National Library of Canada — Bibliothèque nationale du Canada

Canadian Theses Division — Division des thèses canadiennes 0-315-06132-4

Ottawa, Canada
K1A 0N4

54052

PERMISSION TO MICROFILM — AUTORISATION DE MICROFILMER

- Please print or type — Écrire en lettres moulées ou dactylographier

Full Name of Author — Nom complet de l'auteur

JOHN JOSEPH TERRENZIO

Date of Birth — Date de naissance	Country of Birth — Lieu de naissance
Aug, 18, 1951	CANADA

Permanent Address — Résidence fixe

19 BARNER AVE.
RED DEER, ALTA.
T4R 1K2

Title of Thesis — Titre de la thèse

Cue-Control Relaxation With the Retarded

University — Université

University of Alberta

Degree for which thesis was presented — Grade pour lequel cette thèse fut présentée

Master of Education

Year this degree conferred — Année d'obtention de ce grade	Name of Supervisor — Nom du directeur de thèse
1981	Dr. J. Goldberg

Permission is hereby granted to the NATIONAL LIBRARY OF CANADA to microfilm this thesis and to lend or sell copies of the film.

The author reserves other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without the author's written permission.

L'autorisation est, par la présente, accordée à la BIBLIOTHÈQUE NATIONALE DU CANADA de microfilmer cette thèse et de prêter ou de vendre des exemplaires du film.

L'auteur se réserve les autres droits de publication; ni la thèse ni de longs extraits de celle-ci ne doivent être imprimés ou autrement reproduits sans l'autorisation écrite de l'auteur.

Date	Signature
Oct. 14, 1981	J. Terrenzio

NL-91 (4/77)

THE UNIVERSITY OF ALBERTA

CUE-CONTROL RELAXATION WITH THE RETARDED

by

© JOHN J. TERRENZIO

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF EDUCATION

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

FALL 1981

THE UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR JOHN J. TERRENZIO

TITLE OF THESIS CUE-CONTROL RELAXATION WITH THE RETARDED

DEGREE FOR WHICH THESIS WAS PRESENTED MASTER OF EDUCATION

YEAR THIS DEGREE GRANTED 1981

J. Terrenzio

PERMANENT ADDRESS:

19 BARNER AVENUE

RED DEER, ALBERTA

T4R 1K2

DATED Oct. 14, 1981

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled Cue-Control Relaxation with the Retarded submitted by John J. Terrenzio in partial fulfilment of the requirements for the degree of Master of Education.

....
Supervisor

....

....

Date. Oct. 5, 1981

ABSTRACT

A group of five mentally retarded, institutionalized residents received training in cue-controlled relaxation. The effectiveness of this training was assessed via within-session changes in heart rate and skin temperature. A multiple baseline design across subjects was employed, combined with an across-sessions reversal. A within-sessio reversal was also employed in order to establish the effectiveness of the cue. The therapist's subjective ratings of relaxation were compared with physiological measures. The results showed that three the five subjects responded consistently to the treatment with small magnitude heart rate decreases. These small heart rate decreases were also exhibited during the treatment phase of the within-session reversal. Heart rate decreases also correlated quite well with the therapist's subjective ratings of relaxation. It was concluded that the cue-control relaxation training program had a small but directionally consistent effect on the subjects' heart rates. It was also concluded that behavioral measures may be useful indicators of treatment effectiveness. The implications for future research were also discussed.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES (Continued)

CHAPTER I

INTRODUCTION

Objectives

The purpose of this study is to examine the effectiveness of a relaxation training program when used with institutionalized mentally retarded persons. This ~~study~~ attempts to answer the following questions: 1) Is progressive relaxation training an effective means for inducing relaxation when it is used with institutionalized, mentally retarded individuals? and 2) If this training is effective, can the relaxation response be paired with a stimulus in order that the stimulus may be used by these individuals as a cue to induce the relaxation response?

Overview

Cue-controlled relaxation may prove to be an easy and effective method of improving the mentally retarded individual's capability for self-control. This may lead to a greater generalization of therapeutic effects, as well as an improvement in the self-image of these mentally retarded individuals.

Training in cue-controlled relaxation may be effective in the control of agitated states for retarded individuals. These agitated states can result in disruptive behaviors such as self-injury, aggression, threats, and tantrums. Disruptive behaviors occur frequently on wards for the mentally retarded (Burchard, 1967). These behaviors are often annoying and resistant to treatment (Thorne & Shinedling, 1970). Many therapeutic techniques such as punishment, time-out, differential reinforcement of other behavior, and over-correction, have been applied with varying degrees of success (Webster

& Azrin, 1973). There are very few studies which have examined the effectiveness of relaxation training with the retarded. The effects of relaxation with the retarded are often demonstrated through changes in behavioral indices (Harvey, Karan, Bhargava & Morehouse, 1978; Steen & Zuriff, 1977; Webster & Azrin, 1973; Ince, 1976).

To date there is no research demonstrating the physiological effects of relaxation training with the mentally retarded. This study attempted to examine the effects of relaxation training and a cue-control procedure on the heart rates and skin temperatures of five moderately retarded adults. Using pre- and post-session differences in these physiological measures, this study employed a multiple baseline design, combined with across and within session reversals. The therapist's subjective ratings of treatment effectiveness were compared with physiological measures. The State-Trait Anxiety Inventory for Children (STAIC) was employed as a self-report measure of treatment effectiveness. Selected scales of the Adaptive Behavior Scale part II (ABS-II) were employed as an indicator of any transfer of treatment effect from the training room to the residential unit.

CHAPTER II

REVIEW OF THE LITERATURE

Historical Background

Muscular relaxation has long been considered as an important factor in the treatment of various psychophysiological and stress-related disorders. Rooted in the meditative practices of eastern philosophies, current relaxation training procedures figure prominently in a broad range of clinical treatments. The value of taking time to relax has been recognized for many years in eastern cultures where relaxation procedures such as yoga, Zen meditation, and other forms of meditation have been practiced for centuries (Smith, 1975). Recently western society has adapted these meditation techniques into a variety of popular relaxation procedures. This popularity could be based in part on the belief that daily relaxation will help to deter the increase of stress-related disorders that are affecting people in western civilization (Benson, 1975).

One of the most extensively used relaxation procedures was developed by Edmond Jacobson (1938). Jacobson, as a physician, realized the importance of rest and relaxation in the treatment of stress-related disorders. He also realized that in most cases, merely instructing a patient to relax was insufficient and that a more structured procedure was required. Jacobson carried out a series of investigations in an attempt to develop an effective means of achieving a state of neuromuscular relaxation. He also attempted to uncover the physiological and psychological effects of this state.

Jacobson hypothesized that a reduction of muscle tension would result in a corresponding reduction of autonomic nervous system activity through some centrally mediated feedback system. The technique which he developed for acquiring muscular relaxation consisted of:

1) having the subject in a comfortable reclining position,

2) employing alternate tensing and relaxing exercises for major muscle groups, and

3) the gradual reduction and elimination of muscular contractions until the exercises consist of only passive relaxation.

Jacobson frequently asked his subjects for self-reports of feelings or thoughts in order to increase their own awareness of the presence of tension or relaxation. He was also one of the first to employ a biofeedback technique by developing an instrument which allowed him to measure the level of his subjects' electromyographic (EMG) responses, and provide them with verbal feedback (Tarler-Benlolo, 1978).

Jacobson's procedure remains as the most widely used relaxation technique today. Few researchers or clinicians administer this training for the two hundred sessions which Jacobson prescribed, as the effectiveness of even brief training has been well established (Davidson & Schwartz, 1976).

In Germany, Johannes Schultz developed a system of exercises which he called autogenic training (Schultz & Luthe, 1959) at about the same time that Jacobson was developing progressive relaxation in the United States. Schultz had grown dissatisfied with the clinical application of hypnosis. He found that some of his clients grew excessively dependent on the hypnotist while others seemed to be unable to enter a hypnotic state. Since many of his hypnotic subjects frequently reported sensations of heaviness and warmth, Schultz surmised that these sensations could be the clinically valuable properties of hypnosis, and that they might be made available through other means (Stoyva, 1976).

Schultz then developed a series of exercises which combined relaxation and auto-suggestion techniques into a set of six standard exercises requiring passive concentration. The basic foci of these exercises are: 1) feelings of heaviness and warmth in the extremities, and 2) the regulation of cardiac activity and respiration, abdominal warmth, and cooling of the forehead (Schultz & Luthe, 1969). These exercises are to be practiced in a quiet room, with dim lights, in a comfortable reclining position.

The sequencing and progression of the exercises is based on the needs of the individual. The therapist gets feedback concerning the patient's progress through regular reports of the sensations experienced during the exercises. The patient is also asked to employ these exercises frequently in daily home practice sessions.

According to Schultz and Luthe, the regular practice of these exercises results in a psychophysiological shift from the normal state to the autogenic state which activates recuperative and normalizing brain mechanisms that are usually inhibited. The shift to the autogenic state is facilitated by conditions which result in a reduction of afferent and efferent impulses, and by the regular, short periods of passive concentration upon the autogenic phrases (Schultz & Luthe, 1969).

Autogenic training may be thought of as a method for modifying the individual's response to stress by replacing a high arousal, sympathetic response, with a low arousal, parasympathetic response. Learning the autogenic exercise may take anywhere from a few weeks to several months, depending on the ability of the patient. Autogenic training has been applied to a formidable number of stress-related disorders, and is well researched with respect to psychophysiological effects (Tarler-Benlolo, 1978).

During the 1940's and early 1950's, North American interest in the topic of relaxation declined. It was only after Wolpe's introduction of systematic desensitization therapy in 1958 that interest was renewed in this area (Davidson & Schwartz, 1976). Drawing upon Jacobson's work with progressive relaxation, Wolpe (1958) theorized that a state of muscular relaxation would be physiologically incompatible with, and inhibit an anxiety response through a process he called "reciprocal inhibition". Wolpe developed a more efficient relaxation program consisting of six twenty-minute sessions with two daily home practice sessions. He then incorporated this practice with systematic desensitization. At this time, much of the research on progressive relaxation concerned its role as a facilitator in the systematic desensitization process.

Current Applications

There is considerable evidence pointing to the effectiveness of relaxation training when used in conjunction with desensitization for the treatment of phobias and psychosomatic disorders (Tarler-Benlolo, 1978). However, progressive relaxation training has been used more recently as a treatment technique on its own as Jacobson originally intended (Franks & Wilson, 1980), as well as being an adjunct to treatment programs for anxiety-related problems. A variety of relaxation training procedures are now being used to treat an ever broadening range of clinical populations, problems and behaviors. Relaxation training has been used recently in programs designed to relieve headaches (Chesney & Shelton, 1976), insomnia (Pendleton & Tasto, 1976), seizures (Ince, 1976; Wells, Turner, Bellack, & Hersen, 1978), hypertension (Graham, Beiman, & Ciminero, 1977), hyperactivity (Putre, Laffio, Chorost, Marx, & Gilbert, 1977), self-injurious behavior (Steen & Zuriff, 1977), and autistic behavior (Cautela & Groden, 1979).

The Cue-controlled Procedure

The increased use of relaxation training was accompanied by a concern regarding the generalization of the relaxation response to situations occurring beyond the confines of the treatment room (Counts, Hollandsworth, & Alcorn, 1978). The amount of transfer of office procedures to real life situations was subject to a great deal of individual variability (Gurman, 1973). In an effort to increase the generalization of the relaxation response, Cautela (1966) described the technique known as cue-controlled relaxation. At about the same time, Paul described a similar technique which he called conditional relaxation (Ewing & Hughes, 1978). This approach consists of training in deep muscular relaxation followed by the pairing of a cue word with breath exhalations while the client is relaxed. Through repeated pairings, the cue word functions as conditioned stimulus which should elicit the relaxation response (Reeves & Wallace, 1975). The cue-controlled relaxation procedure has a number of advantages. Not only does this procedure facilitate generalization, but it does not require that the client possess any imagery skills. The cue-controlled procedure attempts to make the individual less dependent on the therapist by teaching the client a general coping skill which can be used without therapist contact, after the client has learned to generate his own cues (Barrios, 1978 a).

Cue-controlled relaxation has been applied with varying success as a treatment technique in its own right, as well as being included in some multi-component treatment packages. This technique has also been applied to a broad range of anxiety-related problems such as test anxiety (Counts, et al., 1978), public speaking anxiety (Gurman, 1973), nailbiting (Barrios, 1978 a), multiple anxiety reactions (Barrios, 1978 b), seizures (Wells, et al., 1978), and phobias (Reeves & Mealiea, 1975). Brady (1973) treated a variety of anxiety-related disorders such as stuttering, phobic anxiety, obsessive thoughts, and insomnia, using a miniature metronome that could be worn behind the ear, to cue the relaxation response. This current widespread use of cue-controlled relaxation is indicative of the current tendency among behavior therapists to develop techniques which teach the client a generalizable coping skill that may be implemented with minimal therapist contact (Barrios, 1978 a).

Relaxation with the Retarded

Recently clinicians and researchers have begun to explore the possibility of applying relaxation techniques to stress-related behaviors of the mentally retarded. Webster and Azrin (1973) applied a technique which they called required relaxation, as an overcorrective procedure for disruptive behaviors. While this procedure was far removed from the tension-release procedure originally prescribed by Jacobson, Webster and Azrin (1973) demonstrated that a relaxation training procedure could be applied effectively with clients who were designated as profoundly, severely, and moderately retarded. Steen and Zuriff (1977) treated the self-abusive behavior of a profoundly retarded woman. Their procedure incorporated the gradual removal of restraints with positive reinforcement contingent on successfully relaxing a specific muscle group on command. Peck (1977) reported on the effective use of relaxation training combined with systematic desensitization for the treatment of fear in mildly retarded adults. Wells (et al., 1978) used cue-controlled relaxation in the treatment of a mildly retarded woman's psychomotor seizures. Harvey, Karan, Bhargava, and Morehouse (1978) made use of relaxation training in a multi-component treatment of violent temper outbursts in a moderately retarded woman. More recently, Lessen and McLain (1980) demonstrated the effectiveness of relaxation training combined with Galvanic Skin Response (GSR) biofeedback training in the reduction of hyperactivity in educable mentally retarded children. The emphasis in these cases has been the use of self-control strategies with the retarded (Kurtz & Neisworth, 1976). Progressive relaxation training may be a viable technique for facilitating self-control in the retarded (Peck, 1977).

The Definition and Measurement of Relaxation

Exactly what is meant by a state of relaxation is difficult to define. This complexity arises due to the multiple components involved in relaxation (Davidson & Schwartz, 1976). The relaxed state is generally thought of as an increase in parasympathetic activity, a decreased level of muscular tension, and a decreased level of cognitive anxiety. There is a question of the degree of relaxation. Can an individual be relaxed in one bodily area and not in others? If relaxation is defined as a decrease in arousal: is there a particular point at which it can be said that an individual is relaxed? There is also a question of the relative importance of the somatic and cognitive components of relaxation. Is it possible for an individual to be physically relaxed, yet cognitively anxious? Some investigators employ only physiological indicators, others rely only on standard anxiety questionaires, and still others employ a combination of these two measures (Davidson & Schwartz, 1976).

Jacobson (1938) tried to define the process of relaxation by describing its effects. He specifically delineated two categories of effects elicited by relaxation. Jacobson considered changes in muscle tension, heart rate, and respiration to be the somatic effects of relaxation while decreases in mental and emotional activity were considered to be cognitive effects.

Jacobson (1938) realized the importance of both the cognitive and somatic components in the process of relaxation. He concluded that the generation of thoughts and feelings is not possible when the skeletal muscles are relaxed. Wolpe (1958) seemed to follow Jacobson's rationale in assuming that the absence of proprioceptive feedback from relaxed skeletal muscles is the factor responsible for the inhibition of anxiety during systematic desensitization (Davison, 1966). This line of reasoning would lead one to assume that it is impossible for an individual to be physically relaxed and cognitively anxious at the same time. If this was possible, it would cast doubt upon the peripheralist position of Jacobson.

Davidson and Schwartz (1976) point to the common personal reports from individuals who are physically tired and somatically relaxed yet unable to sleep because their "minds are racing". Addressing this controversy, Davison (1966) cites studies from the animal literature demonstrating that a totally curarized animal can acquire avoidance learning when a shock is paired with a previously neutral stimulus. On the basis of this evidence, Davison concludes that a drug-induced state of complete muscular relaxation is not incompatible with anxiety. It is important to note that curare does not completely inhibit efferent motor commands; it simply prevents their overt expression. This fact led Davison to put forward two hypotheses as to why training in muscle relaxation inhibits anxiety. One suggested that the state of muscular relaxation under curare is quite different from self-induced relaxation, and that perhaps it is a self-produced alteration of efferent messages, rather than a decrease in proprioceptive feedback, which is important for the inhibition of anxiety. The other hypothesis suggests that relaxing one's own muscles through relaxation training may create a positive affect state which in turn inhibits anxiety.

While this research does not verify that it is possible to generate cognitive activity with no effect upon somatic process, it does point out the importance of studying the relative contribution of each component to the relaxation process. Rachman (1968) also drew a distinction between muscular and mental relaxation while examining the role of relaxation in desensitization therapy. He states that the relaxation described in many clinical reports and experiments may be a feeling of calmness which is scarcely related to the actual degree of muscular tension. It may be this sense of calmness or mental relaxation, rather than somatic relaxation, that is the essential component in desensitization therapy.

