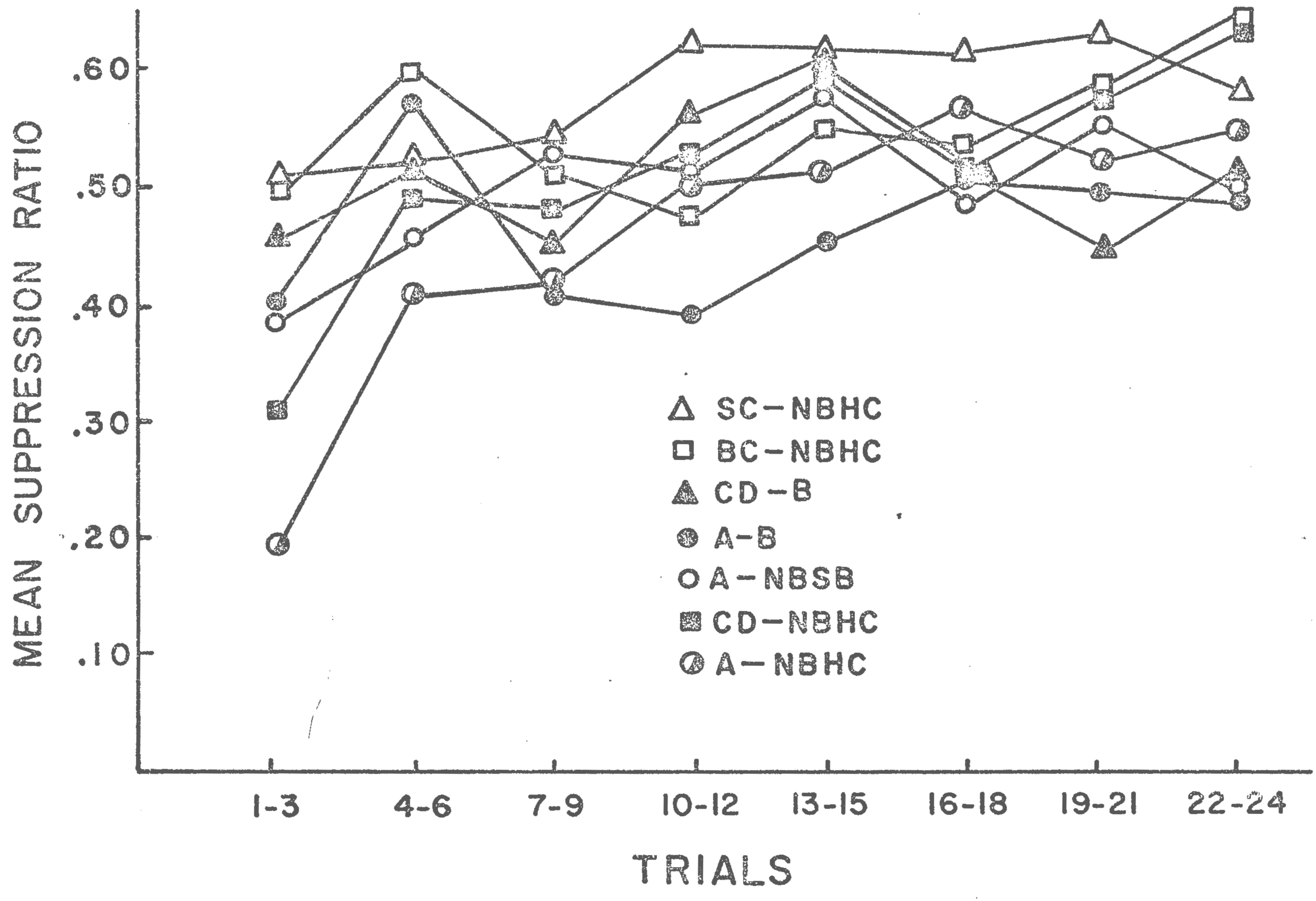
In order to get an overall indication of the amount of response suppression that each condition showed to the CS during Phase III, suppression ratios were calculated and averaged across the eight blocks of three trials for each of the seven conditions. These data are presented in Fig. 1. It is apparent from Fig. 1 that there is a great deal

TABLE 3

Means and Standard Deviations of Total Number of Responses During the First Pre-CS Period for All Conditions

Condition	M	SD
A-B	5.70	4.40
A-NBHC	6.10	4.12
A-NBSB	9.10	2.77
CD-B	5.00	3.40
CD-NBHC	6.90	3.54
SC-NBHC	6.80	3.74
BC-NBHC	7.40	4.40

Fig. 1. Mean suppression ratio over three-trial blocks for all conditions


MEAN SUPPRESSION RATIO
.60
.50
.40
.30
.20
.10
SC–NBHC
BC–NBHC
CD–B
A–B
A–NBSB
CD–NBHC
A–NBHC
1-3
4-6
7-9
10-12
13-15
16-18
19-21
22-24
TRIALS

of suppression for some conditions over the first three trials and that there is somewhat less suppression through about Trial 12. Trials 13-24 show essentially no suppression. Since treatment effects appear to be present mainly on Trials 1-12, Trials 13-24 were not considered in further analyses. Recovery of responding such as that found in the present results is not unusual when compared to that found in similar transfer paradigms (e.g., Kamin, Brimer & Black, 1963).

Avoidance conditions. Since Fig. 1 presents a rather confusing picture, suppression data for the avoidance-trained conditions have been illustrated separately in Fig. 2. The means and standard deviations of the suppression ratios over three-trial blocks for avoidance-trained conditions are presented in Table 4. Since Trials 1-12 contain a great deal of information, the overall results of these trials are presented and analyzed first. Next, a finer analysis has been made of Trials 1-3. Finally, Trial 1 has been analyzed separately.

