THE EFFECTS OF HIGH AND LOW TRAIT ANXIETY ON THE CONCORDANCE OF RESPONSE SYSTEMS BASED UPON AN EMG-ASSISTED DESENSITIZATION TREATMENT FOR PHOBIAS

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INTRODUCTION

Recent literature has focused on the need for psychologists to be concerned with the differential changes in the three measurable response systems involved in emotional responding (Rachman and Hodgson, 1974; Hodgson and Rachman; 1974; Crowe, Marks, Agras, and Leitenberg, 1972; Smith and Nye, 1973). The three response systems that are thought to interact to produce emotional responses in humans were proposed by Lang in 1971. They include the verbal-cognitive, motor-behavioral, and autonomic-physiological systems. It would seem that the most complete success in behavioral treatment would occur only when changes in fear (as evidenced by the verbal-cognitive and biological systems) and avoidance (as evidenced by the behavioral system) vary together over time. Rachman and Hodgson (1974) have offered definitions of terms that can be used to describe variations of fear and avoidance. These include: concordance--a high correlation between fear and avoidance at a particular point in time; discordance--when fear and avoidance are not co-varying at a particular point, synchrony--changes in fear and avoidance which vary together over time; and de-synchrony--changes in fear and avoidance which vary independently or inversely over time. Attention is drawn to the fact that fear and avoidance can vary independently or co-vary.

Research with animals has shown a persistence of fear which continues to influence some behavior patterns even after the elimination of the original symptoms. There are several theories that attempt to describe the mechanisms that underlie fear and avoidance. According to the two-factor theory, a fear response is first established to stimuli through classical conditioning and the instrumental responses which terminate these stimuli (avoidance behaviors) are strengthened through fear reduction (Baum, 1959; Mowrer, 1947; Solomon and Wynne, 1953). Baum (1969) however, provided evidence for the dissociation of fear and avoidance. He found that unavoidable shock in a grid box facilitated acquisition of an instrumental response to avoid shock. Later, he manipulated the instrumental response by varying the overtraining of this avoidance response. The responses of all Ss were extinguished to a common criterion. During the test phase which involved retraining of the original avoidance task, overtraining of the motor response was found to significantly improve the rate of relearning of the avoidance response. This experiment and the results of others (Baum, 1966; DeToledo and Black, 1967; Frumkin and Brookshire, 1970; and Bresnahan and Riccio, 1970) provide support for the idea that classical and instrumental responses can be manipulated independently prior to the acquisition of an avoidance response. Bull and Overmier (1968, 1969) also provide support for the independence of the two processes. They suggest that treatments like systematic desensitization may leave the maladaptive behavior pattern in the S's repertoire, and reduce only the probability of a particular stimulus eliciting the behavior. Baum

(1970) pointed out that the two-factor theory cannot explain the fact that animals still show overt signs of fear even though the avoidance response is no longer present.

Dissociation of classical and instrumental responses may also occur during extinction or elimination of avoidance. In a study to assess fear produced by avoidance training, Kamin, Brimer and Black (1963) found there was "a considerable lack of parallelism between fear and instrumental behavior. . . ." Rats whose responses were extinguished to an intermediate criterion level (five consecutive failures to respond) were still highly fearful of the CS. The measure of fear used was the conditioned suppression effect reported by Estes and Skinner (1941). It consisted of a disruption of ongoing operant behavior (bar pressing) in the presence of the fear-eliciting stimulus. Other findings in the animal literature show that the instrumental response may cease before the CS has lost its fear eliciting properties (Black, 1958, 1959). Baum (1971) supported the idea that the absence of the avoidance response is not an adequate index of the underlying drive state.

There are several other theories that attempt to explain avoidance learning. Gray (1971) concludes that experimental data on animals shows that by blocking an avoidance response, it may be eliminated; however, fear may be left intact or actually increased. Gray acknowledges further

> fear may first increase and then decrease while avoidance responses continue to be made with some efficiency, but if reinforcement for a successful avoidance response consists in fear-reduction on each trial (as claimed by two-process theory) there should be some loss of reinforcement, and therefore some impairment of avoidance, as fear gets less from trial to trial (p. 173).

It is an accepted fact that once it is well-established, avoidance behavior can persist for some time with no decrease in strength even in the absence of fear (Rachman and Hodgson, 1974). Here is where Gray introduces his theory;

> If, on the other hand, reinforcement consists of any approach to safety signals, and if . . . these retain their secondarily rewarding property even when fear is low, this lack of close correlation between the degree of fear and the success of avoidance behavior is less surprising (p. 173).

This theory helps explain why it is possible to see a persistence of avoidance behavior even in the absence of fear. Rachman and Hodgson (1974) mention the possibility that patients whose active avoidance behavior is being maintained by the reinforcing power of safety signals may be the ones who show very persistent neurotic behavior even in the absence of fear or other distress. Herrnstein's (1969) one-factor theory states that avoidance behavior is being maintained because it reduces frequency of aversive (fearful) stimulation. Rachman and Hodgson (1974) criticize Herrnstein's theory for its circularity by showing how it is easy to define aversive stimulation in terms of the avoidance behavior itself. However, they point out that his theory can help to account for the "neurotic paradox" because the discomfort of self-defeating neurotic behavior may be weaker or shorter than the discomfort associated with the noxious stimulation of the feared object or event.

Seligman and Johnston (1973) have proposed a cognitive theory of avoidance learning which contains two components: one cognitive and one emotional. They believe their theory accounts for more of the relevant data than either two-process or discriminative stimulus

(Herrnstein, 1969) theory. The cognitive component assumes that Ss have a preference for shock over no shock, and acquire two expectancies: that responding leads to no shock and not responding leads to shock. According to this theory, the presence of the stated preference and pair of expectancies is a sufficient condition for responding to occur. The principles of the cognitive component account for data on effects of extinction and response-blocking procedures, as well as some other data on extinction and acquisition. The emotional component is based on elicitation of responses by classically conditioned fear. They point out that the addition of the fear component allows their theory to cover most of the major facts of acquisition and extinction of avoidance. This theory, however, does not account for the following phenomena: punishing the avoidance response does not consistently facilitate extinction and can produce "vicious circle" behavior (Brown, 1969), in certain classes of responses (i.e., wheel turning in the rat), acquired avoidance responses can degenerate into escape (Coons, Anderson, & Myers, 1960; Anderson & Nakamura, 1964), the fact that evidence exists that simple exposure to response-outcome contingencies may not be sufficient for expectancies to develop, findings in Tolman and Gleitman's (1949) "latent learning" study, and "learned helplessness" effects, where inescapable shock retards escape and avoidance learning (i.e., Seligman, et al., 1971).

All of the theories presented have yet to be supported by consistent results; however, it is important to be aware of the various theories for avoidance learning when deciding what the most effective techniques for reducing discordance between fear and avoidance are.

Riccio and Silvestri (1972) discuss the fact that even though the development and maintenance of neurotic symptoms have been described in terms of classical conditioning of fear to stimuli and the subsequent acquisition of a response which reduces contact with these stimuli, the implications of this model for the elimination of maladaptive behavior in humans seem to have been for the most part ignored. They found evidence in the clinical literature on humans that elimination of an avoidance response does not adequately reflect concurrent changes in autonomic and verbal behavior and suggest the need for multiple measures of anxiety to assess the effects of experimental and therapeutic operations on avoidance behavior.

It is evident that there are at least three different types of discordance prevalent in the clinical literature on phobic subjects; a) when autonomic changes do not reflect behavioral improvement, b) when verbal reports reflect improvement but avoidance behavior remains, and c) when behavior improves and subjective reports indicate fear remains (see Chapter II, Rationale). In a review of relevant research on human phobic Ss, Hodgson and Rachman (1974) have suggested several hypotheses concerning procedures that could lead to increases in concordance and synchrony. One of the previously (referred to) hypotheses is--concordance among response systems is likely to be high during strong emotional arousal and discordance will be evident when emotional responses are relatively mild. It seems important to ask what effects will initial emotional arousal have on concordance and how will this affect concordance after treatment? As an extension of their hypothesis, it is logical to assume that Ss with high trait

anxiety may respond to a feared situation with more overall emotional arousal than Ss with low trait anxiety. Since high emotional arousal is expected to increase concordance among response systems, it seems likely that the highly aroused Ss (presumably those with high trait anxiety) will initially exhibit more concordance than less aroused Ss (those with low trait anxiety). The question left to answer is, what effect will this initial concordance have on results after treatment? Will concordance still be greater for the high trait anxiety group?

This experiment will attempt to discover what effect individual differences in trait anxiety have on concordance among behavioral, physiological, and subjective measures of fear before and after an EMG-assisted desensitization treatment combination for a specific phobia.

CHAPTER II

RATIONALE

A review of the clinical literature on behavior therapy with phobic Ss by Riccio and Silvestri (1973) showed the elimination of an avoidance response does not adequately reflect concurrent changes in autonomic and verbal behavior. There are several studies on the treatment of human phobic Ss that report a discrepancy between S's overt behavior and their verbal reports (Lang and Lazovik, 1963; Wolpe and Lazarus, 1966; Miller and Nawas, 1969; Hart, 1966; Krapfl and Nawas, 1970; Davison, 1968; Mathews and Shaw, 1973). In general, it was found that improvement in S's approach behavior was not matched by decreases in subjective reports of anxiety. This evidence seems to support similar findings in the animal literature that indicate some residual fear remains even after removal of the symptomatic behavior (Kamin, Brimer, and Black, 1963; Black, 1958, 1959).

Leitenberg, Agras, Butz, and Wincze (1971) found a lack of concordance between autonomic responding and phobic behavior after behavior modification therapy was used on phobic clients. Specifically, in several cases phobic behavior was reduced while concurrent measures of heart rate did not change or only decreased following improvement in behavior on follow-up. Other studies failed to show that the success of desensitization is related to the reduction of skin

conductance responses to phobic stimuli (Leitenberg, et al., 1969; Lang, Melamed and Hart, 1970; Lomont and Edwards, 1967; and Gillan and Rachman, 1974).

Rachman and Hodgson (1974) have referred to still another instance of discordance that is common in the literature. It is known that once avoidance behavior is well-established, it can persist for an extended period of time with no decrease in strength even in the absence of fear. This finding is supported in the animal literature as well (Solomon and Wynne, 1953).

In summary, it is evident that there are at least three different types of discordance prevalent in the clinical literature on phobic Ss: a) when autonomic changes do not reflect behavioral improvement, b) when verbal reports reflect improvement but avoidance behavior remains, and c) when behavior improves and subjective reports indicate fear still remains.

Emotional Arousal and Concordance

One of the hypotheses that will be tested in the present study is an extension of an hypothesis proposed by Hodgson and Rachman (1974). Their hypothesis that states concordance between response systems is likely to be high during strong emotional arousal deserves further discussion. In reference to the problem of discordance between response systems, Hodgson and Rachman presented Lang's (1971) conclusion.

> So-called mild feeling states may involve no more than the verbal report, and we might find little specific activity in the autonomic or behavioral sphere . . . the verbal behavior of a human being is capable of

> reflecting gradations of affect, to which the cruder autonomic system may be completely insensitive (p. 319).

Schacter (1964) has emphasized the lack of concordance between physiological and subjective measures of emotional states. He argues that an emotional state should be defined partly by the prevailing physiological state and partly by the person's own cognitive appraisal of this state. Desynchrony would be evident if the same physiological state was interpreted differently at two points in time. Some psychologists have suggested that the mislabeling process is less likely to occur under conditions of high emotional arousal than under conditions of weak emotional arousal which have been investigated by Schacter and his colleagues (Lang, 1971). Marks, Marset, Boulougouris, and Huston (1971) investigated the effects of flooding (implosive procedures) and found no concordance after treatment between three autonomic measures. It seems that discordance even within a response system is also possible. They did find concordance between two of the autonomic measures but this occurred only during exposure to the most threatening stimulus (i.e., flooding talk). During flooding talk, skin conductance fluctuations correlated significantly with changes in heart rate ($r=0.60$).

