THE RELATIONSHIP BETWEEN SELF-EFFICACY AND BIOFEEDBACK TRAINING OUTCOME IN AN ANXIOUS POPULATION

by

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THE RELATIONSHIP BETWEEN SELF-EFFICACY AND BIOFEEDBACK

TRAINING OUTCOME IN AN ANXIOUS POPULATION

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ABSTRACT

Expectancy of outcome plays an important role in acquiring physiological self-control through biofeedback training. However, many studies either have not addressed this issue explicity or have addressed it only superficially. Recently, Bandura's construct of self-efficacy has been offered as a means for explaining the manner in which performance expectations affect subsequent performance. Bandura defines self-efficacy as "the conviction that one can successfully execute the behavior required to produce outcomes." The goal of this study was to investigate the relationship between self-efficacy and success in biofeedback training. The dependent measures were the Symptoms of Stress Inventory, State-Trait Anxiety Inventory, State scale and State-Trait Anxiety Inventory, Trait scale, self-efficacy measures, and a psychophysiological stress profile. All subjects were screened using the Institute for Personality and Ability Testing anxiety scale and had a sten score of 7 or greater. Subjects were trained twice weekly and followed the three-phase format of exploration, control, and weaning/transfer. Subjects were trained to criterion in their most reactive physiological modality: 11 subjects received electromyography training, 3 received peripheral skin temperature training, 2 received galvanic skin response training, and 17 subjects served as controls.

Where possible the data were analyzed using multivariate analysis of variance. There were significant reductions in electromyography within session and across time. At posttesting, treatment subjects demonstrated positive significant changes in electromyography, heart rate and peripheral skin temperature. Significant reductions in scores on the Symptoms of Stress Inventory, State-Trait Anxiety Inventory, State scale, State-Trait Anxiety Inventory, Trait scale, and increase in self-efficacy for relaxation were found but were uniform for both treatment and control groups. Finally,

self-efficacy did correlate with other paper and pencil measures but not with physiological measures.

These results suggest that biofeedback training in most reactive modality is effective in controlling the physiological component of anxiety and that it is not sufficient to train all subjects in one physiological modality as is usually done. The low correlation between efficacy expectations and training outcome may mean that the link between the cognitive and physiological components of anxiety is not as direct as theorists have suggested.

ACKNOWLEDGEMENTS

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CHAPTER 1

> So very close is the connection between the bodies and the minds of men, and therefore, between physical and mental ailments and their remedies.
>
> Allus Gellius (c.160 A.D.)

Ours has been called the "Age of Anxiety" (Auden, 1950). It is estimated that 5% of the population of the United States suffers from chronic anxiety (Raskin, Johnson, & Rodestvedt, 1973). One definition of chronic anxiety is "a persistent or recurrent state of dread or apprehension accompanied by signs of physiological arousal such as palpitations, tremulousness, tachycardia, and dizziness" (Raskin, Johnson, & Rondestvedt, 1973). Hock and Zubin (1950) have said,

> If anxiety could be controlled by biological or social means, fundamental alterations in the organization of our civilization would ensue and the probability of individual happiness would be greatly enhanced... anxiety is the most pervasive psychological phenomenon of our time...

There is evidence that people are coping ineffectively with anxiety and stress (Albrecht, 1979). Some smoke cigarettes, some drink to excess and some take street or prescription drugs (Albrecht, 1979). Clearly then, there is a need to teach people more effective methods of dealing with anxiety and stress (Woolfolk & Lehrer, 1984).

Anxiety has been conceptualized as consisting of three components: physiological, cognitive and behavioral (Borkovec, 1976; Lazarus, 1974; Nietzel & Bernstein, 1981). It has been proposed that different forms of treatment influence different components of anxiety. Biofeedback, which has been used extensively and effectively in the treatment of anxiety (Carter, Kondo, & Knott, 1975; Hiebert, 1981; Raskin, Johnson, & Rondestvedt, 1973;

Townsend, House, & Addaris, 1975), is generally believed to treat the physiological component of anxiety.

The Problem

Certain challenges have been made to the understanding that biofeedback treats only the physiological component of anxiety. Although three separate response components can be distinguished, the components may be interactive (Borkovec, 1976; Lang, 1968). "Because of their potential interaction, changes in one response component may ultimately effect subsequent changes in the response of one or both of the remaining components" (Borkovec, 1967, p. 267). Changes in the physiological component may effect changes in the cognitions or behaviors or both. Conversely changes in the cognitive or behavioral components may influence or even account for the physiological changes associated with biofeedback.

Meichenbaum (1976) has claimed that biofeedback is primarily a cognitive activity. He suggests that biofeedback training changes clients' perceptions, attributions and appraisals regarding their ability to control physiological responses. He goes on to suggest that clients will change in their ability to control cognitions, feelings and behaviors.

Bandura (1977) proposes a cognitive mechanism involved in psychological procedures in general, including biofeedback. The particular cognitive construct Bandura (1977) has described is called self-efficacy or efficacy expectations. Bandura defines an efficacy expectation as "a conviction that one can successfully execute the behavior required to produce the outcome" (Bandura, 1977, p. 193). Bandura's theory is that "psychological procedures, whatever their form, serve as a means of creating and strengthening expectations of self-efficacy" (Bandura, 1977, p. 193). Expectations of personal mastery are conceptualized as affecting both the initiation and persistence of coping behavior.

How might biofeedback training alter self-efficacy? Bandura (1977) proposes four major sources of information regarding self-efficacy. These are: performance accomplishments, vicarious experience, verbal persuasion, and physiological states/emotional arousal. Performance accomplishments are seen to be the most dependable of these sources. Clearly then, successful performance in biofeedback would be a source of self-efficacy. Alternately, existing self-efficacy would influence successful outcome in biofeedback training. Emotional arousal is seen by Bandura (1977) to be the principal source through which biofeedback operates. People are more likely to expect success when they are relaxed than when they are physiologically aroused (Bandura, 1977). Therefore, if biofeedback reduces arousal, it will increase self-efficacy. Alternately, perceived self-efficacy may reduce physiological arousal. Thus, there is the following relationship between self-efficacy, physiological arousal, and performance accomplshments:

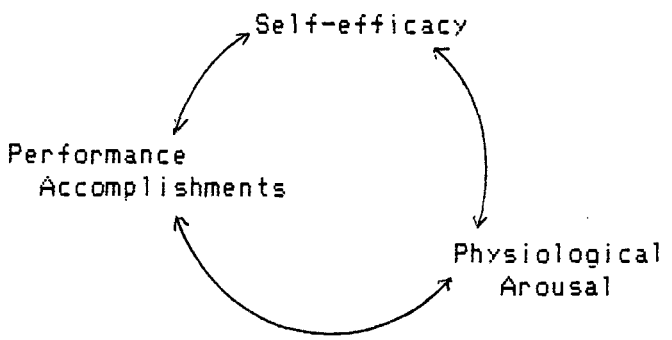

Figure 1. Proposed Theoretical Relationship Between Self-Efficacy, Physiological Arousal and Performance Accomplishments.

The Present Study

The major purpose of this study was to examine the relationship between self-efficacy and training outcome in biofeedback. The work of Bandura (1977) and Holroyd et al. (1984) mentioned above, would indicate that initial levels of self-efficacy might influence training outcome. In order to determine

these relationships, self-efficacy probes were given prior to training, during training, and after training. These were compared to physiological data taken at the same time.

Overview

In this thesis, the questions raised above are addressed. In Chapter Two, a literature review is presented. The focus is on anxiety, biofeedback, self-efficacy and the relationship between these three constructs. In Chapter Three, the research methodology is discussed. In Chapter Four, the data analysis and results are given. In the final Chapter, a discussion of the results and their implications is presented.

CHAPTER 2

REVIEW OF THE RELATED LITERATURE

As described in the preceding chapter, the major purpose of this study was to examine the relationship between self-efficacy and biofeedback training outcome in the treatment of anxiety. The purpose of this chapter is to provide a theoretical rationale for the study. The topics that will be discussed are: anxiety, biofeedback and self-efficacy.