To assess suppression ratio differences across Trials 1-12 for the three avoidance-trained conditions, a Two-Way Repeated Measures Analyses of Variance was performed on the mean response suppression ratio for blocks of three trials. The Analysis of Variance Summary Table for this analysis is presented in Table 5 of the Appendix. Results of this analysis showed a significant conditions effect,

Fig. 2. Mean suppression ratio over three-trial blocks for avoidance-trained conditions

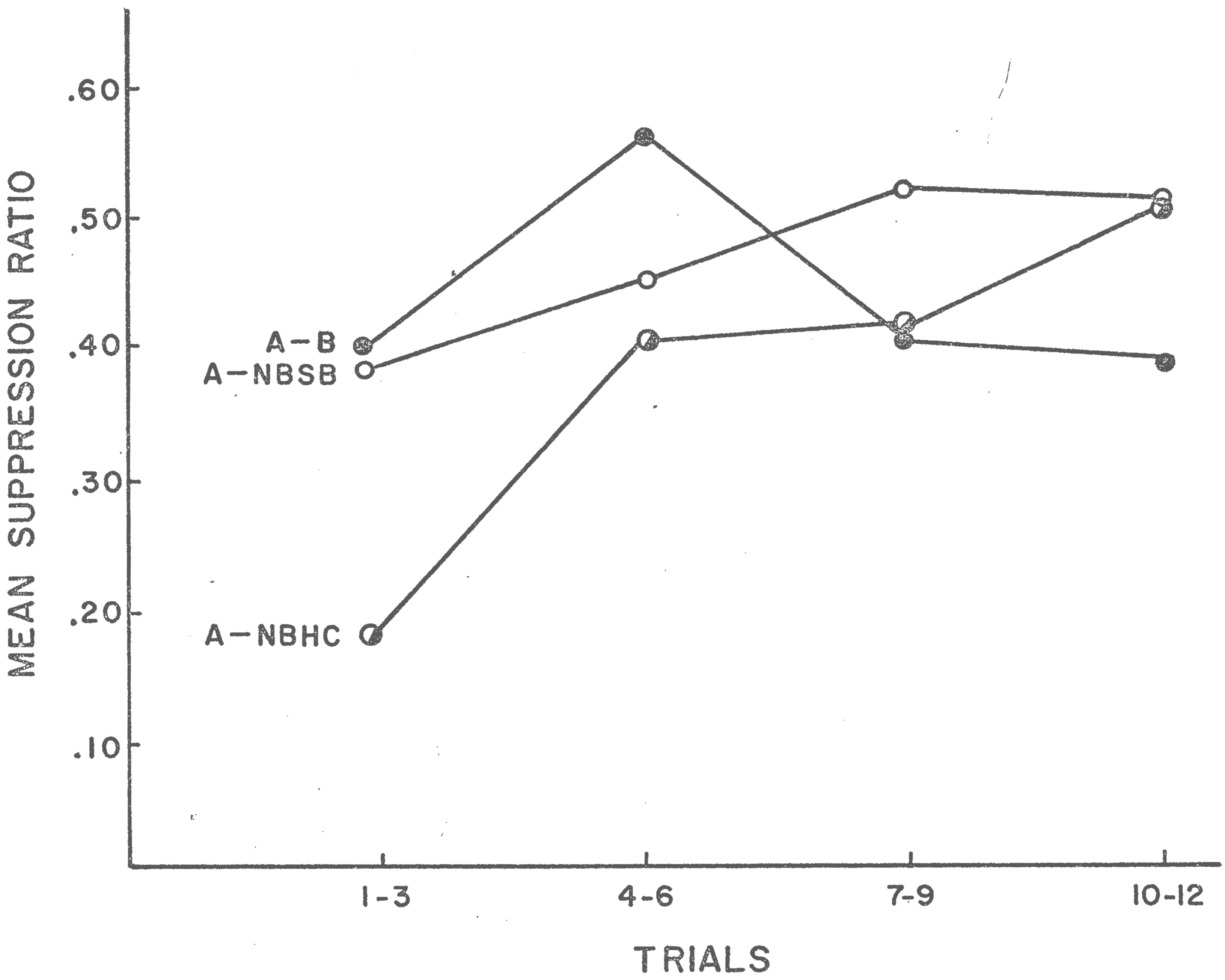

MEAN SUPPRESSION RATIO
.60
.50
.40
.30
.20
.10
A-B
A-NBSB
A-NBHC
1-3
4-6
7-9
10-12
TRIALS

TABLE 4

Means and Standard Deviations of Suppression Ratios Over Three-Trial Blocks for Avoidance-Trained Conditions

Condition		Trials			
		1-3	4-6	7-9	10-12
A-B	M	.40	.56	.41	.39
	SD	.23	.16	.17	.20
A-NBSB	M	.39	.45	.53	.52
	SD	.17	.15	.11	.16
A-NBHC	M	.18	.41	.42	.50
	SD	.15	.21	.15	.20

$F = 6.20$, $df = 2/87$, $p < .01$, a significant trials effect, $F = 15.71$, $df = 3/261$, $p < .01$, as well as a significant conditions by trials interaction, $F = 7.70$, $df = 6/261$, $p < .01$. Since both the trials effect and the interaction are apparent from Fig. 2, multiple comparisons were done only on the conditions effect. Dunn's multiple comparison procedure was employed since the comparisons had been preplanned and there were relatively few comparisons to be made. According to Dunn's test, Condition A-NBHC was significantly different from Conditions A-NBSB and A-B, $p < .01$ and $p < .05$, respectively. Thus, the most response suppression across the first 12 trials was found in Condition A-NBHC. Conditions A-B and A-NBSB showed significantly less response suppression and they did not significantly differ from each other.