In a recent study on emotional arousal and persuasion effects in flooding, Mathews and Shaw (1973) found that high arousal themes provoked more anxiety in phobic Ss, as confirmed by both subjective and autonomic measures. In the first experiment, Ss were given a single session of imaginal flooding with all combinations of continuous vs. discontinuous presentation of high vs. less arousing material. In the second experiment, Ss were given a single session of imaginal

flooding and exposed to the material in either a low-high or high to low order. The use of a high-low arousal theme order resulted in greater attitude changes but more behavioral changes reflecting improvement came from Ss who experienced less-arousing themes continuously presented. Attention and vividness ratings were greater for Ss who were presented the high arousal themes. The authors state that low arousal themes would have been more effective if they could have involved the Ss to the same degree as the high arousal themes. However, even though the finding was not significant, there was evidence that the high-low order was associated with both lower levels and a faster decrease in anxiety as measured by both autonomic and subjective measures. Lang (1970) reported a similar result in a study involving snake phobics who were presented with hierarchically graded films given in a high-low or low-high order of arousing material. Lang found that Ss who viewed the films in the high-low order showed an overall lowering of anxiety, more rapid habituation and consequent lower self-reports of fear. He suggested that the practice of progressing from low-high hierarchies in desensitization be reversed to achieve a greater therapeutic benefit. Mathews and Shaw (1973) felt a better treatment approach would involve elements from both desensitization and implosion also.

According to the above studies, it appears that the high-low order of presentation of hierarchy themes is capable of achieving concordance between at least two measures of anxiety (subjective and physiological). Emotional arousal is evident under the high-arousal themes, and these were the themes that were presented first and

involved the Ss the most. Perhaps other treatment variables, length of session, duration of exposure, etc., could be manipulated in a high-low presentation to achieve concordance between not only the subjective and physiological measures of anxiety, but also the behavioral measures.

Subject Variables (Trait Anxiety) and Emotional Arousal

The previous discussion has dealt with some procedural variations that involve emotional arousal and its effects on concordance. Lick and Bootzin (1975) found that fear intensity of the experimental S could have an important impact on research. Murphy and Bootzin (1973) found that initial level of fear of snakes in snake phobic children did affect the amount of fear reduction as a result of repeated testing without treatment, but it was not related to the success of contact (in-vivo) desensitization. The least fearful children improved almost as much as treated Ss as a result of repeated testing alone while the most fearful Ss showed no significant improvement. Perhaps children with low fear of snakes were able to habituate to the feared stimulus through testing alone, whereas this small amount of exposure did not effect noticeable improvement in highly fearful Ss. Kazdin (1973) found that initial level of fear shown by self-reports and snake avoidance on a behavioral avoidance test was not related to amount of improvement as indicated by repeated testing paired with suggestions for improvement. These results contradict the findings of the previously mentioned study (see Murphy and Bootzin, 1973).

In a study comparing the efficacy of real-life versus imaginal desensitization, Cooke (1966) found that highly anxious Ss showed more fear reduction than low anxious Ss when treated with the standard imaginal desensitization procedure. The low and high anxiety classifications were based on low and high scores on the Bendig Emotionality Scale (Bendig, 1956). His findings contradict some of the clinical reports that suggest that anxious Ss do not respond to behavior therapy as well as less anxious patients (see Lazarus, 1963; Marks and Gelder, 1966: Wolpe, Salter and Reyna, 1965).

Other researchers have focused on specific subject determinants of emotional arousal. Bandura (1969) and Lang (1968) suggested that internal visceral and external cues as well as covert, self-generated stimuli interact with each other to produce the complex response known as emotional arousal. Davison and Wilson (1973) point out the Ellis' (1962) cognitive-rational emotive therapy follows the idea that most of emotional suffering is due to the irrational ways people construe their world. The assumption is that people believe their self-defeating, "internal messages" and these beliefs exert negative effects on behavior.

Izard (1972) states that any clinically useful analysis of anxiety should include a statement of the particular profile or pattern of emotions characteristic of the individual and the experience under consideration. It may be possible to discriminate certain types or groups of individuals as characterized by an anxiety that is defined as a particular pattern of emotions and emotion interactions that occur under specifiable conditions.

Therefore, for the present study, individual differences in trait anxiety will be investigated. Ss will be made up of two groups, low trait anxiety and high trait anxiety; and both groups will share a common phobia. The State-Trait Anxiety Inventory (STAI) will be used in subject selection as well as for periodic measures during behavioral avoidance tests (see Spielberger, Gorsuch and Lushene, 1970).

EMG-Assisted Desensitization

Recently, several studies have suggested that anxiety stress reactions may be reduced by relaxation training with electromyographic (EMG) feedback (Budzynski & Stoyva, 1969; Green, Walters, Green & Murphy, 1969; Green, Green & Walters, 1973). A single group study by Raskin, et al. (1973) indicated that EMG feedback is of limited value in the treatment of chronic generalized anxiety. However, clinical observations by Budzynski (1973) suggest that stress reactions to more circumscribed stimuli may be responsive to biofeedback relaxation training. These findings were applied to a study comparing the effectiveness of EMG Feedback, Progressive Relaxation and Self-Relaxation on reducing anxiety in dental phobic clients (Miller, Murphy, Miller & Smoose, 1976). Dependent measures for this study were EMG level, Dental Anxiety Scale (DAS), and the State-Trait Anxiety Inventory (STAI). The results of this study indicate that both EMG feedback and progressive relaxation led to significant decreases in stress reactions relating to dental phobia. It is interesting to note that on the STAI-Trait measure, the scores of the EMG feedback training group were significantly lower than either the progressive

relaxation or self-relaxation groups. This suggests that the effects of the EMG feedback training generalized beyond the dental situation. These patients reported fewer day-to-day stress reactions after EMG training. This was an unexpected finding since STAI-Trait scores had been expected to remain constant for all groups across all appointments, which is in line with Spielberger's hypothesis (1966) that trait anxiety refers to a relatively stable personality trait.

Other researchers have applied biofeedback with desensitization on specific phobias. Wickramasekera (1972) reports successful results from a case study on the treatment of an "examination phobia" by pairing EMG feedback with systematic desensitization. Reeves and Mealiea (1975) also report positive results in a study using biofeedback-assisted cue-controlled relaxation with systematic desensitization for the treatment of flight phobias. Therefore, the treatment of specific phobias with a combined EMG-desensitization technique could be applied to the present study. Perhaps the pairing of biofeedback and desensitization will allow Ss to achieve more concordance between the various response systems after treatment, since both physiological and cognitive-behavioral systems are involved.

Proposed Investigation

The present study will examine the effects of high and low trait anxiety on the concordance of response systems (behavioral, cognitive, and physiological) before and after treatment for a specific phobia. The treatment used will be a combination of EMG (electromyographic) feedback and modified desensitization (high-low hierarchy presentation).

Hypotheses

The first hypothesis is that initial concordance will be greater among the four dependent measures for the high-trait anxiety group. Kendall's coefficient of concordance and a planned comparison on the pre-test Fisher Z scores for the two groups will be performed to test this directional hypothesis. No predictions can be made on how treatment might affect concordance levels for the two groups.

The second hypothesis is that the EMG-assisted desensitization treatment will be effective in reducing EMG levels across treatment sessions and also in reducing some or all of the dependent measures (EMG, heartrate, STAI-State, distance from phobic object) on the post-tests. The former finding will be examined by the mixed design ANOVA on average per session EMG levels; a main effect on the treatment sessions variable with a decreasing linear trend is predicted. The latter finding of reduction in measures of arousal will be investigated by the four mixed design ANOVA's on the pre and post test data; a main effect of testing sessions will show a significant pre-post reduction in the four dependent measures.

The third hypothesis is that significant differences are expected to occur between the two anxiety groups on the adjusted post test means (as shown by the four ANACOVA's), as well as on the number of slides presented during the last four sessions (as shown by results of the planned t-test). If final concordance in the improved direction is a function of the ability to proceed through more slides in the treatment hierarchy, then the group viewing more slides may show higher concordance on the post tests.

CHAPTER III

METHOD

Subjects

Twenty female snake phobic subjects were selected from introductory psychology courses. Half of the Ss had high-trait anxiety and the other half had low-trait anxiety. A preliminary Behavioral Avoidance Test (BAT) was given to Ss selected. Subjects who were unable to touch the phobic object, or showed marked increments in their phobia following the BAT, failed the BAT and were selected for participation in the present study.

Instruments

The Fear Survey Schedule II (Geer, 1965) was given to all Ss participating in the experiment. This instrument (see Appendix B) consists of 51 specific fears such as "being alone," "blood," "driving a car," "snake," etc. The subject indicates the extent to which he or she fears the stimulus on a 7-point scale ranging from "none" and "very little" at the lower end to "very much" and "terror" at the upper end. Numerical values from 1 to 7 are assigned in order of magnitude to the possible responses. Correlations with the MAS (Manifest Anxiety Scale) of .39 for male college students and .55

for female college students were reported for the FSS. Internal consistency reliability was .93 overall, .92 females and .93 males.

A second instrument that was administered to the Ss is the State-Trait Anxiety Inventory (STAI) (see Appendix C) developed by Spielberger, Gorsuch, and Lushene (1970). The STAI consists of two, twenty-item scales that ask people how they generally feel (A-Trait), and how they feel "right now" (A-State). The A-Trait items were chosen on the basis of comparisons with other known measures of A-Trait, like the Taylor (1953) MAS, while the A-State form has items that were intended to evaluate feelings of tension, nervousness, worry and apprehension. Internal reliability coefficients range from .83 to .92 for the A-State scale and from .86 to .92 for the A-Trait scale. Correlations between the A-Trait scale on various subgroups of college students and neuropsychiatric patients ranged from .73 to .85 with the IPAT Anxiety Scale and the Taylor Manifest Anxiety Scale and from .41 to .58 with the Affect Adjective Checklist. Correlations between the STAI A-State and A-Trait scales depend upon the type and amount of stress that characterize the conditions under which the A-State scale is given. Correlations between the scales varied between .44 and .55 for female undergraduate students and .51 and .67 for male undergraduates under conditions of standard instructions for the STAI. Correlations between A-State and A-Trait under stressful experimental conditions vary from .11 and .53 for female college students and .37 and .67 for male students. Correlations between the A-State scale and the Affect Adjective Checklist (Hostility Scale) were .47. Correlations between the STAI scales and the

Cornell Medical Index were .70 for both scales, indicating a larger number of medical symptoms are associated with high STAI scores (Spielberger, Gorsuch, and Lushene, 1970).

Apparatus

A long, narrow room with windows covered to block out extraneous stimulation was used for both the preliminary BAT and the second BAT, as well as the treatment sessions. The room had an acquarium with a six foot non-poisonous bullsnake in it; the acquarium was set 15 feet inside the room on top of a rollable cart. The acquarium had a removeable top. For the second BAT, a chair was placed in the room 15 feet from the contained which was on the cart with wheels on the legs. The wheels on the legs of the cart allowed the experimenter to roll the cart towards the subject, who was seated 15 feet away in a chair. This insured that the Ss wouldn't have to move during the second BAT as body movements could have affected the readings on their physiological measures. EMG (electromyographic) measures were recorded from an Autogen 1700 Feedback Myograph using standard frontalis placements two inches on either side of the center forehead and one inch above each eyebrow (Venables and Martin, 1967). A ground electrode was secured to the forehead midway between the other electrodes. Stereophonic headphones through which the Ss in the experiment received auditory feedback of ongoing muscular tension were connected to the Autogen unit. The feedback was presented in the form of clicks which were logarithmically proportional to the level of EMG activity being monitored. A Grass Model 7P3 polygraph

with a Model 7P4F EKG Tachograph and 3 silver-silver electrodes were used to record heart rate.