Anxiety

There are various perspectives on the nature of anxiety. Many theorists consider anxiety to consist of three components: behavioral, cognitive, and physiological (Borkovec, 1976; Lazarus, 1974; Nietzel & Bernstein, 1981). For the purpose of this study such a conceptualization is used. Lazarus and Averill (1972) present a theory of emotions in general, and anxiety in particular, which takes into account all three components. They state that "emotions are complex disturbances having three loosely related main components: subjective affect (which includes cognitive appraisal [Lazarus, 1974, p. 21]); physiological changes that are linked to...mobilization for adaptive action; and action impulses having both instrumental and expressive qualities" (Lazarus & Averill, 1972, p. 69). Each of these three components of anxiety is discussed separately.

Cognitive Components of Anxiety

Lazarus and Averill (1972) suggest that the mediator of the anxiety response is cognition. External events are cognitively appraised as anxiety provoking when they are perceived as threatening, and lead to physiological arousal, and behavioral responses such as avoidance. Cognitive appraisal concerns the significance of an event to a person's welfare. In anxiety, the cognitive appraisal is that of threat which involves symbolic, anticipatory,

and uncertain elements. Symbolic elements are differentiated from concrete immediate events. The latter may elicit fear, the former anxiety. Symbolic events are "ideas, concepts, values or cognitive systems to which the person is heavily committed" (Lazarus & Averill, 1972, p. 247). For example an individual may feel threatened by a critical remark made by an employer. This event may be interpreted by the individual as devaluation and result in anxiety. Anticipatory elements involve an ominous foreboding of events which might occur in the future. Uncertain elements involve lack of predictability about what will happen, whether it will happen, when it will happen, and what can be done about it. People find this uncertainty anxiety provoking because "no rationally based action to dispel the danger can be potentiated" (Lazarus, 1966). In this way anxiety is different from the emotions of fear and anger, in which arousal mobilizes for action against a concrete threat.

Physiological Components of Anxiety

Anxiety is closely associated with heightened arousal (Borkovec, 1976; Lang, 1968; Lazarus & Averill, 1972; Paul, 1969; Spielberger, 1972). In this thesis, the term "arousal" is used in a general manner to refer to increased activity in the sympathetic nervous system and the skeletal musculature (Budzynski, 1973). These changes usually include an increase in muscle tension, skin conductance, heart rate, blood pressure, respiration rate, pupillary dilation, and peripheral vasoconstriction (Budzynski, 1973; Germana, 1974; Stoyva, 1976). Although the above pattern is common across most people, some variation does exist.

Arousal can serve an adaptive function for the individual in that it mobilizes the body's resources for quick action (Cannon, 1939). However, excessive arousal often is maladaptive. Beck (1985) describes anxiety disorders as representing "a malfunction of the system for activating and

terminating a defensive response to a threat" (p. 22). "The person afflicted reacts to ordinary life situations as though they were emergencies" (Malmo, 1972, p. 926). Also the anxious person takes longer to recover from stimulation than the normal person (Alexander, 1972). Therefore, heightened physiological arousal is an important component of anxiety.

Behavioral Components of Anxiety

Lazarus and Averill (1972) describe the behavioral components of anxiety as "action impulses having both instrumental and expressive qualities" (p. 69). The instrumental aspect of a behavior refers to the goals the individual seeks to accomplish by the act. Instrumental action in anxiety usually involves an overt avoidance response (Lazarus, 1966). Expressive qualities involve facial expressions, gestures, and postures (Lazarus, 1974). People's voices may quiver, they may demonstrate flat facial affect, and show rigid postural inhibition with no gestures (Beck & Emery, 1985). Usually, both instrumental and expressive qualities are involved in the behavioral component of anxiety.

Summary

Anxiety has three related components: subjective affect (which includes cognitive appraisal); physiological changes; and action impulses having both instrumental and expressive qualities (Lazarus & Averill, 1972). Lazarus and Averill (1972) suggest that it is the cognitive component which is the mediator of the anxiety response. External events are cognitively appraised as anxiety provoking when they are perceived as threatening. This cognitive appraisal of threat leads to heightened physiological arousal and behavioral responses such as avoidance.

In the following section biofeedback and the use of biofeedback in the treatment of anxiety is discussed.

Biofeedback

Definition

Biofeedback systems use electronic equipment to detect information about an individual's biological functions. This information, when communicated to the individual, allows the individual to learn control of otherwise involuntary or unfelt physiological events (Basmajian, 1979; Budzynski & Stoyva, 1984; Danskin & Crow, 1981).

Stages

Biofeedback training occurs in three stages: awareness, control, and transfer (Budzynski, 1973; Budzynski & Stoyva, 1984). The first stage is awareness of bodily responses. Budzynski & Stoyva (1984) comment that individuals may discern that certain thoughts influence bodily reactions. In this way they experientially learn that their cognitions mediate their physiological reponse. Next, individuals learn to consistently reduce their physiological arousal with the assistance of the biofeedback signal. This is the control stage. Finally, individuals learn to transfer this skill to everyday life situations.

Stereotypy of Response in Biofeedback

Individual response stereotypy refers to the tendency of an individual to demonstrate an idiosyncratic pattern of autonomic arousal in response to the presentation of stimuli. This response stereotypy is consistent for the individual (Lacey, Bateman, & Van Lehn, 1953), i.e., there is a tendency for the individual to maintain this pattern across different anxiety provoking conditions (Corson, Schneider, Biondi, & Meyers, 1980). An example of this is an individual who, when anxious, demonstrates a great increase in muscle tension as measured by electromyography (EMG), but only a minimal increase in

skin temperature (ST), galvanic skin response (GSR), or heart rate (HR).

In biofeedback, an individual is usually trained in one response channel. It is assumed that the resulting reduction in arousal will generalize to other response channels (Stoyva & Budzynski, 1975; DeGood & Chisholm, 1977). However Gatchel, Korman, Weis, Smith, and Clark (1978) found that after training, when subjects were exposed to stress-induction conditions, they maintained their physiological reduction only in the trained response channel. Thus, if individuals are not trained in a response channel that constitutes a major component of anxiety for them, they will not be able to regulate the main component of arousal, rendering the treatment ineffective. Consequently, it becomes important to train individuals in their most reactive physiological response channel (Peterson & Hiebert, 1985). Malmo (1975) has argued that an individual's most reactive physiological modality from normal tonic baseline constitutes the major physiological component of anxiety. Tonic baseline refers to an individual's normal level of physiological activity (Malmo, 1975).

Biofeedback in the Treatment of Anxiety

Biofeedback has been used extensively over the past 12 years in the treatment of anxiety (Budzynski & Stoyva, 1973). It has been used for treating both pervasive, chronic forms of anxiety and circumscribed phobias (Budzynski & Stoyva, 1984). A number of studies attest to the superiority of biofeedback over other forms of therapy.

Raskin, Johnson, and Rondestvedt (1973) found that electromyography biofeedback, in combination with daily practice of relaxation, was moderately useful for individuals suffering from severe, chronic anxiety. Tranquilizers and psychotherapy had not been effective with these clients.

Canter, Kondo and Knott (1975) compared the effectiveness of frontal

electromyography biofeedback to progressive relaxation in patients suffering from anxiety neurosis. Both treatments were found to reduce frontal electromyography activity but the biofeedback-trained subjects also showed a reduction in anxiety symptoms.

Another study of interest was one which compared frontal electromyography training with Valium in the treatment of chronic, free-floating anxiety (Lavallee, Lamontagne, Pinard, Annable, & Tetreault, 1977). Electromyography training was found to have a more prolonged therapeutic effect. Finally, Hiebert and Fitzsimmons (1980) found electromyography biofeedback more effective than attention placebos in reducing anxiety.

These studies utilizing biofeedback in the treatment of anxiety have all used electromyography biofeedback, rather than the individual's most reactive modality. Additionally, none of the studies except Hiebert and Fitzsimmons (1980) controlled for cognitive factors such as efficacy expectations. Hiebert and Fitzsimmons (1980) did include a high expectancy discussion group.

A Cognitive Mechanism in Biofeedback

Many mechanisms have been proposed to explain therapeutic effects in biofeedback. Many theorists claim a cognitive mechanism for biofeedback (Bandura, 1977; Holroyd et al., 1984; Lazarus, 1977; Meichenbaum, 1976). Meichenbaum (1976) suggests that clients' cognitions are instrumental in the change process. He proposes a reciprocal relationship between cognition and biofeedback training outcome. He states that biofeedback training changes clients' perceptions, attributions and appraisals regarding their ability to control first their physiological responses, and then their cognitions, feelings and behaviors. Reciprocally, the clients' cognitions may facilitate or hinder training outcome. Meichenbaum suggests that it is not the physiological arousal per se which is debilitating; rather it is the clients'

negative cognitions about the physiological arousal which are maladaptive and which trigger further physiological arousal.