To more carefully assess differences in suppression ratios across Trials 1-3 for avoidance-trained conditions, mean suppression ratios for these trials were plotted and are illustrated in Fig. 3. The means and standard deviations of these data are presented in Table 5. It is apparent from Fig. 3 that Condition A-NBHC shows more suppression than Conditions A-B and A-NBSB. In order to test this difference, a Two-Way Repeated Measures Analysis of Variance was done on the mean response suppression ratio for each condition on Trials 1, 2 and 3. The Analysis of Variance Summary Table for this analysis is presented

Fig. 3. Mean suppression ratio over Trials 1, 2 and 3, for avoidance-trained conditions

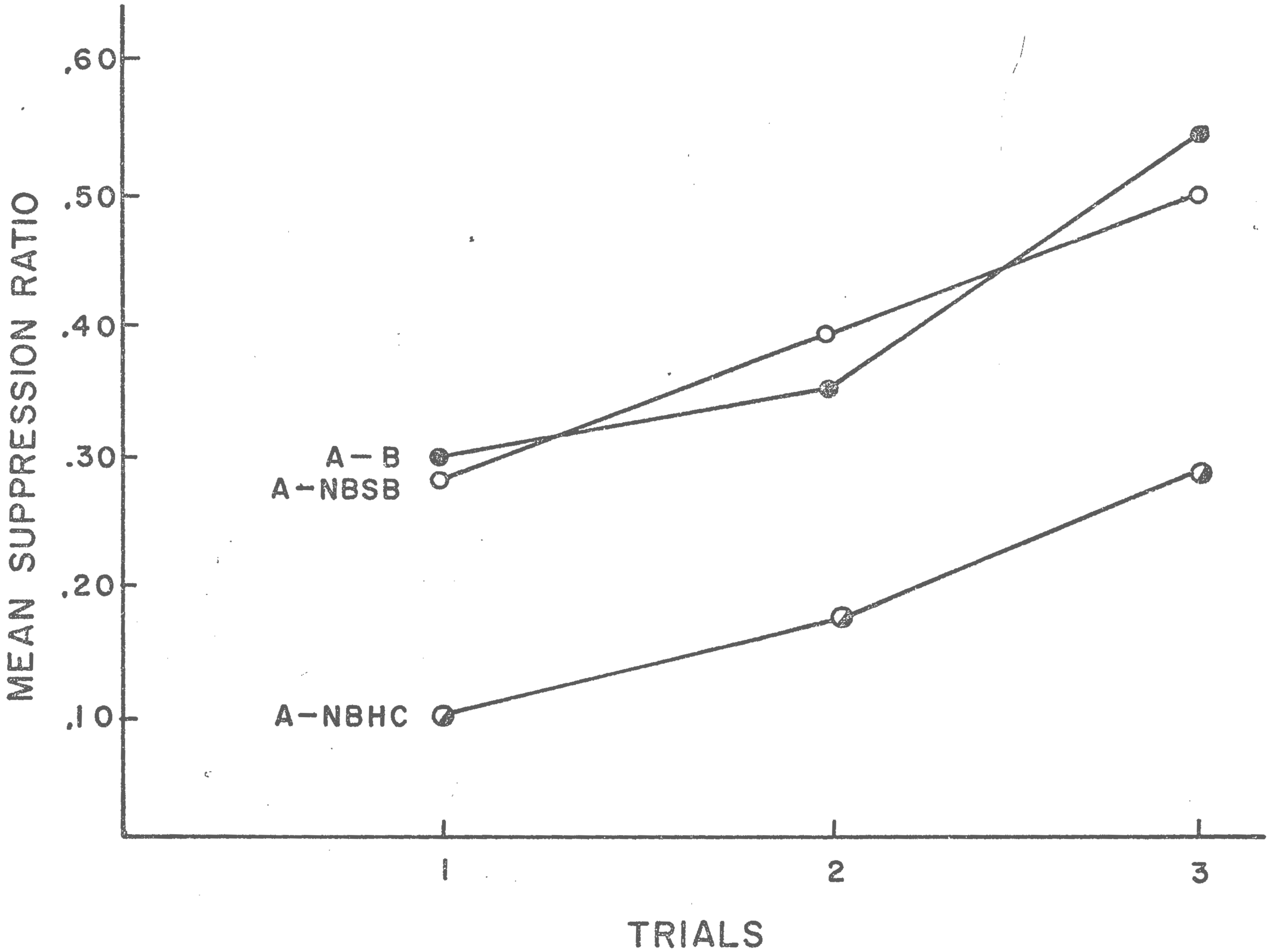

MEAN SUPPRESSION RATIO
.60
.50
.40
.30
.20
.10
A — B
A – NBSB
A – NBHC
1
2
3
TRIALS

TABLE 5

Means and Standard Deviations of Suppression Ratios for Trials 1, 2 and 3 for Avoidance-Trained Conditions

Condition		Trials 1	2	3
A-B	M	.30	.35	.55
	SD	.26	.16	.20
A-NBSB	M	.29	.40	.50
	SD	.17	.07	.20
A-NBHC	M	.10	.17	.28
	SD	.13	.15	.13

in Table 6 of the Appendix. Results of this analysis showed a significant conditions effect, $F = 9.92$, $df = 2/27$, $p < .01$, as well as a significant trials effect, $F = 15.56$, $df = 2/54$, $p < .01$. According to a Dunn's test, Condition A-NBHC significantly differed from Condition A-B and from Condition A-NBSB, both $p < .01$. The significant trials effect is apparent from Fig. 3. As is also apparent in Fig. 3, Conditions A-B and A-NBSB were not significantly different from each other.

To more completely assess suppression differences between avoidance-trained conditions on Trial 1, Dunn's multiple comparison procedure was employed. Dunn's procedure was used in this analysis because these comparisons had been planned and an overall F ratio had not been calculated on these data. Results of Dunn's procedure showed that on Trial 1, Condition A-NBHC significantly differed from both Conditions A-B and A-NBSB, $p < .05$.

Classical-defensive conditions. Mean response suppression ratios for the Classical-Defensive Conditions (Conditions CD-B and CD-NBHC) were plotted and are illustrated in Fig. 4. The means and standard deviations of these data are presented in Table 6. It is apparent in Fig. 4 that only Trials 1-3 show considerable suppression. Fig. 4 also shows considerably more suppression for Condition CD-NBHC as compared to Condition CD-B on Trials 1-3.