The eight slides used for desensitization were selected from a set of 15 purchased from Farrall Instrument Co., Grand Island, Nebraska. The set number was BBB-1, and the slides used in the study were numbered 1, 2, 3, 4, 5, 6, 7, and 15. The slides depicted hierarchically ordered scenes of a snake approaching and climbing on a girl in a sleeping bag. Slides were arranged in a sequence from most threatening to least threatening for the desensitization sessions (15, 7, 6, 5, 4, 3, 2, 1). A Kodak carousel slide projector and a rear-projection screen were used for the last four sessions. The screen was placed directly in front of the seated subject at a distance of three feet.

Training for Experimenters

The experimenters were two female graduate and one female undergraduate psychology students. All experimenters were trained in carrying out the procedures for applying EMG electrodes, conducting the four relaxation training sessions and the four relaxation-desensitization sessions, recording EMG levels and instructing the subjects for both types of sessions. Experimenters received practice on mock Ss until they were able to apply the apparatus for the EMG sessions accurately and smoothly. The primary experimenter was observed by the assistant experimenters for at least one complete relaxation and two complete relaxation-desensitization sessions. When it was judged that the novice experimenters understood all aspects

of both types of sessions, then they were allowed to conduct a session of relaxation training and of modified-desensitization under the observation of the primary experimenter. When the observer judged the novice experimenter competent in all phases of the sessions, the novice experimenter was allowed to conduct further sessions without supervision.

Procedure

Phase I

In the first phase of the study, potential Ss (all female) were asked to fill out the FSS II (Geer, 1965) and the trait form of the STAI (Spielberger, Gorsuch, and Lushene, 1970) during class time. Subjects whose STAI-trait scores ranged from 48 to 52 and from 25 to 32 were respectively ranked for high and low trait anxiety. The high group fell between the 89th and 94th percentiles and the low group fell between the 3rd and 23rd percentiles, based upon norms for female college freshmen. The final twenty Ss chosen to participate in the study shared a common phobia of snakes as indicated by the results of the FSS II and the preliminary BAT. This BAT was a high demand BAT, similar to the one described by Evans (1975). However, no physiological or subjective measures were recorded during this BAT. Subjects were taken to the experimental room, asked to stand on a marker 15 feet from the aquarium containing the snake, and given the following instructions:

> On the cart is a non-poisonous bullsnake that I want you to look at, approach, and touch. In order to proceed with the experiment, it is necessary that you touch this snake.

If a subject hesitated for more than two minutes, or refused to comply, the behavioral avoidance test was ended. Subjects who were unable to

touch the phobic object or showed a marked increase in their phobia upon touch, failed the BAT and were selected for participation in the study. This high-demand BAT was chosen to be used because Bernstein and Paul (1971) in their review of analogue phobia research, pointed out the need for a "high-demand-for-approach" behavioral avoidance test if generality to a clinical population was desired.

In order to determine which Ss were given the BAT, the trait forms of the STAI were scored and Ss were ranked from highest to lowest according to their scores. Pairs were then chosen for the BAT by taking the highest scorer on the STAI and the lowest scorer on the STAI. This was repeated until ten Ss with high trait anxiety and ten Ss with low trait anxiety failed the BAT.

Phase II

In the second phase of the study, all previously selected Ss were given the second BAT. Subjects were ushered to the experimental room and seated in a chair which was placed approximately 15 feet away from the cart with wheels on the legs. The acquarium containing the bullsnake was placed on the cart. EMG measures were obtained by putting electrodes from the Autogen 1700 on the standard frontalis placements. Heartrate was recorded by a Grass Model 7P3 polygraph with an EKG Tachograph (Model 7P4F) that was attached to electrodes which were secured to ventral surface of the Ss' forearms. A ground electrode was attached to the S's left ankle. Subjects then received the following instructions:

> In order to record certain physiological responses (heartrate and muscle tension) during this test, several electrodes will be attached to your forehead,

> arms and ankle. There is no chance for you to receive a shock from these electrodes. Your forehead will be cleaned with alcohol to insure good contact.

The experimenter then cleaned the Ss' forehead with alcohol and attached the three electrodes to the forehead. Two active electrodes were placed one inch above the eyebrows and spaced approximately 3-4 inches apart from each other. The ground electrode was placed in the center of the forehead. One more electrode was attached to each of the ventral surfaces of the forearms and the ground electrode was attached to the Ss' left ankle. The experimenter then finished the instructions to the Ss:

> On the cart is a container containing a snake. This cart will be moved towards you by myself until you signal me me to stop by saying, "stop." You are to allow the cart to get as close to you as you can stand before you signal me to stop. Please do not make any physical movements (like moving arms, wrinkling forehead, clenching teeth, etc.) before or after you have signaled, as these movements will interfere with the measures I am recording. Once you have signaled that the snake is as close to you as you can stand, I will record the two measures and then ask you to fill out a form on how you feel right then.

Subjects were asked if they understood the instructions or had any questions about them. The Ss were then given the BAT. The form given at the end of this BAT was the A-State form of the STAI. This was used as the index for subjective reports of anxiety.

Phase III

After the completion of the second BAT, all Ss were given a standardized set of information explaining the rationale and techniques that will be used for the EMG-assisted, modified desensitization treatment (see Appendix D). Subjects were then told when to

return for the first of their eight treatment sessions which were also carried out individually.

During the first session, Ss were seated in a comfortable chair and asked to sit relaxed with both legs and arms uncrossed. EMG electrodes were attached to the standard frontalis placements. For all sessions, subjects were instructed to sit quietly while an EMG baseline (in average integral microvolts) was recorded. The earphones were placed on the Ss' head after the following information was given:

> The purpose of this session is to help you learn how to relax by using biofeedback. You will hear a crackling or popping sound through these headphones. Your task will be to reduce the rate of the crackling sound. As you reduce the rate of the sound, you are actually reducing the level of tension in your forehead muscle. I will know how relaxed you are by monitoring the forehead muscle also. The session will last 20 minutes. Remember to keep your eyes closed and do not talk or move during the session.

Performance with feedback was monitored at three minute intervals by recording average integral microvolts. Subjects were encouraged to keep the feedback noise as low as possible during the relaxation training period (sessions 1 through 4). Subjects were given a set of instructions for relaxation exercises to practice at home after each EMG session (Appendix E).

At the beginning of the fifth session, Ss were instructed to relax for 10 minutes with EMG feedback and the experimenter recorded forehead tension levels at three minute intervals. The first part of the slide hierarchy was projected on a screen three feet in front of the subject. Slides were shown in most fearful to least fearful order. The use of slides insured that the Ss could visualize the

scenes thereby eliminating any need for them to be able to image. Subjects progressed at their own speed through the remaining hierarchy scenes, moving on to a new slide after they signaled with the left hand that they felt totally relaxed with the preceding slide as well as showed correspondingly low EMG levels. All Ss had a total of four sessions of EMG-relaxation training and four sessions of relaxation-modified desensitization. The experimenters kept a record of each Ss' progress through the slide hierarchy and also monitored the frontalis EMG levels during the desensitization sessions. (See Appendix F for instructions for desensitization sessions.)

Phase IV

For the post test, all Ss underwent the same procedures used in Phase II of this study (the BAT with physiological and subjective measures-note-behavioral measures were how close in feet and inches the S allowed the cart near her). A post test questionnaire to examine effects of menstrual cycle, medication, home relaxation, and cognitive strategy was given to all Ss at the conclusion of the study (Appendix G).

Design

Independent Measures

The independent between subjects variable used in the study was individual differences in trait anxiety. Specifically, this refers to high and low trait anxiety. Ten subjects (those phobic Ss scoring between 48 and 52 on the trait form of the STAI) were assigned to the

high-trait anxiety group and ten subjects (those phobic Ss scoring between 25 and 32 on the trait form of the STAI) made up the low-trait anxiety group. All Ss underwent the same treatment. Pre and post tests were the within subjects variable, and occurred during the pre and post BAT.

Dependent Measures

Behavioral, cognitive, and physiological measures were recorded for all Ss in both the pre and post tests. Behavioral measures were how close in feet or inches does the S allow the phobic object (snake) near her. Cognitive measures were the Ss own rating of their feelings on the A-State form of the STAI. Physiological measures were EMG levels in average integral microvolts and heartrate in beats per minute.

EMG levels across all treatment sessions were recorded as was each Ss' progress through the slide hierarchies in the last four sessions. Total number of slides viewed will be an additional measure of progress.

CHAPTER IV

RESULTS

Introduction

Results will be presented in three separate sections. The first section will examine concordance between response systems for both anxiety groups on pre and post test measures of EMG, heart rate, STAI-State, and distance from phobic object. The second section is an analysis of treatment effectiveness. The final section covers analyses that look at differences in treatment effects between the two anxiety groups.

Concordance Among Response Systems

In order to look at overall concordance for response systems, Kendall's coefficient of concordance was computed on EMG, heart rate, STAI-State, and distance from the phobic object on pre and post test values of these measures for both anxiety groups. This analysis yielded a $W = .302$, $p < .30$ for the high trait anxiety group on the pre test values of the four dependent measures, and a $W = .227$, $p < .70$ for the low trait anxiety group for the pre test values. The W's were not significant and there was no significant difference found between the groups on the pre test values. Therefore, the prediction that the high trait anxiety group would show greater initial

concordance between response systems than the low trait group was not supported. The W's for the post test values of the dependent measures were W = .461, $p<.10$ for the high trait anxiety group and W = .142, $p<.90$ for the low trait anxiety group. Again, no significant differences were found between the high and low groups on the post test values of the dependent measures.

In summary, the high trait anxiety group increased in concordance due to treatment, while the low trait anxiety group decreased in concordance. However, these findings did not reach significance.

An 8 x 8 matrix of Pearson product moment correlations on the pre and post test values of EMG, heart rate, STAI-State, and distance from the phobic object was computed for each anxiety group. This yielded matrices of 28 values each; 1.4 values are expected to be significant at the .05 level by chance alone. Therefore, the lowest two correlations in each matrix will not be reported here. The correlation matrix for the high trait anxiety group yielded three significant r's. The post test value of EMG level correlated highly with the post test measure of distance from the phobic object, $r(10) = + .74$, $p<.007$. A high correlation was obtained between the pre test value of heart rate and the post test value of heart rate, $r(10) = +.75$, $p<.006$. The last significant correlation for the high trait group was between the pre test value of distance from the phobic object and the post test value of distance from the phobic object, $r(10) = + .71$, $p<.01$. The correlation matrix for the low trait anxiety group resulted in five significant r's. The pre and post test values of EMG level correlated highly with each other, $r(10) = + .85$, $p<.001$. Pre and post test values of STAI-State correlated moderately with each other, $r(10) = +.64$, $p<.024$.

The pre test values of STAI-State correlated moderately with the pre test values of distance from the phobic object, $r(10) = +.55$, $p<.05$. The pre test value of heart rate correlated negatively with the pre test value of STAI-State, $r(10) = -.64$, $p<.024$. The pre test value of EMG level correlated negatively with the pre test value of distance, $r(10) = -.54$, $p<.05$. (See Appendix H for correlation matrices for high and low trait anxiety groups.)

The correlations revealed differences in the way the two anxiety groups failed to exhibit initial overall concordance. On the pre test, the high trait anxiety group showed almost no relationship between the dependent measures. However, the low trait anxiety group had two pairs of positively correlated measures (EMG and heart rate; and STAI-State and distance from phobic object) that were negatively related to each other. Figure 1 shows these relationships for both anxiety groups on pre and post tests.

