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The Effectiveness of Systematic Desensitization Employing Muscle Relaxation and Positive Imagery

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THE EFFECTIVENESS OF SYSTEMATIC DESENSITIZATION EMPLOYING MUSCLE RELAXATION AND POSITIVE IMAGERY

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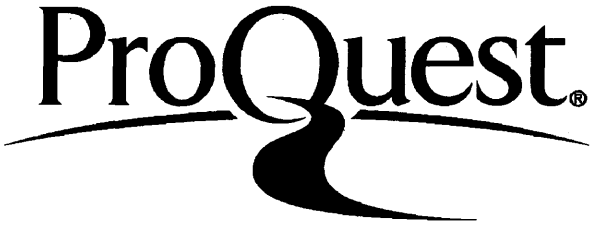

APPROVAL SHEET

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ABSTRACT

This study was designed to examine the role of muscular relaxation in systematic desensitization. Twenty-eight college students with high fear of snakes were divided into four groups. The first was a no-contact control group while the other three all received systematic desensitization. The treatment groups differed only in the incompatible response employed. The first received muscle relaxation training; the second received muscle relaxation training and positive imagery and the third practiced positive imagery only. The study attempted to measure the effectiveness of these three treatment conditions in reducing: 1) phobic behavior as measured by the avoidance test, 2) phobic anxiety as measured by the fear thermometer, the fear schedule survey snake item and the autonomic measures (GSR and finger pulse volume); and 3) generalized anxiety as measured by the fear schedule survey total score and the nonspecific anxiety measure.

All three treatment groups were significantly more improved than the control group on the avoidance test. The relaxation only and relaxation plus imagery groups were significantly more effective than the control group in reduction of phobic behavior as measured by the avoidance test for high fear subjects only and in reduction of phobic anxiety as measured by the fear schedule survey snake item. There were no significant differences between the control group and any of the treatment groups on the fear thermometer, the autonomic measures or the generalized anxiety measures. There were no significant differences among the treatment groups on any measures. The results were interpreted as evidence for the hypothesis that muscular relaxation serves to induce a positive affect state which in turn inhibits anxiety. It was suggested that positive imagery also served this purpose to some extent, but not as effectively as muscular relaxation.

THE EFFECTIVENESS OF SYSTEMATIC DESENSITIZATION EMPLOYING MUSCLE RELAXATION AND POSITIVE IMAGERY

INTRODUCTION

The most common type of behavioral therapy in laboratory studies as well as in clinical practice, has been systematic desensitization (SD). Joseph Wolpe has been by far, the most prominent proponent of SD. Wolpe developed a method of treating maladaptive anxiety through a series of counterconditioning exercises. He based this method on the principle that the association between a particular stimulus and a conditioned response will be weakened if the stimulus is presented in the presence of a response that is incompatible to the conditioned response. According to this principle of reciprocal inhibition, an anxiety evoking stimulus will lose its ability to evoke anxiety if it is presented in conjunction with a response that is incompatible with anxiety (Wolpe, 1958). Wolpe chose deep muscle relaxation (Jacobson, 1938) as the incompatible response. The successful application of this principle, according to Wolpe's theory depends upon limiting the anxiety evoked in each counterconditioning trial to a degree that can be effectively countered by the muscle relaxation. Wolpe's technique is divided into three major components: training in deep muscle relaxation, construction of a hierarchy of anxiety eliciting stimuli, and counterposing the muscle relaxation with the items from the anxiety evoking hierarchy (Wolpe, 1969).

The muscle relaxation training is essentially the procedure described by Jacobson (1938). The subject is seated in a chair that allows

his entire body to be supported without muscular effort. He is instructed to clench his fists as intensely as possible, to concentrate on this tightness and to be aware of the tense feeling in his hands and forearms, and finally to relax his hands totally and notice the loose, relaxed feeling that follows in his hands and forearms. This entire procedure is repeated and then attention is focused on the upper arms. Each muscle group is attended to in turn until the entire body has been relaxed. The amount of training and practice required varies with the individual. Wolpe (1969) claimed to have elicited the greatest anxiety inhibiting effects from the muscle groups in the head and face region. Material for the anxiety eliciting hierarchy is gathered during the same period in which the relaxation training is taking place although the two are done separately. Wolpe (1969) collects hierarchy data from 1) the patient's history; 2) the Willoughby Questionnaire; 3) the Fear Survey Schedule; and 4) probing all situations in which the patient feels maladaptive anxiety. Information is gathered from all of these sources and integrated into a hierarchy of objects and situations that elicit the maladaptive anxiety for which the S is being treated. In order to be effective in SD, the hierarchy must: increase in even increments of anxiety production, increase in steps small enough to allow desensitization of each step, and begin at the lowest possible point of anxiety production (Wolpe, 1969). Attempting to begin the hierarchy too far up the anxiety producing scale or attempting to include too large an anxiety increment between items will allow the resultant anxiety to overcome the relaxing effects of the muscle relaxation training. In order to facilitate the development of a hierarchy consisting of even increments, Wolpe employs the subjective anxiety scale (Wolpe

and Lazarus, 1966). The subjective anxiety scale is a method of reporting the amount of anxiety felt in terms of suds (subjective unit of disturbance). The S is asked to imagine the worst anxiety state he has ever experienced and to consider this state as containing 100 suds. The S is then asked to imagine a state of absolute calm and to consider this state as represented by 0 suds. Using these two states as the upper and lower limits of the anxiety scale, the S is then asked to rate his present feelings. When the S has become familiar with the scale, he is asked to rate the items on the hierarchy in suds, if the items are separated by relatively equal intervals of five to ten suds, the hierarchy is considered satisfactory. If however the items are separated by large or unequal intervals, adjustment is required.