To more completely assess suppression differences

Fig. 4. Mean suppression ratio over three-trial blocks for classical-defensive-trained conditions

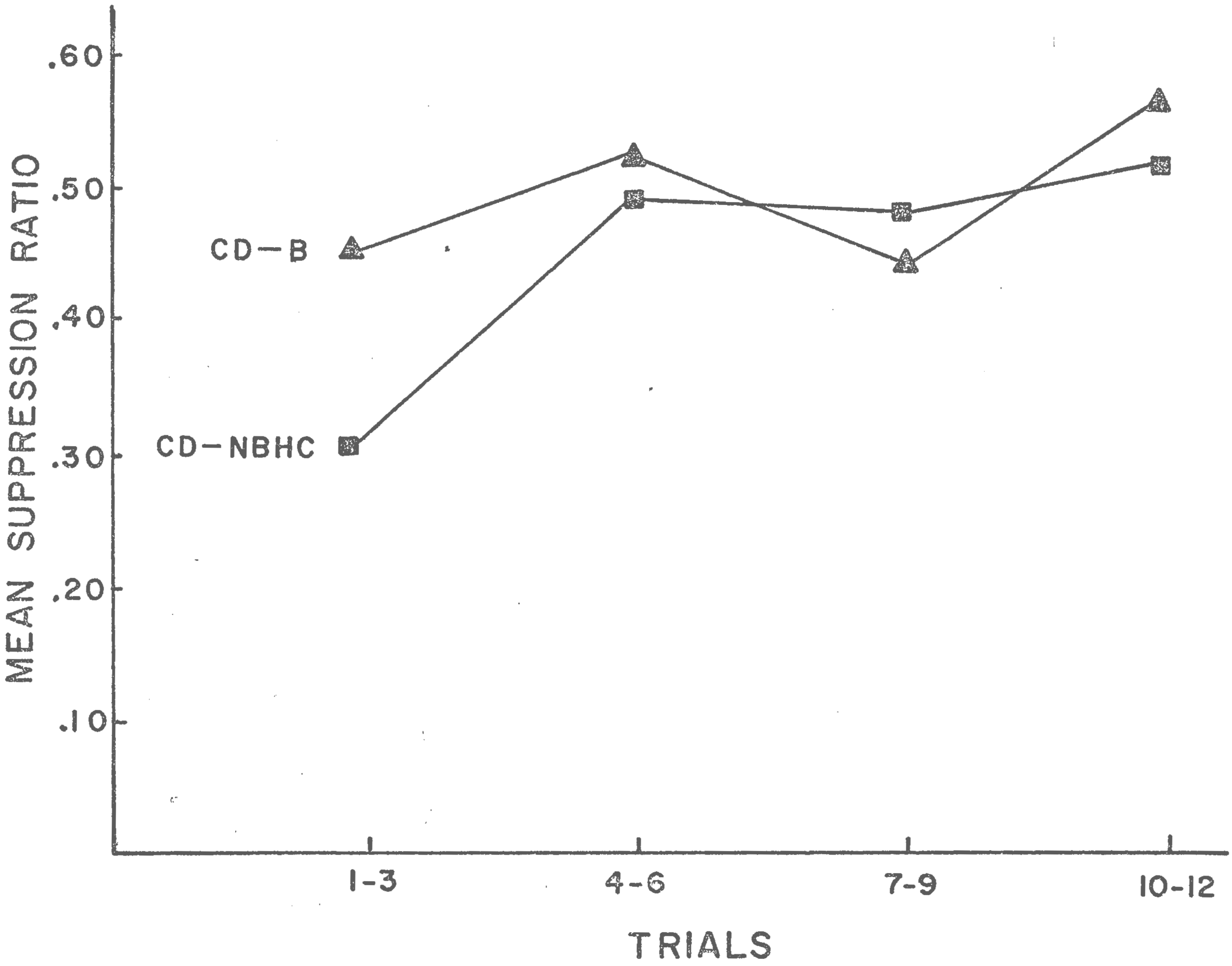

MEAN SUPPRESSION RATIO
.60
.50
.40
.30
.20
.10
CD—B
CD—NBHC
1-3
4-6
7-9
10-12
TRIALS

TABLE 6

Means and Standard Deviations of Suppression Ratios Over Three-Trial Blocks for Classical-Defensive-Trained Conditions

Condition		Trials			
		1-3	4-6	7-9	10-12
CD-B	M	.45	.52	.44	.56
	SD	.17	.15	.19	.18
CD-NBHC	M	.31	.49	.48	.52
	SD	.22	.24	.18	.21

across Trials 1-3 for Conditions CD-B and CD-NBHC, mean suppression ratios for these conditions on Trials 1-3 were plotted and are illustrated in Fig. 5. The means and standard deviations of these data are presented in Table 7. Also illustrated in Fig. 5 are the mean suppression ratios for Condition A-B, to which Conditions CD-B and CD-NBHC had been matched. Fig. 5 suggests that most of the suppresion difference between Conditions CD-B and CD-NBHC, is due to the difference on Trial 1 where Condition CD-NBHC shows far more suppression than does Condition CD-B.

In order to assess differences between Conditions CD-B and CD-NBHC as well as to compare these conditions to Condition A-B, to which they had been matched, a Two-Way Repeated Measures Analysis of Variance was done comparing mean response suppression ratios of these three conditions on Trials 1-3. The Analysis of Variance Summary Table for this analysis is presented in Table 7 of the Appendix. Results of this analysis showed only a significant trials effect, $F = 11.35$, $\underline{df} = 2/54$, $\underline{p} < .01$. Both the conditions effect and the interaction were nonsignificant.

To more completely assess suppression differences between Conditions CD-B, CD-NBHC and A-B on Trial 1, Dunn's multiple comparison procedure was employed. Results of Dunn's procedure showed that on Trial 1 the only significant difference was between Conditions CD-B and CD-NBHC, $\underline{p} < .01$. This suggests that blocking significantly reduces

Fig. 5. Mean suppression ratio on Trials 1, 2 and 3, for classical-defensive-trained conditions and condition A-B