The resultant intercorrelations were transformed to Fisher Z scores and z-tests for independent correlations were used to test for differences between the high and low trait anxiety groups on the correlations for both pre and post test values. For this aspect of the study, a significance level of .10 was deemed sufficient because of the exploratory nature of this part of the study. The tests of significance between correlations yielded no significant differences between the groups for the pre test. However, on the post test, the high trait anxiety group showed significantly different relationships than the low trait group on the two pairs of variables: distance from phobic object and EMG level ($z = 1.88$, $p<.06$, two tailed) and distance from phobic object and STAI-State ($z = 1.79$, $p<.07$, two tailed). In

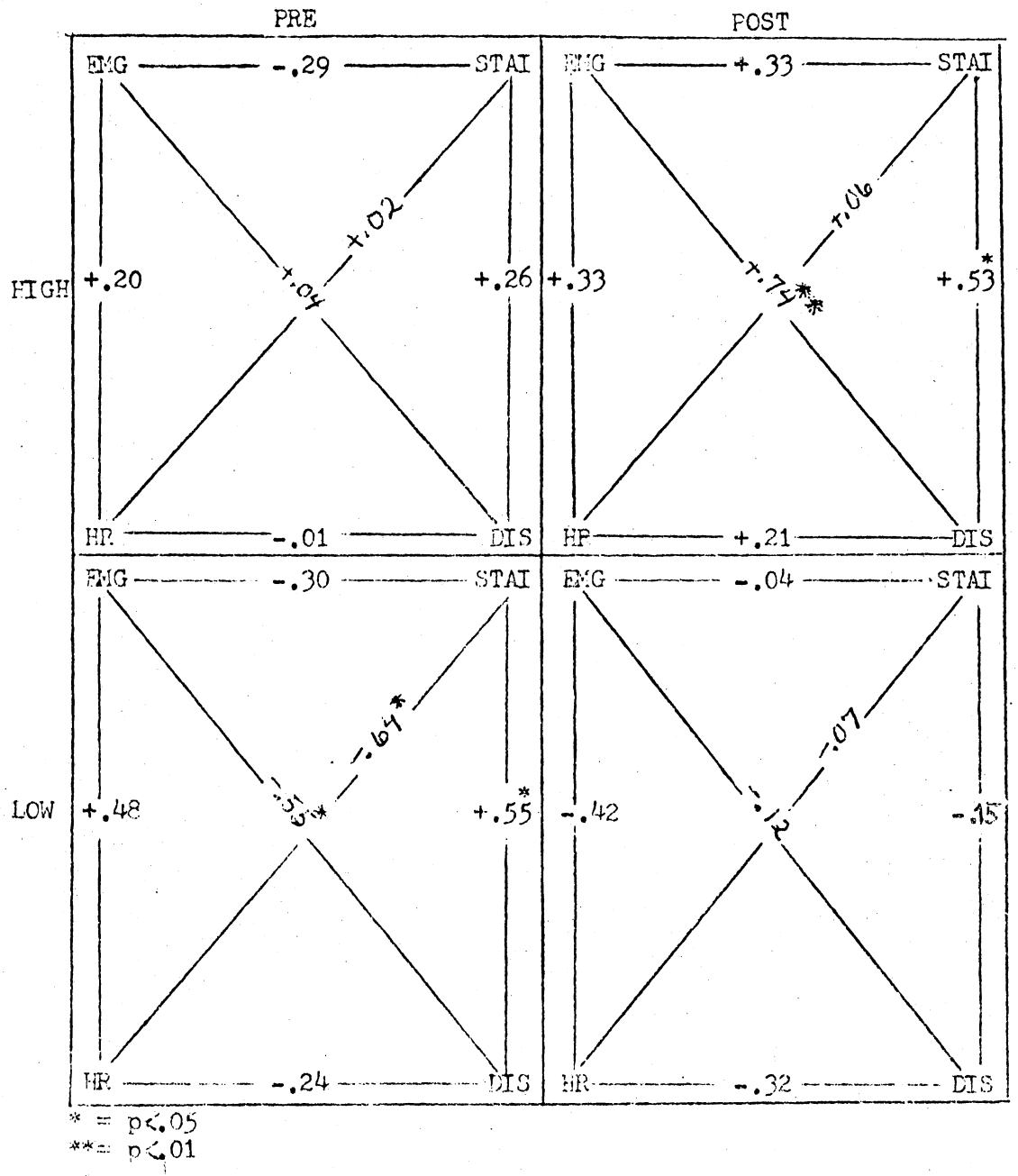

Figure 1. Relationship of Dependent Measures for High and Low Trait Anxiety Groups on Pre and Post Tests

In both of these relationships, the high positive correlations for the high group were different than the negative correlations for the low group.

Tests of significance between dependent correlations from pre to post were performed for both anxiety groups separately. Only one significant difference from pre to post was found for the high trait anxiety group and this was between distance from phobic object and EMG level, $t(7df) = 3.17$, $p<.02$, two tailed. On the pre test, the high trait anxiety group showed no relationship between distance and EMG, and this shifted to a positive relationship between distance and EMG on the post test. Two significant differences from pre to post were found for the low trait anxiety group. The relationship of heart rate and EMG level was found to be significant pre to post, $t(7df) = 5.63$, $p<.001$, two tailed, and the relationship between distance from phobic object and STAI-State was also found to be significant pre to post, $t(7df) = 3.67$, $p<.01$, two tailed. For the low trait group, going from pre to post tests changed the relationship between heart rate and EMG from positive (pre) to negative (post) and between distance from phobic object and STAI-State from positive (pre) to negative (post). Therefore, treatment affected the two anxiety groups differently. For high trait anxiety subjects, treatment increased concordance between EMG (muscle tension) and behavioral avoidance. For low trait anxiety subjects, treatment decreased concordance between heart rate and muscle tension and also between cognitive (subjective) anxiety and behavioral avoidance.

Treatment Effectiveness

A mixed design ANOVA on Groups (2) x Sessions (8) x Trials (3) was performed on EMG treatment data. The between Ss variable was the high and low anxiety groups, and the within Ss variables were the eight treatment sessions and first three trials of each session. Main sessions and Trials effects were predicted. Results of this analysis are presented in Table I. Non-significant means are given in Appendix I.

There was no significant group effect on the EMG treatment session data indicating that EMG relaxation training across sessions did not affect the anxiety groups differently. A main effect on average EMG level across sessions was found which showed that relaxation training significantly reduced muscle tension levels for both groups. A main effect on the average EMG level across the first three trials was obtained as EMG levels showed a significant reduction from the first to third trials within all eight sessions. The Groups by Trials interaction indicated that the average EMG level for the three trials was significantly different for the anxiety groups. The low anxiety group showed decreases in EMG level on the three trials averaged across all eight sessions, while the high anxiety group showed no evidence of decrease in EMG level across the first three trials.

Four mixed design ANOVAs were performed to examine differences between the anxiety groups on the pre and post test data for EMG, heart rate, STAI-State, and distance from the phobic object. The high and low anxiety groups were the between Ss variable and the pre

TABLE I

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF TREATMENT SESSIONS AND TRIAL WITHIN SESSIONS FOR HIGH AND LOW ANXIETY GROUPS ON EMG LEVELS AND CORRESPONDING MEANS

Summary of Analysis of Variance

Source	Ss	df	MS	F	P
Between Ss					
Group (A)	10.29	1	10.29	1.24	NS
Ss within groups	149.54	18	8.31		
Within Ss					
Sessions (B)	4.56	7	.65	2.76	.05
Trials (C)	.58	2	.29	8.31	.01
AxB	.91	7	.13	.55	NS
AxC	.24	2	.12	3.38	.05
BxC	.41	14	.29	.94	NS
BxSs within groups	29.71	126	.24		
CxSs within groups	1.25	36	.35		
AxBxC	.18	14	.13	.42	NS
BxCxSs within groups	7.78	252	.31		

Corresponding Means for EMG Level

Sessions	1	2	3	4	5	6	7	8
M	1.54	1.55	1.42	1.31	1.41	1.39	1.31	1.27

Trials	1	2	3
M	1.45	1.39	1.36

Groups	High	Low
M	1.55	1.25

Trials		1	2	3
Groups				
High	M	1.56	1.54	1.53
Low	M	1.32	1.24	1.19

and post test were the within Ss variable. A main effect on testing session (pre to post) was expected for all four measures. The results of these analyses are presented in Tables II through V. Non-significant means for the ANOVAs are given in Appendix H.

The main effect on Time (Pre to Post) was significant for three of the four dependent measures. The ANOVAs show significant decreases on EMG, STAI-State, and distance from the phobic object from pre to post tests for both anxiety groups as predicted. However, the ANOVA on heart rate indicates that the EMG-assisted desensitization treatment did not affect improvement for this measure of arousal.

Only one S was able to touch the snake after treatment. This S was from the high trait anxiety group.

Group Differences in Treatment Effects

Four one-way Analyses of Covariance (ANACOVAs) were performed on the four dependent measures of EMG, heart rate, STAI-State, and distance from the phobic object for both anxiety groups. The covariate in each of the simple ANACOVAs was the pre test value of the dependent measure on the adjusted post test means. Results of these analyses indicate no significant differences between groups on the four dependent measures after treatment. The covariates for EMG, STAI-State, distance, and heart rate all accounted for a significant amount of variance on the post test scores of these measures. Results are presented in Appendix J.

A planned t-test between the two anxiety groups on total number of slides viewed during the last four treatment sessions was computed. A $t = 2.084$, $df = 18$, $p<.10$ was found to be non-significant for a

TABLE II

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF HIGH AND LOW ANXIETY GROUPS AND PRE AND POST TESTS ON EYES OPEN EMG LEVEL WITH CART IN PLACE AND CORRESPONDING MEANS

Summary of Analysis of Variance

Source	Ss	df	MS	F	P
Between Ss					
Group (A)	.77	1	.77	.02	NS
Ss within groups	71.80	18	3.99		
Within Ss					
Time (Pre & Post)(B)	12.75	1	12.75	15.18	.01
AxB	.37	1	.37	.44	NS
BxSs within groups	15.12	18	.84		

Corresponding Means for EMG Level

Time	Pre	Post
Eyes Open		
EMG M	3.94	2.81

TABLE III

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF HIGH AND LOW ANXIETY GROUPS AND PRE AND POST TESTS ON HEART RATE WITH CART IN PLACE AND CORRESPONDING MEANS

Summary of Analysis of Variance

Source	Ss	df	MS	F	P
Between Ss					
Group (A)	302.50	1	302.50	1.64	NS
Ss within groups	3,317.62	18	184.31		
Within Ss					
Time (Pre & Post)(B)	8.09	1	8.09	.22	NS
AxB	.90	1	.90	.02	NS
BxSs within groups	651.75	18	36.21		

Corresponding Means for Heartrate

	Pre	Post
High Group	76.45	77.65
Low Group	82.25	82.85

TABLE IV

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF HIGH AND LOW ANXIETY GROUPS AND PRE AND POST TESTS ON STAI-STATE ANXIETY WITH CART IN PLACE AND CORRESPONDING MEANS

Summary of Analysis of Variance

Source	Ss	df	MS	F	P
Between Ss					
Group (A)	11.03	1	11.03	.08	NS
Ss within groups	2,559.24	18	142.18		
Within Ss					
Time (Pre & Post)(B)	1,974.03	1	1.974.03	55.74	.001
AxB	2.02	1	2.02	.06	NS
BxSs within groups	637.43	18	35.41		

Corresponding Means for STAI-State Anxiety

Time	Pre	Post
STAI-State Anxiety M	52.20	38.15

TABLE V

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF HIGH AND LOW ANXIETY GROUPS AND PRE AND POST TESTS ON DISTANCE FROM PHOBIC OBJECT WITH CART IN PLACE AND CORRESPONDING MEANS

Summary of Analysis of Variance

Source	Ss	df	MS	F	P
Between Ss					
Group (A)	156.03	1	156.03	.14	NS
Ss within groups	19,725.42	18	1,095.86		
Within Ss					
Time (Pre & Post)(B)	5,175.63	1	5,175.63	18.21	.01
AxB	540.22	1	540.22	1.90	
BxSs within groups	5,116.53	18	284.25		

Corresponding Means for Distance

Time	Pre	Post
Distance	57.10	34.35

two tailed test (t critical for p .05 = 2.101). Therefore, there was no significant difference between the two anxiety groups on number of slides viewed. The mean number of slides for the high trait anxiety group was 20.4 and for the low anxiety group, 41.5; however, variability within each group was great enough to prevent this difference from being significant.