Stressing the possible importance of cognitive relaxation leads us into the realm of mentalistic concepts. While it is possible to define somatic relaxation as reduced muscle activity accompanied by reduced efferent motor commands (Davidson & Schwartz, 1976), cognitive relaxation must be defined as a subjective feeling of calmness. Muscular relaxation is easily measured. However, subjective feelings of calmness can be quantified with much less precision.

Cognitive Measures

Anxiety inventories such as the Taylor Manifest Anxiety Scale (Taylor, 1953), the State-Trait Anxiety Inventory (Speilberger, Gorsuch, & Lushene, 1968), the Affect Adjective Checklist (Zuckerman, 1960), and the S-R Inventory of Anxiousness (Endler, Hunt, & Rosenstein, 1962) have all been used to evaluate the effectiveness of relaxation training and other anxiety reducing techniques. However, due to the fact that these inventories include many items concerning the somatic elements of anxiety, they cannot be classified exclusively as cognitive measures of anxiety reduction.

Behavior therapists commonly assess the effectiveness of relaxation training by asking the client to indicate on a ten-point scale how he feels. A rating of ten would indicate the most anxious the individual has ever felt, while a rating of one would indicate complete relaxation, as if the client was about to fall comfortably asleep (Rimm & Masters, 1974). This assessment technique does not fall exclusively within the cognitive domain due to the fact that it relies on the individual's perception of his state of relaxation. The individual may be attending to, and assessing, his cognitive and somatic levels of relaxation. However, Riddick and Meyer (1973) demonstrated that subjective reports of calmness often contradict physiological indicators.

Many researchers have recorded electrodermal responses as an indirect measure of cognitive activity while studying various aspects of relaxation (Alexander, White, & Wallace, 1977; Mathews & Gelder, 1969; Moan, 1979; Schandler & Grings, 1976). Electrodermal activity has been employed frequently as an index of arousal and emotional activity. However, the many contradictory findings in the literature has led to widely varied interpretations of these measures (Edelberg, 1972). In an attempt to clarify these complex relationships, Kilpatrick (1972) examined electrodermal activity in response to various cognitive activities. His results indicated that phasic electrodermal activity (skin conductance response or SCR) is a good index of autonomic emotional activity, while tonic skin conductance (skin conductance level or SCL) seemed to be a good indicator of changes in cognitive activity.

Somatic Measures

Somatic measures of relaxation are usually quantified with the aid of physiological monitors. Electromyography (EMG) is frequently employed as a dependent variable in numerous studies of relaxation (Ewing & Hughes, 1978; Mathews & Gelder, 1969; Paul, 1969; Schandler & Grings, 1976). Since EMG is based on the detection of the muscle action potentials produced when the muscles contract, it is primarily a measure of somatic activity in specific muscle sites (Blanchard & Epstein, 1978). In studies of relaxation, EMG is typically recorded from the forearm (Mathews & Gelder, 1969; Paul, 1969) or the frontalis muscles (Haynes, Mosely, & McGowan, 1975; Reinking & Kohl, 1975; Schandler & Grings, 1976). It is generally accepted that frontalis EMG is a better indicator of overall bodily relaxation than EMG from the forearm. This is due to the fact that the frontalis is difficult to relax, so that when this muscle group is relaxed the relaxation should generalize to other parts of the body (Davidson & Schwartz, 1976).

However, there is no conclusive evidence to indicate that EMG control for one muscle group will reliably produce changes in any other muscle group (Blanchard & Epstein, 1978). In fact, Burish and Horn (1979) found that an arousal manipulation condition had very little effect on subjects' EMG responses. While in clinical application, Carter, Kondo, and Knott (1975) found that EMG feedback and progressive muscle relaxation training both led to significant decreases in frontalis tension levels.

Heart rate is also a popular dependent measure in many studies of relaxation training (Carroll, Marzillier, & Watson, 1979; Lehrer, 1972; Mathews & Gelder, 1969; Paul, 1969). There are several reasons for the widespread measurement of heart rate: it is relatively easy to measure, and it is subject to control by both the sympathetic and parasympathetic branches of the autonomic nervous system. Even though there is evidence indicating that heart rate primarily reflects somatic processes, this measure may at times be confounded by other factors. Carroll (et al., 1979) found that asking subjects to imagine specific scenes produced increases in heart rate even when the scenes were peaceful and relaxing. This supports Lacey's (1967) proposal that cardiac acceleration is associated with cognitive activity, since this activity demands the active rejection of external stimuli. A decrease in heart rate should be indicative of increased parasympathetic activity, as well as decreased cognitive activity. Therefore, heart rate decreases should be reflective of the relaxation response, even though biofeedback studies have demonstrated that large scale increases are much easier to produce than large scale decreases (Blanchard & Epstein, 1978).

Blood pressure and heart rate are more closely related to state anxiety than any other physiological measures (Johnson & Spielberger, 1968). However, blood pressure is difficult to monitor on a continuous basis as it varies from moment to moment between two values; the highest value being the systolic pressure, and the lowest value being the diastolic pressure (Blanchard & Epstein, 1978). Blood pressure is often used as an indicator of the effectiveness of relaxation training (Graham, et al., 1977; Johnson & Speilberger, 1968; Schandler & Grings, 1976; Steptoe, 1978). The work with blood pressure is mainly centered on clinical, biofeedback treatment of sustained elevated blood pressure for which there is no physiological explanation (essential hypertension). This is not surprising since hypertension is considered to be a major, widespread health problem (Blanchard & Epstein, 1978).

Skin temperature increase was reported by Benson (1975) to be characteristic of the relaxation response. Boudewyns (1976) has also shown that skin temperature tends to increase after relaxation training and decreases under conditions of stress. An increase in skin temperature is caused by the increase in peripheral blood flow which accompanies the parasympathetic response of vasodilation. A decrease is caused through the action of the sympathetic response of vasoconstriction. Biofeedback researchers have found that in normals it is generally easier to produce skin temperature decreases (Blanchard & Epstein, 1978).

Respiration is also frequently employed in studies of relaxation training (Mathews & Gelder, 1969; Paul, 1969; Schandler & Grings, 1976). While most studies of relaxation simply employed respiration rate, this does not appear to be as sensitive a measure as methods which measure the relative contributions of abdominal and thoracic components of respiration (Stoyva, 1976).

It remains unclear whether expected changes in physiological measures are equivalent to a state of relaxation. It has been demonstrated that there is often a poor relationship between physiological measures and self-reports of anxiety (Mathews & Gelder, 1969; Reinking & Kohl, 1975; Riddick & Meyer, 1973). It may be that cognitive factors play a large role in relaxation, such that changes in physiological states may be a necessary, but not a sufficient, condition to influence self-reports of relaxation (Blanchard & Epstein, 1978).

Behavioral Measures

Behavioral measures are employed in many studies of relaxation in order to assess the effectiveness of various procedures in the treatment of stress-related behavior. Ratings of overt signs of anxiety have been used to assess the effectiveness of various treatments of speech anxiety (Gatchel, Hatch, Maynard, Turns, & Taunton-Blackwood, 1979; Goldfried & Trier, 1974). Headache frequency, duration, and severity have been reported in order to assess the effectiveness of various treatments in the relief of tension headaches (Chesney & Shelton, 1976). Self-report measures of the latency of sleep onset have been used as dependent measures in the treatment of insomnia (Haynes, Sides, & Lockwood, 1977; Pendleton & Tasto, 1976). Barrios (1978 (a)) used nail length as a dependent measure in the treatment of chronic nailbiting. Seizure frequencies were employed to assess the effectiveness of relaxation training in the treatment of seizures (Ince, 1976; Wells, et al., 1978). Steen and Zuriff (1977) employed frequency counts of bites and scratches as a dependent measure in the treatment of self-injurious behavior. In the treatment of disruptive behavior with the retarded the frequency of tantrums is often recorded as a dependent measure (Harvey, et al., 1978; Schneider, Ross, & Dubin, 1979; Webster & Azrin, 1973).

Haynes (et al., 1975) state that the ultimate criterion for assessing the differential effectiveness of various relaxation training techniques must be overt behavior change. Physiological and self-report measures may be important indicators of the immediate effect of relaxation training on the individual; however, the clinical utility of these procedures can only be assessed through behavioral measures.

Relative Effectiveness of Relaxation Techniques

Davidson and Schwartz (1976) point out that the different strategies employed in relaxation techniques produce different physiological response patterns. However, due to the absence of a theoretical foundation, and the lack of standardized procedures for biofeedback and relaxation training, it is very difficult to make meaningful comparisons between studies. Tarler-Benlolo (1978) states that it is difficult to reach any definite conclusions regarding the relative effectiveness of various procedures due to the extreme variability in methodologies. The results of studies comparing relaxation training with biofeedback are somewhat conflicting. Nevertheless, most studies indicate that either method can effectively produce positive results (Tarler-Benlolo, 1978).

Recent research indicates that EMG biofeedback and progressive muscle relaxation are equally effective in producing EMG reductions (Franks & Wilson, 1979). Qualls and Sheehan (1979) point out that in some studies EMG biofeedback was found to be as effective as a no-feedback control in reducing EMG measures. They point out that this discrepancy could be due to individual differences in capacity for absorption. They concluded that subjects with a high capacity for absorbed attention and imaginative involvement relaxed more in the no-feedback condition, which allowed withdrawal from the external environment. However, conditions such as biofeedback, that impose an attentional demand, might be preferable for subjects with a limited capacity for absorbed attention and imaginative involvement.

In comparing the physiological effects of relaxation training and hypnosis, Paul (1969) found that while relaxation training had a significantly greater effect on somatic measures of relaxation, both treatments led to similar reductions in measures of cognitive anxiety. Davidson and Schwartz (1976) postulated that while hypnosis can be considered as a purely cognitive procedure, progressive relaxation training affects both somatic and cognitive domains. They point to Paul's (1969) results for confirmation of the hypothesis that relaxation procedures which primarily affect somatic processes will be the most effective in the reduction of somatic anxiety, while techniques focusing on cognitive activity will be most effective in the relief of cognitive anxiety.

These studies illustrate that the effectiveness of various relaxation training procedures is determined by a number of factors. The characteristics of the procedure must be considered in conjunction with individual characteristics, and the type of anxiety which the individual experiences. It would seem however, that an effective treatment would incorporate procedures affecting both the cognitive and somatic domains.

Rationale

Cue-controlled relaxation could be used with the retarded in an attempt to decrease the severity and frequency of disruptive behaviors. Disruptive behaviors frequently occur on wards for the mentally retarded (Hamilton, Stephen, & Allen, 1967; Burchard, 1967). Not only are these behaviors annoying, but they may often endanger the safety of others, as well as being resistant to treatment (Barnett & Bensberg, 1965; Thorne & Shinedling, 1970). Residents who exhibit these behaviors often cause major disruptions and therefore they are often excluded from training classes and community placements (Lyon & Bland, 1969). Treatment of these disruptive behaviors often fails due to a delay between the disruptive act and staff reaction to the disruptions (Barnett & Bensberg, 1965). At times staff may require authorization before applying some consequences (Barnett & Bensberg, 1965), or the consequence may be so distasteful that it is applied only as a last resort (Webster & Azrin, 1973). If inhibitory consequences are to be effective in reducing the frequency of disruptive behaviors, they must be applied consistently, immediately after the disruptive act occurs (Azrin & Holz, 1966).

In order to minimize the delay between disruptions and reactions to them, the treatment should not be distasteful, unduly coercive, or stressful (Webster & Azrin, 1973). One attempt to meet the above criteria which is often used as a consequence for disruptive behavior, is time-out from positive reinforcement. Time-out is a temporary withdrawal of reinforcers (Ferster & Skinner, 1957) which usually consists of secluding the disruptor in a barren room. Time-out seclusion has been used effectively to reduce the frequency of many problem behaviors (Bostow & Bailey, 1969; Burchard & Tyler, 1965; Repp & Deitz, 1974; Tyler & Brown, 1967; Wolf, Risely, & Mees, 1964). However, in some cases time-out seclusion may result in tantrums and other emotional behavior such as freezing, trembling, and wetting (Pendergrass, 1971). At other times the use of time-out may actually increase the frequency of problem behaviors (Solnick, Rincover, & Peterson, 1977).

Foxx and Azrin (1972) have developed a procedure called "Overcorrection" or "Restitution" in an attempt to inhibit undesirable behavior without emotional side effects. In overcorrection, intensive training in appropriate behavior is given in that the disruptor is required to rectify the effects of his disruptive behavior. Webster and Azrin (1973) state that many disruptive behaviors such as self-injury, physical aggression, threats, crying, screaming, cursing, and tantrums are often preceded by an agitated state. The overcorrection in these instances could be directed toward the agitated state, rather than towards the disruptive act. The overcorrection used is practice in being calm and relaxed. Therefore, agitated disruptors were required to spend an extended period in relaxation in their own beds. Disruptions resulted in extensions of the time period, while refusal, in the case of one subject led to her being restrained in bed.

There have been many recent advances in training the mentally retarded. Even though this research is highly relevant, it fails to affect the day to day work with the handicapped. Staff trained in workshops complain that on returning to their jobs, they are not given the opportunity to use what they have learned (Mittler, 1977). However, cue-controlled relaxation should be relatively easy to apply in an institutional setting.

A program of cue-controlled relaxation could offer some advantages in dealing with problematic behaviors of moderately retarded adults. Cue-controlled relaxation requires that ward staff follow a simple set of instructions, and record the occurrence of behaviors. Ward staff are not responsible for the delivery of reinforcement or punishment. This is a relatively small infringement on the time of already overburdened staff, as well as a safeguard against the abuse of the program.

MacNamara (1977) states that behavior modification programs are often abused in institutional settings. He cites a case in which the behavioral methods suggested by a consulting psychologist were subsequently twisted into cruel and unusual punishments. A program of cue-controlled relaxation does not even require the reinforcement of appropriate behaviors which Mansdorf, Bucich, and Judd (1977) cite as one of the weakest training skills of institutional ward staff.

Schneider, Ross, and Dubin (1979) successfully used a procedure which involved the operant training of an alternative response (the sitting response). This response was paired with the verbal instruction "sit" in a variety of settings. Cue-controlled relaxation is also an alternative response paired with a verbal cue.

However, cue-controlled relaxation differs in that its main emphasis is on self-control rather than on external control. Many current researchers are emphasizing the use of self-control techniques with the mentally retarded (Harvey, Karan, Bhargava, & Morehouse, 1978; Mahoney & Mahoney, 1976; Kurtz & Neisworth, 1976). It is felt that the teaching of self-control has implications for more efficient use of staff time, as well as benefitting the generalization of therapeutic gains, and the resident's self-concept (Harvey, et al., 1978).

There are not many studies reporting on the effectiveness of relaxation training procedures with the retarded. Many of these studies employed an A-B design using frequency of a specific behavior as a dependent measure (Ince, 1976; Shaw & Walker, 1979; Steen & Zuriff, 1977; Webster & Azrin, 1973). The results of these studies have generally been positive. However, due to the limitations of the experimental designs employed, they offer only weak conclusions regarding the effectiveness of the treatment (Hersen & Barlow, 1976). Harvey (et al., 1978) employed an A-B design with a multiple baseline across situations. However, the relaxation training was included in a multi-component treatment package and the relative effectiveness of the relaxation training procedure could not be determined. Wells (et al., 1978) employed an A-B - A-B design and established that cue-controlled relaxation was effective in the treatment of seizures for a mildly retarded woman. Studies that employed physiological measures gave biofeedback information to train a specific physiological response, and then used measures of this response to illustrate the effectiveness of relaxation training (Carter, Lax, & Russell, 1979; Lessen & McLain, 1980).

The present study investigated the effects of relaxation training and a cue-control procedure on physiological, self-report, and third-party report measures for the retarded. It was predicted that the relaxation training and cue-controlled procedures would produce consistent reductions in heart rates and increases in skin temperatures for the mentally retarded subjects. Decreases in state-anxiety were expected as a result of relaxation training. There was no change expected in the third-party report of behavior problems in the residential setting, as there was no attempt to generalize the relaxation response across settings.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

Research Design

The study presented here employed a multiple baseline design across five subjects, combined with a reversal design across sessions. After establishing baselines (A), the treatment (B) was sequentially applied to each subject. The multiple baseline procedure supplies indirect evidence for the treatment effect when a change in the dependent variable(s) occurs for the treated subject, while measures of the dependent variable(s) for untreated subjects remain unchanged (Hersen & Barlow, 1976). The across session reversal (A-B - A-B) was added to this design in order to strengthen the conclusions which could be derived regarding the treatment's effect on the target behaviors. A within session reversal was included in order to demonstrate the effectiveness of the cue-control procedure.

Subjects

The subjects for this study were referred from the group home division of the Michener Centre in Red Deer, Alberta. This institution is a residential treatment centre which serves approximately 1,600 mentally retarded residents. Residents who were referred for treatment indulged in tantrums, or destructive behavior, or became easily upset. All of the residents who were referred for treatment were tested on the Peabody Picture Vocabulary Test (PPVT) in order to estimate their receptive language abilities. Subjects were selected on the basis of their PPVT scores, as well as their availability for participating in a continuous long-term program. The overall raw score mean on the PPVT for the subjects who were referred for treatment was 64.4. The mean raw PPVT scores for the subjects chosen for training was 79.4. The range of the PPVT raw scores for the selected subjects was 70 to 87. This reflects a range in mental ages from 8 years, 9 months, to 12 years, 5 months. The sample consisted of three females and two males, with an age range from 19 to 36 years old. Five subjects (S1, S2, S3, S4, S5) were selected in order to ensure that at least three would complete the training program. All five of the subjects, however, completed all of the experimental phases and are therefore included in the final analysis. While three of the five subjects received regular medications, these were held constant throughout the experimental conditions.