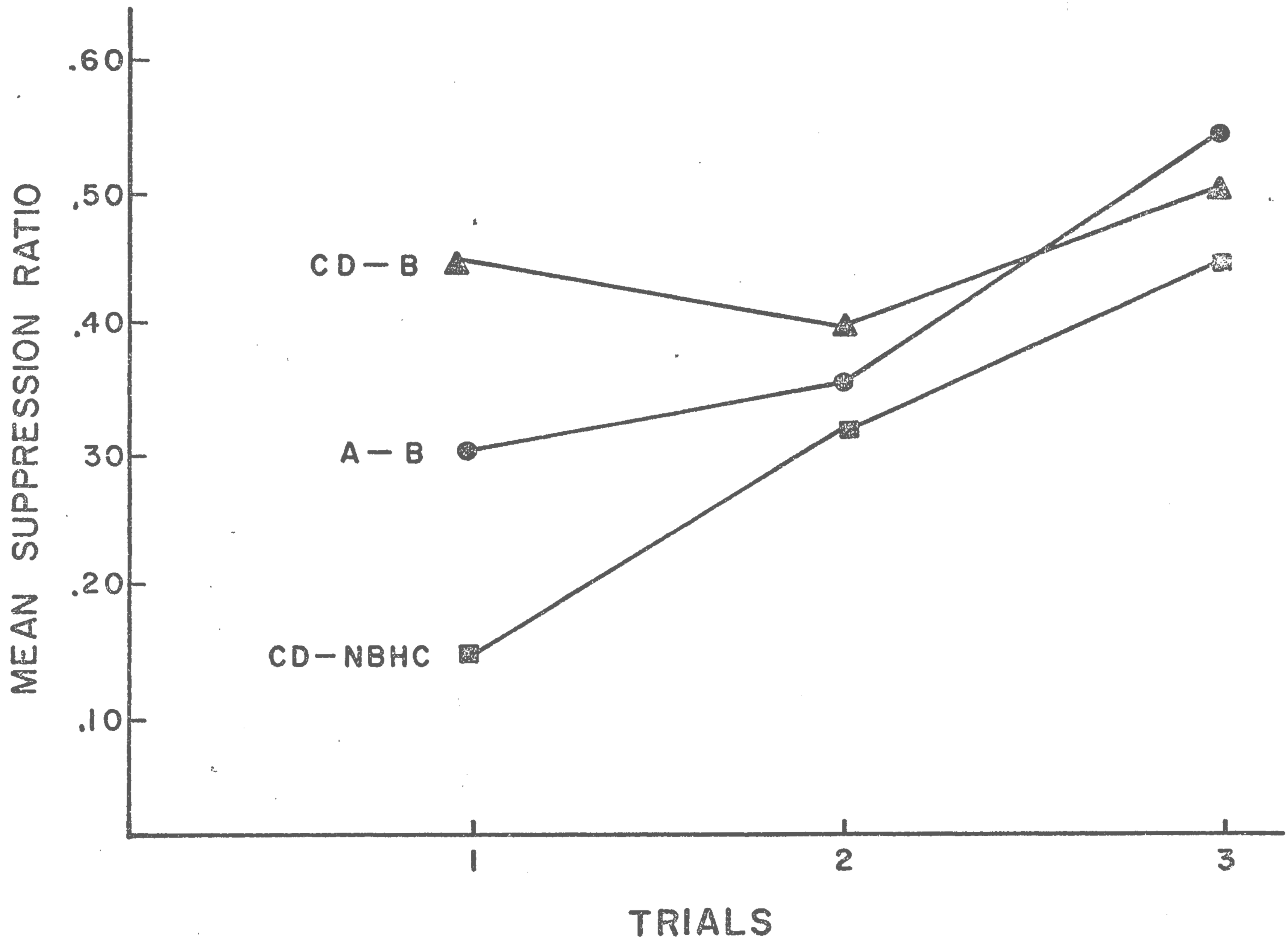

MEAN SUPPRESSION RATIO
.60
.50
.40
30
.20
.10
CD—B
A—B
CD—NBHC
1
2
3
TRIALS

TABLE 7

Means and Standard Deviations of Suppression Ratios for Trials 1, 2 and 3 for Classical-Defensive-Trained Conditions

Condition		Trial 1	Trial 2	Trial 3
CD-B	M	.45	.39	.50
	SD	.21	.20	.09
CD-NBHC	M	.14	.32	.45
	SD	.15	.18	.20

suppression when fear is learned in a classical-defensive paradigm.

Control conditions. To assess any differences in the control conditions, Conditions BC-NBHC and SC-NBHC, for Trials 1-3, where most other treatment effects seem to have occurred, mean response suppression ratios for the two control conditions were plotted and are illustrated in Fig. 6. The means and standard deviations of these data are presented in Table 8. It is clear from Fig. 6 that Conditions BC-NBHC and SC-NBHC show essentially no response suppression and produce very similar response patterns. Also plotted in Fig. 6 are mean suppression ratios on Trials 1, 2 and 3 for Condition A-NBHC to which both control conditions had been matched. Here it is quite clear that Condition A-NBHC differs from the two control conditions on Trials 1, 2 and 3.

In order to assess the differences between the conditions illustrated in Fig. 6, a Two-Way Repeated Measures Analysis of Variance was done on the mean response suppression ratio on each of the three trials. The Analysis of Variance Summary Table for this analysis is presented in Table 8 of the Appendix. Results of this analysis show a highly significant conditions effect, $F = 32.65$, $\underline{df} = 2.27$, $\underline{p} < .01$. Both trial and interaction effects were nonsignificant. Dunn's multiple comparison procedure was employed to compare differences among the

Fig. 6. Mean suppression ratio on Trials 1, 2 and 3, for control conditions and Condition A-NBHC