Lazarus (1977) takes this approach further. He postulates that cognitive mechanisms are the essential means by which biofeedback works. As mentioned previously, Lazarus and Averill (1972) suggest that the mediator of the anxiety response is cognition. It is a cognitive appraisal of threat which leads to heightened arousal. Lazarus (1977) suggests that if this heightened arousal is to be reduced, it must be mediated by changes in cognition.

In this thesis cognitive mechanisms are postulated to explain therapeutic effects in biofeedback. The particular cognitive mechanism proposed is that of expectations.

Self-Efficacy Theory

Client expectations have been found to influence powerfully the outcome of psychological interventions (Shapiro, 1971). A number of authors have discussed the influence of client expectations in biofeedback treatment outcome (Orne, 1982; Plotkin, 1980). Individuals who expect success tend more readily to acquire skill in biofeedback.

One theory which explains the effects of client expectation and quantifies these effects is self-efficacy theory (Bandura, 1977). Bandura (1977) defines an efficacy expectation as "a conviction that one can successfully execute the behavior required to produce the outcome" (p. 193). Bandura (1977) theorizes that "psychological procedures, whatever their form, serve as means of creating and strengthening expectations of personal efficacy" (p. 193). The construct of self-efficacy is differentiated from that of outcome expectation. An outcome expectation is defined as "a person's estimate that a given behavior will lead to a certain outcome" (p. 193). Efficacy expectations are assessments of the individal's capacity to do what

is required. They are a process variable. Outcome expectations are assessments of the appropriateness of particular behavior in producing the desired outcome. They are a product variable.

Essentially, perceptions of self-efficacy are judgements (Bandura, 1980). People avoid activities which they believe are beyond their ability to cope with, while they select and perform with confidence, activities of which they believe themselves capable (Bandura, 1977). Judgements of self-efficacy determine how long individuals will persist in a specific task in the face of obstacles and how much energy they will expend in doing so. Those with perceptions of high efficacy will perservere in spite of difficulties. Those with perceptions of low efficacy will lessen their efforts or give up on the task. Since high persistence usually produces high accomplishments, efficacy expectation would appear to be crucial in the attainment of coping behaviors (Bandura, 1977; Brown & Inouye, 1978; Schunk, 1981).

Bandura (1982) claims that perceived efficacy may have wide explanatory power in predicting behavioral change (Bandura, 1977; Bandura & Adams, 1977; Bandura, Adams, & Beyer, 1977). There is considerable empirical evidence to support this hypothesis (Bandura, Reese, & Adams, 1982; Bandura & Schunk, 1981; Condiotte & Lichtenstein, 1981; Lee, 1982, 1984).

Sources of Information Regarding Self-Efficacy

Self-efficacy is acquired through a process of self-appraisal. Bandura (1977) proposes four major sources of information regarding self-efficacy. These are: performance accomplishments, emotional/physiological arousal, verbal persuasion, and vicarious experience.

Bandura (1977) considers performance accomplishments to be the most dependable of these sources because they are based on personal mastery which involves direct experience with tasks. Successful performance generally

enhances self-efficacy while task failure attenuates efficacy expectations. Walsh (1985), in his review of self-efficacy research, determined that studies in clinical, educational, sports, and laboratory settings have consistently found moderate correlations between efficacy expectations and performance.

Information regarding self-efficacy may also arise from physiological arousal (Bandura,1977). High physiological arousal may signal anxiety which in turn may lead to judgements of low efficacy. Physiological arousal is seen by Bandura to be the principal source through which biofeedback operates. Thus performance accomplishments and physiological arousal are the principal sources of information regarding self-efficacy relevant to this study.

It has been suggested that self-efficacy is both a cause and result of effective training in biofeedback (Bandura, 1977; Holroyd et al., 1984). Walsh (1985) indicates that, although this proposition has not been well researched, there does appear to be a reciprocal relationship between self-efficacy and performance in general. Successful performance in biofeedback is a source of self-efficacy. Alternately, existing self-efficacy influences successful outcome in biofeedback training. Also, perceived self-efficacy may reduce physiological arousal. Alternately, people are more likely to expect success when they are relaxed than when they are physiologically aroused. Thus, there is the following reciprocal relationship between self-efficacy, physiological arousal and performance accomplishments. (See Figure 2).

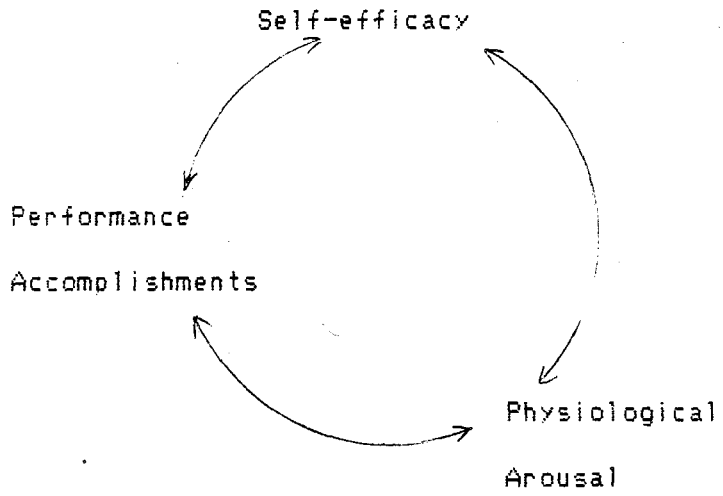

Figure 2. Proposed Theoretical Relationship Between Self-Efficacy, Physiological Arousal and Performance Accomplishments.

Holroyd, et al. (1984) found empirical evidence to support the hypothesis that biofeedback operates by a cognitive mechanism of change and that self-efficacy is both a cause and result of effective training. Specifically, Holroyd, et al. (1984) have illustrated, in diagrammatic form, a behavioral and a cognitive model of therapeutic change in biofeedback (A corresponds to the behavioral model and B to the cognitive model).

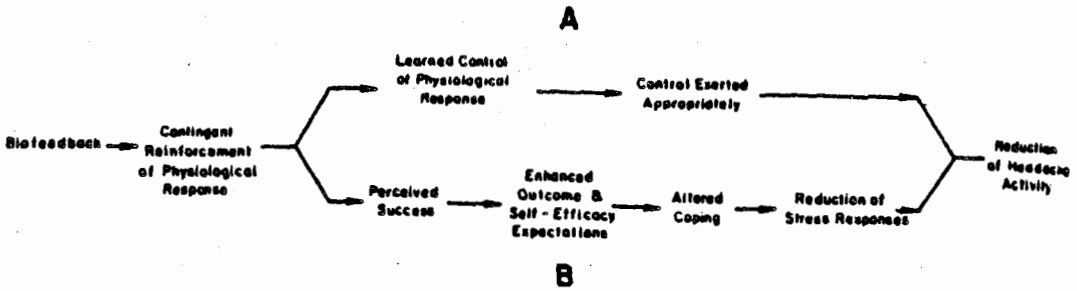

Figure 3. Two models of therapeutic change in electromyography biofeedback training.

From "Change Mechanisms in Electromyography Biofeedback Training: Cognitive Changes Underlying Improvements in Tension Headache" by K.A. Holroyd, et al., 1984, Journal of Consulting and Clinical Psychology, 52, p. 1040. Copyright 1984 by the American Psychological Association. Reprinted by permission.

Holroyd, et al. (1984) hypothesized that model B is the accurate one. They hypothesized that if

> patients perceive biofeedback to be a credible treatment and perceive themselves as succeeding at the biofeedback task through their own efforts they will view a) [their symptoms] as having an internal locus of control and b) themselves as self-efficacious (i.e., as capable of influencing [their symptoms]) (p. 1040).

In turn, these cognitive changes are expected to increase coping behaviors. Results indicated that, regardless of actual decreases in arousal during biofeedback, subjects receiving feedback indicating that they were successful showed significant decreases in headache activity.