Measuring Devices

Heart rate was monitored through the detection of finger pulses via a photoplethysmograph. The photoplethysmograph reacts to changes in light intensity caused by a change in blood volume as a result of a heart beat (Weinman, 1967). The probe consisted of a light source and a photo-detector. The light source was a gallium arsinide infrared emitting diode, supplied with 30 milliamperes of current, with a power of 3 milliwatts, and a wavelength of 9,400 Angstoms. A silicon photo-transducer was used as the light detector. The probe was placed on the ring finger of the subject's right hand. The number of heart beats were counted and digitally displayed after each minute. Heart rate was recorded in this way for a five-minute period before and after each baseline and treatment session. The pre-session and post-session readings were averaged. The pre-session mean was then subtracted from the post-session mean, giving a change in mean heart rate for each session.

Skin temperature was monitored directly using the Biotic Band. This band consists of a photo-chemical strip which was worn on the subject's right wrist. The subject's skin temperature is displayed digitally, within ±.14 degrees Celsius, as the chemicals react to the subject's skin temperature. Skin temperatures were recorded after each minute for a five-minute period before and after each session. The pre- and post-session readings were averaged. The pre-session mean was then subtracted from the post-session mean, giving an average change in mean skin temperature for each session.

The State-Trait Anxiety Inventory for Children (STAIC) was developed by Speilberger, Edwards, Lushene, Montuori, and Platzek (1973) especially to measure anxiety in children nine to twelve years of age. It may also be used with older children who are below average in ability. State anxiety (A-state) is thought of as a transitory anxiety state that is a conscious perception of feelings of tension that fluctuate over time. Trait anxiety (A-trait) is considered to be a relatively stable characteristic of anxiety proneness, or the individual's tendency to experience states of anxiety.

The test-retest reliability coefficients for the A-trait scale is moderate, ranging from .65 - .71. Since A-state should reflect the influence of situational factors at the time of testing, low test-retest correlations for this scale should be expected. The actual coefficients reported range from .31 - .47. A measure of internal consistency would be more appropriate for this scale. The alpha reliability for the A-state scale is reported to range from .82 to .87. The alpha coefficients for the A-trait scale were .78 to .81 (Spielberger, et al., 1973).

The therapist's subjective rating was a score, on a scale of one to twenty, which was assigned by the therapist before and after each session. These ratings were made before any physiological measures were recorded. These ratings were based on the subject's gross motor behaviors so that scores would be reflective of the following behaviors:

Rating	Behavior
1	Fidgety, cannot sit still.
5	Sits, but still fidgets.
10	Sits calmly.
15	Relaxed, sitting up, eyes closed.
20	Relaxed, slumped in chair.

The Adaptive Behavior Scale part II (ABS-II) is a behavior problem checklist designed to provide measures of maladaptive behaviors for retarded individuals (Nihira, Foster, Shellhaas, & Leland, 1974). For the purpose of this study particular sub-domains were selected, from the ABS part II, which seemed to have the greatest probability of being affected by relaxation training. The five sub-domains which were selected for analysis are presented below with their respective mean reliabilities.

Sub-domain		Mean Reliability
I	Violent and Destructive Behavior	.59
VI	Stereotyped Behavior and Odd Mannerisms	.62
X	Self-Abusive Behavior	.49
XI	Hyperactive Tendencies	.57
XIII	Psychological Disturbances	.45

(Nihira, et al., 1974).

Procedure

Prior to the first baseline session, the STAIC was administered to each subject. An ABS part II was also completed for each subject by the residential staff. To accommodate the sequential application of the treatment, baseline measures were taken for varying durations. There were five baseline sessions for S1, seven baseline sessions for S2 and S3, and nine baseline sessions for S4 and S5.

The treatment procedure followed the guidelines of Bernstein and Borkovec (1973) with a few minor alterations. Bernstein and Borkovec (1973) recommended that the slight movement of an index finger should be used to signal that a particular muscle group has reached a specified level of relaxation. It was observed that this procedure seemed to be overly distracting to the subjects, who seemed to be unable to understand how to follow these instructions correctly. Peck (1977) made similar observations, therefore, it was decided to omit this practice. Another slight alteration was required for S3. This subject seemed to respond quite slowly to the relaxation training procedure. As a result, in session fourteen, S3 was asked to repeat the phrase "slow down, unwind, and relax", after completing the relaxation training procedure. This slight alteration in procedure seemed to be quite helpful.

At the beginning of each session, the subjects would be allowed a five-minute adaptation period. At the end of this period, the therapist would rate each subject's level of relaxation. Then heart rate and skin temperature were recorded after each minute of a five-minute period. The baseline condition (A) was free of any experimental demand, except that subjects were asked to assume the same semi-reclining position that would be assumed in the treatment condition (B). Training sessions were conducted by the experimenter/therapist following the schedule set down by Bernstein and Borkovec (1973) with only slight changes for individual differences in responsiveness. At the end of each session subjective ratings, heart rates, and skin temperatures were again recorded.

Cue-Control

The cue-control procedure was introduced by the therapist during the four muscle groups, recall and counting session (Bernstein & Borkovec, 1973). For each client this occurred somewhere between sessions 20 and 23. Counting from one to ten was chosen as the stimulus with which the relaxation response would be paired. Initially the therapist counted alone. In the next session the subjects were asked to count along with the therapist, counting to themselves. In the following session the subjects were instructed to use the cue-control procedure independently. Thus, the treatment progressed from a fairly intrusive set of tension and release exercises, to a relatively inobtrusive instruction to use the cue-control procedure.

Within-Session Reversal

The within-session reversal was implemented after subjects used the cue-control procedure independently. Subjective ratings, heart rates, and skin temperatures were recorded as in previous sessions. The effect of this procedure was displayed via minute by minute fluctuations in heart rate and skin temperature across baseline and treatment phases. After recording baseline data, the subjects were asked to use the cue-control procedure. Measurements were again recorded. This was followed by a return to baseline and a reinstatement of the cue-control procedure.

Across-Sessions Reversal

The across-sessions reversal was introduced immediately after the within-session reversal. This procedure consisted of a return to baseline for two sessions without practising the relaxation training procedures, followed by the two final experimental sessions in which the relaxation training procedure was reintroduced. After the final session, the STAIC was administered again and the residential staff were again asked to complete an ABS part II for each resident.

Sessions

Sessions were approximately 45 minutes in duration, two times a week. Each subject was trained individually. The number of training sessions required for each subject ranged from 14 to 18.

CHAPTER IV

RESULTS

The results from both the heart rate and the skin temperature monitors are graphically presented in Figures 1 to 10. These graphs are plotted so that data points that are above the zero level will reflect a change in the expected direction. Therefore, an increase in skin temperature and a decrease in heart rate will be indicated by a rise in the data points. Heart rates are recorded as the mean difference in beats per minute, between the pre-session and post-session measures. Skin temperatures are also recorded as the mean difference in degrees centigrade, between pre-session and post-session measures.

Heart Rate

The results in Figures 1 to 5 show that heart rates decreased after each subject was trained in muscular relaxation. Table 1 displays the mean difference in heart rates for the initial baseline (A) and treatment (B) phases. Here it can be seen that each subject evidenced an average decrease in heart rate ranging from -1.4 to -12.49 beats per minute below baseline levels. The subjects S2, S4, and S5 displayed the largest decrements in heart rate during the treatment. All three of these subjects consistently responded to the treatment phase with decreases in heart rate. The assumption that the treatment was the important factor in producing this heart rate decrease is strengthened by the reversal data. During the withdrawal phase, four of the five subjects responded with heart rate increases. When the treatment was reinstated, all subjects responded with decreases in heart rate.

The data for S1 does not show as great a heart rate reduction in the treatment phase as the other subjects. The average decrease across phases is small, and at some points in the treatment phase S1 responded with decreases which were not as great as those recorded during the baseline phase. There is only a slight bit of evidence for the effectiveness of the treatment with S1. During the withdrawal phase S1 responded with the only heart rate increase that was recorded for him. After the treatment was reinstated, S1's heart rate decreases were comparable to those recorded during the baseline phase. From this evidence it can not be concluded that the treatment had any consistent effect on S1's heart rate.

The results for S3 also reflect a relatively small reduction in heart rate. In this case, however, it should be noted that S3's last heart rate increase was recorded in session 13. After this point in treatment, S3 responded consistently with decreases in heart rate. The dramatic effect of the reversal phase in this case also lends support to the assumption that the treatment was a significant factor in the reduction of S3's heart rate.

Skin Temperature

The results in Figs. 6 to 10 show the mean change in skin temperature within sessions for each subject. These results reflect a relatively inconsistent fluctuation in skin temperatures across all program phases. Table 2 displays the mean temperature differences recorded for each subject in the initial baseline and treatment phases. Examination of this table reveals that four of the five subjects responded with s[illegible] temperature decreases during the treatment phase of the program. These changes in skin temperature are opposite in direction from the changes which should be expected as a result of relaxation training.

The only subject to respond to the treatment with a mean temperature increase was S1. Examination of Fig. 6 reveals that this change is not directionally consistent, and that the magnitude of these temperature increases is often smaller than those recorded during baseline sessions. During the withdrawal phase S1 responded with a slight temperature decrease as well as a small temperature increase. There was no noticeable change in skin temperature after reintroducing the treatment phase.

The skin temperature data for the remaining four subjects is graphically displayed in Figs. 7 to 10. As seen in Table 2, these subjects responded to treatment with an overall mean decrease in skin temperature. Visual inspection of Figs. 7 to 10 does not reveal any consistent variation in skin temperature changes with respect to the treatment. The temperature changes which were recorded during the treatment phase are well within the range of the differences observed during baseline. The data from the reversal phase does little to confirm the presence of any treatment effect. There was only one notable response to the withdrawal phase from S5. This subject responded with a relatively large temperature increase for the first withdrawal session. The next withdrawal session resulted in a temperature increase which was comparable to those increases recorded in the treatment phase. After the treatment was reinstated, there was no noticeable change in S5's skin temperature response. This evidence indicates that overall the subjects' skin temperatures did not varv consistently as a result of the treatment.

Within-Session Reversal

Figures 11 to 20 display each subject's heart rate and skin temperature for the within-session reversal which was conducted in order to establish the effectiveness of the cue-control. Examination of this data reveals that all subjects responded to the cue-control procedure with a decrease in heart rate. With the return to baseline, each subject responded with a heart rate increase followed by another heart rate decrease when the cue-control procedure was reintroduced. This data indicates that the cue-control procedure was effective in reducing the subjects' heart rates.

Examination of the skin temperature data seems to indicate that the cue-control procedure had no consistent effect on the subjects' skin temperatures. S1's skin temperature was relatively stable across both the baseline and cue-control periods for this session. At first glance it may appear that the subjects responded to the cue-control procedure with decreases in skin temperature. However, the fact that the subjects' skin temperature responses do not fluctuate consistently within the reversal period of this session, seems to indicate that these skin temperature changes are not the result of a treatment effect.

Most of the subjects displayed different response patterns across the phases of this session. The skin temperatures recorded for S1 were relatively stable across the entire session. All of the other subjects responded to the initial treatment phase with decreases in skin temperature. However, on the return to baseline, these subjects again responded with decreases in skin temperature. On the reintroduction of the cue-control procedure, S2 and S5 had no change in skin temperature while S3 responded with an increase in skin temperature and

S4 responded with a further skin temperature decrease. This evidence indicates that the cue-control procedure did not consistently influence skin temperatures.

State-Trait Anxiety Inventory for Children

Table 3 displays each subject's STAIC scores recorded during the baseline phase and after completion of the treatment phase. T-tests comparing pre- and post-test means revealed a significant decrease on the state anxiety scale ($t = -3.92$, $df = 4$, $p < .05$) as well as a significant increase on the trait anxiety scale ($t = 2.78$, $df = 4$, $p < .05$). A decrease in state anxiety was expected as a result of treatment. However, there was no change expected for the trait anxiety scores.

Therapist's Subjective Rating

Biserial correlations were calculated comparing changes in the therapist's subjective rating (SR) of relaxation with changes occurring in heart rate and skin temperature. The SR scale was chosen as the dichotomous variable. The median point, a difference of +5 between pre-session and post-session ratings, was selected as the point of division. This variable was then correlated with the pre- and post-session mean difference scores for heart rate and skin temperature.

The resulting correlations are displayed in Table 4. Examination of this data reveals that the therapist's subjective ratings of relaxation correlate with the heart rate responses of four subjects, well beyond the .01 confidence level. While S1's heart rate does not correlate well with SR, the changes in S1's skin temperature do correlate with SR at the .05 level. This data indicates the therapist's judgement of the effectiveness of relaxation training correlates very well with some physiological measures.

Adaptive Behavior Scale part II

The pre- and post-test scores for the five selected scales of the ABS - II behavior problem checklist are presented in Table 5. T-tests for correlated samples revealed that there were no significant differences between pre- and post-test measures on any of the five scales (t's = 1.49 to 1.63, $p > .05$). This result should be expected considering that there was no attempt made to generalize the relaxation response beyond the boundaries of the training room.

Multiple Baseline

The multiple baseline procedure offered very weak support for the treatment effect. This supporting evidence can only be seen in the heart rate data. Examination of Figures 1 to 5 reveals that S1 showed only slight changes in heart rate differences during the treatment phase - displaying no noticeable treatment effect, while other subjects were still in the baseline phase. The only supporting evidence from the multiple baseline procedure can be seen in the data for S2. In session 9, S2 seemed to begin a trend of larger heart rate decreases. At this time S4 and S5 were still in the baseline phase, displaying little change in their heart rate differences. Subject 3 was also slow to respond to the treatment. Changes in heart rate differences for this subject indicate a treatment effect well after the treatment phase was introduced to S4 and S5.

The multiple baseline procedure offers no support for the treatment effect with the skin temperature data. Most of the changes in skin temperature recorded during the treatment phase were well within the range of the changes recorded during the baseline phase.

CHAPTER V

DISCUSSION

The results indicate that relaxation training and the cue-control procedure affected the heart rates of the subjects who were trained in these procedures. This effect was evidenced by the fact that subjects consistently responded with heart rate decreases when the treatment was applied. Skin temperatures, on the other hand, did not seem to be affected consistently by the relaxation training or the cue-control procedure. The STAIC indicated that there was an expected decrease in state anxiety; however, there was also an unexpected increase in trait anxiety. The biserial correlations indicated that the therapist's subjective ratings of relaxation correlated very well with the changes in heart rate for four of the five subjects. The one subject with subjective ratings that did not correlate well with heart rate, did display a significant correlation with skin temperature. As expected, there were no significant changes in severity of behavior problems as measured by the five selected sacles of the ABS. The multiple baseline procedure offered very weak support for the treatment effect.

It is curious to note that while a treatment effect was evidenced through changes in heart rate, there was no noticeable consistent effect evidenced through changes in skin temperature. While both of these measures are considered to be indicators of parasympathetic activity, correlations among physiological indicators are typically reported to be quite low (Paul, 1969; Duffy, 1972). Duffy (1972) also states that single systems are often better in yielding consistent relations with psychological variables than combined results across systems. It is also possible that for most subjects, skin temperatures were more greatly affected by some factor which was beyond experimental control. King and Montgomery (1981) found they could produce the most dramatic changes in skin temperature by instructing subjects to utilize muscular activity in combination with external feedback. Feedback alone, or feedback combined with instructions to relax, were found to have little effect on the subjects' skin temperatures. Zuckerman (1971) pointed out that different subjects vary in responsiveness across autonomic systems, so that the majority of subjects will have a most powerful, or most likely response channel. This response specificity among subjects could account for the fact that S1 was the only subject who displayed a slight amount of success according to the skin temperature data. This could also account for the fact that S1 was the only subject for whom SR and mean skin temperature changes were significantly correlated.

Many biofeedback researchers report that it is easier to produce skin temperature decreases (vasoconstriction) than it is to produce skin temperature increases (vasodilation). However, it is also commonly reported that it is easier to produce the sympathetic response of heart rate increase rather than the parasympathetic response of heart rate decrease (Blanchard & Epstein, 1978). In biofeedback studies, Surwit, Shapiro, and Feld (1976) found that while there were large individual differences in the ability to modify skin temperatures, the average skin temperature increase was found to be .25°C. The small magnitude of these changes indicates that a precise measuring instrument must be used in order to accurately reflect skin temperature changes. The error of measurement for the biotic band is ±.14°C. While this seems to be an accurate temperature recording device, the error of measurement is quite large when compared to the average skin temperature increases which have been recorded in biofeedback studies. This suggests that while the biotic band might be a useful instrumental aid in the home practice of skin temperature control, it cannot be used as a replacement for a thermistor probe in the laboratory setting.

The fact that changes in SR scores correlated well with changes in some physiological measures for all subjects is a matter of interest. Regardless of the magnitude of the error of measurement for the biotic band; the fact that SR correlated well with skin temperature changes for S1, the poorest heart rate responder, can not be ignored. Not only does this fact support Zuckerman's (1960) findings that different subjects respond more markedly on different autonomic systems; it also suggests that the therapist's subjective rating may be dependent upon a more global aspect of relaxation which is not restricted to any particular physiological measure.