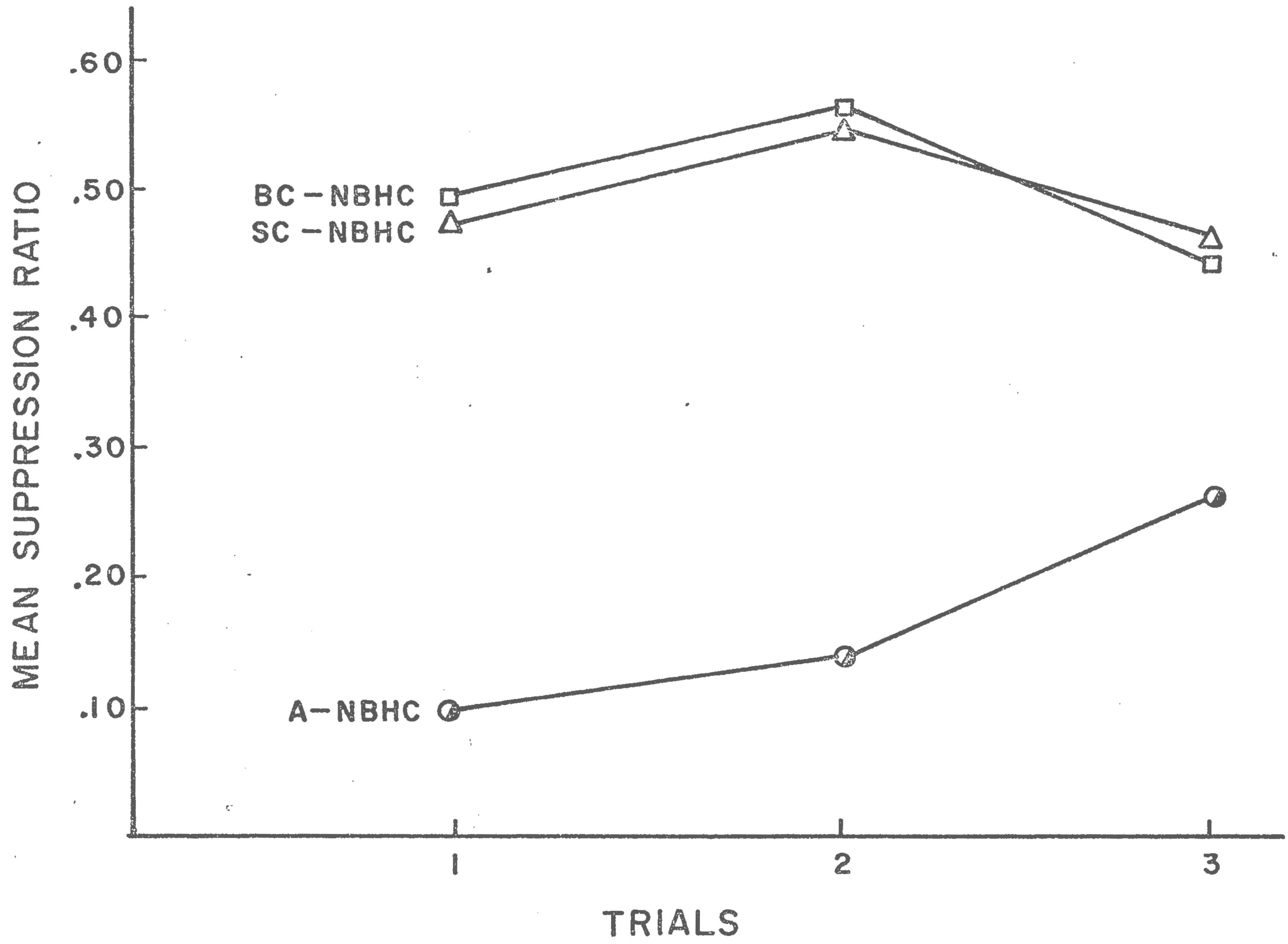

MEAN SUPPRESSION RATIO
.60
.50
.40
.30
.20
.10
BC-NBHC
SC-NBHC
A-NBHC
1
2
3
TRIALS

TABLE 8

Means and Standard Deviations of Suppression Ratios for Trials 1, 2 and 3 of Control Conditions

Condition		Trial 1	2	3
BC-NBHC	M	.48	.55	.45
	SD	.21	.22	.06
SC-NBHC	M	.47	.54	.46
	SD	.20	.15	.14

conditions. According to Dunn's procedure, Condition A-NBHC significantly differed from both Conditions BC-NBHC and SC-NBHC ($p < .01$).

DISCUSSION

The major hypothesis of the present study, that fear of an auditory CS (conditioned in an avoidance paradigm) would be reduced after response prevention, was supported. The results over Trials 1-12 showed significantly more response suppression for Condition A-NBHC as compared to Condition A-B. Finer analyses done respectively on Trials 1-3, and on Trial 1 showed similar results. These data indicate that the animals' fear of the white noise CS was reduced as a function of the blocking treatment. These results, in general, support Solomon, Kamin and Wynne's (1953) original theoretical assumption that avoidance reduction after response prevention treatments may be a function of a weakened classically conditioned fear response to the CS. The results also corroborate those of other studies (e.g., Baum, 1969a; Berman & Katzev, 1972; and Spring, Prochaska & Smith, 1974) which suggest that response prevention reduces fear to the CS. However, a distinction should be made between those studies which merely report a reduction in avoidance behavior as a result of response prevention and those, such as the present study, which report a reduction in measured effects of fear to the CS as a result of response prevention. That these two results do not necessarily parallel each other has been pointed out by Kamin, Brimer and Black (1963) who demonstrated that even after avoidance behavior had been extinguished, there was still a good deal of the effects of fear to the CS as measured by a CER technique.

In should also be pointed out that response prevention in the present study did not completely eliminate the fear response to the CS. Indeed, there was significant response suppression on Trial 1 for Condition A-B when compared to Control Conditions BC-NBHC and SC-NBHC ($t = 2.24$, $p < .05$). This suggests that blocked animals were still somewhat fearful of the CS although they were significantly less fearful than animals nonblocked in their home cages.

The fact that blocked animals were still somewhat fearful of the CS suggests a possible explanation linking those studies which report that response blocking does not lead to a reduction of fear (e.g., Page & Hall, 1953; Coulter, Riccio & Page, 1969) and those studies that suggest that it does lead to a reduction of fear (e.g., Baum, 1969a). Perhaps differences in the amount of fear existing after blocking have been one source of the discrepancy in the response prevention literature. Less sensitive measures of the effects of fear (e.g., approach into the CS area or extinction of the conditioned avoidance response) might not have detected the differences between complete fear elimination and a partial reduction in fear to the CS, whereas the CER technique did. An example of difficulties arising from insensitive fear measures may be found in Spring's (1973) study in which he reports that although animals would not escape an old CS, they would not approach it either. Thus, it is possible that studies which have used less sensitive fear measures might have succeeded in partially reducing fear to the CS but this partial fear reduction may have gone undetected due to the lack of sensitivity in the fear measure.