Measurement of Self-Efficacy

Efficacy expectations have three dimensions: magnitude, strength, and generality (Bandura, 1977). Magnitude of an efficacy expectation refers to

the difficulty of tasks to which efficacy extends. If a list were made of skills arranged in order of increasing difficulty, the number of these tasks that the person felt they could successfully perform would indicate the magnitude of self-efficacy. Strength refers to the degree to which expectations are extinguishable by disconfirming experiences. Generality refers to the degree to which efficacy expectations are specific to a task. An efficacy expectation which has high generality encompasses a range of related behaviors. There is some evidence that enhanced self-efficacy is likely to generalize to situations other than the one which was treated (Bandura, Adams, & Beyer, 1977; Bandura, Jeffrey, & Gajdos, 1975). However, this generalization occurs most predictably to activities similar to the one treated (Bandura, Blanchard, & Ritter, 1969).

Summary

In this literature review it was proposed that anxiety consists of three interacting components (cognitions, physiological arousal, and behaviors) and that the mediator of the anxiety response is cognition. Also, it was proposed that expectations are a possible cognitive mechanism through which biofeedback operates in the treatment of anxiety. A theory which explains and quantifies the effects of client expectation is self-efficacy theory. An efficacy expectation is defined as "a conviction that one can successfully execute the behavior required to produce the outcome" (Bandura, 1977, p.193). The major purpose of this study was to examine the relationship between self-efficacy and training outcome in biofeedback for the treatment of anxiety. The second purpose of the study was to test the efficacy of biofeedback treatment with the most reactive physiological modality, rather than using the standard method of training in frontal electromyography which does not take into account individual

response stereotypy.

Hypotheses

The goal of this study was to investigate the relationship between self-efficacy and success in biofeedback training while training subjects in their most reactive physiological modality.

The hypotheses were as follows:

1. Treatment subjects will demonstrate greater reductions in the State-Trait Anxiety Inventory, State scale (STAI-S) and Trait scale (STAI-T) than control subjects.
2. Treatment subjects will demonstrate greater reduction in the Symptoms of Stress Inventory (SOSI) than control subjects.
3. Treatment subjects will demonstrate greater increases in self-efficacy (of relaxation, anxiety reduction, control of life in general) than control subjects.
4. Treatment subjects will demonstrate greater reduction in the psychophysiological profile measures than control subjects in pretreatment-posttreatment comparison.
5. There will be a positive relationship between efficacy expectations and physiological self-control skill acquisition.

Chapter 3

DESIGN AND METHODOLOGY

The hypotheses for this study were presented in the previous chapter. In this chapter the methodology used to test these hypotheses is described. Initially the research design is described followed by a discussion of the sample, equipment and facilities, and staff. Next the screening measure is described. This is followed by a discussion of the assessment procedure, dependent measures, and treatment procedures.

Research Design

The design used in this study was a 2X2 factorial analogue of a multiple baseline design. This format was adopted because limited laboratory resources and researchers permitted only a small number of subjects to be in the study at any one time. The study began with seven treatment subjects (group 1) and nine control subjects (group 2) at Time #1. When treatment was complete, both groups of subjects were posttested at Time #2. After the testing at Time #2, control subjects moved immediately into the treatment condition and a new group of ten control subjects (group 3) was recruited and pretested. Thus the assessment at Time #2 served as a postest for group 1, simultaneously as a postest and pretest for group 2, and as a pretest for group 3. After group 2 completed treatment they were posttested at Time #3, along with group 3. The pattern could be continued as often as necessary in order to obtain sufficient sample sizes to permit further analyses. In practice, the pattern was terminated at assessment Time #3. See Figure 3.

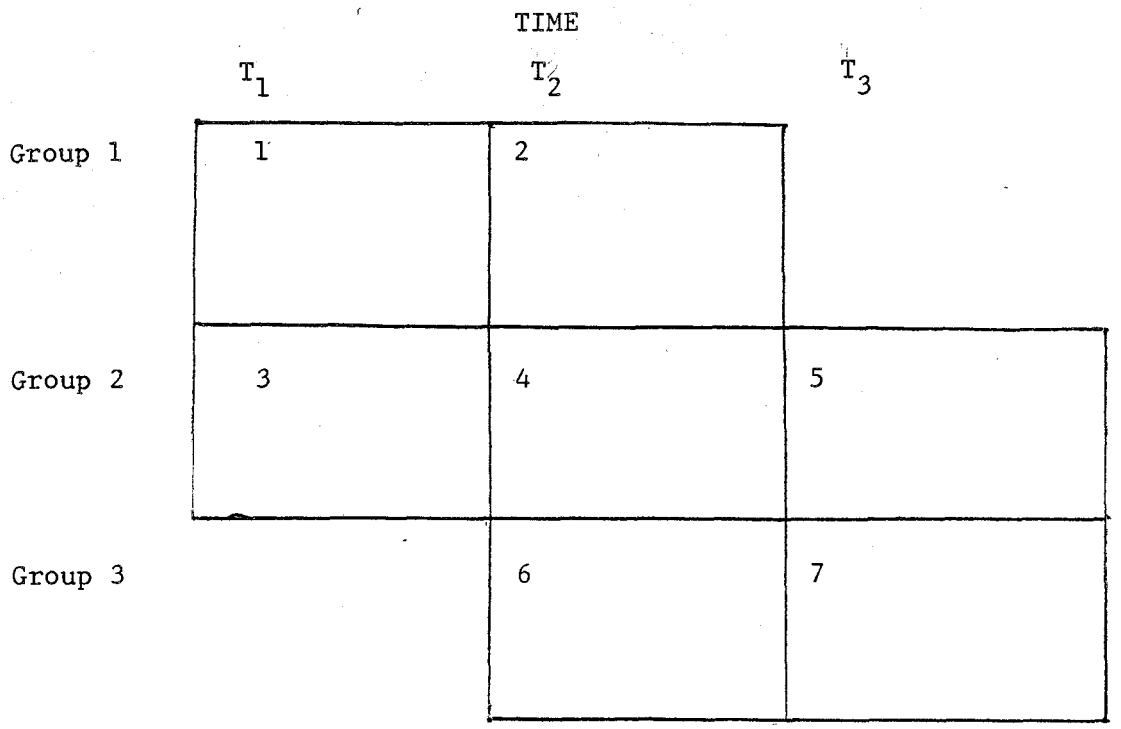

Figure 3. Two by Two Factorial Analogue of a Multiple Baseline Design.

Upon completion of the data collection, a series of tests was conducted to determine the acceptability of collapsing the 2X2 factorial analogue of a multiple baseline design into a 2X2 factorial design for repeated measures. These procedures are discussed in Chapter Four. It is argued that if subjects in the respective pretest conditions could be shown to be equivalent, then the groups could be combined into a 2X2 factorial design for repeated measures. See Figure 4.

CONDITION	TIME	
	Pretest	Posttest
Biofeedback	Cell * #1 and cell #4	Cell #2 and Cell #5
Control	Cell #3 and cell #6	Cell #4 and cell #7

*Cell numbers refer to cells in Figure 3.

Figure 4. Two by Two Factorial Design for Repeated Measures.

Sample

Potential subjects were recruited from advertisements in the campus newspaper at Simon Fraser University; notices on billboards in prominent places around the campus; and letters sent to possible referral sources, e.g. counselling agencies, doctors, and a massage therapist. The advertisements and letters requested subjects who considered themselves to be anxious and were interested in learning to manage their anxiety by means of biofeedback training. Potential subjects were screened using the Institute for Personality and Ability Testing Anxiety Scale Questionnaire (Cattell, 1963). (See section on screening instruments). A Sten score (see page 23 for explanation) of seven or above was the criterion for inclusion in the study.

Twenty-eight subjects met the criterion for inclusion in the study. Two of these subjects withdrew from the program due to migraines which prevented them from attending sessions. Subjects completed a questionnaire (see Appendix D) which requested demographic information. The questionnaire also requested information regarding situations and events that were

anxiety-producing for the individual. Subjects ranged in age from 21 to 57 with a mean of 29.7 years. See Table I for detailed demographic information.

The first group of 16 subjects was assigned randomly to either the treatment or the control group. Following the first set of training sessions, the control group became the second treatment group. A group of ten subjects served as the control group in the second round of the study. Upon completion of the study, biofeedback training was offered to these 10 subjects for ethical reasons. Five of these people were actually trained. The results of this final group of treatments could not be included in the data analysis because there was no control group with which to compare them.