This correlational data indicates that the therapist's subjective ratings may be an accurate reflection of the effectiveness of relaxation training, which should be reported in the literature more often. The validity of this measure could be assessed more accurately using a larger sample and a greater variety of physiological monitors. This avenue of study may be important, considering the fact that in a majority of the clinical applications of relaxation training there is often no standard, objective measure of the effectiveness of procedures which were employed. Luiselli, Marholin, Steinman, and Steinman (1979) reviewed seventy studies that were published over a three-year period which attempted to induce muscular relaxation. They found that in 70%

of these studies there was no indication that the relaxation training procedures employed were assessed. While subjective ratings are bound to be confounded by the therapist's bias, the rating is easy to apply and it is free of the demand characteristics related to self-report measures, and the response specificity of elaborate physiological measures.

The results from the STAIC indicate that subjects had significant reductions in state anxiety, as well as significant increases in trait anxiety. This result was quite unexpected since Stoudenmire (1972, 1973, 1975) has repeatedly demonstrated that while state anxiety is significantly reduced as a result of training in muscle relaxation, trait anxiety measures remain unchanged. The discrepant results which were found in the present study suggest that self-report measures may not be very reliable indicators for a retarded population. The actual test-retest reliability should be examined with a larger sample from this population in order to assess how closely this reliability coefficient approximates the coefficients reported by Spielberger (et al., 1973).

The scores from the ABS part II indicate that the subjects' behavior on their units did not change as a result of relaxation training. This result was expected. There should be no change in the subjects' behavior until after an attempt has been made to generalize the relaxation response beyond the confines of the training room.

The expected support for the treatment effect was not obtained through the multiple baseline procedure. According to the data for changes in heart rate, there appears to be a great deal of individual variability in responsiveness to the relaxation training procedure. As a result, some subjects who were introduced to the treatment phase displayed very little change in heart rate differences within the time period that other subjects were allowed to remain in the baseline condition. It might be said that the succeeding baseline intervals were too short to clearly emphasize the treatment effect. This may be true, however examination of Figures 1 and 3 reveals that S1 and S3 responded to relaxation training very slowly, according to their heart rate differences. Witholding the treatment from the other subjects until S1 and S3 had displayed a treatment effect would have resulted in an unreasonably long baseline period for S4 and S5.

It seems as though relaxation is a skill (Bernstein & Borkovec, 1973) which is acquired at an idiosyncratic rate. This being the case, it may be that the multiple baseline design is not an adequate method for illustrating the effectiveness of relaxation training.

It is interesting to note that S3 required a slight change in procedure to facilitate relaxation. Examination of Fig. 3 reveals that S3 responded with a heart rate increase for the last time in session 13. After this session, S3 was instructed to forget about the fidgety nervous behaviors that she frequently displayed. Instead she was instructed to repeat the phrase "slow down, unwind, relax" over and over until she felt calm. Not only did this slight shift in procedure result in more consistent heart rate decreases, but the effects were also reflected in a decrease in the frequency of fidgety behaviors. This observation supports the proposal of Davidson and Schwartz (1976) that different relaxation training procedures lead to different patterns of physiological responses, across and within subjects.

Summary

The main finding of this study was that most subjects responded to relaxation training with small decreases in heart rate. The cue-control procedure also seemed to be effective in eliciting a small heart rate decrease. Skin temperatures did not vary systematically with relaxation training. The therapist's subjective ratings were found to be accurate reflections of changes in heart rate for most subjects, and it seems to be a good estimate of some global aspect of relaxation. The self-report measure (STAIC) was found to be of questionable value with this population. The reliability of this measure when used with a retarded population should be examined. Third party reports (ABS part II) indicated there was no significant change in the subjects' problem behaviors on the home unit, indicating the necessity of training for generalization.

Conclusion

The main consideration of this study has been that a decrease in heart rate is a reflection of parasympathetic activity which is indicative of the relaxation response and the effectiveness of relaxation training with a retarded population. However, given the confounding factors of the response specificity of physiological measures, the demand characteristics and dubious validity of self-report measures, the best indicators of the effectiveness of relaxation training with the retarded must lie in behavioral measures. Establishing the existence of a consistent physiological reaction may be important, but improvement in the quality of the retarded person's life can only be measured through the duration and frequency of anxiety-related behaviors.

Future Research

There are many questions left unanswered with regards to relaxation training and the retarded. In the course of this study, it was noted that the retarded clients could not relate any pleasant scenes, or times when they had been very relaxed in the past. It may be interesting to examine the relative effectiveness of procedures which rely mostly on verbal imagery to induce relaxation with a retarded population. Considering the questionable reliability of self-report measures with the retarded, it might be useful to include a self-report measure along the lines of a relaxation thermometer. This rating could be compared with physiological measures in order to examine its validity.

This study did not incorporate a biofeedback component. It may be worthwhile to incorporate biofeedback training with relaxation procedures, leading to a more efficient means of inducing the relaxation response with the retarded. It may even be possible to operantly condition certain physiological responses with non-verbal, lower functioning retarded individuals. The relative effectiveness of internally vs. externally generated cues could also be examined.

In a group design, the effectiveness of relaxation might be examined with sub-classes of the retarded population. Classes could be divided on the basis of IQ, age, organisity, or any other factor which might be relevant. How effectively the relaxation response is generalized to other situations by the retarded also needs to be examined.

Limitations

The conclusions which can be drawn from the multiple baseline across subjects design are limited in that there is no indication of the generalizability of the relaxation training effects to members of various sub-categories of the retarded population. There is also no indication that the relaxation response can be generalized beyond the laboratory setting. The need for further research in these areas is clearly indicated. A further examination of the effectiveness of the cue-control might have been employed by monitoring the effects of the cue-control procedure prior to any training in relaxation. The effects of the relaxation training program were demonstrated mainly through a change in average heart rate within-sessions. The effects of this training may be more clearly demonstrated by employing a greater variety of physiological measures and behavioral indices.

Follow-up

Upon the completion of this study an attempt was made to generalize the relaxation response to each subject's home unit. In a three month follow-up unit staff indicated that in three of the five cases the relaxation procedure was used regularly, and that it seemed to be effective in reducing the severity of problem behaviors.

The relaxation procedures were discontinued for one subject who developed a serious medical condition which required surgery. At this time the subject became extremely paranoid and would not trust either the therapist or unit staff members. The relaxation procedures were also discontinued for another subject who seemed to be gaining little from the regular practice.

Table 1

Average mean differences in heart rate for initial baseline and treatment phases

Subjects	$\Delta\bar{H}_1$	$\Delta\bar{H}_2$	$\Delta\bar{H}_2 - \Delta\bar{H}_1$
S1	−5.08	− 6.48	− 1.4
S2	−0.06	−12.55	−12.49
S3	−1.03	− 3.27	− 2.24
S4	−4.82	− 9.56	− 4.74
S5	−1.82	− 8.23	− 6.41

$\Delta\bar{H}_1$ – Average mean heart rate difference of initial baseline phase

$\Delta\bar{H}_2$ – Average mean heart rate difference of initial treatment phase

Table 2

Average mean differences in skin temperature for initial baseline and treatment phases

Subjects	$\Delta\bar{T}_1$	$\Delta\bar{T}_2$	$\Delta\bar{T}_2 - \Delta\bar{T}_1$
S1	−0.076	0.510	0.586
S2	0.007	−0.340	−0.347
S3	0.970	0.399	−0.571
S4	0.041	−0.110	−0.150
S5	0.280	0.210	−0.070

$\Delta\bar{T}_1$ – Average mean skin temperature difference of initial baseline phase

$\Delta\bar{T}_2$ – Average mean skin temperature difference of initial treatment phase

Table 3

Pre- and post- test scores for the STAIC and t-test scores

Subjects	State		Trait	
	Pre	Post	Pre	Post
S1	26	20	36	43
S2	57	52	37	40
S3	26	24	40	40
S4	39	34	40	52
S5	21	20	31	37

$\Sigma D = -19$	$df = 4$	$\Sigma D = 28$	$df = 4$
$t = -3.92$	$p < 0.05$	$t = 2.78$	$p < 0.05$

Table 4

Bi-serial correlations of therapist's subjective ratings with heart rate and skin temperature changes

Subjects	$r_{SR \times HR}$	$r_{sr \times T}$	df (N-2)
S1	−0.299	0.43 *	25
S2	−0.87 **	0.07	24
S3	−0.72 **	−0.26	27
S4	−0.55 **	−0.21	25
S5	−0.68 **	−0.23	25

* $p < 0.05$

** $p < 0.01$

Table 5

Pre- and post- test differences for selected scales of the ABS - II and t-test scores for each scale

Subjects	Scale 1	Scale 6	Scale 10	Scale 11	Scale 13
S1	0	−2	+1	−3	−2
S2	0	−1	−2	+4	−28
S3	+4	−3	−1	+1	−9
S4	+1	−4	−1	+1	−2
S5	+9	+1	0	+2	+9
df = 4					
t =	1.63^{0}	-0.49^{0}	-1.18^{0}	0.877^{0}	1.05^{0}