When the muscle relaxation training and hierarchy construction is completed, desensitization may begin. The S is administered an abbreviated form of the relaxation training instructions and asked to raise his index finger if he still feels anxiety. If anxiety is signaled, the amount of anxiety is determined in suds. The anxiety is alleviated through further relaxation instructions as well as presenting pleasant imagery to be visualized. The first image from the hierarchy is presented as soon as the therapist is satisfied that the S is free of anxiety. The first image is the neutral one that is not directly related to the anxiety producing material. The image is presented for a period of five to ten seconds and followed by a ten to twenty second period of relaxation. A second period of presentation followed by relaxation is then administered and if no anxiety is signaled (by the raised index finger), the same procedure is followed with the second hierarchy item which is actually the first item dealing with

the anxiety eliciting behavior. The procedure is repeated with each item on the hierarchy until the entire hierarchy can be visualized without eliciting anxiety. In the event of an anxiety signal from the S, the anxiety producing image is immediately terminated and a period of relaxation follows. The procedure is then reinstated, beginning with the image before the one that elicited the anxiety.

The above SD technique is the standard method outlined by Wolpe (1969) and has been demonstrated to be very effective (Wolpe, 1969; Agras, 1965; Davison, 1968; Lang and Lasovik, 1965; Lanyon, Monosevitz, and Imber, 1968; Nawas, Welsch, and Fishman, 1970; Lomont and Edwards, 1965). Several variations of Wolpe's technique have also been employed with varying degrees of success. SD administered to groups of S's with similar phobias has been consistently shown to be as effective as individual SD (Ihli and Garlington, 1969; Lazarus, 1961; Paul and Shannon, 1966; Mann and Rosenthal, 1969). Cohen (1969) compared SD with interaction among therapy group members with SD without the interaction and found that the interaction group was more effective. He suggested that the group discussion of disturbing experiences might have served as further desensitization. When administering SD in groups, the therapist adjusts the pace of hierarchy presentation to the most anxious member of the group, i.e., if any single S indicates anxiety to a particular item, the image is terminated and the standard procedure for resuming presentation is followed. While group administration may or may not produce the beneficial effects of interaction found by Cohen, experience has shown that this method may be employed in research without fear of adverse effects. A necessary condition of group administration is the employment of a standard hierarchy rather than individually tailored ones. Prior

research has demonstrated that the strict Wolpean method of hierarchy construction and presentation is not a prerequisite for successful desensitization. Two independent studies (Emery and Krumboltz, 1967; Ihli and Garlington, 1969) have achieved similar results with standard and individually ordered hierarchies while Cohen (1969) has found high anxiety hierarchies to be as effective as graduated ones. Miller and Nawas (1970) found that SD was no more effective when presented in the standard Wolpean manner than when strict attention was not paid to completely desensitizing each item before proceeding to the next. They inferred from this that strict individual control of pace through the hierarchy was not necessary and therefore, standard sessions could be taped. Standardized, taped SD sessions have been shown to be effective by two different groups of investigators (Nawas, Fishman, and Pucel, 1970; Donner and Guerney, 1969) although Donner and Guerney did find a strong but insignificant trend towards superior results with a live therapist present.

SD has also been shown to work effectively with direct or vicarious treatment (Mann and Rosenthall, 1969; Rimm and Mederio, 1970; Ritter, 1968) and with spaced and massed sessions (Lanyon, Monosevitz, and Imger, 1968; Ramsey, Barents, Breaker and Kruseman, 1966). Although both of the above studies found spaced and massed sessions to be significantly effective, Ramsey et al. (1966) found spaced trials to be significantly more effective than massed, and Lanyon, et al. (1968) found a greater generalization of effect with spaced trials. Other studies have provided some evidence of generalization of treatment effect from the specific fear treated to fear of similar objects and generalized anxiety (Garlington and Cotler, 1969; Ihli and Garlington, 1969).

Although Wolpe presents the hierarchy scenes in imagination, in vivo item presentation has been found to be as effective as imaginal presentation (Cooke, 1966; Garfield, Darvin, Singer and McBrearty, 1967; O'Neil and Howell, 1964; Ritter, 1968). In addition to the above studies, there have been numerous clinical reports of successful in vivo desensitization (Freeman and Kendrick, 1964; Garney and Hegrenes, 1966; Grossberg, 1965; Haslam, 1965; Leventhall, 1968; Murphy, 1964; Schmidt, 1964).

While the above variations of SD have enhanced its clinical value, they have also demonstrated the lack of strict theoretical understanding. The precise function of some aspects of Wolpe's desensitization procedure have not been clearly defined. Wolpe's technique employs muscular relaxation training as the incompatible response which overcomes anxiety. Most of the clinical applications of in vivo SD mentioned above were performed without muscle relaxation training. Murphy (1964) reported the employment of muscle relaxation training but the activity level of the patient during therapy makes the maintenance of a deep level of muscular relaxation rather unlikely. Most of the authors provided strong therapist support and reinforcement during therapy which may have encouraged a calm attitude in itself incompatible with anxiety. Freeman and Kendrick (1964) reported successful in vivo desensitization with no muscular relaxation and minimal therapist contact and support. None of the above reports included no therapy control groups or standard desensitization groups for comparison.

Laboratory studies designed to investigate the role of muscular relaxation in SD have arrived at conflicting conclusions. Rimm and

Medeiros (1970) investigated the role of muscular relaxation in participant modeling which is a form of vicarious desensitization in which the subjects observed a fearless model performing progressively more anxiety producing behavior with a harmless snake. Those subjects who observed the model either with or without relaxation training improved significantly more than those who received relaxation training only and a no-treatment control group. There was no significant difference between those who observed with the relaxation training and those who observed without relaxation. Ritter (1968) compared vicarious desensitization which was similar to the participant modeling procedure mentioned above to direct in vivo desensitization. Relaxation training was not employed with either group. Both groups improved significantly more than a no-treatment control group and the direct desensitization group which received strong therapist support improved signifcantly more than the vicarious group. There was no standard desensitization group included in the study. Wolpin and Raines (1966) desensitized two subjects without relaxation training, two while they were tensing their muscles and two with top hierarchy items only. All six subjects touched the snake after four or five ssssions. This study did not include no-treatment or standard desensitization groups and Bandura (1967) claims that the post tests were confounded by excessive modeling. Crowder and Thornton (1970) compared systematic desensitization to programed fantasy which consists of hierarchy presentation with no relaxation training and minimal therapist contact and to bibliotherapy. They found SD and programed fantasy to be significantly more effective than bibliotherapy with no significant differences between SD and programed fantasy. They

suggested from these findings that relaxation training may be effective only in so far as it is usually accompanied by a lack of arousal and the 10-20% failures usually found with SD may be subjects who relax muscularly but remain mentally aroused. Davison (1965b) treated two subjects with in vivo desensitization and three subjects with in vivo desensitization without relaxation training. Both groups showed more improvement than the no-treatment controls. Two of the three no-relaxation subjects and both relaxation subjects touched the beetle but the relaxation subjects showed greater anxiety reduction. There were no statistical comparisons of pre- and post-measures.