Equipment and Facilities

All sessions were conducted on an individual basis, in a quiet, temperature monitored room. Subjects were seated in a comfortable recliner facing a curtained window. The experimenter was seated on a stool adjacent to the subject, facing the biofeedback cabinet. This position allowed for visual monitoring of both the subject and the equipment. The questionnaires were filled out in the same or an adjoining room.

Frontal electromyography (EMG), heart rate (HR), peripheral skin temperature (PST), and galvanic skin resistance (GSR) were monitored simultaneously using Colbourne Instruments modular biofeedback equipment. Frontal electromyography electrodes, using the standard clinical procedure, were applied an inch and a half above and horizontal to the eyebrow line. The central electrode served as the reference for recording and was located equidistant from the two active electrodes. Impedences of 10,000 ohms or less were maintained throughout recording and output channelled through a Colborne Instruments hi-gain bioamplifier. Heart rate was recorded using a Colborne Instruments S71-40 blood flow pulse monitor which measured

Table 1

Demographic Data for 26 Participants

Demographic Descriptors

Treatment Condition		Treatment	Control
Group Size		16	17
Age	20 - 29	5	8
	30 - 39	9	8
	40 - 49	1	0
	50 - 59	1	1
	Mean	33.3	30.9
Sex	Male	11	6
	Female	5	11
Self-assessed anxiety (1-10)	1 - 2	1	0
	3 - 4	3	2
	5 - 6	3	6
	7 - 8	6	7
	9 -10	3	2

pulsatile blood flow from an optical desensitometer applied to the palmar surface of the left thumb. Periperal skin temperature was taken from a Yellow Springs thermistor applied to the ventral surface of the middle finger of the left hand and monitored through an S71-30 temperature module. Galvanic skin response was recorded by measuring the voltage drop between two silver-silver chloride electrodes. Output was channeled through a Colborne Instruments 571-20 skin resistance module.

Continuous checks for proper functioning of the equipment were made using visual voltmeters. All data were channelled through a Colborne multichannel microprocessing printer.

Staff

The experimenters were two female Master's students in counselling. Of the 16 treatment subjects, 12 were trained by one experimenter and 4 by the other. The same experimenter conducted the pre- and posttests for both treatment and control subjects as well as training sessions for each subject. This was done to keep experimenter effects constant.

Screening Instrument

The screening instrument used in this study was the Institute for Personality and Ability Testing (IPAT) Anxiety Scale Questionnaire. According to the authors, this test is designed to assess individuals' current perception of their manifest anxiety level, whether it is situationally determined or relatively independent of the situation (Cattell & Scheier, 1963). The IPAT correlates highly with physiological measures of anxiety (Cohen, 1965; Smith, 1973) and has been used in previous research of this nature (Hiebert & Fitzsimmons, 1981; Hiebert & Fox, 1981).

The IPAT scale's median correlation with the Taylor Manifest Anxiety Scale (Taylor, 1953) was found to be .70 (Krug, Scheier, & Cattell, 1976) and .79 with the Eysenck Personality Inventory N Scale, another measure of

anxiety (Eysenck & Eysenck, 1964). This concurrent validity was determined by testing 2800 subjects involved in 16 studies. Most were undergraduate students. Raw scores were converted to standard ten (Sten) scores. Standard ten scales are fixed at a range of ten points, each one-half a standard deviation in width, on the assumption of a normal distribution with a mean of 5.5. According to the test manual, a score of 8 or above indicates a person whose anxiety is high. The lowering of the score for inclusion of 7 was made on the basis of the clinical judgement of the researcher. A number of visibly agitated people scored 7 on the IPAT anxiety scale. Additionally the IPAT manual states that a score of 7 is borderline high. Subjects who received a Sten score between 7 and 10 on the IPAT anxiety scale were accepted into the study.

Dependent Measures

Two types of dependent measures were used in the study: a psychophysiological stress profile and self-report questionnaires. The self-report measures were: The State-Trait Anxiety Inventory , Trait scale (STAI-T) and State scale (STAI-S) (Spielberger, 1968); The Symptoms of Stress Inventory (SOSI) (Thompson & Leckie, 1979); and a Self-Efficacy Questionnaire patterned after Bandura & Adams (1977; see Appendix E).

The Psychophysiological Stress Profile

The psychophysiological stress profile used an A-B-A design. Two stressors were used for the B condition with a 2 minute recovery period between the two stressors. In this study, the purpose of the stress profile was to assess the effectiveness of training as well as to determine the subject's most reactive modality for training purposes.

The procedure began with 12 minutes of relaxation in which subjects were instructed to do whatever they usually did to relax. This was followed by two activities designed to serve as stressors. The first was a three

minute serial sevens subtraction task (Budzynski, 1977, 1978). Subjects were asked to mentally subtract 7's sequentially from the number 1000. Subjects were misinformed that there ability to perform this task accurately was related to their I.Q. Ths was done in order to increase the stressful nature of the task. Subsequently, there was a two minute relaxation (recovery) period. This was followed by a three minute reading comprehension task taken from the Gilmore Oral Reading Test (Gilmore & Gilmore, 1968). After reading two detailed passages, subjects were asked a series of detailed questions. This was followed by another two minute recovery period and finally by a 12 minute relaxation period.

The major portion of the first session was spent conducting the psychophysiological stress profile. It was explained to the subjects that this would determine their unique response to anxiety and was to be used to establish which modality individuals would be trained in. Explanations were given about each modality as the subject, seated in a recliner, was attached to the sensors. Next the sequence of relaxation and stressor periods was explained. Physiological readings were recorded at three minute intervals during the relaxation and stressor periods and at 15 second intervals during the recovery periods. The posttest psychophysiological stress profile utilized the same procedure using the same serial seven's task and an alternate form of the Gilmore Reading Test.

Assessment of Most Reactive Modality

Reactivity is operationally defined as "the response to a stressor over and above any initial variability at resting physiological levels" (Petersen, 1981, p. 44). The procedure used to determine this was "the difference between the individual's stimulus score and mean initial baseline value, divided by the standard deviation of the individual's initial baseline score" (Petersen & Hiebert, 1984, p. 127). This procedure is

called the ZR transformation. Discrete scores were obtained by dividing the 12 minute baseline into 4 equal periods. The mean and standard deviation were calculated from these four numbers. The formula is as follows:

$$ZR = \frac{\bar{X}_S - \bar{X}_{1B}}{SD_{1B}}$$

where $\bar{X}S$ = the mean physiological level during a stressor

$\bar{X}1B$ = the mean initial resting physiological baseline

SD1B = the standard deviation of the initial physiological baseline

This ZR transformation was used with the following decision rules:

1. Where only one modality had ZR scores above 1 on the two stressors, the modality was determined to be the most reactive physiological modality.
2. Where two or more modalities had ZR values exceeding 1, that modality which had the highest ZR value was determined to be the most reactive physiological modality.
3. Where two or more modalities had ZR values exceeding 1 and the ZR scores were of approximately equal value, the modality which had greater increase in ZR value from stressor 1 (serial sevens) to stressor 2 (oral reading), was determined to be the most reactive modality.
4. Where most reactive modality was not discriminable using rule 3, the modality with the most recovery period ZR scores above one was determined to be the most reactive modality. Using these procedures, 11 subjects were found to be most reactive in electromyography, 2 in galvanic skin response and 3 in peripheral skin temperature.

State-Trait Anxiety Inventory

The State-Trait Anxiety Inventory consists of separate self-report scales for measuring two distinct anxiety concepts: state anxiety (A-State) and trait anxiety (A-Trait). Each part consists of 20 statements that ask people to describe how they feel. The Trait scale asks people how they generally feel. The State scale asks people how they feel at a particular point in time.

In the test manual, state anxiety is defined as "a transitory emotional state or condition of the human organism that is characterized by subjective, consciously perceived feelings of tension and apprehension, and heightened autonomic nervous system activity. A-States may vary in intensity and fluctuate over time" (Spielberger et al., 1970, p. 3). Trait anxiety is defined as "relatively stable individual differences in anxiety proneness, that is, to differences between people, in the tendency to respond to situations perceived as threatening with elevations in A-State intensity" (Spielberger et al., 1970, p. 3). Both the state and trait anxiety forms were used in this study.