The second hypothesis of the study was that the conditioning environment *per se* would acquire special TS properties which would actually be blocked even though the white noise CS did not come on. This led to the prediction that animals nonblocked in the shuttle box would show less suppression than animals nonblocked in their home cages. The results supported this hypothesis and prediction. Results on Trials 1-12 showed significantly more response suppression for Condition A-NBHC than for Condition A-NBSB. Finer analyses done respectively on Trials 1-3 and on Trial 1 showed similar results. These results suggest that the conditioning environment *per se* did acquire special CS properties which were blocked in Condition A-NBSB.

In fact, it was found that response suppression in Condition A-B did not significantly differ from response suppression in Condition A-NBSB. This suggests that blocking in the CS environment is equally effective regardless of whether or not the discriminative CS is presented. This finding is somewhat difficult to interpret since in the shuttle box situation it is assumed that only the white noise CS reliably signaled the UCS (shock). Other stimuli in the environment should have become relatively redundant. This would not be true in an alley or other one-way apparatuses where one might expect spatial cues to be more informative and therefore more critical in blocking.

These results suggest that perhaps the entire conditioning environment acquired aversive properties which were subsequently blocked during Condition A-NBSB even though the white noise CS did not come on. This blocked or reduced fear to the conditioning environment could have generalized to the discriminated CS in the lever box during the CER test phase. This would have produced a reduction in response suppression in Condition A-NBSB.

Another purpose of the present investigation was to evaluate the effectiveness of blocking when fear to the CS was learned under two different conditions. The Avoidance Condition provided the animal with the opportunity to control its environment to the extent that it learned to actively avoid the UCS. The Classical-Defensive Condition did not afford the animal the opportunity to control its environment in that it could not avoid the UCS. That is, the UCS was presented regardless of the animal's behavior.

Results of the Analysis of Variance which was done over Trials 1-3 comparing response suppression for Conditions CD-B, CD-NBHC and A-B showed a nonsignificant effect of conditions. This is probably due to the fact that although there are some apparent differences on Trial 1, Trials 2 and 3 show similar response patterns (see Fig. 5).

To further investigate whether avoidance training and classical-conditioning interact differently with blocking as well as to investigate the apparent decrease in the response suppression ratio for group A-B on Trials 10-12 which is apparent in Figs. 1 and 2, additional analyses were conducted. The first additional analysis was a Two-Way Repeated Measures Analysis of Variance comparing Conditions A-B and CD-B, with Conditions A-NBHC and CD-NBHC on Trial Block 1-3. The Analysis of Variance Summary Table for this analysis is presented in Table 9 of the Appendix. The results of this analysis showed Condition A-B to have significantly more response suppression than Condition CD-B, $F = 4.58$, $\underline{df} = 1/58$, $\underline{p} < .05$. Condition A-NBHC showed significantly more response suppression than Condition CD-NBHC, $F = 29.45$, $\underline{df} = 1/58$, $\underline{p} < .01$. The interaction was not significant.

The second analysis was a Two-Way Repeated Measures Analysis of Variance comparing Conditions A-B and CD-B with Conditions A-NBHC and CD-NBHC on Trial-Block 10-12. The Analysis of Variance Summary table for this analysis is presented in Table 10 of the Appendix. The results of this analysis showed Condition A-B to have significantly more response suppression than Condition CD-B, $F = 4.71$, $\underline{df} = 1/58$, $\underline{p} < .05$. No differences were found between the nonblocked conditions. However, there was a significant interaction between conditioning and blocking treatments, $F = 4.99$, $\underline{df} = 1/58$, $\underline{p} < .05$.

Results of these analyses suggest that there are different amounts of fear conditioned in each paradigm and that blocking interacts differently with the effects of fear depending upon the conditioning paradigm. These findings do not generally support a two-factor theory which would predict equal fear conditioning in either the avoidance or classical paradigms. A possible factor contributing to the differences obtained may be the fact that the ten extinction trials were given before the CER Phase (the ten criterion trials). These extinction trials may have had differential effects on the A-B and CD-B animals.

The fact that the apparent decrease in the response suppression ratio for Condition A-B appears real is somewhat difficult to explain. It may suggest that the fear-reducing effects of blocking are longer-lasting when fear is learned in a classical rather than an avoidance paradigm. Alternatively, it may suggest some kind of incubation of fear phenomenon. A test of the reliability of this finding would seem to be a potentially worthwhile investigation.

Another source of support for the idea that blocking reduces fear to the CS comes from the analysis which was done comparing Conditions CD-B and CD-NBHC on Trial 1. Condition CD-B showed significantly less suppression than did Condition CD-NBHC. This suggests that animals in Condition CD-B had less fear to the CS than did animals in Condition CD-NBHC. It should be pointed out, however, that this difference existed only on Trial 1. This is illustrated in Fig. 5. Other trials showed essentially similar responding for the two classically-conditioned groups. Thus, it seems that the nonblocked classically-conditioned animals recover from fear to the CS more quickly than nonblocked avoidance-conditioned animals.

Results of the Analysis of Variance done on the mean response suppression ratio for the first three trials of Control Conditions BC-NBHC and SC-NBHC and Avoidance-Trained Condition A-NBHC (to which both control groups had been matched) showed a highly significant conditions effect. Both the backward conditioning control and the sensitization control condition significantly differed from Condition A-NBHC. This difference is clearly illustrated in Fig. 6. Also illustrated in Fig. 6 is the fact that both control conditions showed very similar response patterns on Trials 1-3. Although both conditions showed a very slight amount of response suppression on Trial 1, this effect was so minor that it did not warrant further consideration. The fact that the control conditions did not show a significant amount of response suppression and that they did significantly differ from Condition A-NBHC suggests that the response suppression found in Condition A-NBHC was due to the CS-UCS contingency rather than to any pseudoconditioning or sensitization phenomena.

Although considerable care must be exercised in extrapolating the present findings to the clinical setting, several generalized implications may be useful in contributing guidelines to a subhuman analogue of Implosive Therapy. Also, generalizations and suggestions may be offered for the use of response prevention procedures with humans who are in need of treatment for a conditioned fear. Such generalizations must be made cautiously, particularly since cognitive variables (e.g., demand characteristics) are known to effect human responses to feared objects (Bernstein, 1973). Although these problems are recognized, it seems quite likely that laboratory analogues will shed considerable light on similar procedures with humans (Morganstern, 1973).