Davison has also completed a study in which SD was found to be superior to SD without relaxation. In 1968 he compared the effectiveness of SD, SD without relaxation, relaxation paired with irrelevant hierarchy items and a no-treatment control group. He found the SD group to be significantly more improved than the other three groups with no significant differences among those three. He considered these findings to be support for the counter conditioning explanation of desensitization. He concluded that deep muscle relaxation training does in fact inhibit anxiety during SD and the increase in approach behavior on the part of the SD S's is due to an actual reduction in underlying anxiety (according to self reports). Lomont and Edwards (1965) investigated the effectiveness of SD with and without muscle relaxation training and found that SD with relaxation training was significantly or nearly significantly more effective in three of five measures of snake fear. The SD procedure without relaxation was considered useless. Schubot (1966) treated

15 snake phobic subjects with SD including hypnotic and muscular relaxation and a second group of 15 subjects with SD with no relaxation training. He found both treatments to be significantly effective in increasing approach behavior and decreasing subjective fear reports. There were no significant differences in effectiveness between the two treatment procedures for low fear subjects (those who would stand next to the caged snake but would not lift it). The procedure that included muscular and hypnotic relaxation was significantly more effective in the treatment of high fear subjects (those who would not approach within five feet of the cage) however. Unfortunately, muscular and hypnotic relaxation were combined in the same treatment level, making their separate effects impossible to determine. In 1965, Rachman compared the effectiveness of SD, SD without muscle relaxation training, relaxation training only and a no-treatment control. He found SD to be significantly more effective than the other three groups with no significant differences among those three. He interpreted these findings as support for the counter-conditioning hypothesis and evidence for the necessity of muscular relaxation in SD. Rachman (1968) later reconsidered the above results in light of additional research reports however and stated that the mental calmness which usually accompanies muscular relaxation is the necessary element. He cited as support for this contention, work by Lader (1968) and Mathews (1968) who have found that subjects have looked and reported feeling calm with no decline in EMG readings. This suggestion that a state of mental relaxation or calmness is the critical factor has received experimental support. As mentioned previously, Crowder and Thornton (1970) concluded that muscle relaxation

may be effective only in so far as it is usually accompanied by a lack of arousal and the 10-20% failures usually found with SD may be subjects who have relaxed muscularly but not mentally. Nawa, Welsch and Fishman (1970) compared no therapy and pseudo desensitization control groups to three variations of SD. The first group received standard SD; the second received SD with muscle tensing instead of relaxation training and the third received SD with neutral tasks in place of relaxation. They found that the standard SD group was significantly more effective than the muscle tensing and neutral task SD groups which were not significantly different from one another but were significantly more effective than the control groups. They concluded from these results that the muscle relaxation itself was not necessary to SD. They suggested that it was probably the sense of monotonous calm usually induced by Jacobson's technique which facilitates desensitization and which is not as well established by muscle tensing or neutral tasks. Wolpe and Lazarus (1966) listed three types of difficulties encountered in SD, the first of which is "difficulties in relaxation." Within this category they included the patient who relaxes his muscles but remains afraid. Although Wolpe's standard SD procedure employed muscle relaxation as the incompatible response, Wolpe and Lazarus (1966) have mentioned other incompatible responses including assertive responses, sexual responses, feeding behavior and positive imagery.

SD has in fact been successfully applied with incompatible responses other than muscular relaxation. The first recorded success of a desensitization type procedure employed feeding as the incompatible response (Jones, 1924). Wolpe also employed food in

his early desensitization work. He reduced shock-induced avoidance responses in cats by feeding them progressively closer to the cage in which they had been shocked (Wolpe and Lazarus, 1966).

While performing in vivo desensitization with children in whom relaxation was difficult to establish, Lazarus and Abramovitz (1962) successfully employed positive imagery as the incompatible response. They first interviewed the patients in order to determine each patient's favorite fantasies and heroes. They then encouraged the children to engage in these fantasies and introduced hierarchy items within the context of them. This article was a clinical report of three individual patients and therefore contained no control groups or statistical analysis. Folkins, Lawson, Opton and Lazarus (1968) compared three treatment conditions to a no-treatment control group in the desensitization of subjects with a high fear of industrial accidents. The first group viewed films of industrial accidents while practicing muscle relaxation; the second viewed the film while imagining positive scenes and the third practiced muscle relaxation only with no films. They found all three treatments significantly more effective than the control group with no significant differences among the three. They concluded from their findings that relaxation training only and cognitive rehersal were both slightly more effective than the entire SD procedure. Bandura (1969) has criticized this study severely for methodological errors. He stated that neither the treatment conditions nor the data justified the author's conclusions. The films were shown automatically during treatment with no consideration of the subject's anxiety level and the control groups anxiety reactions were lower than those of the treatment groups during the

baseline period of measurement.

In summary, SD without muscle relaxation training has been successfully employed in numerous clinical applications (Freeman and Kendrick, 1964; Garney and Hegrenes, 1966; Grossberg, 1965; Haslam, 1965; Leventhal, 1968; Murphy, 1964; Schmidt, 1964) and laboratory studies (Davison, 1965; Crowder and Thornton, 1970; Rimm and Medeiros, 1970; Ritter, 1968; Wolpin and Raines, 1966). Many other studies have found SD with relaxation to be significantly more effective than SD without relaxation (Davison, 1968; Lomont and Edwards, 1967; Nawas, Welsch and Fishman, 1970; Rachman, 1965; Schubot, 1966). Two of these studies found SD without relaxation to be somewhat effective (Nawas, Welsch and Fishman, 1970; Schubot, 1966), while the other three found no difference between SD without relaxation and control groups (Davison, 1968; Lomont and Edwards, 1967; Rachman, 1965). Many of the above studies have been criticized for lack of control groups or methodological difficulties. These conflicting results may be explicable in terms of the manner in which muscle relaxation training works. It has been suggested that the actual value of muscle relaxation training is not the muscular manipulations themselves but rather the state of mental calmness that usually accompanies them (Crowder and Thornton 1970; Nawas, Welsch and Fishman, 1970; Rachman, 1968; Wolpe and Lazarus, 1966).