$^{0}p > 0.05$

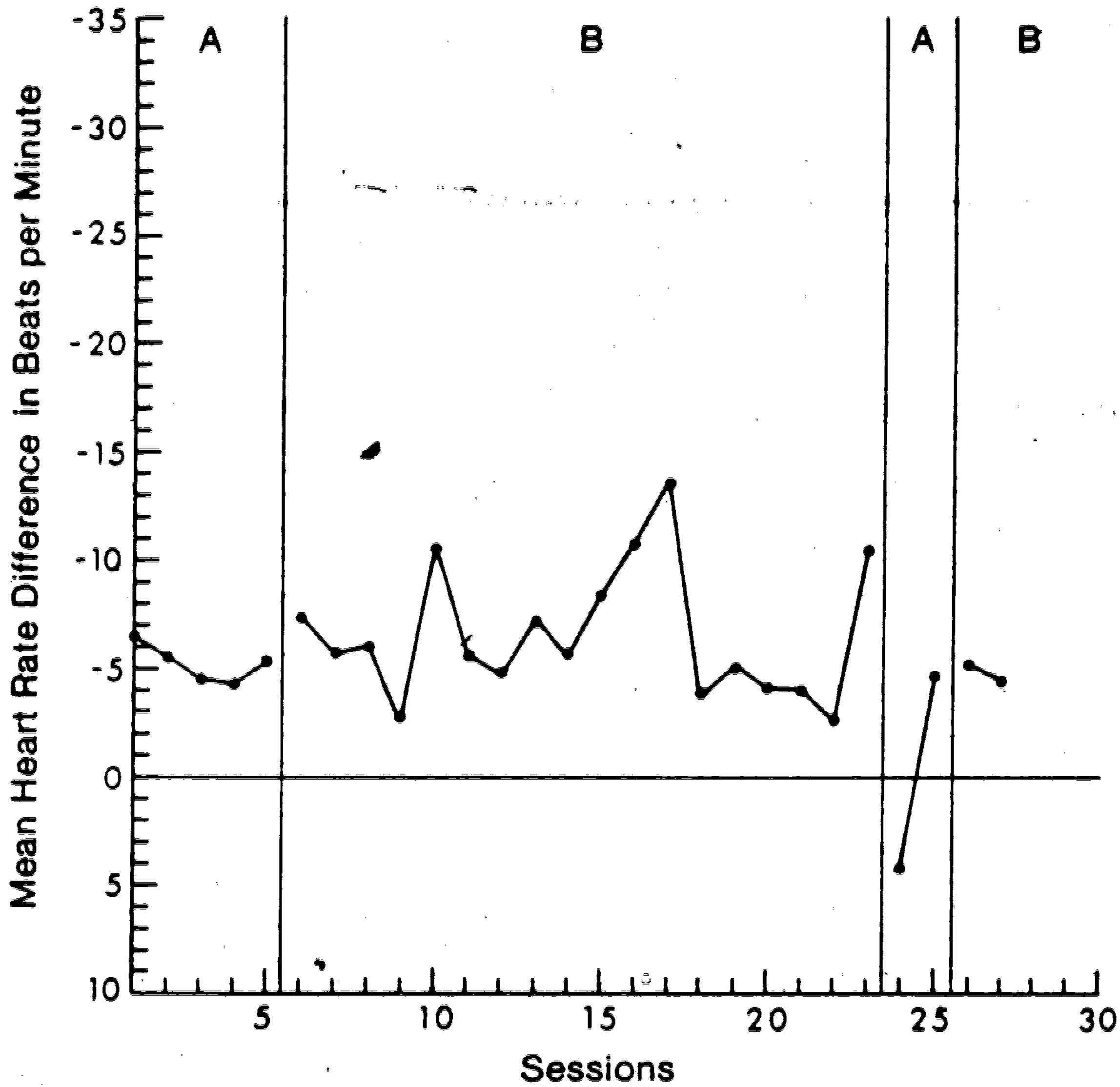

Figure 1 – Pre- and post- session differences in mean heart rate – subject 1

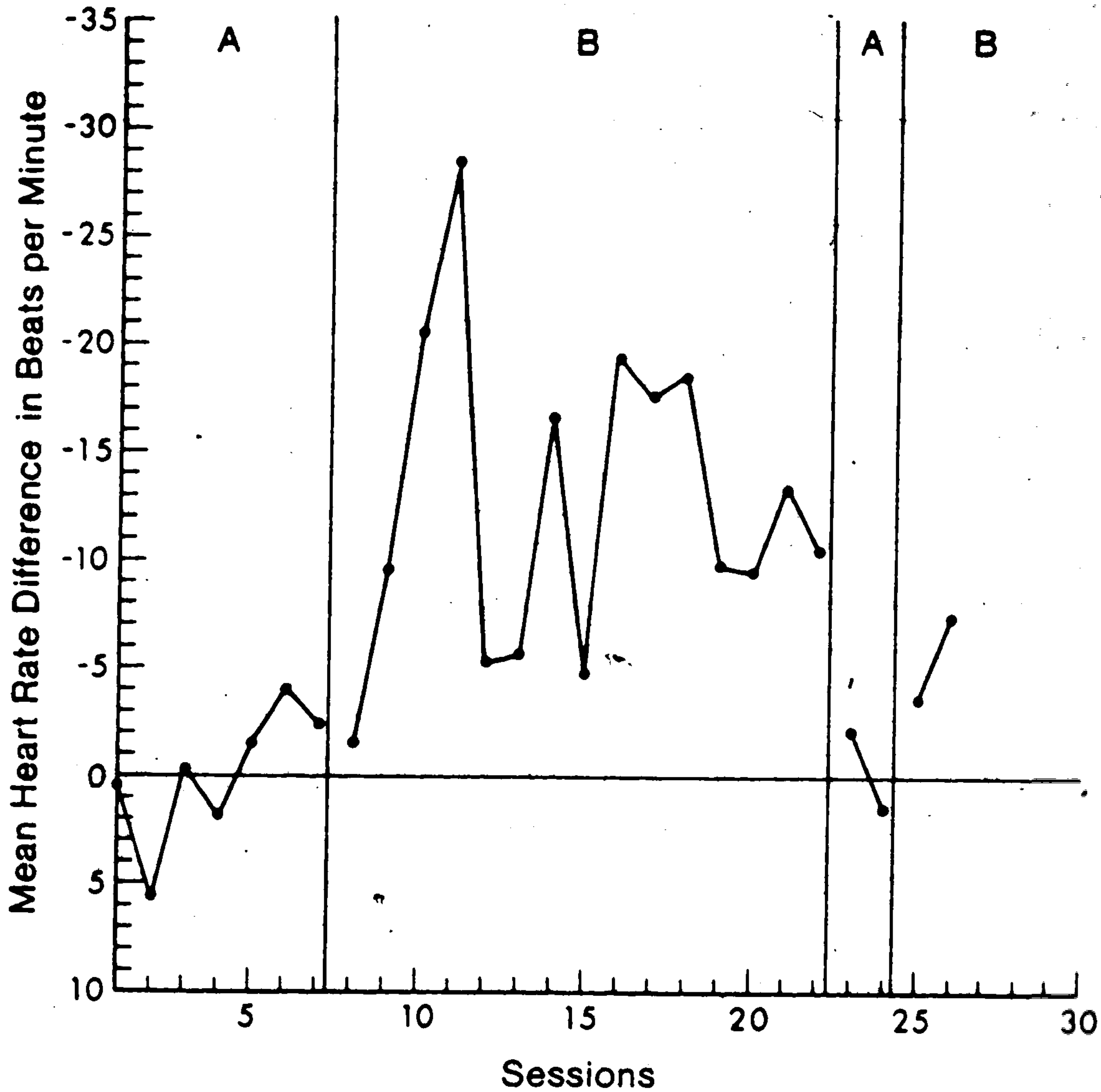

Figure 2 – Pre- and post- session differences in mean heart rate – subject 2

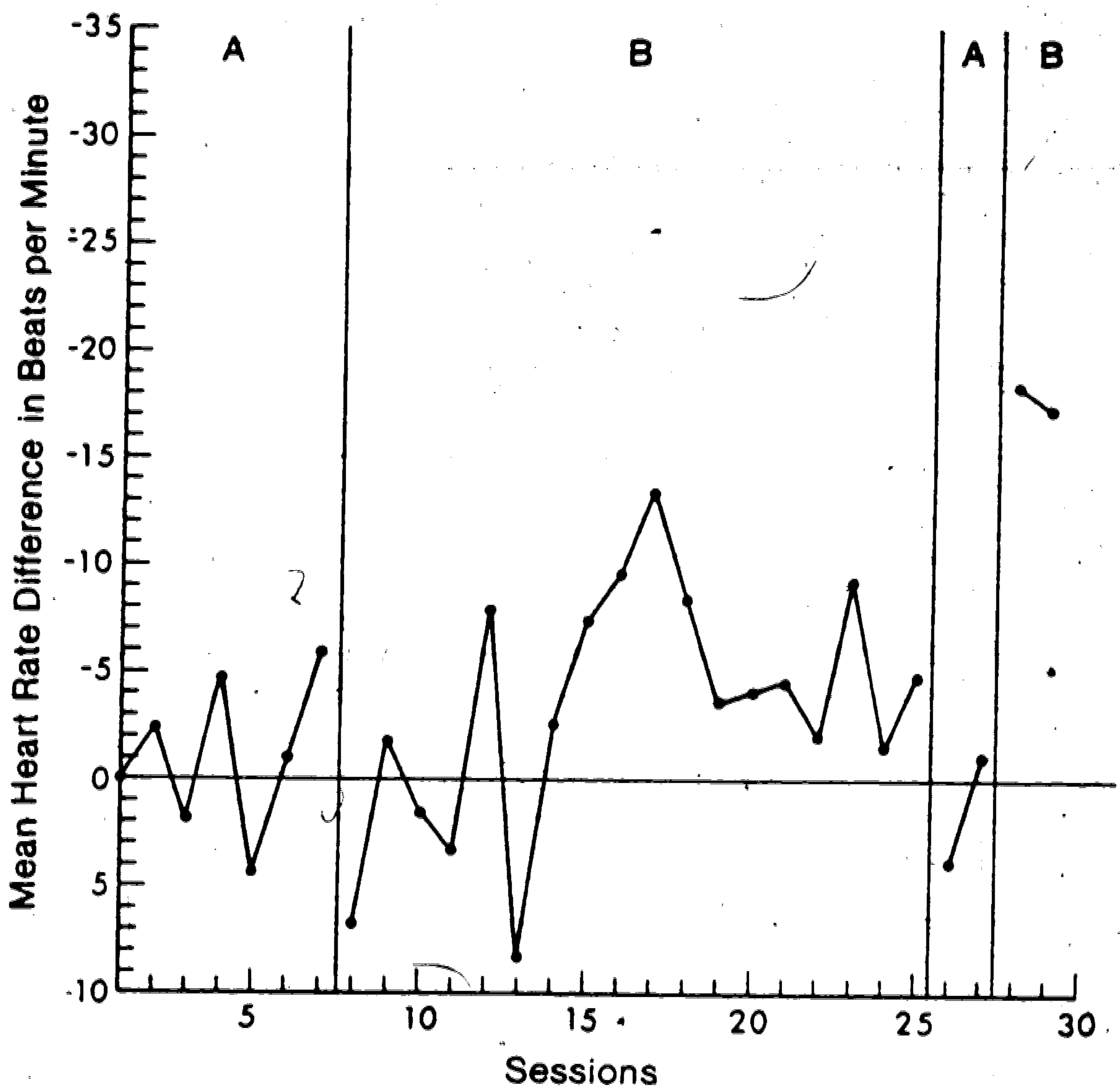

Figure 3 – Pre- and post- session differences in mean heart rate – subject 3

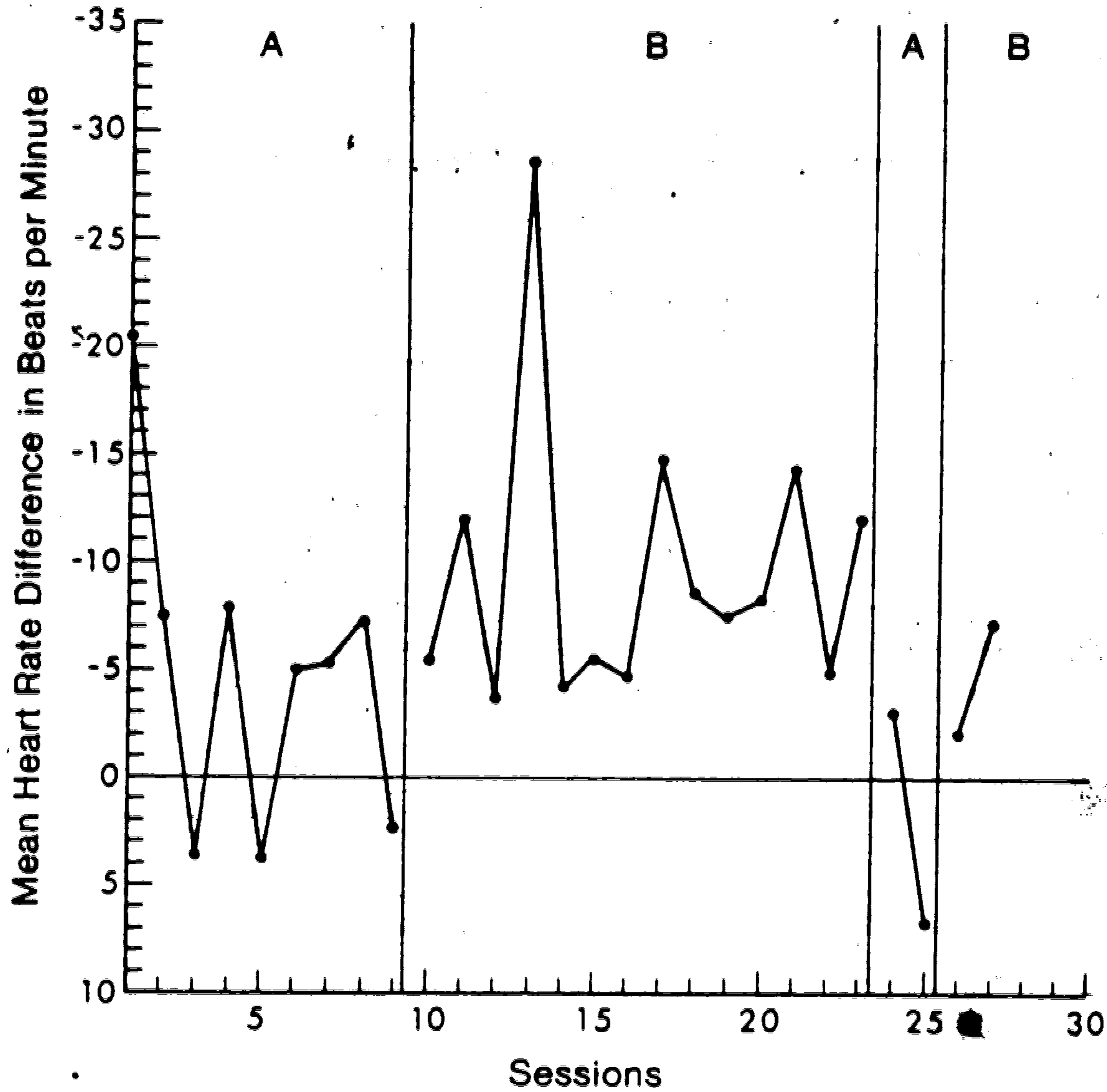

Figure 4 – Pre- and post- session differences in mean heart rate – subject 4

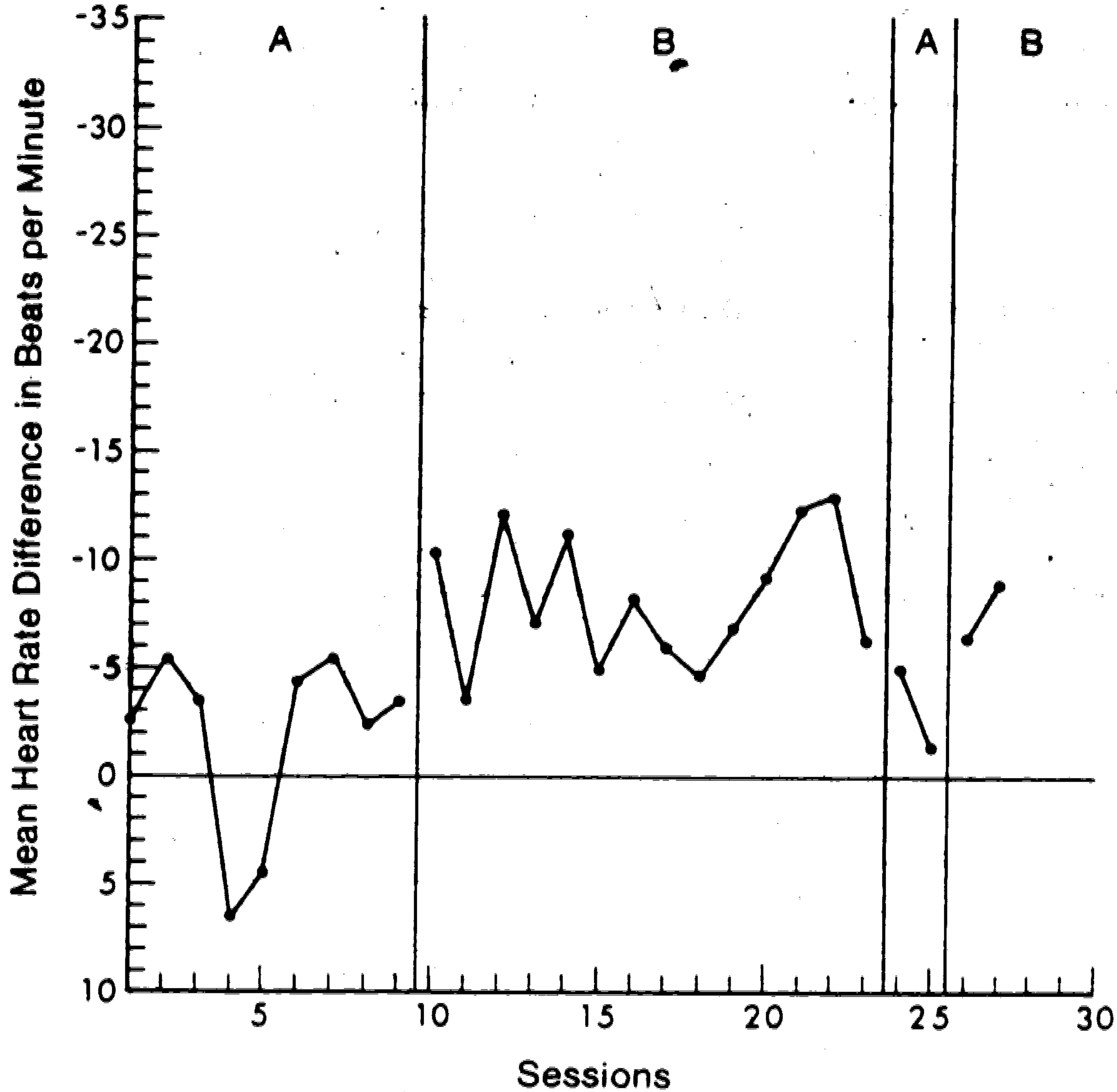

Figure 5 – Pre- and post- session differences in mean heart rate – subject 5

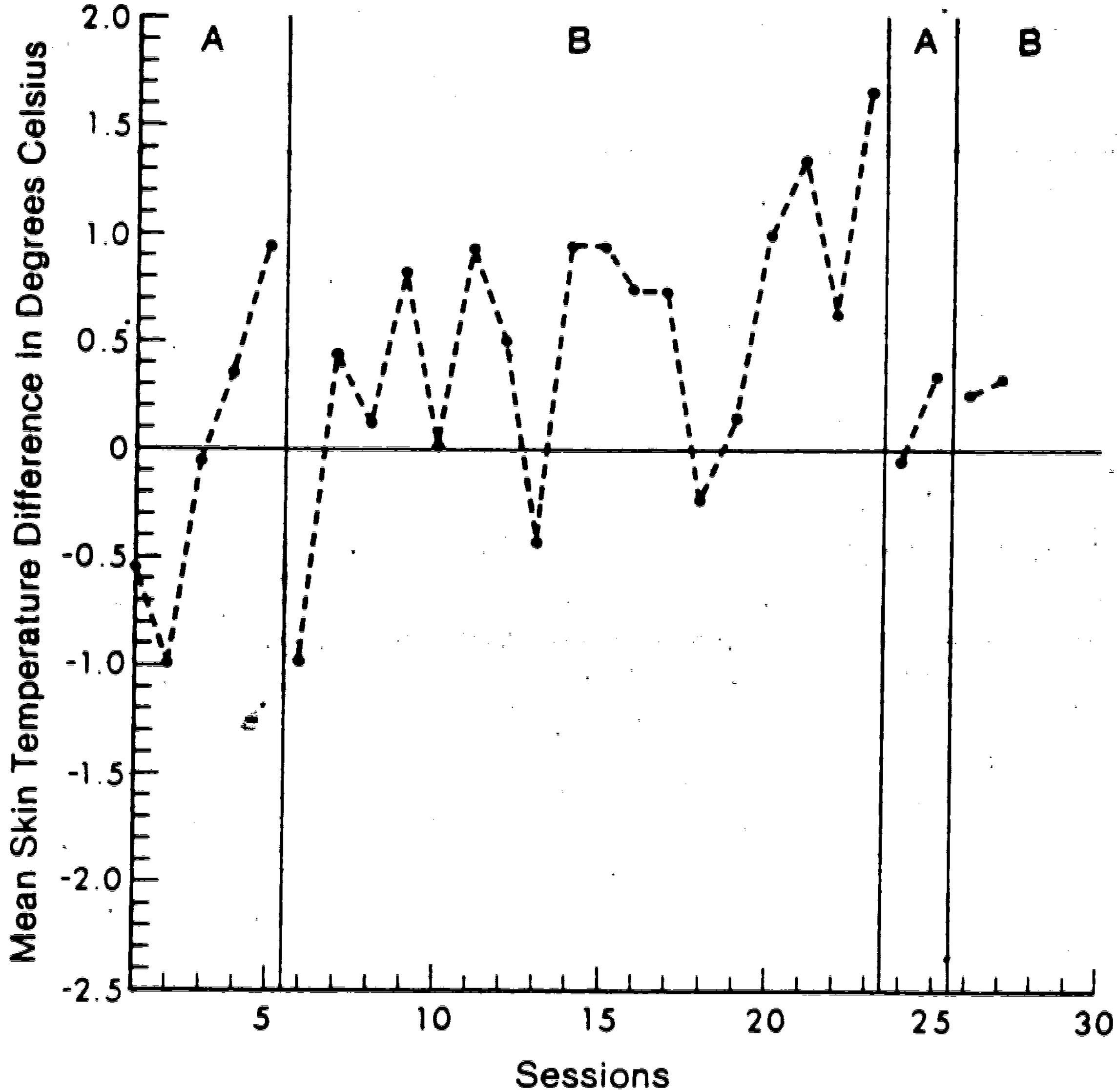

Figure 6 – Pre- and post- session differences in mean skin temperature – subject 1

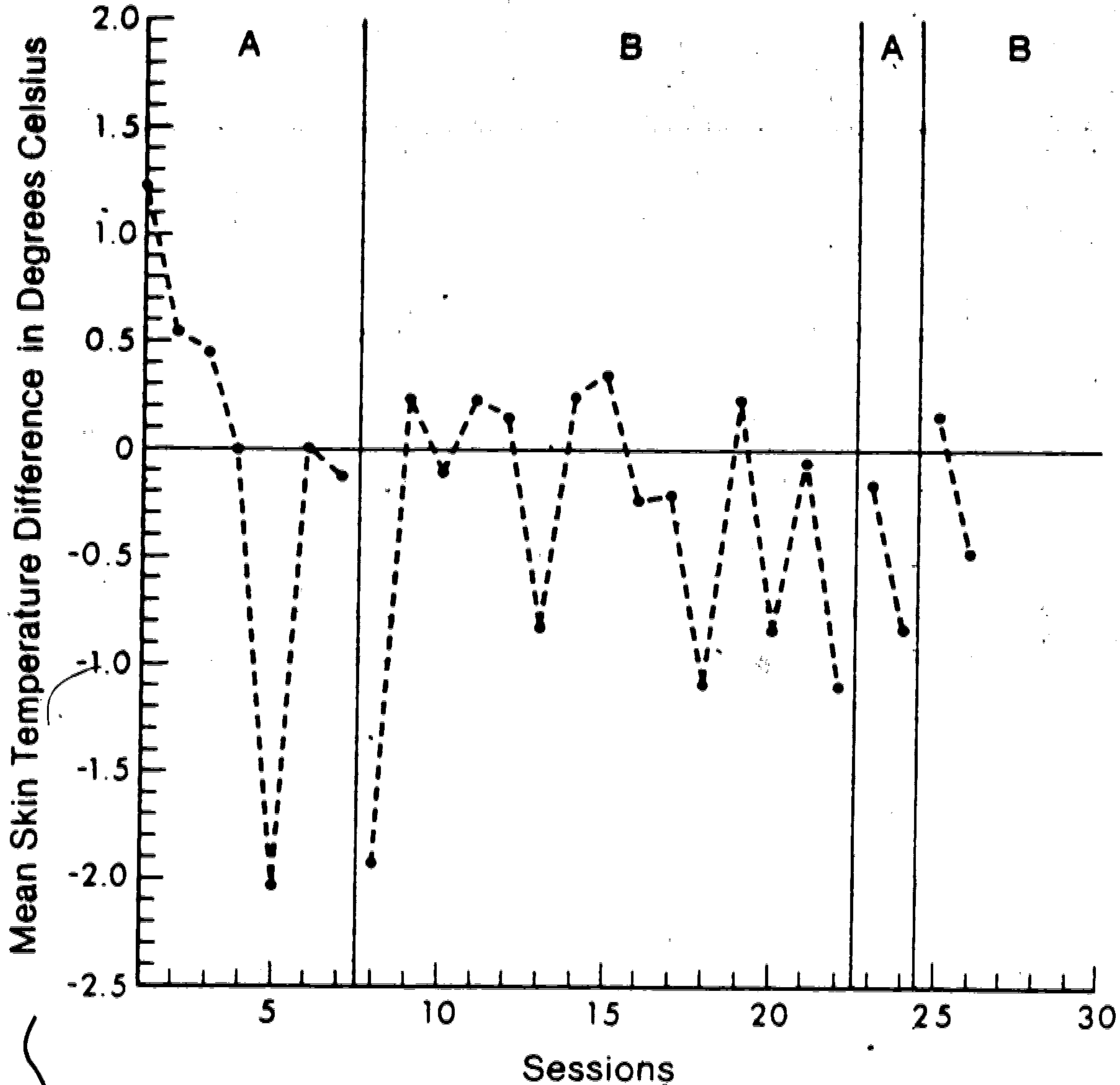

Figure 7 – Pre- and post- session differences in mean skin temperature – subject 2