The State-Trait Anxiety Inventory has been used extensively in anxiety research (Hiebert & Fitzsimmons, 1981; Hiebert & Fox, 1981; Leal, Baxter, Martin, & Marx, 1981; LeBoeuf, 1977; Townsend, House, & Addario, 1975). It has been shown that scores on the A-State scale increase in response to various forms of stress and decrease as a result of relaxation training (Spielberger et al., 1970).

Reliability data are given in the test manual. Test-retest correlations range from .73 to .86 for the A-Trait scale. Those for the A-State range from .16 to .54. These low A-State correlations are to be expected because a measure of A-State reflects the influence of "unique situational factors existing at the time of testing" (Spielberger et al.,

1970, p. 9). Internal consistency correlations for the A-State range from .83 to .92 (Spielberger et al., 1970).

Concurrent validity is demonstrated by the State-Trait Anxiety Inventory's correlations with the IPAT anxiety scale (r = .75) and the Taylor Manifest Anxiety Scale (r = .80) (Spielberger et al., 1970). Construct validity was determined using 977 undergraduate students. Mean scores for state anxiety were "considerably higher in the EXAM condition than in the NORM condition for both males and females" (Spielberger et al., 1970, p. 11).

Symptoms of Stress Inventory

Symptoms of Stress Inventory (SOSI) is a clinical instrument which attempts to quantify the perception of the physiological, behavioral and cognitive components of stress responses. The Inventory has been developed only recently (Leckie & Thompson, 1977, 1978, 1979) and has been adopted, in part, from The Cornell Medical Index (1949). Normative data are therefore only beginning to be established.

Reliability for the total Symptoms of Stress Inventory questionnaire is .96 (Chronbach's alpha) and coefficients for the subscales vary between .71 and .87. Test-retest reliability has not been established. No validity data are provided. However the instrument is beginning to be used in both clinical and research settings (Hiebert & Eby, 1985).

The Symptoms of Stress Inventory consists of 118 items rated on a 5-point frequency scale. There are 10 subscales: Peripheral, Cardiopulmonary, Neural, Gastrointestinal, Muscle Tension, Habit Patterns, Depression, Anxiety, Anger, and Cognitive Disorganization. These subscales are scored separately then added together for the total score.

Self-Efficacy Questionnaire

Efficacy probes were used at five points during treatment in order to

assess the relationship between perceptions of self-efficacy and performance in biofeedback. The scale was based on that used by Bandura and colleagues (cf. Bandura & Adams, 1977). Each efficacy probe was personalized to a specific anxiety-producing situation identified by the subject at the prescreening session. Examples of situations given included: writing exams, speaking in public, thinking about financial concerns, and trying to get everything done in the day.

The Efficacy Questionnaire was administered at the pretest, the second, fourth, sixth and eighth treatment sessions as well as the postest. The purpose of the questionnaire was to elicit information about subjects' judgement of their ability to be more relaxed or less anxious in the identified situation. There were 22 efficacy probes in all (11 relaxation probes and 11 anxiety probes) followed by three probes which elicited information about generalization to life in general. (See Appendix E for a sample copy of the Self-Efficacy Questionnaire).

The rating scale for each probe ranged from 10 to 100 marked at intervals of 10. Verbal descriptions occurred at four points: 10 - very uncertain, 40 - maybe, 70 - pretty sure, 100 - very certain. Prior to subjects responding to this questionnaire at the pretest, the rating scale and the gradation of questions on each probe was explained. The responses of the subjects at the pretest were checked by the experimenter for logical responses which indicated understanding of the instructions.

In Chapter Two, the measurement of self-efficacy was discussed in terms of magnitude, strength and generality. The magnitude or level of self-efficacy refers to the number of performance tasks individuals feel they can perform. This was not examined in this study as only one task was used. In this study, strength of efficacy measures reported are all average strength scores. To obtain average strength scores, individual responses to

a given set of efficacy probes were summed and the sum was divided by the number of probes in that set.

Treatment Procedures

As outlined in the Research Design section subjects participated at two different time periods. The first 16 participants were assigned sequentially to the treatment group or a delayed treatment control group. At the time of posttesting, the control subjects moved immediately into the treatment condition and another 10 subjects were assigned to the control condition. After reading the information sheet (see Appendix A), and signing the consent form (see Appendix B), subjects were informed to which group they were assigned and which of the two counsellors would be training them. All subjects (treatment and control) received a psychophysiological assessment and completed all pencil and paper measures.

Subjects were trained to the criterion of maintaining one standard deviation below baseline mean level for at least 4 minutes on two separate occasions for electromyography, heart rate, and galvanic skin response subjects, and for skin temperature subjects; raising finger temperature at a rate of at least 1°C/Minute and maintaining a minimum of 32°C for at least four minutes on two successive occasions. One subject reached criterion in six sessions, three subjects reached criterion in seven sessions, and twelve subjects reached criterion in eight sessions.

Session One

Session One began with a discussion of anxiety and biofeedback while the experimenter connected the subject to the equipment. Participants were told that when they were anxious their bodies reacted with increased heart rate, respiration rate, sweat gland activity, muscle tension and decreased hand temperature. The idiosyncracy of each individual's anxiety response was explained. Participants were informed of their most reactive

physiological modality and it was explained that they would be trained in that modality. Then it was explained that biofeedback uses electronic equipment to detect bodily anxiety reactions. This information is fed back to the individual by means of an auditory tone or light bar. Thus biofeedback teaches people to control directly an otherwise involuntary or unfelt response. The idea that biofeedback training occurs in three stages was explained to the subjects. The first stage is an awareness stage. The individual explores what will make the signal go down. The next stage, that of control, involves learning to reduce the signal consistently. Finally, the transfer stage involves learning to use the control skill in everyday life situations.

When the individual was connected to the equipment, obvious control instructions were given, such as clenching the teeth to increase muscle tension or taking a deep breath to decrease galvanic response activity. Then instructions were given to begin to train, to experiment with different things they thought might bring down the signal. It was emphasized that it would likely take some time to determine what would be required to reduce the signal.

Actual training time for this and all subsequent sessions was 20 minutes. After the training, subjects were given descriptive praise and were shown the training tape produced by the Colbourne multichannel microprocessing computer. The subject's attention was drawn to the channel on which they were trained. The subjects were queried about any thoughts or feelings they had during the training period.

Subjects were then instructed to attempt to recapture this state for 15-20 minutes per day. They were taught to monitor their progress by recording their pulse, breathing rate and finger temperature before and after each practice session. Subjects were given data sheets on which to

record this information.

Subjects were also taught how to monitor their daily anxiety levels by the use of Subjective Units of Disturbance (SUDS) (Wolpe, 1958, 1969) using a procedure similar to that described by Hiebert & Fox (1981). Subjects were given a sheet of paper and asked to write on the top of it a situation that made them the most up-tight or anxious. This situation was labelled 100. Subjects were instructed to write on the bottom of the page a situation in which they were very relaxed and not at all anxious. They were informed that every other situation fits somewhere on this scale. A rationale was provided which indicated that this exercise would help subjects to be aware of what makes them anxious and to what degree it does so. In addition some people become aware of a "cut-off" point, a critical level above which they are anxious and are affected in an adverse way. When one knows one's Subjective Units of Disturbance scale level, it is easier to stop earlier the escalating anxiety.

Each subsequent session began with an overview of that session and a review of the prior session as well as a review of the home practice and Subjective Units of Disturbance monitoring. This was following by 20 minutes of training, followed by debriefing. This entire procedure lasted 50 minutes.

Session Two

The purpose of the second session was to become more selective in exploration. The subject was hooked up to the equipment while it was explained that it was not necessary for people to be able to label or describe what it is they do to change the tone or light as long as they can make the tone or light decrease.

Session Three

The third session marked the beginning of the control stage. This

stage was reviewed with subjects. Following this session, subjects were to write down their Subjective Units of Disturbance levels every 1/2 hour during the following week.

Session Four

In the fourth session, a "cue" was introduced that could be used to trigger the feeling of relaxation (Barrios & Shigetomi, 1980; Hiebert, 1980; King, 1980). Subjects were instructed to use two four-count breaths as a relaxation "cue" after the manner of Hiebert (1980) and Stroebel (1982). If they were being trained in electromyography, heart rate, or galvanic skin response they were to imagine a wave of relaxation spreading from their head over their entire body. If they were being trained in skin temperature, they were to imagine a wave of warmth spreading from their hands. During the following week, subjects were to monitor their Subjective Units of Disturbance level every 1/2 hour but only write it down every hour, in order to begin fading the use of the writing aid.