Davison (1966) investigated the effect of curarization on rats in an effort to determine the process by which muscle relaxation training reduces anxiety. He stated that the Jacobson-Wolpe explanation of the effectiveness of muscle relaxation training as an anxiety inhibitor assumes that the reduction of proprioceptive feedback

from muscles which have been relaxed is incompatible with a state of anxiety. He deprived rats of proprioceptive feedback by injecting curare, which paralyzes the motor end plates of nerves and prevents muscle tension. They maintained a state of alertness and anxiety however when stimulated from the environment. In light of these results, Davison offered two possible explanations for the anxiety-inhibiting effect of muscle relaxation: 1) relaxing one's own muscles generates a strong positive affect state which inhibits anxiety; and 2) since curare-induced relaxation differs from self-induced relaxation in that only with self-induced relaxation must there be a reduction in efferent messages to the muscles from the cortex, this reduction in efferents from the cortex may be the source of relaxation.

Muscle relaxation training has been found to be an effective inhibitor of anxiety. Presentive aversive stimuli to subjects who are practicing muscle relaxation has been found to reduce the autonomic arousal capabilities of the threatening cue (Gringus and Uno, 1968). Paul (1969, 1969b) has compared the effectiveness of muscle relaxation, hypnotic suggestion and rest with instructions to relax in the reduction of subjective and physiological measures of arousal. He found in both studies that muscular relaxation and hypnotic suggestion were significantly more effective than rest with instructions to relax. He also found muscular relaxation to be more effective than hypnotic suggestion in both studies but this difference was significant in the 1969 study only. Reports of successful SD without relaxation may be explicable in terms of the mental calmness hypothesis. Food, sexual responses, assertive responses, and therapist support may all serve as a means of maintaining an attitude incompatible with anxiety. In actual practice, therapists often include both muscle

relaxation training and positive imagery in the SD procedure.

In order to determine whether the decisive factor involved in muscle relaxation training is the muscular manipulation or the mental calmness which usually accompanies it, it is necessary to measure the relative effectiveness of SD employing muscular relaxation, positive imagery and the two in combination. This study attempted to measure the effectiveness of these three treatment conditions in reducing: 1) phobic behavior as measured by the avoidance test; 2) phobic anxiety as measured by the fear thermometer, the fear schedule survey snake item, and autonomic measures; and 3) generalized anxiety as measured by the fear schedule survey total score and the nonspecific anxiety measure.

METHOD

Subjects

The subjects were 28 volunteers from the William and Mary student body. They were accepted as subjects if they passed the criteria of snake phobia as described in the procedure section, were not under psychological treatment, and had not been previously treated for their fear of snakes. The 28 subjects who fulfilled these requirements consisted of 21 women and seven men.

Apparatus

The phobic stimulus (PS) was a harmless king snake approximately four and a half feet in length. The PS was presented to the subjects in an avoidance test apparatus (ATA) which consisted of a small wooden cage with a transparent plastic front and a wire grid top that locked closed. The cage was mounted on wheels and placed on a 15 foot long wooden runway that was marked at one foot intervals. A cord and pully arrangement allowed the S to control the position of the cage on the runway by rotating a wooden handle placed near his right hand. The physiological responses were recorded on an E&M Instrument Co. Physiograph Model Six. The galvanic skin response (GSR) was recorded through two finger tip electrodes (Pb, 1" x 3/4") and the finger pulse volume (FPV) was recorded through a photoelectric plethysmograph.

The pre and post tests took place in a windowless room approximately

10 feet by 20 feet in size which contained a 7-foot-square aluminum Faraday cage at one end. The temperature in this room was maintained at approximately 72° Fahrenheit. The therapy sessions were conducted in a quiet 15' x 15' room that contained seven wooden chairs with cushioned seats and back rests.

Measures

Avoidance Test. There were six measures of anxiety administered both before and after treatment. The primary measure was the avoidance test (AT) which was a direct measure of phobic behavior. During the AT the S was seated in the dentist's chair at one end of the ATA. The snake was in the cage at the opposite end of the 15-foot runway. The S was asked to draw the PS as close to him as he felt he was able. If the S was able to draw the cage the full 15 feet, he was asked to touch the cage, open the cage, touch the PS, pick it up out of the cage and finally to place it in his lap. The AT was terminated upon a signal from the S that he did not wish to continue. Points were awarded on the following basis: one point was awarded for each foot the S drew the PS toward him; one point for touching the cage; one point for opening the cage; two points for touching the PS; two points for picking up the PS; two points for placing it in his lap and an additional point for each minute up to five that the snake was held in the lap.

Fear Survey Schedule. In 1965, Geer developed a fear survey schedule (FSS-II) which has been used as a tool for self evaluations of fear of commonly feared objects and situations. The schedule consisted of a list of 51 items to be rated by the S on a seven-point fear scale ranging from "none" to "terror." The fear schedule employed

in this study was identical to Geer's with the exception of two items. Item 10 was altered from "rats and mice" to "laboratory rats and mice" and item 39 was altered to read "harmless snakes" rather than "snakes." Each S received an item 39 score on the FSS-II, as well as a full scale score.

Fear Thermometer. The fear thermometer (FT) was administered to each S immediately after the AT. Developed by Walk in 1956, the FT consists of a 10-point scale on which the S rates the amount of fear he felt in the presence of the PS.

Physiological Measures. Galvanic skin response (GSR) and finger pulse volume (FPV) were monitored on the physiograph during the pre and post tests. GSR was monitored through soft lead electrodes taped to the index and ring fingers while FPV was measured through the photoelectric plethysmograph attached to the middle finger.