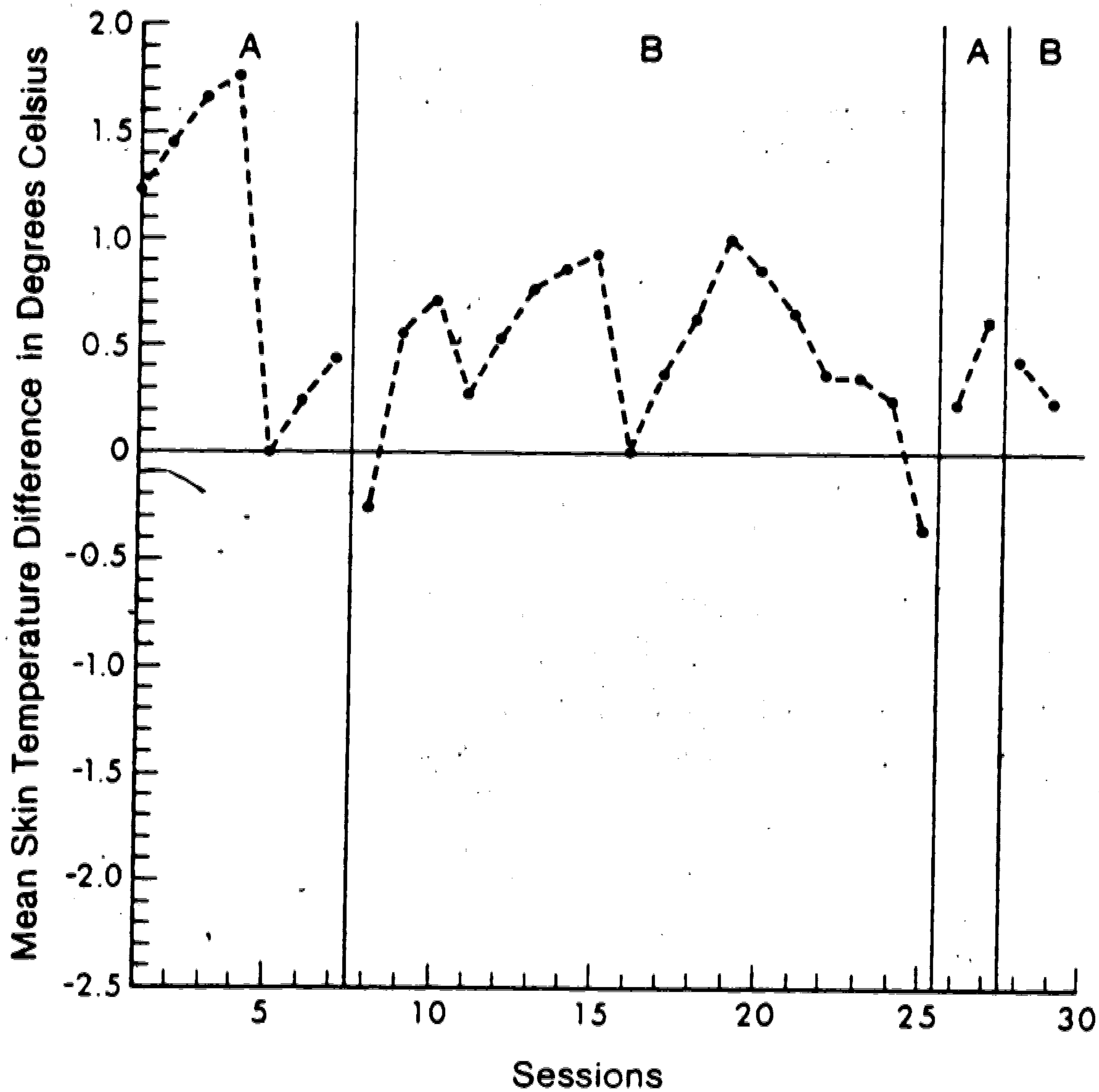

Figure 8 – Pre- and post- session differences in mean skin temperature – subject 3

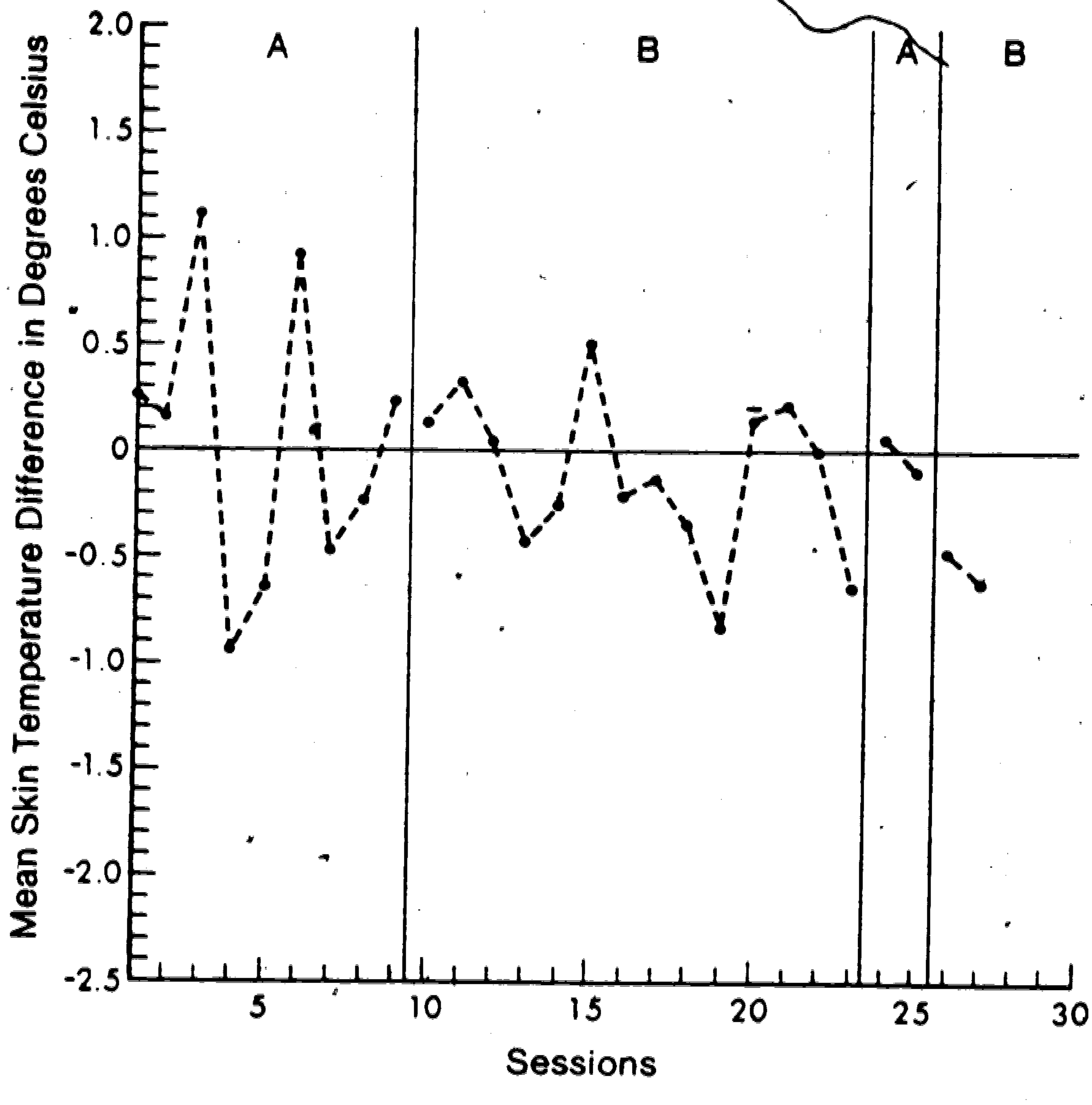

Figure 9 – Pre- and post- session differences in mean skin temperature – subject 4

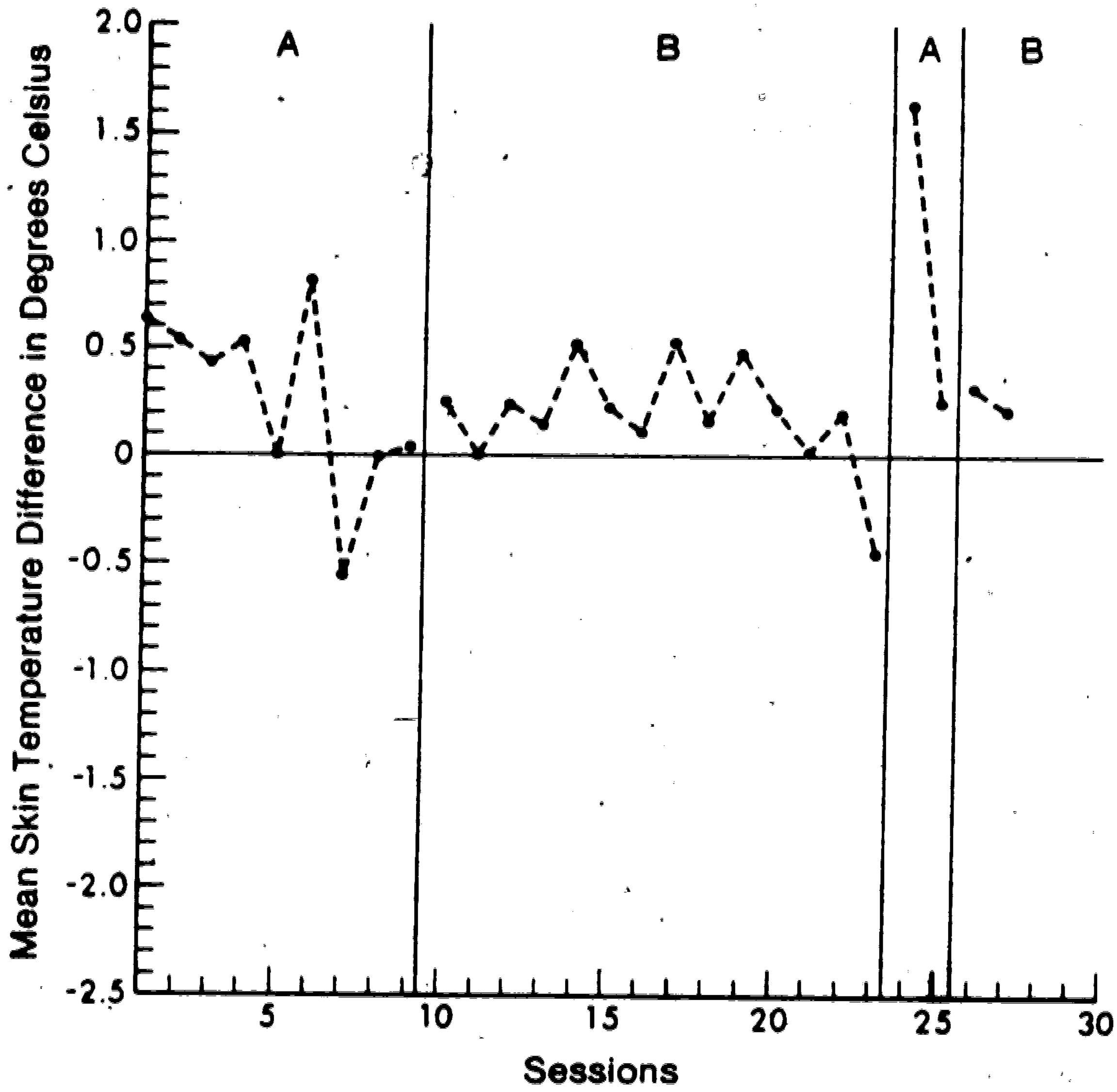

Figure 10 – Pre- and post- session differences in mean skin temperature – subject 5