CHAPTER V

DISCUSSION

The major focus of the study was the comparison of concordance among cognitive, physiological, and behavioral response systems for high and low trait anxious snake phobic Ss. The first comparison examined initial (pre test) concordance for the two anxiety groups. The prediction was made that Ss exhibiting high emotional arousal would show more concordance on the pre test than Ss with lower emotional arousal. This expectation followed directly from the hypothesis proposed by Hodgson and Rachman (1974) which states concordance between response systems is likely to be high during strong emotional arousal and discordance will be evident when emotional responses are relatively mild. The pre test was expected to produce emotional arousal in all the Ss since it involved the presentation of a phobic stimulus (i.e., the snake) to snake phobic Ss. However, the high trait anxiety group was expected to be more emotionally aroused and show more concordance between response systems than the low trait anxiety group. This was hypothesized because high trait anxious Ss are generally anticipated to exhibit state anxiety elevations more frequently than low trait anxiety Ss since they react to a wider range of situations as dangerous or threatening (Spielberger, Gorsuch, and Lushene, 1970). Given high intercorrelations between the trait scale

of the STAI and other measures presumed to tap neuroticism, it was expected that the high trait anxiety group would also respond more intensely to a specific phobic stimulus (Eysenck, 1957). Contrary to what was hypothesized, no differences were found for overall concordance between the two anxiety groups on the pre test. However, the reasons for this lack of overall concordance were different for the two anxiety groups. Correlations of response systems for the high trait anxiety group (pre test data) showed virtually no relationships between combinations of the four dependent measures (EMG level, heart rate, state anxiety, and distance from the phobic object). However, for the low trait anxiety group, the finding of no overall concordance among the four dependent measures of emotional arousal was due to two relatively distinct clusters of dependent measures. The two physiological measures were positively correlated to each other and the subjective and behavioral indices were positively related one to the other. However, the physiological cluster was discordant with the subjective-behavioral cluster. Therefore, the lack of overall concordance for the low trait anxiety Ss was based on the discordant relationship between the two concordant pairs of measures.

Therefore, the hypothesis that concordance would be higher for response systems during strong emotional arousal was only partially supported, if one assumes an inverse relationship represents more discordance than no relationship at all. One problem with this interpretation is that it assumes high and low trait anxious Ss differed in their levels of emotional arousal on the pre test. In fact, on all of the four pre test measures of arousal, there were no differences between the two trait anxiety groups. The apriori operational

definition of emotional arousal in this study (i.e., high versus low trait anxiety) did not result in different degrees of emotional arousal.

The lack of group differences on the four pre test measures of arousal could be due to the subjects perceiving the behavioral avoidance test as a threat of physical danger since changes in state anxiety caused by threats of physical danger have been found to be unrelated to level of trait anxiety (Hodges, 1967; Hodges and Spielberger, 1966). High trait anxiety Ss, however, are more likely to respond with increased state anxiety intensity in situations that involve interpersonal relationships that threaten self-esteem (i.e., events in which failure is experienced, or when personal adequacy is being evaluated-taking an intelligence test) (Spence and Spence, 1966; Spielberger, 1966b; Spielberger and Smith, 1966). Perhaps the behavioral avoidance test was not perceived as a threat to self-esteem and therefore did not increase state anxiety scores for the high trait anxiety group as compared to the low trait anxiety group. However, the effect of treatment does provide an example of lowered emotional arousal for both groups which would provide a better test of Hodgson's and Rachman's hypothesis of more discordance under conditions of low emotional arousal.

After treatment, differences in concordance among specific response system relationships were found between the two anxiety groups. Treatment increased concordance between muscle tension and behavioral avoidance for the high trait anxiety group and decreased concordance between heart rate and muscle tension and also between cognitive anxiety and behavioral avoidance for the low trait anxiety group.

The low trait anxiety group in the lowered arousal state following treatment (post test situation) showed a decrease in concordance among response systems. This finding clearly supports Hodgson's and Rachman's hypothesis. Yet, for the high trait anxiety group, the effect of lowered emotional arousal increased concordance which is opposite to the hypothesized expectation. Therefore, trait anxiety and situational emotional arousal interact to modify the hypothesis that reduced emotional arousal would result in greater discordance among response systems.

The EMG-assisted desensitization treatment was found to significantly reduce EMG level, STAI-State measures, and distance from phobic object for both anxiety groups. Heart rate was not influenced by this treatment for either anxiety group. Only six Ss (four from the high trait group and two from the low trait group) showed marked decreases in heart rate on the post test. The average reduction for these six Ss was 8.7 beats per minute. Of the remaining fourteen Ss, seven Ss (four from the high trait group and three from the low trait group) showed marked increases in heart rate after treatment (average increase equalled 10.5 beats per minute); and seven Ss (five from the low trait group and two from the high trait group) showed essentially no change in heart rate after treatment. The results on heart rate are difficult to interpret since approximately one-third of the Ss showed reductions on this measure, one-third showed increases and one-third showed little or no change. Another problem with interpretation involves the dearth of studies available that are comparable to the present one. DeGood and Adams (1976) compared the relative tonic and phasic heart rate effects of biofeedback training,

deep muscle relaxation, and a no-feedback/music procedure during two criterion situations (a 25 minute training period for the above treatments and pre to post training reductions in heart rate reactivity to a series of aversive tone-shock trials). For the first criterion, heart rate decreases of the feedback and no-feedback/music groups were not distinguishable; however, both groups showed significantly greater heart rate reductions than the muscle relaxation group. For the second criterion, the feedback Ss exhibited the most heart rate control followed by the muscle-relaxation and no feedback groups. In the present study, perhaps the EMG relaxation training had the specific effect of lowering muscle tension levels and did not directly influence heart rate. There are several studies that involve response specificity that are related to the development of biofeedback and could offer explanations for the specificity effect of learning EMG found in this study. Miller (1969) and DiCara (1970) found that curarized rats could learn to control specific autonomic responses based upon special reinforcement contingencies. Shapiro, Crider and Tursky (1964) found that student nurses who were given feedback for producing spontaneous skin-potential responses learned to control this response without simultaneously affecting heart rate, respiration rate, or skin-potential level. Even within the cardiovascular system itself, Shapiro, Tursky, and Schwartz (1970b) found evidence for operantly reinforced blood-pressure vs. heart rate specificity. Subjects who exhibited the best heart rate control after operant conditioning of heart rate, showed little difference in their systolic blood pressure; while the best operantly conditioned blood pressure control subjects showed little difference in their heart rate. Basmajian

(1967) states that EMG feedback is remarkably specific. Therefore, the fact that the EMG-assisted relaxation training used in the present study reduced only levels of frontalis muscle tension and had little or no effect on heart rate is not surprising.

Treatment did result in significant reductions on the other three dependent measures as previously mentioned. The finding of treatment effectiveness is supported by the Miller, et al. (1976) study which compared the effectiveness of EMG feedback and progressive relaxation in reducing stress reactions in dental phobic clients while in the dental setting. Both EMG feedback and progressive relaxation training produced significant decreases in physiological and subjective measures of anxiety as compared to self-relaxation control procedures. Other studies have found similar results (Coursey, 1975; Renking and Kohl, 1975). None of the above studies, however, used a behavioral avoidance test as did the present study. Research more comparable to the present study reports positive results on phobias treated with a biofeedback-desensitization combination (Wickramaskera, 1972; Reeves and Mealiea, 1975).

When examining this study's results as evidence of an effective treatment for phobias, it is apparent that a major deficit is the lack of a control group. Yet studies on desensitization effectiveness using comparable control groups (snake or rat phobic Ss) show non-significant changes in fear reduction for the phobias over time (Miller, 1971; Hekmat, 1973; Barrett, 1969). A look at percentage change scores on dependent measures of other studies as compared to the present study's percentage change scores shows the lack of change in the control groups clearly. Percentage change scores of dependent

measures (pre to post) used in the present study were: EMG level -32%, heart rate +2%, state anxiety - 26%, and distance from phobic object -28% for the high trait anxiety group; for the low trait anxiety group, percentage change scores were -25% for EMG level, +1% for heart rate, -28% for state anxiety, and -51% for distance; for both groups combined, EMG level reduced 29%, heart rate +1%, state anxiety -27%, and distance -40%. A comparable study using a control group was the Miller, et al. (1976) treatment study for dental phobics which yielded percentage change scores of -42% for EMG level and -45% for state anxiety for the EMG biofeedback group; -50% for EMG level and -37% for state anxiety for the progressive relaxation group; and the control group showed only slight changes, EMG level -6% and state anxiety +3%. The Miller (1971) study on desensitization effectiveness included approach scores that can be compared to the distance measure used in the present study. The percentage change scores for the desensitization group with therapeutic instructions were -46% for avoidance, and -64% for subjective anxiety. Percentage change scores for the group receiving pseudotherapy with therapeutic instructions were -15% for avoidance and -52% for subjective anxiety. The no treatment control percentage change scores were -2% for avoidance and -13% for subjective anxiety. Hekmat's (1973) study comparing the effectiveness of systematic desensitization, semantic desensitization, and implosive therapy resulted in percentage change scores of -73% for the behavior avoidance test and -44% for subjective anxiety for the systematic desensitization group. The scores for the control group were -2% for the behavior avoidance test and -4% for subjective anxiety. From these results, the conclusion can be made that the treatment used in the present

study resulted in greater changes than the changes for control groups used in comparable studies.

Another point already mentioned in the discussion of concordance was that after treatment, differences among specific response system relationships were found between the two anxiety groups. On the post test, the high trait anxiety group showed significantly different relationships between distance from the phobic object and EMG level and between distance from the phobic object and STAI-State anxiety than the low group. For both relationships, the high positive correlation for the high trait anxiety group differed from the negative correlations for the low anxiety group. Therefore, treatment did affect the two anxiety groups differently. To return to the issue of concordance, treatment increased concordance for the high trait anxiety group between muscle tension and behavioral avoidance. However, for the low trait anxiety group, treatment decreased concordance between heart rate and muscle tension and also between cognitive anxiety and behavioral avoidance. Treatment appears to have uncoupled the two physiological responses as well as the subjective and behavioral systems for the low trait anxiety group. Looking at just the relationship between behavioral avoidance and muscle tension before treatment, the low trait anxiety Ss appeared to keep avoidance inversely dependent upon degree of muscle tension; the more tension, the less avoidance--the less tension, the more avoidance. Assuming tension preceded avoidance, low trait anxious Ss once relaxed felt the need to stay relaxed; thus they exhibited more avoidance. However, once these Ss felt tense they might as well not avoid a fearful stimulus to maintain a "relaxed image" since it was evident that they were already tense.

People who describe themselves as typically relaxed may let this expectation influence their behavior in phobic situations.

After treatment, the high trait anxiety group showed a more direct relationship between behavioral avoidance and muscle tension; the more tension, the more avoidance and the less tension, the less avoidance. Clearly, this finding represents a more concordant relationship between behavior and level of muscle tension than the one found for the low trait anxiety Ss prior to treatment.

In conclusion, the present study was an attempt to discover the effects of individual differences in trait anxiety on concordance of response systems before and after a treatment for phobias. Results showed that the two anxiety groups differed in initial concordance in a more specific fashion than anticipated. Treatment was found to affect more concordance improvement for the high trait anxiety group and to cause an uncoupling of at least two pairs of response systems in the low trait anxiety Ss. Both anxiety groups did show significant treatment effects in all response systems examined in this study with the exception of heart rate due to the specificity of the biofeedback training for muscle tension.