The major finding of the present study that has relevance to an animal analogue is the fact that response prevention was successful in reducing fear to the CS. However, it is important to point out that response prevention did not completely reduce fear to the CS. Indeed, a significant amount of fear to the CS remained after response prevention. This suggests that although implosion may reduce some fear to the CS, a significant amount of fear may still be present after treatment. This may be part of the reason why Katzev and Balch (1974) have recently found that extinguished avoidance responding is easily reinstated. The implications for therapy are either that the treatment may not be successful even though some fear reduction has occurred, or, that the treatment may appear successful but avoidance behavior may be easily reinstated upon the brief presentation of the CS-UCS contingency at some later time. These possibilities must be weighed with the traumatic experience that implosion usually creates for the client and the therapist must make an ethical decision between employing Implosive Therapy or some other treatment which may be equally as good (Morganstern, 1973).

A second finding that may be relevant to Implosive Therapy is that during blocking, the CS environment was equally effective in reducing fear to the CS regardless of the presence of the discriminated CS. This finding implies that perhaps it is not necessary for the therapist to present the identical CS in order that response prevention may work. This suggestion complements Stampfl and Levis' (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). On the other hand, this suggestion contradicts Spring's (1973) suggestion that "unless the specific chain of events initially leading to the fear of the CS-UCS is closely replicated, response prevention may not be effective" (p. 105).

Another finding that may be relevant is the fact that response prevention was not equally effective regardless of the original conditions of learning fear. Indeed, response prevention seems to be more effective when fear is learned in a classical-conditioning paradigm. This suggests that it may make a difference (with regard to the success of Implosive Therapy) whether the client was able to avoid the feared object while the original learning of fear was occurring.

In summary, the major hypotheses of the present experiment were supported by the results. First, fear of an auditory CS (conditioned in an avoidance paradigm) was reduced after response prevention. Second, fear conditioning did occur to aspects of the conditioning environment *per se*. This fear was substantially blocked even though the auditory CS did not come on during Condition A-NBSB. Finally, response prevention was found to be more effective when fear to the CS was originally conditioned in a classical-defensive as compared to an avoidance paradigm.

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APPENDIX

Analyses of Variance Summary Tables

TABLE 1

Analysis of Variance Summary Table

for Number of Avoidance Trials

Source	Sum of Squares	df	Mean Squares	F
Total	2168.79	29		
Condition	223.20	2	111.60	1.55
Error	1945.60	27	72.06	

TABLE 2

Analysis of Variance Summary Table for

Total Number of Avoidance Responses

Source	Sum of Squares	df	Mean Squares	F
Total	684.00	29		
Condition	76.20	2	38.10	1.69
Error	607.80	27		

TABLE 3

Analysis of Variance Summary Table

for Total Amount of UCS Time

Source	Sum of Squares	df	Mean Squares	F
Total	1090.46	29		
Condition	152.34	2	76.17	2.19
Error	938.12	27	34.75	

TABLE 4

Analysis of Variance Summary Table
for Responding During the First
Pre-CS Period of CER Phase

Source	Sum of Squares	df	Mean Squares	F
Total	1018.285	69		
Condition	105.486	6	17.581	1.21
Error	912.800	63	14.489	

TABLE 5

Analysis of Variance Summary Table for
Conditions A-B, A-NBHC and A-NBSB over
Trial Blocks 1-3, 4-6, 7-9, and 10-12

Source	Sum of Squares	df	Mean Squares	F
Total	14.301	359		
Condition	0.473	2	0.237	6.20*
Error	3.320	87	0.038	
Trial	1.398	3	0.466	15.71*
Condition x Trial	1.370	6	0.228	7.70*
Error	7.740	261	0.030	

*$p < .01$

TABLE 6

Analysis of Variance Summary Table for Conditions A-B, A-NBHC and A-NBSB over Trials 1, 2 and 3

Source	Sum of Squares	df	Mean Squares	F
Total	4.140	89		
Condition	0.920	2	0.460	9.92*
Error	1.251	27	0.046	
Trial	0.708	2	0.354	15.56*
Condition x Trial	0.033	4	0.008	0.36
Error	1.228	54	0.023	

*$p < .01$

TABLE 7

Analysis of Variance Summary Table for Conditions A-B, CD-B and CD-NBHC over Trials 1, 2 and 3

Source	Sum of Squares	df	Mean Squares	F
Total	4.213	89		
Condition	0.304	2	0.152	2.81
Error	1.461	27	0.054	
Trial	0.654	2	0.327	11.35*
Condition x Trial	0.237	4	0.059	2.05
Error	1.557	54	0.029	

*$p < .01$

TABLE 8

Analysis of Variance Summary Table for Conditions BC-NBHC, SC-NBHC and A-NBHC over Trials 1, 2 and 3

Source	Sum of Squares	df	Mean Squares	F
Total	4.465	89		
Condition	1.929	2	0.964	32.65*
Error	0.797	27	0.030	
Trial	0.079	2	0.039	1.45
Condition x Trial	0.198	4	0.050	1.83
Error	1.462	54	0.027	

*$p < .01$

TABLE 9

Analysis of Variance Summary Table for Conditions A-B, CD-B, A-NBHC, and CD-NBHC on Trial Block 1-3

Source	Sum of Squares	df	Mean Squares	F
Total	5.843	119		
Condition	0.216	1	0.216	4.58*
Error	2.733	58	0.047	
Treatment	0.960	1	0.960	29.45**
Condition x Treatment	0.046	1	0.046	1.41
Error	1.889	58	0.033	

*$p < .05$

**$p < .01$

TABLE 10

Analysis of Variance Summary Table for Conditions A-B, CD-B, A-NBHC and CD-NBHC on Trial Block 10-12

Source	Sum of Squares	df	Mean Squares	F
Total	5.154	119		
Condition	0.211	1	0.211	4.71*
Error	2.600	58	0.045	
Treatment	0.046	1	0.046	1.26
Condition x Treatment	0.182	1	0.182	4.99*
Error	2.114	58	0.037	

* $p < .05$