Non-specific Anxiety measure. Geer (1966) has developed a technique for measuring physiological responses to certain objects. He measured GSR as the S viewed a series of ten cards, the first seven of which were neutral animals while the last three were the same negative animals. As used in this study, the non-specific anxiety measure (NAM) consisted of seven neutral animals (dog, rabbit, herron, goat, squirrel, deer, and cat) followed by three pictures of spiders. GSR and FPV were measured during the 30 second period following the presentation of each spider picture. The NAM was employed in an attempt to measure anxiety reactions to negative but phobic irrelevant animals as an indication of general anxiety reduction.

Procedure. The FSS-II was administered to approximately 400 students who were not informed of the exact purpose of the survey.

They were told that it was an attempt to determine the availability of subjects with various fears and that some of the respondents might be asked to volunteer at a later date. All students who checked "much," "very much," or "terror" on item 39, "harmless snakes" received a description of the study, and were invited to volunteer. They were advised that if they did volunteer and wished at any time during the study to withdraw they would be free to do so. All of those prospective subjects who volunteered, were not under psychological care, and had not been previously treated for their fear of snakes were administered the pre test.

Each S was pre tested individually. He was seated in a dentist's chair which was located in the Faraday cage at one end of the test room. The S's left hand was secured to the arm of the chair with a loose rubber strap in order to remind him not to move his left hand during the pre test. The GSR electrodes and photocell plethysmograph were attached to the subject's fingers and the S was asked to relax as much as possible during a ten-minute adaptation period. The NAM and AT were administered after the adaptation period with an additional ten-minute adaptation period between the two. The FT was completed immediately after the AT.

The S completed both the NAM and AT by himself in the testing room. In order to avoid modeling and therapist support and reinforcement, the tester remained outside the room with the physiograph during both measures. The tester observed the pre test through a video tape monitor which was connected to a camera in the testing room. Prior to the AT, the S was instructed to progress as far through the approach steps as he felt he could without becoming too upset, but

not to force himself to do anything he really did not want to do. He was reminded that the AT would be terminated upon his signal that he was finished. Twenty-four subjects refused to touch the locked cage. Four additional subjects who touched the cage but refused to open it were also accepted. The 28 accepted subjects terminated the AT with the locked cage at an average distance of slightly over six feet away. The subjects were divided into four groups according to AT score and sex. The average approach distance in all four groups was six feet and three of the four groups were comprised of five females and two males while the fourth included six females and one male. The groups were then randomly assigned to the four conditions.

The control group (CG) was a no treatment control group. These subjects received no contact or information about the study between the pre test and the post test.

The treatment groups all received six 50-minute sessions of group treatment. The first 25 minutes of the first session was identical for all three groups. The first ten minutes were devoted to a brief explanation of SD including instruction in the use of the SUDS scale (Wolpe and Lazarus, 1966). The explanation emphasized a learning viewpoint rather than a symbolic interpretation of irrational fears. The next 15 minutes were spent practicing imagery. The subjects were asked to imagine as vividly as possible four neutral and pleasant scenes as they were described by the experimenter. Emphasis was placed on detail, color, motion, and realism. The final 35 minutes of the first session were devoted to inducing a state incompatible with anxiety by three different techniques. The

muscle relaxation group (RG) practiced muscle relaxation training in a manner patterned after the procedure suggested by Wolpe and Lazarus (1966). The imagery group (IG) practiced imagining a very calm and peaceful scene. Emphasis was placed on producing as realistic an image as possible and the subjects were encouraged to place themselves in the scene and feel the calm, peaceful feelings they would experience there. The scene consisted of a detailed description of a very quiet lake on a pleasant spring day. The relaxation plus imagery group (RIG) practiced an abbreviated form of the muscle relaxation training employed by the relaxation group for the first 20 minutes and an abbreviated form of the imagery practice employed by the imagery group for the last 15 minutes. All subjects were asked to practice the procedures they had learned during the first session between sessions.

The second session for each group began with the form of relaxation training appropriate to that group (muscle relaxation, imagery or both). This training was continued until all subjects in the groups reported a score of zero to five on the SUDS scale. When all subjects attained this level of relaxation, the presentation of hierarchy items was begun. The subjects were instructed in the following manner, "I am now going to ask you to imagine a number of scenes. You will imagine them clearly and they will interfere little if at all with your state of calmness. If however you feel disturbed or worried at any time, you can attract my attention by raising your right index finger." The first hierarchy item was presented for five seconds and followed by a 20 second relaxation period. The item was then presented for ten seconds and followed by

a 25-second relaxation period. The same procedure was repeated for each of the hierarchy items in order. An additional ten-second presentation and 25-second relaxation period was included for items 13 through 19. When any subject signaled anxiety to a hierarchy item, the presentation was terminated immediately and a one-minute relaxation period followed. An additional five-second trial followed the relaxation period if the initial anxiety signal was in response to the first presentation of an item. The standard process was then resumed as long as anxiety was not signaled on this second five-second trial. When anxiety was signaled to the second five-second trial or to a ten-second trial, the presentation was terminated and followed by a one-minute relaxation period. The therapist then proceded with the hierarchy presentation, beginning with the last item that was completed without an anxiety signal.

The third through sixth therapy sessions followed the same pattern as the second. Each session began with the appropriate method of incompatible response training which was continued until all subjects reported a SUDS score between zero and five. Due to a significant decrease in the amount of time required for this process, the fourth through sixth sessions were limited to 40 minutes. All S's were presented with the following standard hierarchy that was adapted from the one developed by O'Neil and Howell (1969).

1. An emply classroom with a blank blackboard.

2. The same empty classroom with the word "snake" written on the blackboard.

3. An empty snake cage.

4. A person with his hand in the empty cage.

5. A small snake in a locked cage across the classroom.

6. A large snake in a locked cage across the classroom.

7. A large snake in a locked cage up close.

8. A small snake in a cage with the door open.

9. A large snake in a cage with the door open.

10. A small snake on an open table.

11. A small snake in a cage with a person reaching in the door.

12. A person with a gloved hand touching a small snake.

13. A large snake in a cage with a person reaching in the door.

14. A large snake on an open table.

15. A person touching a large snake.

16. A person with both gloved hands holding a large snake.

17. A person holding a large snake with both bare hands.

18. A large snake being held up to but not touching a person's face.

19. A large snake being held up to and touching a person's face.

There was a seven to ten day period between the last therapy session and the post test. The FSS-II was administered prior to the post test which was identical to the pre test with one exception. A red marker was placed on the runway of the ATA at the point where the subject halted the cage on the pre test. The subject was asked to halt the cage at that point during the post test before continuing with the AT. This period was established in order to allow a direct comparison of physiological responses on the pre and post tests with the PS at comparable distances. Upon completion of the post test each subject was interviewed in order to gain any additional information that might be available as well as to ascertain that no unpleasant feelings or side effects were present.