The results of the present study have implications for future research on individual differences in concordance as they relate to specific effects of various treatments for anxiety. A major question on the importance of concordant improvement in response systems remains to be answered. If the treatment used in the present study was effective in significantly reducing most of the dependent measures of fear, then what do the group differences in concordance after treatment found in this study imply? A follow-up study on the Ss used in the

present study could answer this question. If Ss in the high trait anxiety group (the group more concordant after treatment) maintained or increased their reductions on measures of fear and avoidance on a six month follow-up and the low trait group did not, then it could be hypothesized that more concordance leads to synchrony (changes in fear and avoidance that vary together over time). Then the relationship of more concordance in the improved direction after treatment leading to a longer lasting improvement would be clear. However, if both anxiety groups showed no difference in response to the follow-up, then the importance of achieving concordance among response systems could be questioned.

Another suggestion for future research is to try and remove the specificity effects of EMG training by conditioning heart rate decreases as well since heart rate was the physiological system measured in this study that showed no reliable change after treatment.

The present study was designed to test only one of Hodgson and Rachman's hypotheses; however, they offered several others in their 1974 article that could lead to research on differences in concordance among response systems. One hypothesis is that concordance between response systems will be greater under low levels of demand and high levels of demand will produce discordance. They cite results from two studies Miller and Bernstein (1972) and Bandura and Barab (1973) that suggest that a high level of demand partially uncoupled the behavioral response system from other response systems. Their explanation for this is that highly motivated Ss (those under high demand) are able to control a tendency for flight or avoidance in spite of autonomic and subjective signs of fear. Another hypothesis involves

synchrony and states that the degree of synchrony resulting from a therapeutic intervention will be a function of the particular therapeutic technique employed. The previous finding of partial uncoupling of fear and avoidance under conditions of high demand suggests that desensitization and flooding (implosive) approaches to treatment may differentially affect changes among response systems over time. The present study used the same desensitization treatment for all Ss, but future research on phobias could examine differential effects of desensitization and flooding on synchrony as Hodgson and Rachman (1974) see desensitization as being a low demand treatment and flooding as being a high demand treatment. The present study varied the hierarchy presentation typically used in desensitization to one that progressed from most to least threatening scenes in order to combine elements from both desensitization and implosion as several studies suggested this procedure would result in lower levels and faster decreases in anxiety as measured by both autonomic and subjective measures (Mathews and Shaw, 1973; Lang, 1970). The next hypothesis is that the degree of concordance between measures in different response systems after a treatment intervention, will increase during the follow-up period. This will be tested in the planned six month follow-up for the Ss used in the present study. The last hypothesis states that in the treatment of phobic behavior, the desynchrony between physiological and other measures will be greater for skin-conductance than for heart rate. Hodgson and Rachman (1974) have found that several studies measuring physiological responses in order to assess changes in phobic behavior have reported some amount of agreement between subjective changes and heart rate changes. However, skin-conductance

does not show this agreement and may be influenced by factors other than fear. There are a number of studies that failed to show consistent reductions in skin-conductance responses to phobic stimuli after desensitization (Leitenberg, et al., 1969; Lang, et al., 1970; Lomont and Edwards, 1967; Gillan and Rachman, 1974). The present study did not measure skin-conductance but used heart rate as a physiological measure of fear instead. As mentioned before, the lack of treatment success in consistently reducing heart rate was seen to be a result of the specificity effect of the EMG training.

It appears that there are still many avenues for research on concordance among response systems, individual differences and differences in treatment effectiveness on concordance yet to be explored. The best measure of treatment effectiveness or "cure" is one that results in improvement across all response systems that maintain a disorder over a period of time. Studies that shed light on effective treatments for stress-related diseases that are so prevalent in our society are particularly needed.

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APPENDIXES

APPENDIX A

LITERATURE REVIEW

On the basis of observations of experimental studies on anxiety, Wolpe (1958) devised a counterconditioning hypothesis for eliminating maladaptive anxiety. He called this the "reciprocal inhibition principle" which means the anxiety-evoking potential of a given stimulus will be permanently weakened, if a response antagonistic to anxiety can be made to occur in the presence of the anxiety-evoking stimulus. Wolpe then focused on Jacobson's (1938) progressive relaxation training and found it to be capable of producing a response pattern that was incompatible with anxiety. In the early 1950's Wolpe devised a form of treatment for reducing human anxiety which he called "systematic desensitization". The incompatible response was deep muscle relaxation and the counterconditioning procedure was followed by presenting anxiety-eliciting stimuli through imagery. The stimuli were arranged in a hierarchical order and presented from least to most disturbing.

Systematic desensitization is a treatment which includes: 1) training in deep relaxation, 2) construction of hierarchies of anxiety-eliciting stimuli, 3) desensitization proper--the graduated pairing, through imagery, of anxiety-eliciting stimuli with the relaxed state. Many variations of the above three sets of operations are possible when searching for the most effective desensitization treatment for a given disorder.

Relaxation training is usually done with a shortened version of Jacobson's (1938) progressive relaxation training. The client is taught to relax by successively tensing and releasing muscle groups in the body on instruction from the therapist. This process is often aided by suggestions of warmth, relaxation, and calmness. The usual

procedure for relaxation training is to use about half of each therapy hour to achieve relaxation, and to have the client practice at home between sessions.

Anxiety hierarchies are graded lists of anxiety eliciting stimuli that are constructed during the first half of the session when relaxation begins. Before desensitization proper, the client's imagery is evaluated to assure that imaging the feared stimuli does elicit anxiety.

The procedure for desensitization proper is as follows:

> A deep state of relaxation is induced, and instructions are given to signal even the slightest degree of tension, discomfort, or anxiety. The lowest item in a hierarchy is then presented by verbal instructions from the therapist, after which the therapist pauses briefly to allow unimpeded imagination of the item. After the appropriate exposure time, the client is instructed to stop visualizing the scene and merely continue relaxing. Each hierarchy item is repeated at least twice, working up the hierarchy from weakest to strongest stimuli. The therapist ensures that higher items are not presented until each lower item can be imagined without disturbance. Should any item result in disturbing reactions, the client is immediately instructed to stop visualizing the scene and relaxation is again induced. Each session is concluded with a "successful" item presentation, and following sessions begin where previous sessions terminate, until all hierarchies have been completed (Paul, 1969, p. 69).

Although systematic desensitization has been successfully used as a treatment for disorders other than phobias; the present review will cover only those studies relevant to the present study (phobia-related studies).

The first controlled study on systematic desensitization therapy was Lang and Lazovik's (1963) investigation involving snake phobic

undergraduates. The assessment procedures included in this study were the 50-item FSS (Fear Survey Schedule) and the FSS snake item rated on a 7 point self-report scale. Ss were divided into two matched groups, an experimental group (n=13) and a control group (n=11). The experiment was divided into two parts: training (5 sessions of 45 minutes duration) and desensitization proper (11 sessions). Later, an additional 10 Ss were given the desensitization treatment and 10 others were given a "pseudotherapy" to control for placebo effects. In the pseudotherapy procedure, Ss were hypnotized, given relaxation suggestions and asked to visualize pleasant scenes for the first third of each session. The last two-thirds of the session were arranged so that Ss went through hierarchies of non-anxiety aspects of their lives. This procedure controlled for amount of contact with the therapist, used the same therapist as the experimental group, and controlled for relaxation, hierarchies, and provided a rationale for therapy. Results showed that the desensitization group significantly improved in reduction of phobic behavior. Both subjective ratings of fear and overt avoidance behavior improved and gains were still evident or increased at the 6-months follow-up. This investigation was well-controlled and did show some concordance and synchrony among the subjective and behavioral measures; however, results would have been more complete with the addition of an autonomic measure.

Another well-controlled study on the effectiveness of desensitization was carried out by Davison (1965). He used 28 non-psychiatric female Ss all of whom demonstrated excessive fear of snakes. The Ss were divided into four groups as follows: Group I received

desensitization under relaxation; Group II received relaxation training but were given irrelevant images to consider while relaxing; Group 3 was given desensitization without relaxation; and Group 4 received no active treatment but was assessed prior to and after the experiment was completed. The same therapist ran the treatments for all Ss. Results showed that the "desensitization under relaxation" group showed greater improvements than the other three groups, which did not differ. Davison showed that it is not relaxation or desensitization alone that reduce fear; but a combination of both is required.

Rachman (1965b) reported a similar result. Four small groups of spider phobic Ss were assigned to the following groups: desensitization with relaxation, desensitization without relaxation, relaxation only, and no-treatment controls. The effects of treatment were assessed by subjective reports, avoidance tests, and fear estimates. Marked reductions in fear were found only in the desensitization with relaxation group, and it was concluded that the combination of relaxation and desensitization was more effective than separate treatments.

Paul (1966) presented the first extensive factorial study of S.D. therapy as compared to traditional psychotherapeutic techniques. This study is worth mentioning even though the 96 Ss were being treated for interpersonal-performance anxiety rather than specific phobias. After an initial stress assessment (Ss were required to present a speech to an unfamiliar audience--where shortly before presentation, subjective, physiological (pulse rate and palmar sweat, and behavioral measures were recorded), Ss were assigned to five separate groups. These groups were: 1) S.D., 2) insight-oriented psychotherapy, 3) attention-placebo treatment, 4) no-treatment "waiting list" controls,

and 5) no-contact controls. Five experienced therapists conducted the treatments. The 5 weekly, one-hour sessions were taped and observed by the investigator and a TOS (Therapist Orientation Sheet) was filled out to control for technique usage in the insight-oriented therapy. The results showed that on all 3 measures (cognitive, behavioral, and physiological) the group treated by desensitization showed significantly greater reduction than the untreated controls. Desensitization was considered to be superior to both the attention-placebo or insight-oriented treatments. The desensitization group was the only one showing a significant reduction on physiological measures. A carefully implemented two-year follow-up was included and percentages of Ss showing significant improvements were as follows: S.D.-85%, insight-oriented psychotherapy-50%, nonspecific attention-placebo-50%, untreated controls-22%.

Cooke (1966a) compared relaxation with in-vivo exposure of fearful stimuli to S.D. in an analog study. Ss were administered the Bendig Emotionality Scale, the FSS, and a behavioral avoidance test; also, a Fear Behavior Checklist was completed by 3 "blind" observers behind a one-way window. The 12 Ss with the highest FBC scores were chosen for the study and were further classified as "high and low anxiety" on the basis of Emotionality Scale scores. Two Ss within each level of anxiety were randomly assigned to groups to receive 1) S.D., 2) in-vivo desensitization, or 3) no treatment. Both groups were treated in four sessions and therapist characteristics were held constant across them. The two treatment groups did not differ between themselves, but both showed significantly greater reductions in anxiety and avoidance than the untreated controls. The high emotionality

group was found to show greater improvement with systematic desensitization than the low emotionality group, while no differences were found with the in vivo procedure. Since pre-post data are not presented, it becomes hard to tell whether this finding may be a result of group inequalities or other factors.

A study that compared the effectiveness of massed and spaced treatment sessions for S.D. was conducted by Ramsay, Barends, Breuker, and Kruseman (1966). Twenty nonpsychiatric Ss with fears of various animals were given desensitization under conditions of massed practice (two 40 minute sessions with 8 hierarchy items) and spaced practice (four 20 minute sessions with 4 hierarchy items). This way Ss in the two groups received the same amount of time in treatment and the same number of item presentations. Results showed a highly significant drop in fear due to the treatment, and the spaced practice condition was found to be more efficient in reducing fear.

An exploratory investigation of the speed of generalization from desensitization to real-life situations was described by Rachman (1966). The sequence of the study was: a) The S was exposed to an anxiety provoking stimulus involving spiders and was asked to estimate the degree of fear he experienced. b) This was immediately followed by desensitization treatment which lasted about 15 minutes. c) After completion of desensitization, the S was exposed to the original stimulus in vivo. d) This avoidance test was repeated 24 hours later and then 3 days or one week later. The study showed that reductions in fear transferred from the desensitization session almost immediately. A little less than 50% of the Ss showed spontaneous recovery of some degree of fear.