Session Five

In the fifth session, the focus was on getting "down" more quickly. The cue was practised three or four times.

Session Six

The sixth session moved toward the end of the control stage and the beginning of the transfer stage. Towards the end of the session, subjects were given one minute with no feedback to see if they could maintain their performance. During the following week, Subjective Units of Disturbance monitoring was to be done every fifteen minutes but only written down every two hours. In this way, the use of the Subjective Units of Disturbance written record was being phased out, and the Subjective Units of Disturbance monitoring was becoming a strictly cognitive activity. Subjects were instructed to practise their "cue" in some "real-life" situations.

Session Seven

In session seven, the importance of transfer was stressed. It was explained to the subjects that they needed to learn to use this technique without the biofeedback equipment. To assist this process, subjects received no feedback during minutes 5 and 6, 11 and 12, and 15 and 16. The cue was practiced once after training and a personalized covert modelling sequence was given (See Appendix F). During the following week, Subjective Units of Disturbance were to be monitored every 15 minutes but the writing was faded out completely.

Session Eight

In the final session, transfer training continued. The first 90 seconds involved no feedback. At the 90 second point, feedback was instituted. Again no feedback was given during minutes 5 and 6, 11 and 12, and 15 and 16. Following training, subjects practised their cue three times. Subjects were instructed to continue their home practice at least three to four times per week in order to maintain the skill, and to use the cue regularly in an active coping way whenever they felt themselves becoming tense or anxious.

Following the eight treatment sessions or when the individual reached the training criterion (whichever came first), a posttest psychophysiological profile was given in a manner that controlled for environmental and time influences (Corson, Schneider, Biondi, & Meyers, 1980).

Summary

A 2X2 factorial analogue of a multiple baseline design was used in this study. Upon completion of the data collection, a series of tests was conducted to determine the acceptability of collapsing the 2X2 factorial analogue of a multiple baseline design into a 2X2 factorial design for

repeated measures. Sixteen subjects were trained in biofeedback while seventeen subjects served as the control. Dependent measures were the psychophysiological stress profile, the State-Trait Anxiety Inventory and the Symptoms of Stress Inventory and the self-efficacy questionnaire.

Results are presented in the next chapter.

Chapter 4

RESULTS

Two types of data were obtained from subjects in this study: pencil and paper measures and measures of physiological reactivity. The pencil and paper measures were the Symptoms of Stress Inventory, State-Trait Anxiety Inventory, State scale, and Trait scale, Self-Efficacy Questionnaires for relaxation, anxiety, and life in general. The measures of physiological reactivity are frontal muscle tension as measured by electromyography, heart rate, and peripheral skin temperature. These physiological modalities were measured under baseline and stressor conditions during the pretest and posttest. Also, the pencil and paper measures were administered during the pretest and posttest. Additionally, physiological and self-efficacy data were recorded during training.

In addition, home practice data were obtained. Physiological data recorded by the participants involved monitoring their pulse rate, respiration rate and peripheral skin temperature, before and after relaxation (Hiebert, Cardinal, Dumka, & Marx, 1983; Hiebert, Dumka, & Cardinal, 1983).

The research hypotheses, results of statistical analyses, and conclusions are presented in this chapter. The reader will notice that the number of subjects varies from analysis to analysis. This resulted from a loss of data for some subjects due to equipment malfunctioning, recording artifact, and failure to complete some self-report measures.

Preliminary Analyses

A series of tests were conducted to determine the acceptability of combining the different cohorts of the multiple baseline design into a 2X2 factorial design for repeated measures. If subjects in the respective pretest conditions could be shown to be equivalent, then the groups could be

combined to a 2X2 factorial design for repeated measures. Data from cells one, three and six, as well as cells one, four and six were analyzed using 1X3 MANOVA (See Figure 4 and Appendix C). There were no significant main effects for Group in either case. Thus, subjects were shown to be equivalent upon commencing treatment, and the group could be combined to a 2X2 factorial design for repeated measures.

Hypotheses

The first group of hypotheses pertains to the pencil and paper measures of anxiety.

Hypothesis #1

Treatment subjects will demonstrate greater reductions in State-Trait Anxiety Inventory, State scale and Trait scale scores, than control subjects.

Hypothesis #2

Treatment subjects will demonstrate greater reduction in the Symptoms of Stress Inventory than control subjects.

Hypothesis #3

Treatment subjects will demonstrate greater increases in self-efficacy (of relaxation, anxiety reduction, control of life in general) than control subjects.

Results . Data from pencil and paper measures of anxiety (State-Trait Anxiety Inventory, State scale and Trait scale), symptoms of stress (Symptoms of Stress Inventory) and self-efficacy (self-efficacy of relaxation, self-efficacy of anxiety, self-efficacy of life in general) were analyzed using a 2X2 MANOVA for repeated measures. There was no significant main effect for Group resulting from this analysis. There was a significant main effect for Time, T (1,25)= 1.25, p = .007. Subsequent univariate F tests showed significant reduction on the: Symptoms of Stress Inventory, F

(1,25) = 15.40, p = .001; State-Trait Anxiety Inventory, State scale, F (1,25)= 4.14, p = .05; State-Trait Anxiety Inventory, Trait scale, F (1,25) = 12.57, p = .01; self-efficacy of relaxation, F (1,25) = 5.17, p = .03 (see Tables 2 and 3). There were no significant interaction effects. Thus, scores on four dependent measures decreased across time, but there were no differential treatment effects.

Conclusion . There was no evidence to support the hypotheses that treatment subjects showed greater reductions in anxiety (as evidenced by State-Trait Anxiety Inventory, State scale and State-Trait Anxiety Inventory, Trait scores), symptoms of stress (as evidenced by Symptoms of Stress Inventory scores), or increases in self-efficacy (as evidenced by self-efficacy of relaxation, anxiety, and life in general) than did control subjects. Alternatively, on the average subjects in the study showed equal improvement across time on four of these six measures.

Hypothesis #4

Treatment subjects will demonstrate greater reduction in the psychophysiological profile measures than control subjects in pretreatment-posttreatment comparison.

Results . Physiological data were analyzed using a 2X2X4 MANOVA with repeated measures on the last two factors. The between subjects factor was Group (treatment, control). The within subjects factors were Time (pretest, posttest) and Stress Profile condition (Baseline 1, Stressor 1, Stressor 2 and Baseline 2). Eleven subjects received electromyography training, 2 received galvanic skin response training and 3 received skin temperature training. There was no significant main effect for Group (treatment, control). There was a significant main effect for Time (pretest, posttest), I (1,21)= .51, p = .05. Subsequent univariate F tests showed a

Table 2

Means for Symptoms of Stress Inventory (SOSI), State-Trait Anxiety Inventory, State Scale (STAI-S) and Trait Scale (STAI-T) Scores

Measure	Group	n	Time		Total
			Pretest	Posttest	
SOSI	Treatment	14	107.00 (41.85)	75.29 (37.05)	91.15 (39.45)
	Control	13	111.77 (40.38)	91.54 (33.04)	101.66 (36.71)
	Column Total	27	109.39 (41.12)	83.42 (35.05)	
STAI-S	Treatment	14	40.29 (11.94)	35.43 (13.00)	37.86 (12.47)
	Control	13	43.08 (11.38)	40.69 (8.91)	41.89 (10.15)
	Column Total	27	41.69 (11.66)	38.06 (10.96)	
STAI-T	Treatment	14	48.86 (6.71)	41.21 (9.69)	45.04 (8.20)
	Control	13	48.54 (10.17)	45.38 (7.46)	46.96 (8.82)
	Column Total	27	48.70 (8.44)	43.30 (8.58)	

NOTE: Numbers in parentheses in this and all other tables indicate standard deviations.