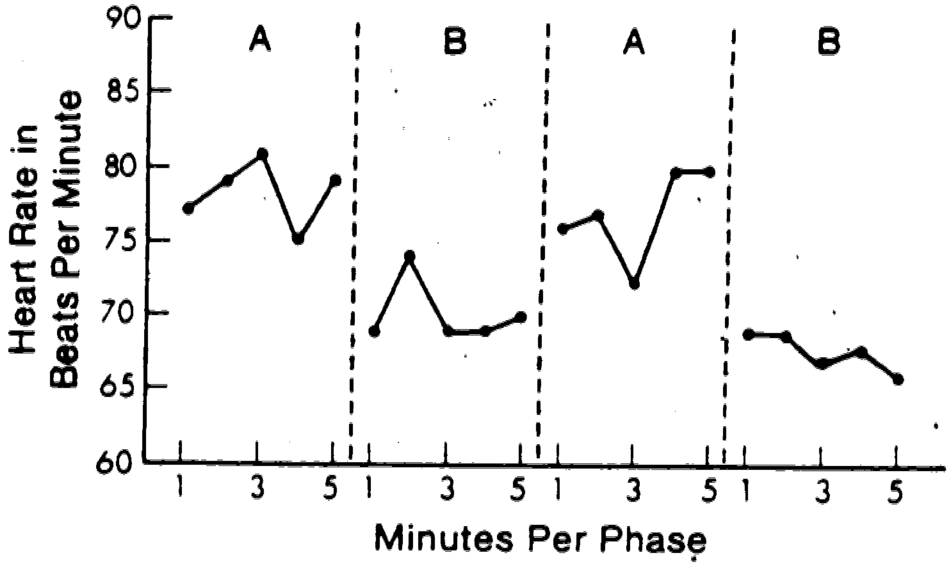

Figure 11 - Heart rate during within- session reversal - subject 1

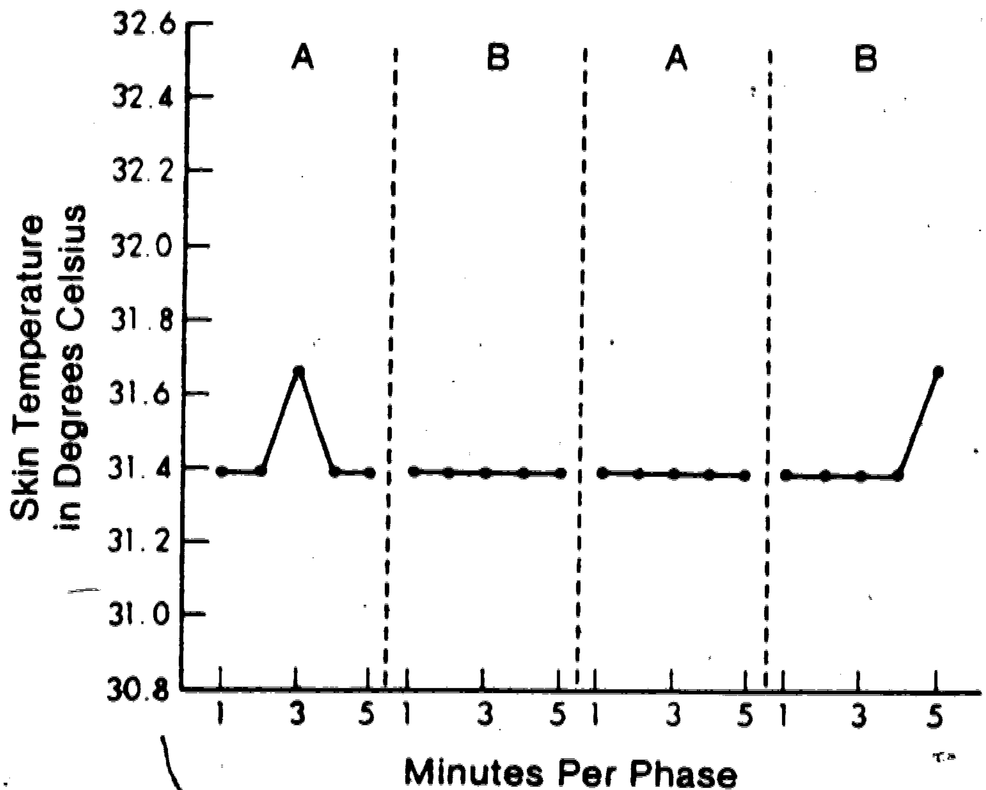

Figure 12 - Skin temperature during within- session reversal - subject 1

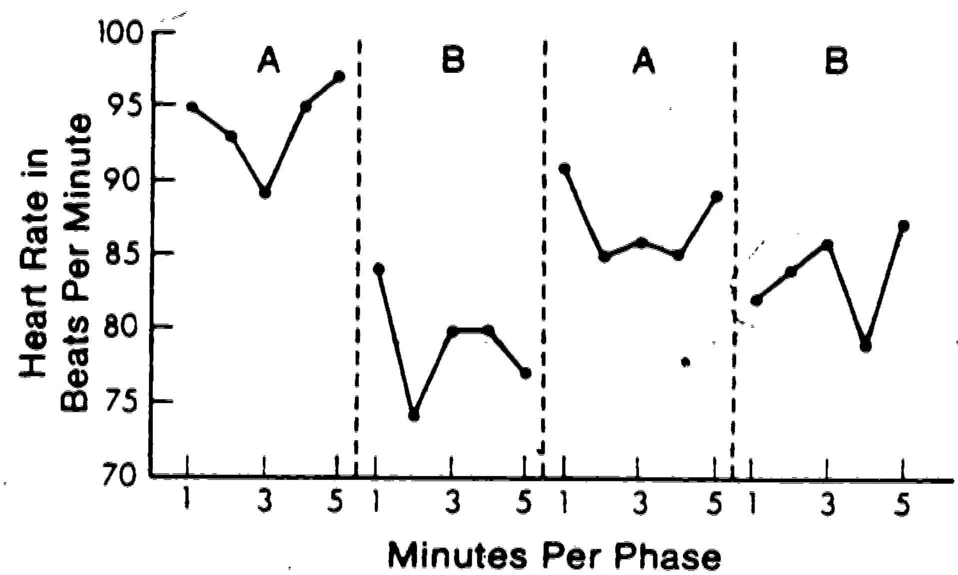

Figure 13 – Heart rate during within- session reversal – subject 2

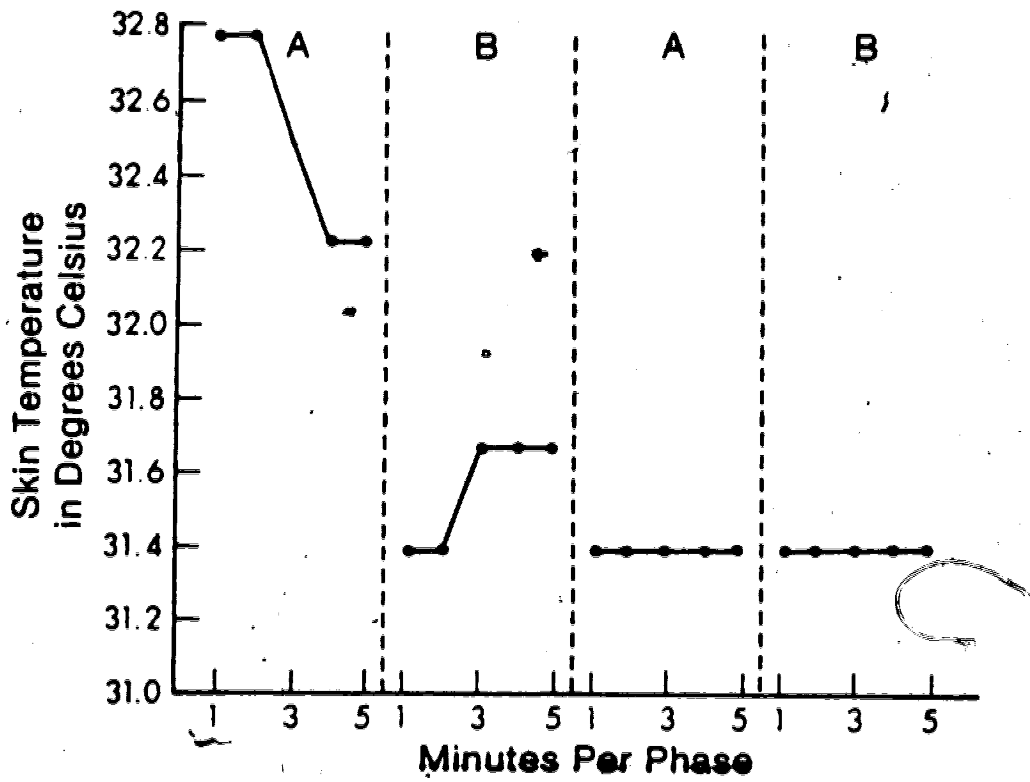

Figure 14 – Skin temperature during within- session reversal – subject 2

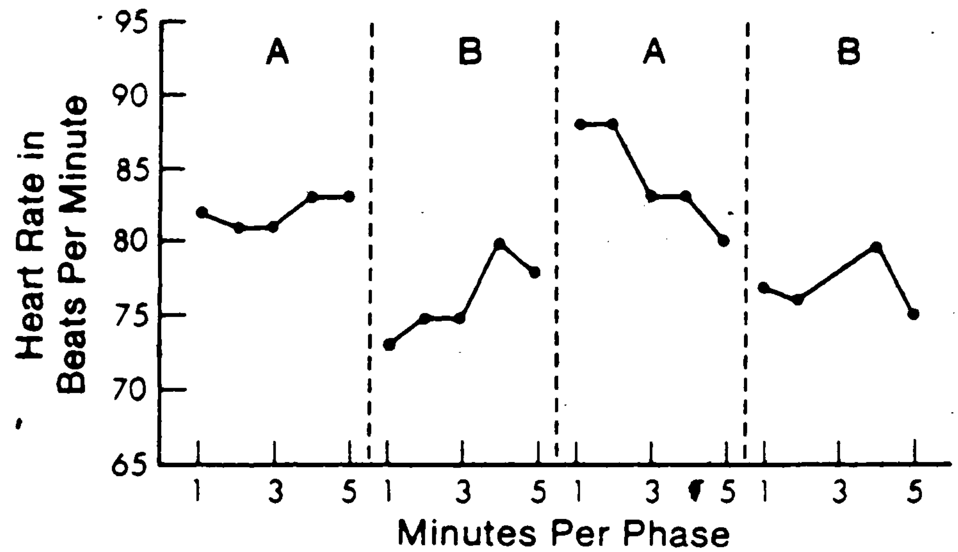

Figure 15 – Heart rate during within- session reversal – subject 3

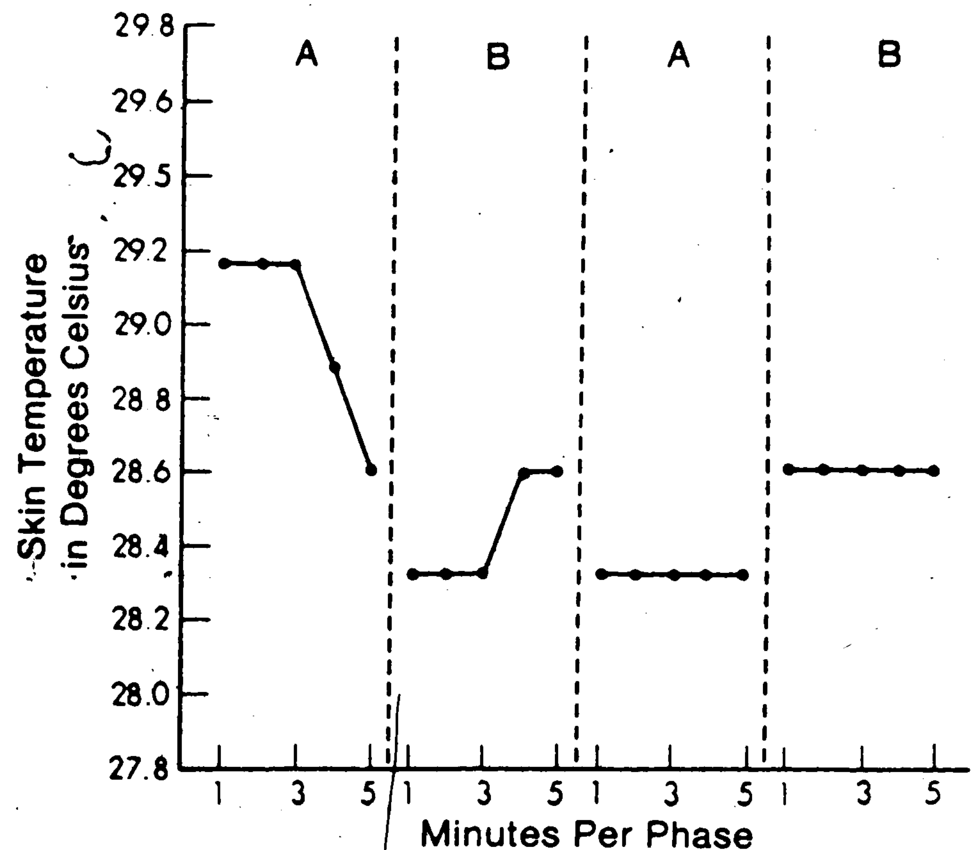

Figure 16 – Skin temperature during within- session reversal – subject 3

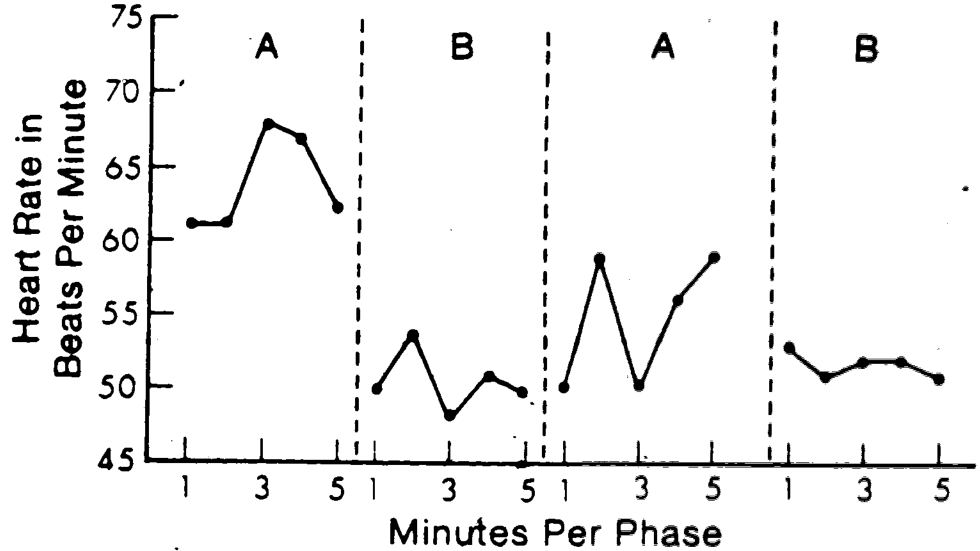

Figure 17 - Heart rate during within- session reversal - subject 4

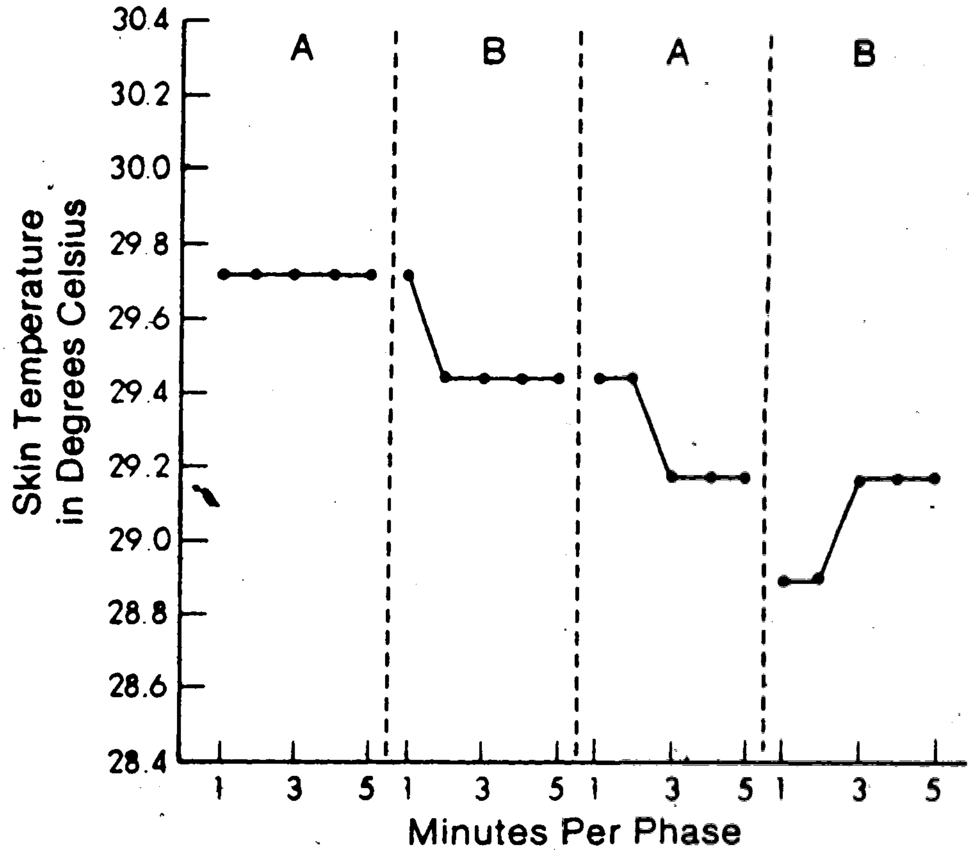

Figure 18 - Skin temperature during within- session reversal - subject 4

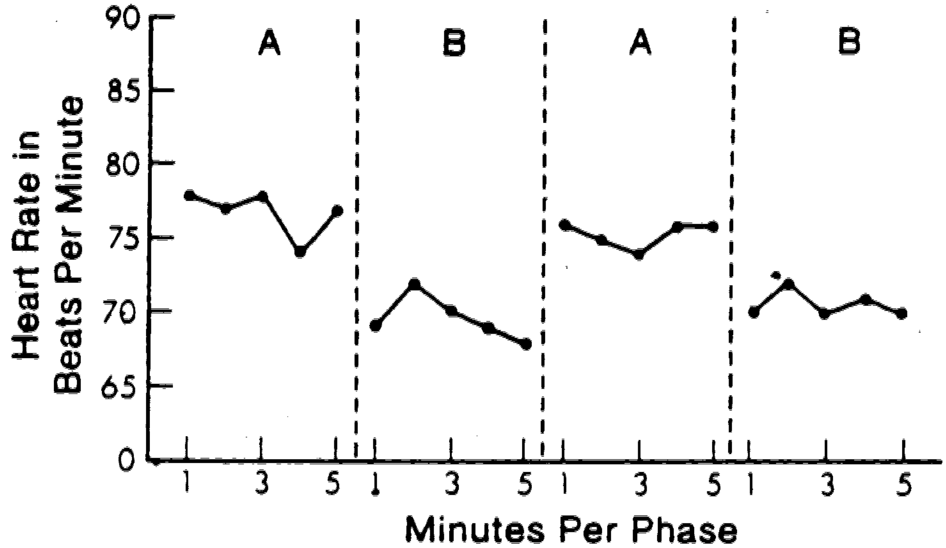

Figure 19 – Heart rate during within- session reversal – subject 5

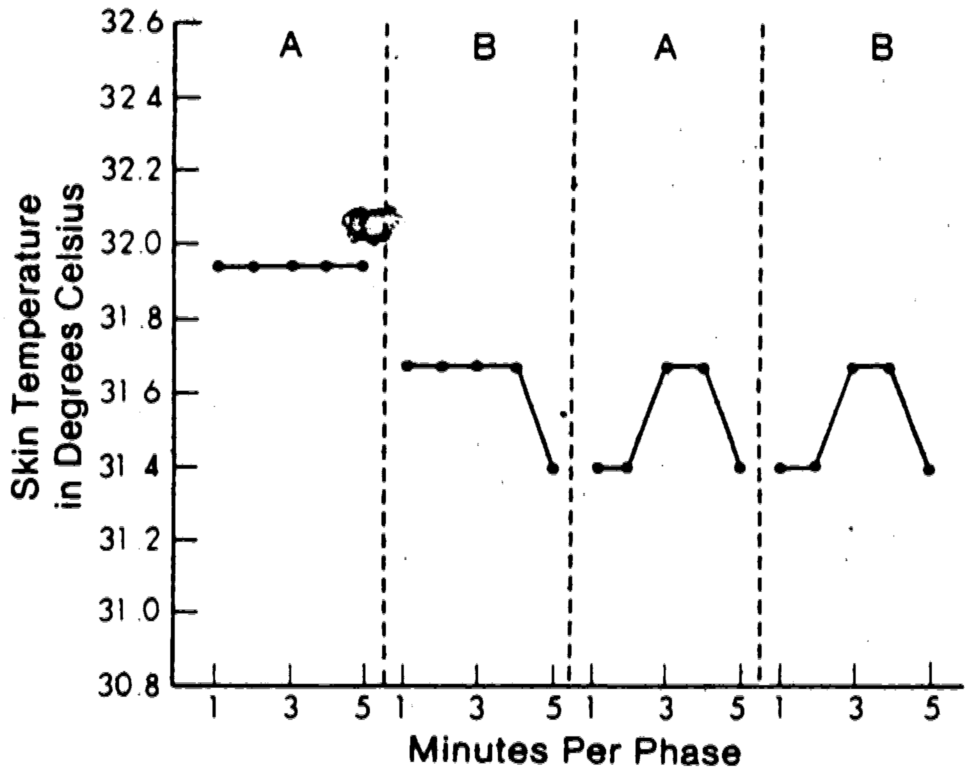

Figure 20 – Skin temperature during within- session reversal – subject 5

REFERENCES

Alexander, A.B., White, P.D., & Wallace, H.M. Training and transfer of training effects in EMG biofeedback assisted muscular relaxation. Psychophysiology, 1977, 14(6), 551-559.