RESULTS

A completely randomized analysis of variance (Kirk, 1968) was performed on the data from each of the eight measures. As stated in the method section, the AT was considered the primary measure of phobic behavior. The AT data were analyzed as difference scores arrived at by subtracting the post test scores from the pre test scores. The analysis of variance for these AT scores was significant at the .025 level ($F=4.29$, $df=3/24$, $p<.025$). The t-test for differences

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Insert Table I about here

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among several means (Bruning and Kintz, 1968) was applied to determine which specific means differed from one another. The three treatment groups differed significantly from the control group (mean square within groups--11.52, $df=24$, $t=2.064$, $p<.05$) with no significant

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Insert Table II about here

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difference among the three treatment conditions.

All treatment groups included similar but wide distributions of pre therapy AT scores. Upon visual inspection of the AT data, it appeared that there might have been differential treatment effects among high fear subjects that were not apparent when the groups were analyzed as units. In order to investigate this possibility, all subjects who halted the cage at a distance of at least five feet were

Table 1

Analysis of Variance: Avoidance Test

Source	df	Mean square	F
Between groups	3	49.46	4.29*
Within groups	24	11.52	

*$p < .025$

Table 2

t-test for Differences Among Several Means: Avoidance Test

		CG	RG	RIG	IG
		1.71	6.86	7.71	5.86
CG	1.71	--	5.15*	6.00*	4.15*
RG	6.86		--	0.85	1.00
RIG	7.71			--	1.85
IG	5.86				--

* $p<.05$

analyzed separately. These groups consisted of the four highest fear subjects in each treatment group. The analysis of variance was significant at the .025 level of confidence ($F = 4.947$, $df = 3/12$, $p<.025$). Tukey's HSD test for a posteriori pairwise comparisons among the means (Kirk, 1968) was applied to the data resulting in significant differences between the control group and both the relaxation group and the relaxation plus imagery group. There were no significant differences between the relaxation group and the relaxation plus imagery group or between the imagery group and any other group (Mean square within groups = 9.85, q .05, 12 = 4.20, HSD = 6.59).

Insert Tables III and IV about here

All subjects received two scores on the FSS-II: an item 39 (harmless snake) score and a total score. The data from both of these measures as well as the FT were analyzed in the form of pre test minus post test difference scores. The analysis of variance for the FSS-II item 39 data was significant at the .05 level of confidence ($F = 3.44$, $df = 3/23$, $p<.05$). A t-test for the differences among several means (Bruning and Kintz, 1968) demonstrated that the relaxation

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Insert Table V about here

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group and the relaxation plus imagery group were significantly more effective than the control group (mean square within groups = 1.09, $df = 23$, $t = 2.069$, $p<.05$). There were no significant differences between the relaxation group and the relaxation plus imagery group

Table 3

Analysis of Variance; AT,
High Fear Subjects

Source	df	Mean Square	F
Between Groups	3	48.73	4.947*
Within Groups	12	9.85	

* $p < .025$

Table 4

Tukey's HSD Test;
AT High Fear Sbujects

	CG 2.25	IG 7.25	RG 9.25	RIG 10.00
CG 2.25	--	5.00	7.00*	7.75*
IG 7.25		--	2.00	2.75
RG 9.25			--	.75
RIG 10.00				--

* $p<.05$

Table 5

Analysis of Variance: FSS-II, item 39

Source	df	Mean square	F
Between Groups	3	3.75	3.44*
Within Groups	23	1.09	

* $p<.05$

group or between the imagery group and any other group.

Insert Table VI about here

There were no significant differences among groups for the FSS-II total scores ($F = .4486$, $df = 3/23$, $p>.20$) or the FT data ($F = .333$, $df = 3/24$, $p>.20$).

Insert Tables VII and VIII about here

In order to control for individual variation in baseline rate, the physiological measures were all stated in terms of the post test score as a percentage of the pre test score. During the NAM, the responses were scored for thirty second periods immediately following the introduction of the three spider cards. GSR was scored in terms of duration of response of at least 1000 ohms above baseline during this period. FPV was measured as the mean pulse magnitude during these periods. There were no significant differences found between groups on the NAM for GSR ($F = 1.068$, $df = 3/24$, $p>.20$) or FPV ($F = 1.504$, $df = 3/24$, $p>.20$). The GSR and FPV were measured for the AT during the 30 second periods preceeding termination on the

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Insert Tables IX and X about here

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pre test AT and the red marker on the post test AT. They were scored in the same manner as has been described above for the NAM. There were no significant differences among groups in AT measures of GSR

Table 6

t-test for Differences Among Several Means:
FSS-II, item 39

		CG	RG	RIG	IG
		.71	2.14	2.29	1.33
CG	.71	--	1.43*	1.58*	.62
RG	2.14		--	.15	.81
RIG	2.29			--	.96
IG	1.33				--

* $p < .05$

Table 7

Analysis of Variance: FSS-II Total

Source	df	Mean square	F
Between Groups	3	273.873	.4486*
Within Groups	23	610.48	

* $p > .20$

Table 8

Analysis of Variance: FT

Source	df	Mean square	F
Between Groups	3	2.81	.333*
Within Groups	24	8.64	

* p>.20

Table 9

Analysis of Variance: NAM, GSR

Source	df	Mean square	F
Between Groups	3	9,067.33	1.068*
Within Groups	24	8,492.21	

* $p > .20$

Table 10

Analysis of Variance: NAM, FPV

Source	df	Mean square	F
Between Groups	3	28,168.82	1.504*
Within Groups	24	18,724.76	

* p>.20

(F - .7658, df - 3/24, p>.20) or FPV (F - .5654, df - 3/24, p>.20).