Krapfl (1968) gave either socially administered S.D. or tape recorded S.D. to snake phobic Ss. Behavioral avoidance tests were given after 5 sessions of treatment and again 6 weeks later. Ss in all treatment conditions showed increases in approach behavior while Ss in the control groups showed only slight increases in approach behavior that had all but disappeared at the follow-up. There were no significant differences among the experimental conditions, which was interesting since one of the taped conditions involved a sequence from most to least aversive items. Initially, this condition elicited a high level of emotional responding and some negative reactions to the procedure.

Valins and Ray (1967) designed a study to demonstrate that cognitive labeling of one's internal physiological reactions can affect avoidance behavior. Paid volunteers, who rated themselves as fearful of snakes, were shown pictures of increasingly fearsome snakes as well as slides with the word "shock" followed by shock stimulation. One group was given false heartbeat feedback suggesting that their heart rates were not affected by the snakes but were adversely affected by shocks. The control group was exposed to the same tape, but they were told the sounds they heard were meaningless. All Ss were then given a behavioral avoidance test for snakes. The results showed that the two groups did not differ significantly in approach behavior. This finding is hard to interpret because S's initial fearfulness was not objectively evaluated.

An investigation to evaluate the mechanisms of change involved in S.D. was conducted by Davison (1968b). After the pretest assessment, snake phobic Ss were randomly assigned to the following groups:

1) S.D., 2) pseudodesensitization, 3) exposure only, or 4) no treatment. Results showed that Ss treated by systematic desensitization exhibited a significantly greater reduction of avoidance scores than the other Ss. The S.D. group was the only group to show improvement on the self-report scales, but this measure did not reach significance. These results agree with those found in other studies (Lang and Lazovik, 1963; Lang, 1964; Lang, et al., 1965; Lang, 1965b).

O'Neil and Howell (1969) conducted a study to test the effectiveness of various modes of hierarchy presentation for reducing fear in 30 snake phobic males. The three modes of presentation were: S.D., projecting photographed scenes on a screen, and enacting the same scene in vivo before the group. All groups showed a substantial reduction in snake fear and there were no significant differences among groups. Both behavioral and self-report measures were used to evaluate the progress and they seemed to correlate fairly well with each other. This study showed that group desensitization is a practical way to treat Ss who suffer from the same phobia and supports similar findings by other researchers (Lazarus, 1961; Rachman, 1965c, 1966a, 1966b; Shannon and Wolff, 1967).

Leitenberg, Agras, Barlow, and Oliveau (1969) presented evidence that therapeutically oriented instructions and social reinforcement might add to progress in fear reduction of Ss treated with S.D. Of the two groups of Ss, the group of snake phobics that were told they were participating in an experiment on visualization improved only slightly in avoidance behavior; while the group of Ss that were told they were receiving a form of therapy that was known to be effective,

and were praised for completion of hierarchy items, improved much more.

Nawas (1970) however, did not find any differences between groups of S.D. Ss who were informed that they were progressing well, poorly, or received no such information. This experiment showed a substantial treatment effect and Ss awareness was clearly established. Similar results were found in a study presenting Ss with either therapeutic instructions, no instruction, or misleading instructions where all three conditions led to reductions in snake phobic behavior (Miller, 1972).

COMPARISON OF SYSTEMATIC DESENSITIZATION TO FLOODING AS A TECHNIQUE

Riccio and Silvestri (1973) suggest that a more permanent elimination of avoidance behavior takes place when treatment involves extinction of motivational as well as discriminative aspects of the CS. They hypothesized that flooding is capable of incorporating the extinction of both the motivational and discriminative properties of the phobic stimuli, while systematic desensitization appears to be mainly oriented toward changing the discriminitive properties of the phobic stimuli.

> During systematic desensitization S is presented with a graded series of phobic-related scenes while he is in a previously trained state of relaxation. The S is then instructed to signal the therapist whenever these scenes disrupt his relaxation and he begins to experience anxiety. At this point, S is directed to discontinue his imagery and resume a relaxed state. In this manner, S experiences a minimum of anxiety in response to the images and is indeed afforded an avoidance response to the stimuli.

> In contrast, during implosive therapy (flooding), S is asked to imagine high intensity scenes of the phobic object in an attempt to elicit a strong anxiety reaction. These scenes are specifically intended to confront S with the most gruesome, dreaded aspects of his fear, while denying him an opportunity to escape the situation until his anxiety has subsided. Accordingly, flooding forces S to experience both the onset and termination of his anxiety while in the continuous presence of the phobic scene (1973, p. 7).

Since flooded Ss are forced to experience anxiety while in the presence of phobic images, weakening of their motivational or fear-eliciting potential is hypothesized. However, flooding studies have produced conflicting results. Failures were found when Ss were flooded for short periods (Rachman, 1965) and when it was suspected that subjects cognitively diverted their attention from the images, evidencing avoidance (Fazio, 1970). It seems that these failures to support the effectiveness of flooding procedures were due to the lack of sufficient time for extinction to occur (Eysenck, 1968; Rohrbaugh, Riccio and Arthur, in press), or to the reinforcement of S's avoidance response (cognitive shift) through anxiety reduction. Successes involving the use of flooding have been reported by several investigators (Malleson, 1959; Boulougouris and Marks, 1962; Wolpin and Raines, 1966; Miller and Levis, 1971).

Conflicting results have been obtained from studies attempting to compare the efficacy of flooding and systematic desensitization. Barrett (1969) and Boulougouris, et al. (1971) found flooding was more effective (reduced fears more quickly in phobic Ss); while Willis and Edwards (1969), Rachman and Hodgson (1970), and Mealiea (1967) found systematic desensitization to be more effective using similar clients. There are other studies that have found both flooding and

systematic desensitization to be capable of producing significant reductions in fear (Calef and MacLean, 1970; and De Moor, 1970). In a review on flooding and implosive procedures, Morganstern (1973) describes various methodological errors (misinterpretations of data, invalid assumptions, and lack of proper controls) of the above mentioned studies, explaining that because of these deficiencies, no real cause-effect relationships between treatment and outcome can be concluded from these studies. He also points out the growing interest in the role of cognitive factors (expectancy and demand characteristics) in flooding and desensitization studies (Borkovec, 1972; Davison and Valins, 1968, 1970; Gaupp, Stern, and Galbraith, 1972; Wilkins, 1971) and concludes this is an area needing empirical research. Mathews and Shaw (1973) suggest that anxiety level experienced by Ss, duration of flooding themes or sessions, etc. could make up uncontrolled differences between studies that may account for observed variations. Riccio and Silvestri (1973) tried to explain the discrepancy between flooding and systematic desensitization results by pointing out that the advantages of flooding techniques were offset by the tendency of flooding Ss to cognitively remove themselves from the fearful situation. They suggest a modification of flooding where Ss are exposed to fearful stimuli of gradually increasing intensity, but Ss are not allowed to control CS onset or termination. This can be seen as a combination of positive techniques from both flooding and desensitization. This procedure allows Ss to remain receptive to treatment (therapy) as well as increasing chances for extinguishing both the motivational and discriminative functions of phobic stimuli.

APPENDIX B

FEAR SURVEY SCHEDULE II

The items in this questionnaire refer to things and experiences that may cause fear or other unpleasant feelings. Write the number of each item in the column that describes how much you are disturbed by it nowadays.

	None	Very Little	A Little	Some	Much	Very Much	Terror
1. Sharp objects							
2. Being a passenger in a car							
3. Dead bodies							
4. Suffocating							
5. Failing a test							
6. Looking foolish							
7. Being a passenger in an airplane							
8. Worms							
9. Arguing with parents							
10. Rats and Mice							
11. Life after death							
12. Hypodermic needles							
13. Being criticized							
14. Meeting someone for the first time							
15. Roller Coaster							
16. Being alone							
17. Making mistakes							
18. Being misunderstood							
19. Death							
20. Being in a fight							
21. Crowded places							
22. Blood							
23. Heights							
24. Being a leader							
25. Swimming alone							
26. Illness							
27. Being with drunks							
28. Illness or injury to loved ones							
29. Being self-conscious							

FSS-II (Continued)

	None	Very Little	A Little	Some	Much	Very Much	Terror
30. Driving a car							
31. Meeting authority							
32. Mental illness							
33. Closed places							
34. Boating							
35. Spiders							
36. Thunderstorms							
37. Not being a success							
38. God							
39. Snakes							
40. Cemeteries							
41. Speaking before a group							
42. Seeing a fight							
43. Death of a loved one							
44. Dark places							
45. Strange dogs							
46. Deep water							
47. Being with a member of the opposite sex							
48. Stinging insects							
49. Untimely or early death							
50. Losing a job							
51. Auto accidents							

APPENDIX C

STATE-TRAIT ANXIETY INVENTORY

STATE ANXIETY

SELF-EVALUATION QUESTIONNAIRE

Developed by C. D. Spielberger, R. L. Gorsuch and R. Lushene

STAI FORM X-1

NAME _____ DATE _____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you *feel* right now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
1. I feel calm	①	②	③	④
2. I feel secure	①	②	③	④
3. I am tense	①	②	③	④
4. I am regretful	①	②	③	④
5. I feel at ease	①	②	③	④
6. I feel upset	①	②	③	④
7. I am presently worrying over possible misfortunes	①	②	③	④
8. I feel rested	①	②	③	④
9. I feel anxious	①	②	③	④
10. I feel comfortable	①	②	③	④
11. I feel self-confident	①	②	③	④
12. I feel nervous	①	②	③	④
13. I am jittery	①	②	③	④
14. I feel "high strung"	①	②	③	④
15. I am relaxed	①	②	③	④
16. I feel content	①	②	③	④
17. I am worried	①	②	③	④
18. I feel over-excited and "rattled"	①	②	③	④
19. I feel joyful	①	②	③	④
20. I feel pleasant	①	②	③	④

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577 College Avenue, Palo Alto, California 94306

TRAIT ANXIETY

SELF-EVALUATION QUESTIONNAIRE

STAI FORM X-2

NAME _____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
21. I feel pleasant	①	②	③	④
22. I tire quickly	①	②	③	④
23. I feel like crying	①	②	③	④
24. I wish I could be as happy as others seem to be	①	②	③	④
25. I am losing out on things because I can't make up my mind soon enough	①	②	③	④
26. I feel rested	①	②	③	④
27. I am "calm, cool, and collected"	①	②	③	④
28. I feel that difficulties are piling up so that I cannot overcome them	①	②	③	④
29. I worry too much over something that really doesn't matter	①	②	③	④
30. I am happy	①	②	③	④
31. I am inclined to take things hard	①	②	③	④
32. I lack self-confidence	①	②	③	④
33. I feel secure	①	②	③	④
34. I try to avoid facing a crisis or difficulty	①	②	③	④
35. I feel blue	①	②	③	④
36. I am content	①	②	③	④
37. Some unimportant thought runs through my mind and bothers me	①	②	③	④
38. I take disappointments so keenly that I can't put them out of my mind	①	②	③	④
39. I am a steady person	①	②	③	④
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	①	②	③	④

APPENDIX D

RATIONALE AND TECHNIQUES FOR TREATMENT USED IN THIS STUDY

The purpose of this treatment is therapeutic (i.e., to reduce your fear of snakes). Therefore, an effective treatment which combines relaxation training and viewing of various scenes of snakes on slides will be used.

You will receive 4 (30 minute) sessions of EMG (electromyograph) biofeedback. The purpose of these sessions is to train deep muscle relaxation. EMG biofeedback is a relatively new procedure that allows you to be aware of and learn to control the amount of muscle tension in the frontalis muscle of your forehead. Tension (in the form of electrical activity of the frontalis muscle) is picked up by 3 electrodes worn on the forehead; this electrical activity is transformed into a clicking sound that is fed back to you through headphones. During the relaxation training, you will be instructed to reduce the rate of the clicking sound. This means you are actually reducing the level of tension in your forehead muscle. You will also receive a set of relaxation instructions to use at home between your EMG relaxation sessions. After each EMG session, find 10 minutes at home to practice the take-home relaxation procedure. This will increase your ability to learn how to relax.