Azrin, N.H., & Holz, W.C. Punishment. In W.K. Honig (Ed.), Operant Behavior: Areas of Research and Application. New York: Appleton-Century-Crofts, 1966.

Barnett, C.D., & Bensberg, G.J. Behavioral management of the institutionalized mentally retarded - a survey. Mental Retardation, 1965, 3, 7-11.

Barrios, B.A. Self-administered cue-controlled relaxation in the reduction of chronic nail biting. Psychology, 1978, 15, 42-50. (a)

Barrios, B.A. Cue-controlled relaxation as a generalizable coping skill: a case report. Psychology, 1978, 15, 14-17. (b)

Benson, H. The Relaxation Response. New York: William Morrow, 1975.

Bernstein, D.A., & Borkovec, T.D. Progressive Relaxation Training: A Manual for the Helping Professions. Champaign: Research Press, 1973.

Blanchard, E.B., & Epstein, L.H. A Biofeedback Primer. Massachusetts: Addison-Wesley Publishing Company, 1978.

Bostow, D.E., & Bailey, J.B. Modification of severe disruptive and aggressive behavior using brief timeout and reinforcement procedures. Journal of Applied Behavior Analysis, 1969, 2, 31-37.

Boudewyns, P.A. A comparison of effects of stress vs. relaxation instruction on the finger temperature response. Behavior Therapy, 1976, 7, 54-67.

Brady, J.P. Metronome-conditioned relaxation: a new behavioral procedure. British Journal of Psychiatry, 1973, 122, 729-730.

Burchard, J.D., Tyler, V.O. Jr. The modification of delinquent behavior through operant conditioning. Behaviour Research and Therapy, 1965, 2, 245-250.

Burchard, J.D. Systematic socialization: a programmed environment for the habilitation of antisocial retardates. Psychological Records, 1967, 17, 461-476.

Burish, T.G., & Horn, P.W. An evaluation of frontal EMG as an index of general arousal. Behavior Therapy, 1979, 10, 137-147.

Canter, A., Kondo, C.Y., & Knott, J.R. A comparison of EMG feedback and progressive muscle relaxation training in anxiety neurosis. British Journal of Psychiatry, 1975, 127, 470-477.

Carroll, D., Marzillier, J.S., & Watson, F. Heart rate and self-report changes accompanying different types of relaxing imagery. Behaviour Research and Therapy, 1980, 18, 273-279.

Carter, J.L., Lax, B., & Russell, H. Effects of relaxation and EMG training on achievement of educable retarded boys. Education and Training of the Mentally Retarded, 1979, 14(1), 39-41.

Cautela, J.R. A behavior therapy approach to pervasive anxiety. Behaviour Research and Therapy, 1966, 4, 99-111.

Cautela, J.R., & Groden, J. Relaxation: A Comprehensive Manual for Adults, Children, and Children with Special Needs. Champaign, Illinois: Research Press, 1979.

Chesney, M.A., & Shelton, J.L. A comparison of muscle relaxation and electromyogram biofeedback treatments for muscle contraction headaches. Journal of Behavior Therapy and Experimental Psychiatry, 1976, 7, 221-225.

Counts, D.K., Hollandsworth, J.G., & Alcorn, J.D. Use of electromyographic biofeedback and cue-controlled relaxation in the treatment of test anxiety. Journal of Consulting and Clinical Psychology, 1978, 46(5), 990-996.

Davidson, R.J., & Schwartz, G.E. The psychobiology of relaxation and related states: a multi-process theory. In D.I. Mostofsky (Ed.), Behavior Control and Modification of Physiological Activity. New Jersey: Prentice-Hall, 1976.

Davison, G.C. Anxiety under total curarization: implications for the role of muscular relaxation in the desensitization of neurotic fears. The Journal of Nervous and Mental Disease, 1966, 143(5), 443-448.

Duffy, E. Activation. In N.S. Greenfield, & R.A. Sternbach (Eds.), Handbook of Psychophysiology. New York: Holt, Rinehart and Winston, 1972.

Edelberg, R. Electrical activity of the skin. In N.S. Greenfield, & R.A. Sternbach (Eds.), Handbook of Psychophysiology. New York: Holt, Rinehart and Winston, 1972.

Endler, N.S., Hunt, J.M., & Rosenstein, A.J. An S-R inventory of anxiousness. Psychological Monographs, 1962, 76 (Whole No. 536).

Ewing, J.W., & Hughes, H.H. Cue-controlled relaxation: its effect on EMG levels during aversive stimulation. Journal of Behavior Therapy and Experimental Psychiatry, 1978, 9, 39-44.

Ferster, C.B., & Skinner, B.F. Schedules of Reinforcement. New York: Appleton-Century-Crofts, 1957.

Foxx, R.M., & Azrin, N.H. Restitution: a method of eliminating aggressive-disruptive behaviors of retardates and brain damaged patients. Behaviour Research and Therapy, 1972, 10, 15-27.

Franks, C.M., & Wilson, G.T. (Eds.). Annual Review of Behavior Therapy Theory and Practice. New York: Brunner/Mazel, 1980.

Gatchel, R.J., Hatch, J.P., Maynard, A., Turns, R., & Taunton-Blackwood, A. Comparison of heart rate biofeedback, false feedback, and systematic desensitization in reducing speech anxiety: short- and long-term effectiveness. Journal of Consulting and Clinical Psychology, 1979, 47(3), 620-622.

Goldfried, M.R., & Trier, C.S. Effectiveness of relaxation as an active coping skill. Journal of Abnormal Psychology, 1974, 83, 348-355.

Graham, L.E., Beiman, I., & Ciminero, A.R. The generality of the therapeutic effects of progressive relaxation training for essential hypertension. Journal of Behavior Therapy and Experimental Psychiatry, 1977, 8, 161-164.

Grimm, L.G. The evidence for cue-controlled relaxation. Behavior Therapy, 1980, 11, 283-293.

Gurman, A.S. Treatment of a case of public-speaking anxiety by in vivo desensitization and cue-controlled relaxation. Journal of Behavior Therapy and Experimental Psychiatry, 1973, 4, 51-54.

Hamilton, J., Stephens, L., & Allen, P. Controlling aggressive and destructive behavior in severely retarded institutionalized residents. American Journal of Mental Deficiency, 1967, 71, 852-856.

Harvey, J.R., Karan, O.C., Bhargava, D., & Morehouse, N. Relaxation training and cognitive behavioral procedures to reduce violent temper outbursts in a moderately retarded woman. Journal of Behavior Therapy and Experimental Psychiatry, 1978, 9, 347-351.

Haynes, S.N., Moseley, D., & McGowan, W.T. Relaxation and biofeedback in the reduction of frontalis muscle tension. Psychophysiology, 1975, 12(5), 547-552.

Haynes, S.N., Sides, H., & Lockwood, G. Relaxation instructions and frontalis electromyographic feedback intervention with sleep-onset insomnia. Behavior Therapy, 1977, 8, 644-652.

Hersen, M., & Barlow, D.H. Single Case Experimental Designs: Strategies for Studying Behavior Change. New York: Pergamon Press, 1976.

Ince, L.P. The use of relaxation training and a conditioned stimulus in the elimination of epileptic seizures in a child: a case study. Journal of Behavior Therapy and Experimental Psychiatry, 1976, 7, 39-42.

Jacobson, E. Progressive Relaxation. Chicago: University of Chicago Press, 1974, first published 1938.

Johnson, D.T., & Speilberger, C.D. The effects of relaxation training and the passage of time on measures of state- and trait-anxiety. Journal of Clinical Psychology, 1968, 24, 20-23.

Kilpatrick, D.G. Differential responsiveness of two electrodermal indices to psychological stress and performance of a complex cognitive task. Psychophysiology, 1972, 9, 218-226.

King, N.J., & Montgomery, R.B. The self-control of human peripheral (finger) temperature: maneuvers as aids to biofeedback training. Behavior Therapy, 1981, 12, 263-273.

Kurtz, P.D., & Neisworth, J.T. Self-control possibilities for exceptional children. Exceptional Children, 1976, 42, 212-217.

Lacey, J. Somatic response patterning and stress: some revision of activation theory. In M. Appley & R. Trumbull (Eds.), Psychological Stress: Issues in Research. New York: Appleton-Century-Crofts, 1967.

Lehrer, P.M. Physiological effects of relaxation in a double-bling analog of desensitization. Behavior Therapy, 1972, 3, 193-208.

Lessen, E.I., & McLain, B. Relaxation training and GSR used to reduce hyperactivity in intermediate aged EMR children. Behavioral Engineering, 1980, 6(3), 117-121.

Luiselli, J.K., Marholin, D. II, Steinman, D.L., & Steinman, W.M. Assessing the effects of relaxation training. Behavior Therapy, 1979, 10, 663-668.

Luthe, W. Autogenic training: method, research and application in medicine. American Journal of Psychotherapy, 1963, 17, 174-195.

Lyon, R., & Bland, W. The transfer of adult mental retardates from state hospitals to nursing homes. Mental Retardation, 1969, 7, 31-36.

Mansdorf, I.J., Bucich, D.A., & Judd, L.C. Behavioral treatment strategies of institution ward staff. Mental Retardation, 1977, 15(5), 22-24.

Mathews, A.M., & Gelder, M.G. Psycho-physiological investigations of brief relaxation training. Journal of Psychosomatic Research, 1969, 13, 1-12.

Mittler, P. Research to practice in the field of handicap. Journal of Practical Approaches to Developmental Handicap, 1977, 1(1), 4-9.

Moan, E.R. GSR biofeedback assisted relaxation training and psychosomatic hives. Journal of Behavior Therapy and Experimental Psychiatry, 1979, 10, 157-158.

Nihira, K., Foster, R., Shellhaas, M., & Leland, H. AAMD Adaptive Behavior Scale Manual. Washington, D.C.: American Association on Mental Deficiency, 1974.

Paul, G.L. Physiological effects of relaxation training and hypnotic suggestion. Journal of Abnormal Psychology, 1969, 74(4), 425-437.

Peck, C.L. Desensitization for the treatment of fear in the high level adult retardate. Behaviour Research and Therapy, 1977, 15, 137-148.

Pendergrass, V.E. Effects of length of timeout from positive reinforcement and schedule of application in suppression of aggressive behavior. Psychological Records, 1971, 21, 75-80.

Pendleton, L.R., & Tasto, D.L. Effects of metronome-conditioned relaxation, metronome-induced relaxation, and progressive muscle relaxation in insomnia. Behaviour Research and Therapy, 1976, 14, 165-166.

Putre, W., Loffio, K., Chorost, S., Marx, V., & Gilbert, C. An effectiveness study of relaxation: a training tape with hyperactive children. Behavior Therapy, 1977, 8, 355-359.

Qualls, P.J., & Sheehan, P.W. Capacity for absorption and relaxation during electromyographic feedback and no-feedback conditions. Journal of Abnormal Psychology, 1979, 88(6), 652-662.

Rachman, S. The role of muscular relaxation in desensitization therapy. Behaviour Research and Therapy, 1968, 6, 159-166.

Reeves, J.L., & Mealiea, W.L. Biofeedback-assisted cue-controlled relaxation for the treatment of flight phobias. Journal of Behavior Therapy and Experimental Psychiatry, 1975, 6, 105-109.

Reinking, R.H., & Kohl, M.L. Effects of various forms of relaxation training on physiological and self-report measures of relaxation. Journal of Consulting and Clinical Psychology, 1975, 43(5), 595-600.

Repp, A.C., & Deitz, S.M. Reducing aggressive and self-injurious behavior of institutionalized retarded children through reinforcement of other behaviors. Journal of Applied Behavior Analysis, 1974, 7, 313-325.

Riddick, C., & Meyer, R.G. The efficacy of automated relaxation training with response contingent feedback. Behavior Therapy, 1973, 4, 331-337.

Rimm, D.C., & Masters, J.C. Behavior Therapy Techniques and Empirical Findings. New York: Academic Press, 1974.

Schandler, S.L., & Grings, W.W. An examination of methods for producing relaxation during short-term laboratory sessions. Behaviour Research and Therapy, 1976, 14, 419-426.

Schneider, H.C., Ross, J.S.G., & Dubin, W.J. A practical alternative for the treatment of tantrum and self-injurious behavior. Journal of Behavior Therapy and Experimental Psychiatry, 1979, 10, 73-75.

Schultz, J.H., & Luthe, W. Autogenic Training: A Psychophysiologic Approach to Psychotherapy. New York: Grune & Stratton, 1959.

Schultz, J.H., & Luthe, W. Autogenic therapy. Volume 1, Autogenic Methods. New York: Grune & Stratton, 1969.

Shaw, W.J., & Walker, C.E. Use of relaxation in the short-term treatment of fetishistic behavior: an exploratory case study. Journal of Pediatric Psychology, 1979, 4(4), 403-407.

Smith, J.C. Meditation as psychotherapy: a review of the literature. Psychological Bulletin, 1975, 82, 558-564.

Solnick, J.V., Rincover, A., & Peterson, C.R. Some determinants of the reinforcing and punishing effects of time-out. Journal of Applied Behavior Analysis, 1977, 10(3), 415-424.

Spielberger, C.D., Gorsuch, R.L., & Lushene, R. State-Trait Anxiety Inventory. Palo Alto: Consulting Psychologists Press, 1968.

Spielberger, C.D., Edwards, C.D., Lushene, R.E., Montuori, J., & Platzek, D. STAIC Preliminary Manual. Palo Alto: Consulting Psychologists Press, 1973.

Steen, P.L., & Zuriff, G.E. The use of relaxation in the treatment of self-injurious behavior. Journal of Behavior Therapy and Experimental Psychiatry, 1977, 8, 447-448.

Steptoe, A. The regulation of blood pressure reactions to taxing conditions using pulse transit time feedback and relaxation. Psychophysiology, 1978, 15(5), 429-438.

Stoudenmire, J. Effects of muscle relaxation training on state and trait anxiety in introverts and extroverts. Journal of Personality and Social Psychology, 1972, 24(2), 273-275.

Stoudenmire, J. The effect of length of sessions and spacing of sessions on muscle relaxation training. Journal of Community Psychology, 1973, 1(2), 235-236.

Stoudenmire, J. A comparison of muscle relaxation training and music in the reduction of state and trait anxiety. Journal of Clinical Psychology, 1975, 31(3), 490-492.

Stoyva, J. Self-regulation and stress-related disorders: a perspective on biofeedback. In D.I. Mostofsky (Ed.), Behavior Control and Modification of Physiological Activity. New Jersey: Prentice-Hall, 1976.

Surwit, R.S., Shapiro, D., & Feld, J.L. Digital temperature auto-regulation and associated cardiovascular changes. Psychophysiology, 1976, 13, 242-248.

Tarler-Benlolo, L. The role of relaxation in biofeedback training: a critical review of the literature. Psychological Bulletin, 1978, 85(4), 727-755.

Taylor, J.A. A personality scale of manifest anxiety. Journal of Abnormal and Social Psychology, 1953, 48, 285-290.

Thorne, E.D., & Shinedling, M. Volunteer student 'behavior engineers': should they attempt to establish or eliminate target behaviors? Mental Retardation, 1970, 8, 9-11.

Tyler, V.O. Jr., & Brown, G.D. The use of swift brief isolation as a group control device for institutionalized delinquents. Behaviour Research and Therapy, 1965, 5, 1-9.

Webster, D.R., & Azrin, N.H. Required relaxation: a method of inhibiting agitative-disruptive behavior of retardates. Behaviour Research and Therapy, 1973, 11, 67-78.

Weinman, J. Photoplethysmography. In P.H. Venables, & I. Martin (Eds.), A Manual of Psychophysiological Methods. New York: Wiley, 1967.

Wells, K.C., Turner, S.M., Bellack, A.S., & Hersen, M. Effects of cue controlled relaxation on psychomotor seizures: an experimental analysis. Behaviour Research and Therapy, 1978, 16(1), 51-53.

Wolf, M., Risley, T., & Mees, H. Application of operant conditioning procedures to the behavior problems of an autistic child. Behaviour Research and Therapy, 1964, 1, 305-312.

Wolpe, J. Psychotherapy by Reciprocal Inhibition. Stanford: Stanford University Press, 1958.

Zuckerman, M. The development of an affective adjective for the measurement of anxiety. Journal of Consulting Psychology, 1960, 24, 457-462.

Zuckerman, M. Physiological measures of sexual arousal in the human. Psychological Bulletin, 1971, 75, 297-329.