Insert Tables XI and XII about here

Table 11

Analysis of Variance: AT, GSR

Source	df	Mean square	F
Between Groups	3	168,206.71	.7658*
Within Groups	24	219,628.69	

* $p > .20$

Table 12

Analysis of Variance: AT, FPV

Source	df	Mean square	F
Between Groups	3	2,439.03	.5654*
Within Groups	24	4,313.75	

* $p > .20$

DISCUSSION

The purpose of this study as stated in the introduction was to investigate the role of muscle relaxation training in SD. The effectiveness of muscular relaxation, positive imagery and the two in combination were compared in order to determine whether SD with relaxation training has been effective due to the muscular manipulation or to the induction of a state of mental calmness. This experiment was designed to measure the effectiveness of the three treatment conditions in reducing: 1) phobic behavior as measured by the avoidance test; 2) phobic anxiety as measured by the fear thermometer, the fear schedule survey snake item and autonomic measures; and 3) generalized anxiety as measured by the fear schedule survey total score and the nonspecific anxiety measure.

The avoidance test has been commonly relied upon as the most objectively scored behavioral indication of treatment effectiveness. According to the AT, all three treatment conditions were significantly more effective than the control group with no significant difference among the three. Although the differences were not significant, the imagery group improved an average of 5.86 points on the AT as compared to averages of 6.86 and 7.71 for the relaxation group and relaxation plus imagery group respectively. Upon visual inspection of the data, it appeared that the relatively low fear subjects in all three treatment groups improved at approximately equal rates. The experimenter felt that the presence of this relatively constant subgroup within each treatment

group might have masked possible differential effects among the higher fear subjects. In order to investigate this possibility, the four highest fear subjects (those who halted the cage at least five feet away) in each group were analyzed separately. When this was done, only the relaxation group and relaxation plus imagery group were effective. These results corresponded to the FSS-II snake item data which were also significant only for the relaxation group and the relaxation plus imagery group.

The other two measures of phobic anxiety were not significant. These negative results may be an indication that SD actually enables the subject to function despite anxiety rather than lowering his anxiety level. This conclusion was not strongly supported however due to the significant reduction of anxiety ratings on the FSS-II snake item as well as some methodological difficulties. The FT which was not significantly decreased was administered immediately after the AT both before and after therapy. While the treatment conditions did not exhibit a change in FT ratings significantly different from the control group, they were rating fear of a snake that was significantly closer during the post test than the control group. The treatment subjects approached significantly closer to the snake than the control group did with no corresponding increase in fear rating. In order to obtain a more accurate measurement, the FT should have been administered during pre and post tests with the snake at comparable distances. This was not done in this experiment because the experimenter wished to avoid any contact with the subjects during the AT to eliminate any possible modeling or supportive effects. In future experiments, it would be advisable to elicit the FT ratings during the pre and post tests with the snake at comparable positions.

There were no significant differences among groups in autonomic indices of phobic anxiety. The cage was halted during the post test in order to allow autonomic measurements at comparable distances from the snake. It became apparent during the post experimental interview however that this situation was not strictly equivalent for all groups. While most control subjects had no expectations of improvement and considered the AT essentially completed at the red halt marker, the treatment subjects were apprehensive about further performance. In short, many of the treatment subjects reported anticipating more intimate future contact with the snake while performing the post test rather than attending to the snake where it was.

The treatment conditions did not alter generalized anxiety as measured by the FSS-II total score or the NAM. The FSS-II was administered initially as a general survey with no mention of this specific experiment. The second administration was prior to the post test and the subjects' general anxiety level may have been affected by their immediate situation eliciting greater anxiety and their consciousness of the snake factor. Prior research has indicated that SD has had a significant effect in the reduction of generalized anxiety as measured by the FSS-II (Garlington and Cotler, 1969; Ihli and Garlington, 1969; Lanyon et al., 1968). The discrepancy between the above studies and the present one may have been a function of the above-mentioned difference in testing situations during the pre and post tests.

In summary, all three treatment groups were found to be significantly effective in reducing phobic behavior as measured by the AT. When only high fear subjects were considered, only the RG and

RIG treatments were significant. Phobic anxiety as measured by the FSS-II snake item was significantly reduced for subjects in the RG and RIG groups. Further evidence of phobic anxiety reduction was supplied by the FT ratings which displayed no significant differences despite the fact that the treatment group subjects were rating fear of a snake that was significantly closer during the post test. The autonomic measures produced no significant results as a measure of phobic anxiety during the AT or as a measure of generalized anxiety during the NAM. The FSS-II total score, the second measure of generalized anxiety, was also insignificant.

The AT was the only direct measurement of phobic behavior and has commonly been accepted as the primary means of measuring therapeutic success. The significance of treatment conditions including relaxation training as measured by the AT was consistent with most of the prior research concerning SD with relaxation. SD with muscle relaxation training has consistently been found significantly effective in the treatment of specific phobias although the role played by the relaxation training has not been precisely defined. Both conditions that included muscle relaxation training were significantly effective according to the AT, the AT for high fear subjects only and the FSS-II item 39. The imagery group was significantly effective on the AT data for full groups only. The positive imagery would have been expected to be totally ineffective if the muscular manipulation itself was a necessary factor in desensitization. The calm state produced by the tranquil imagery may have been accompanied by some degree of muscular relaxation, but this did not appear to be significant as indicated by the reports from the subjects and their posture during the sessions.

The effect of muscular relaxation training was readily apparent in the physical attitude of the RG and RIG subjects while the IG subjects maintained relatively upright, rigid positions.

The data collected in this study are consistent with the hypothesis that muscular relaxation commonly serves as a means of producing some physiological or affect state that is incompatible with anxiety. Positive imagery may also have encouraged this state although not as efficiently as muscular reaction. The effectiveness of muscular relaxation as a tranquilizing agent was further supported by the post experimental interview in which many of the RG and RIG subjects reported practicing muscular relaxation to relieve tension apart from the experimental situation while none of the IG or RIG subjects reported using positive imagery in this manner.