In the last 4 (30 minute) sessions, you will be given the first 10 minutes to relax. Then, during the last portion of the session, you will be shown slides which have different scenes of snakes on them. These slides will be shown to you one at a time until you indicate (and your muscle tension level indicates) that you feel relaxed while viewing the scene. After you indicate you are relaxed with the slide being shown, the next slide in the sequence will be shown to you and so on until the end of each session.

It will be necessary for you to attend all sessions in order for the treatment to achieve its maximum benefit.

After you have completed all treatment sessions, you will come in once more and repeat the session you had before treatment started.

APPENDIX E

INSTRUCTIONS FOR HOME RELAXATION

Remember:

1. The idea is to tense each muscle group. Try to tense only one group of muscles at a time and leave the rest of your body relaxed.

2. Your breathing: fill your lungs--be a stomach breather!

3. Always inhale as you tense your muscles. Always exhale as you relax.

4. You should practice relaxation once a day for 10 minutes after each EMG-relaxation session.

   (Notice what relaxation feels like. Discriminate between relaxation and tension.)

Muscle Groups

1. Right hand and forearm (make a fist)
2. Right bicep
3. Left hand and forearm (make a fist)
4. Left bicep
5. Forehead (frown)
6. Cheek muscles (draw back corners of mouth)
7. Neck
8. Shoulders and chest
9. Abdomen
10. Right thigh
11. Right calf
12. Right foot (arch foot, press toes down)
13. Left thigh
14. Left calf
15. Left foot (arch foot, press toes down)

APPENDIX F

INSTRUCTIONS FOR DESENSITIZATION SESSIONS

First, I will record your baseline for one minute, eyes shut. Then you will have 10 minutes to relax with feedback. I will tell you when the 10 minutes are up at which time I will turn off the sound. I want you to open your eyes slowly and continue to relax while I take a one minute baseline with eyes open. After that is done we will continue with the last part of the session. I will then tell you the instructions for the slide-viewing portion of the session.

Slide Instructions

When each slide is shown to you you are to keep looking at it as long as it is on the screen. After you feel relaxed with viewing the slide, signal this to me by placing your left hand over the side of the arm of the chair. (Demonstrate to S.) After a certain time has passed, a certain reading is reached--the next slide in the sequence will be shown to you. If you do not feel relaxed with a slide after you have already signaled to me, just put your left hand back on the arm of the chair until you again feel relaxed. Do the same thing for each slide you see. Remember not to move or wrinkle your forehead, etc. (Ss viewed next slide after they reached the level of their eyes open baseline or lower and after they signaled they were relaxed.)

APPENDIX G

POST TEST QUESTIONNAIRE

This questionnaire will provide information on various events (your menstrual cycle, medication, home relaxation exercises, etc.) that could have influenced the physiological measures taken for this study.

On the calendar below mark an X over the day your period started and an O over the day it ended.

FEBRUARY															MARCH													
M	T	W	Th	F	S	S	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S		
14	15	16	17	18	19	20	21	22	23	24	25	26	27	1	2	3	4	5	6	7	8	9	10	11	12	13		

Circle the word below the statement that best describes your experience:

1) Amount of discomfort just before period starts.

none a little some much very much

Description of discomfort. Circle any or all that apply.

moody physical discomfort irritable

2) Amount of discomfort during period.

none a little some much very much

Description of discomfort. Circle any or all that apply.

moody physical discomfort irritable

---

3) How many times did you do the relaxation exercises at home? _____

4) Did you find them helpful in learning how to relax? Circle one.

not at all a little some much very much

---

5) What, if any, medication did you use while participating in this study? _____

6. Did you use any particular strategy (other than the feedback) to assist you in relaxing during the sessions? Circle one.

Yes No

If you circled Yes, describe your strategy in the space below:

APPENDIX H

CORRELATION MATRICES FOR FOUR DEPENDENT MEASURES, PRE AND POST, HIGH AND LOW GROUPS

CORRELATION MATRIX FOR HIGH TRAIT GROUP

PEARSON CORRELATION COEFFICIENTS

	EMGAC	HRPRE	HRPOS	STAIP	STAIA	BATP	BATA
EMGPC	0.4057 (10) S=0.122	0.1972 (10) S=0.293	0.3370 (10) S=0.170	-0.2859 (10) S=0.212	0.1083 (10) S=0.383	0.0379 (10) S=0.459	0.3046 (10) S=0.196
EMGAC		0.4472 (10) S=0.097	0.3242 (10) S=0.180	0.3032 (10) S=0.197	0.3248 (10) S=0.180	0.3844 (10) S=0.136	0.7415 (10) S=0.007
HRPRE			0.7473 (10) S=0.006	0.0145 (10) S=0.484	-0.0451 (10) S=0.451	-0.0126 (10) S=0.486	0.0437 (10) S=0.452
HRPOS				0.1006 (10) S=0.391	0.0662 (10) S=0.428	0.2508 (10) S=0.242	0.2081 (10) S=0.282
STAIP					0.4505 (10) S=0.096	0.2605 (10) S=0.234	0.4202 (10) S=0.113
STAIA						0.1025 (10) S=0.389	0.5329 (10) S=0.056
BATP							0.7148 (10) S=0.010
BATA							

CORRELATION MATRIX FOR LOW TRAIT GROUP

PEARSON CORRELATION COEFFICIENTS

	LEMGPC	LEMGAC	LHRPRE	LHRPOS	LSTAIP	LSTAIA	LBATP	LBATA
LEMGPC		0.8583 (10) S=0.001	0.4834 (10) S=0.078	-0.3865 (10) S=0.135	-0.3045 (10) S=0.196	-0.0412 (10) S=0.455	-0.5448 (10) S=0.052	-0.1991 (10) S=0.291
LEMGAC			0.4468 (10) S=0.098	-0.4239 (10) S=0.111	-0.2088 (10) S=0.281	-0.0449 (10) S=0.451	-0.5166 (10) S=0.063	-0.1181 (10) S=0.373
LHRPRE				-0.0056 (10) S=0.494	-0.6380 (10) S=0.024	-0.4833 (10) S=0.079	-0.2406 (10) S=0.252	0.4138 (10) S=0.117
LHRPOS					0.0860 (10) S=0.407	-0.0676 (10) S=0.426	0.2177 (10) S=0.273	-0.3201 (10) S=0.184
LSTAIP						0.6463 (10) S=0.022	0.5495 (10) S=0.050	-0.1518 (10) S=0.338
LSTAIA							0.0822 (10) S=0.411	-0.3484 (10) S=0.162
LBATP								0.5300 (10) S=0.058
LBATA								

APPENDIX I

NON-SIGNIFICANT MEANS FOR ANOVAs

Means for mixed design ANOVA (Groups x Sessions x Trials) on EMG level.

Group		High			Low			
EMG		1.55			1.25			
Sessions	1	2	3	4	5	6	7	8
Group								
High (EMG)	1.62	1.76	1.62	1.43	1.59	1.51	1.43	1.40
Low (EMG)	1.46	1.33	1.23	1.18	1.23	1.27	1.19	1.14

	Trials	1	2	3
Sessions	1	1.66100	1.50599	1.45450
	2	1.57000	1.54250	1.52650
	3	1.45300	1.41650	1.39350
	4	1.34000	1.30650	1.26750
	5	1.45250	1.36750	1.41350
	6	1.46250	1.35350	1.35500
	7	1.35450	1.33400	1.24150
	8	1.26750	1.30350	1.23750

High Group

	Trials			
Sessions	1	1.65200	1.61700	1.59400
	2	1.77500	1.75500	1.75500
	3	1.64000	1.62500	1.60400
	4	1.42500	1.42800	1.43500
	5	1.61500	1.52000	1.63000
	6	1.56500	1.47100	1.49500
	7	1.44900	1.46300	1.38000
	8	1.38500	1.44400	1.37300

Low Group

	Trials			
Sessions	1	1.67000	1.39500	1.31500
	2	1.36500	1.33000	1.29800
	3	1.26600	1.20800	1.18300
	4	1.25500	1.18500	1.10000
	5	1.29000	1.21500	1.19700
	6	1.36000	1.23600	1.21500
	7	1.26000	1.20500	1.10300
	8	1.15000	1.16300	1.10200

Means for mixed design ANOVA (Groups by Time (Pre & Post)) on eyes open, EMG level with cart.

Group	High	Low
EMG Eyes Open with Cart	3.41	3.33

Time	Pre	Post
Group		
High	4.08	2.75
Low	3.80	2.86

Means for mixed design ANOVA (Groups by Time (Pre & Post)) on heart-rate with cart.

Group	High	Low
Heartrate	77.05	82.55

Time	Pre	Post
Heartrate	79.35	80.25

Time	Pre	Post
Group		
High	76.45	77.65
Low	82.25	82.85

Means for mixed design ANOVA (Groups by Time (Pre & Post)) on STAI-State anxiety with cart.

Group	High	Low
STAI-State	45.70	44.65

Time	Pre	Post
Group		
High	52.50	38.90
Low	51.89	37.40

Means for mixed design ANOVA (Groups by Time (Pre & Post)) on distance from phobic object with cart.

Group	High	Low
Distance	47.70	43.75

Time	Pre	Post
High	55.40	40.00
Low	58.80	28.70

APPENDIX J

RESULTS FOR ANACOVAs ON DEPENDENT MEASURES

SUMMARY TABLE FOR THE ANALYSES
OF COVARIANCE

EMG Post Cart by Group with EMG Pre Cart

Source	SS	df	MS	F	p
Covariate	13.277	1	13.277	16.207	.001
Group	.280	1	.280	.342	NS
Residual	13.296	17	.819		

STAI Post Cart by Group with STAI Pre Cart

Covariate	560.362	1	560.362	9.725	.006
Group	6.639	1	6.639	.115	NS
Residual	979.546	17	57.620		

BAT Post Cart by Group with BAT Pre Cart

Covariate	3,093.899	1	3,093.899	9.970	.006
Group	819.415	1	819.415	2.641	.119
Residual	5,275.211	17	310.306		

HR Post Cart by Group with HR Pre Cart

Covariate	940.595	1	940.595	16.331	.001
Group	12.499	1	12.499	.217	NS
Residual	979.154	17	101.697		

Group	Criterion Mean	Adjusted Criterion Mean
High (on EMG)	2.76	2.69
Low (on EMG)	2.86	2.93
High (on STAI)	38.90	38.73
Low (on STAI)	37.40	37.57
High (on BAT)	40.00	40.76
Low (on BAT)	28.70	27.94
High (on HR)	77.65	79.43
Low (on HR)	82.85	81.07

APPENDIX K

RESULTS FOR MULTIPLE REGRESSION ANALYSIS

TABLE I

MULTIPLE REGRESSION ANALYSIS: R^2's, BETA WEIGHTS, AND SIMPLE R's FOR ANXIETY GROUPS ON TRAIT SCORES AS PREDICTED BY DEPENDENT MEASURES IN PRE TEST

	EMGPRE	HRPRE	STAIPRE	BATPRE	R^2
Low Trait					
β	-.944	.619	.641	-.552	
Simple R	-.539	-.113	.230	.166	.495
High Trait					
β	.331	.343	-.508	-.102	
Simple R	.405	-.283	-.634	-.218	.576

TABLE II

MULTIPLE REGRESSION ANALYSIS: R^2's, BETA WEIGHTS, AND SIMPLE R's FOR ANXIETY GROUPS ON TRAIT SCORES AS PREDICTED BY DEPENDENT MEASURES IN POST TEST

	EMGPOST	HRPOST	STAIPOST	BATPOST	R^2
Low Trait					
β	-.230	.477	.439	.354	
Simple R	-.494	.432	.294	.076	.475
High Trait					
β	--	-.023	.042	--	
Simple R	--	-.156	.125	--	.043

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Master of Science

Thesis: THE EFFECTS OF HIGH AND LOW TRAIT ANXIETY ON THE CONCORDANCE OF RESPONSE SYSTEMS BASED UPON AN EMG-ASSISTED DESENSITIZATION TREATMENT FOR PHOBIAS

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