Davison (1968) has offered two possible explanations for the anxiety inhibiting effects of muscle relaxation training. As a result of his work with the curarization of rats, Davison (1968) has suggested that muscle relaxation may: 1) generate strong positive affect states which in turn inhibit anxiety; or 2) include inhibitory efferent messages to the muscles from the cortex which inhibit anxiety. Desensitization procedures have been successfully employed with the in vivo method of item presentations as well as with relatively active incompatible responses such as sexual behavior. It seems unlikely that the cortex would have been sending inhibitory efferent messages to the muscles in these cases. While it is possible that the various responses that have been successfully employed as the incompatible responses in SD inhibit anxiety through different processes, the most parsimonious explanation at this time appears to be Davison's first alternative above.

The generation of a strong positive affect state as a response incompatible with anxiety not only provides an explanation for the results of this study, it also accounts satisfactorily for many of the variations of standard SD that have been employed. Incompatible responses such as feeding, sexual responses, and positive imagery would all be effective in producing a positive affect state incompatible with anxiety although the degree to which they served this purpose would vary. The success of vicarious desensitization procedures (Mann and Rosenthal, 1969; Rimm and Medeiros, 1970; Ritter, 1968) might also be explicable according to this hypothesis. The opportunity for the subject to view the anxiety producing situation from a distance with no personal involvement could produce a positive affect state even with no particular incompatible response provided. Although most of the in vivo desensitization cases reported in the introduction were completed without relaxation training, almost all included therapist support and reinforcement. Bandura (1969) suggested that relationship-induced affect responses could serve to mitigate emotional arousal. Therapist support and reinforcement could provide the incompatible response if Bandura is correct.

This hypothesis has broad implications when applied to therapy. While muscular manipulation appears to be the most reliable means of inducing a strong positive affect state for desensitization, some subjects do find it very difficult to relax. Various other means of inducing the positive affect state may be more condusive to individual application. During the present study, a common scene was required for all positive imagery subjects in order to allow group administration. Positive imagery may be much more effective when it is tailored to the

individual's fantasies in the manner reported by Lazarus and Abramovitz (1962). Various other methods of inducing positive affect states such as food, sexual behavior or drugs would be more appropriate with certain patients or specific fear categories.

The development of reliable SD techniques employing incompatible responses that were directly controllable by the patient such as eating or drug induced relaxation would allow the patient to maintain a self-administered SD program with a single therapist acting as a consultant to numerous patients.

APPENDIX A

Individual Sbuject Data and Group Means

TABLE I: Avoidance Test

Pre test Scores minus Post test Scores

Groups	CG	RG	RIG	IG
Subjects				
1	0	8	17	7
2	5	12	6	5
3	0	10	10	8
4	4	7	7	9
5	2	5	8	3
6	1	5	3	6
7	0	1	3	3
EX	12	48	54	41
$\bar{X}$	1.71	6.86	7.71	5.86

TABLE II: FSS-II, item 39

Pre test Scores minus Post test Scores

Groups	CG	RG	RIG	IG
Subjects				
1	0	1	0	1
2	-1	3	2	2
3	1	2	4	-
4	2	2	3	1
5	3	3	3	1
6	0	2	2	1
7	0	2	2	2
EX	5	15	16	8
$\bar{X}$	.71	2.14	2.29	1.33

TABLE III: FSS-II, Total Score

Pre test Score Minus Post test Score

Groups	CG	RG	RIG	IG
Subjects				
1	58	34	-18	20
2	18	24	7	3
3	1	20	25	-
4	-15	31	27	24
5	69	78	14	- 6
6	5	-25	-16	34
7	- 2	27	8	29
EX	134	189	83	104
$\bar{X}$	19.14	27.00	11.86	17.33

TABLE IV: Fear Thermometer

Pre test Score Minus Post test Score

Groups	CG	RG	RIG	IG
Subjects				
1	0	3	7	1
2	-1	6	0	0
3	-1	0	3	4
4	1	2	4	-1
5	1	2	4	-1
6	2	-6	-1	4
7	1	-2	-4	2
EX	3	5	13	9
$\overline{X}$	.43	.71	1.86	1.29

TABLE V: Nonspecific Anxiety Measure; GSR

Post test Measure as a Percentage of Pre test Measure

Groups	CG	RG	RIG	IG
Subjects				
1	101.47	94.50	148.40	42.54
2	66.14	334.31	73.74	53.46
3	80.85	138.50	263.11	262.14
4	64.55	58.94	42.10	85.22
5	130.48	388.18	168.83	79.76
6	241.47	50.50	94.52	52.75
7	89.31	169.50	43.23	77.06
EX	774.27	1234.43	832.93	652.93
$\bar{X}$	110.61	176.35	118.99	93.28

TABLE VI: Nonspecific Anxiety Measure; FPV

Post test Measure as a Percentage of Pre test Measure

Group	CG	RG	RIG	IG
Subject				
1	69.72	100.70	150.34	183.24
2	102.28	770.11	97.78	57.57
3	163.58	93.21	177.55	71.98
4	90.87	98.04	165.60	158.97
5	259.29	151.50	229.26	113.60
6	150.30	407.46	73.76	98.15
7	103.06	133.75	57.88	77.24
EX	939.10	1754.77	952.17	760.75
$\bar{X}$	134.16	250.68	136.02	108.68

TABLE VII: Avoidance Test; GSR

Post test Measure as a Percentage of Pre test Measure

Group	CG	RG	RIG	IG
Subject				
1	68.08	88.46	120.96	97.61
2	23.33	302.27	119.56	34.42
3	2500.00	217.39	571.42	214.28
4	77.01	16.66	233.33	4.16
5	67.74	245.90	109.85	13.63
6	220.58	5.55	100.00	2.00
7	76.19	49.12	11.33	133.33
EX	3032.93	1142.74	1266.45	499.43
$\bar{X}$	433.28	163.25	180.92	71.35

TABLE VIII: Avoidance Test; FPV

Post test Measure as a Percentage of Pre test Measure

Group	CG	RG	RIG	IG
Subject				
1	131.08	93.30	64.61	230.51
2	92.65	113.51	64.10	32.74
3	34.18	26.04	125.57	94.38
4	276.76	47.23	83.23	151.42
5	200.29	109.11	95.21	94.40
6	127.04	140.76	77.92	142.30
7	67.52	260.14	104.30	70.48
EX	929.52	790.09	614.94	816.23
$\bar{X}$	132.79	112.87	87.85	116.60

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