Table 3

Means for Self-Efficacy of Relaxation (SER), Self-Efficacy of Anxiety (SEA), and Self-Efficacy of Life in General (SEL) Scores

Measure	Group	n	Time		Total
			Pretest	Posttest	
SER	Treatment	14	39.14 (24.11)	63.43 (21.77)	51.29 (22.94)
	Control	13	55.00 (19.77)	51.38 (22.57)	53.19 (21.17)
	Column Total	27	47.07 (21.94)	57.41 (22.17)	
SEA	Treatment	14	43.29 (22.76)	61.50 (22.47)	52.40 (22.62)
	Control	13	57.92 (20.52)	52.23 (22.22)	55.08 (21.37)
	Column Total	27	50.61 (21.64)	56.87 (22.35)	
SEL	Treatment	14	79.29 (19.20)	82.86 (22.42)	81.08 (20.81)
	Control	13	79.23 (28.05)	78.85 (17.81)	79.04 (22.93)
	Column Total	27	79.26 (23.63)	80.86 (20.12)	

Table 4

Means and Standard Deviations of Physiological

Measures for Group X Pretest/Posttest

Measure	Group	n	Time		Total
			Pretest	Posttest	
EMG (microvolts)	Treatment	13	3.33 (1.59)	2.79 (1.29)	3.06 (1.44)
	Control	10	3.10 (1.79)	3.13 (1.70)	3.12 (1.75)
	Column Total	23	3.22 (1.69)	2.96 (1.50)	
ST (^{0}Centigrade)	Treatment	13	32.40 (3.95)	33.64 (1.62)	33.02 (2.79)
	Control	10	32.86 (2.87)	32.97 (4.18)	32.92 (3.53)
	Column Total	23	32.63 (3.41)	33.31 (2.90)	
HR (Beats per minute)	Treatment	13	69.89 (20.82)	69.53 (9.33)	69.71 (15.08)
	Control	10	68.43 (7.49)	66.81 (15.61)	67.62 (11.55)
	Column Total	23	69.16 (14.16)	68.17 (12.47)	

NOTE: EMG = Electromyograph, ST = Skin Temperature, and HR = Heart Rate in this and subsequent tables.

significant reduction in electromyography, F (1,21) = 7.92, p = .01 (see Table 4), indicating lower posttest scores for both groups.

There was also a main effect for condition, T (3,63)= 1.37, p <.01. Subsequent univariate F tests showed an increase in electromyography and heart rate and a decrease in peripheral skin temperature during the stressor conditions; electromyography, F (3,63) = 14.40, p < .00; heart rate, F (3,63) = 3.35, p = .02; and peripheral skin temperature, F (3,63) = 9.25, p < .01, indicating that the stressors were indeed stressors for these subjects as a group.

There was no significant interaction effect between group and condition (see Table 5), nor was there a significant condition x time interaction. However there was a significant group x time interaction effect on the MANOVA, T (1,21)= .47, p = .06. Subsequent univariate F tests showed a significant reduction in electromyography, F (1,21) = 7.48, p = .01 for the treatment group but not the control group (see Table 4).

There was also a significant group x condition x time interaction on the MANOVA, T (3,63)= .28, p = .06. Subsequent univariate F tests showed interactions for heart rate, F (3,63) = 3.20, p = .03; and electromyography, F (3,63) = 3.17, p = .03 (see Tables 6 and 8).

Explanations for group x condition x time interactions for heart rate and electromyography can be gained from visual inspection of Figures 6 and 8. Visual inspection of Figure 6 indicates that treatment subjects recovered from the stressors during baseline 2 of posttesting to substantially lowered levels of heart rate. Visual inspection of Figure 8 indicates that the significant electromyography interaction is due to the control subjects being more reactive to the stressors during posttest than at pretest. One further observation from the Figures is of interest. Figure 7 indicates that the nature of the graph lines is likely responsible

Table 5

Means and Standard Deviations of Physiological Measures for Group X Condition Interaction

Heart Rate (beats per minute)

Group	n	Condition				Total
		B_1	S_1	S_2	B_2	
Treatment	13	69.95 (14.35)	72.86 (17.60)	70.85 (13.83)	65.16 (12.53)	69.71 (14.58)
Control	10	66.21 (6.27)	68.44 (13.75)	69.36 (8.84)	66.47 (8.48)	67.62 (9.34)
Column Total	23	68.08 (10.31)	70.65 (15.68)	70.11 (11.34)	65.82 (10.51)	

Skin Temperature (° C)

Group	n	Condition				Total
		B_1	S_1	S_2	B_2	
Treatment	13	33.08 (2.15)	33.05 (2.14)	33.00 (2.11)	32.97 (2.17)	33.03 (2.14)
Control	10	32.94 (3.29)	32.94 (3.27)	32.90 (3.28)	32.89 (3.26)	32.92 (3.28)
Column Total	23	33.01 (2.72)	33.00 (2.71)	32.95 (2.70)	32.93 (2.72)	

Electromyograph (microvolts)

Group	n	Condition				Total
		B_1	S_1	S_2	B_2	
Treatment	13	2.52 (1.52)	3.31 (1.44)	4.02 (2.06)	2.41 (1.41)	3.07 (1.61)
Control	10	2.57 (1.70)	3.18 (1.53)	3.95 (2.39)	2.74 (1.77)	3.11 (1.85)
Column Total	23	2.55 (1.61)	3.25 (1.49)	3.99 (2.23)	2.58 (1.60)	

NOTE: The stress profile conditions are Baseline 1, Stressor 1, Stressor 2, and Baseline 2.

Table 6

Means of Physiological Measures for

Group X Pre/Post X Condition Interaction

Heart Rate (beats per minute)

Time	Group	n	Condition				Total
			B_1	S_1	S_2	B_2	
Pre	Treatment	13	69.60 (19.66)	70.16 (28.57)	70.52 (23.19)	69.25 (18.13)	69.89 (20.82)
	Control	10	66.82 (7.04)	72.04 (9.69)	69.49 (8.38)	65.37 (8.45)	68.43 (7.49)
	Total	23	68.39 (15.27)	70.98 (22.01)	70.07 (17.95)	67.56 (14.57)	
Post	Treatment	13	70.29 (12.01)	75.56 (12.87)	71.18 (8.68)	61.07 (13.45)	69.53 (9.33)
	Control	10	65.60 (12.06)	64.85 (23.14)	69.24 (15.68)	67.56 (16.13)	66.81 (15.16)
	Total	23	68.25 (11.99)	70.90 (18.41)	70.34 (11.94)	63.89 (14.70)	

NOTE: The stress profile conditions are Baseline 1, Stressor 1, Stressor 2, and Baseline 2.

Table 7

Means of Physiological Measures for

Group X Pre/Post X Condition Interaction

Skin Temperature (° C)

Time	Group	n	Condition				Total
			B_1	S_1	S_2	B_2	
Pre	Treatment	13	32.46 (3.95)	32.43 (3.94)	32.38 (3.93)	32.34 (3.99)	32.40 (3.95)
	Control	10	32.89 (2.90)	32.89 (2.84)	32.85 (2.86)	32.82 (2.88)	32.86 (2.87)
	Total	23	32.65 (3.46)	32.63 (3.44)	32.58 (3.44)	32.55 (3.48)	
Post	Treatment	13	33.69 (1.62)	33.66 (1.63)	33.62 (1.61)	33.60 (1.63)	33.64 (1.62)
	Control	10	32.98 (4.21)	32.99 (4.18)	32.95 (4.19)	32.96 (4.14)	32.97 (4.18)
	Total	23	33.38 (2.97)	33.37 (2.95)	33.33 (2.95)	33.32 (2.93)	

NOTE: The stress profile conditions are Baseline 1, Stressor 1, Stressor 2, and Baseline 2.

Table 8

Means of Physiological Measures for

Group X Pre/Post X Condition Interaction

Electromyograph (microvolts)

Time	Group	n	Condition				Total
			B_1	S_1	S_2	B_2	
Pre	Treatment	13	2.77 (1.73)	3.74 (1.68)	4.23 (2.29)	2.60 (1.60)	3.33 (1.59)
	Control	10	2.72 (1.95)	2.97 (1.44)	3.69 (2.11)	3.00 (2.04)	3.10 (1.79)
	Total	23	2.75 (1.78)	3.40 (1.59)	3.99 (2.18)	2.77 (1.77)	
Post	Treatment	13	2.26 (1.34)	2.88 (1.26)	3.81 (1.99)	2.22 (1.32)	2.79 (1.29)
	Control	10	2.42 (1.54)	3.38 (1.71)	4.22 (2.70)	2.49 (1.65)	3.13 (1.70)
	Total	23	2.32 (1.40)	3.10 (1.46)	3.99 (2.28)	2.34 (1.44)	

NOTE: The stress profile conditions are Baseline 1, Stressor 1, Stressor 2, and Baseline 2.

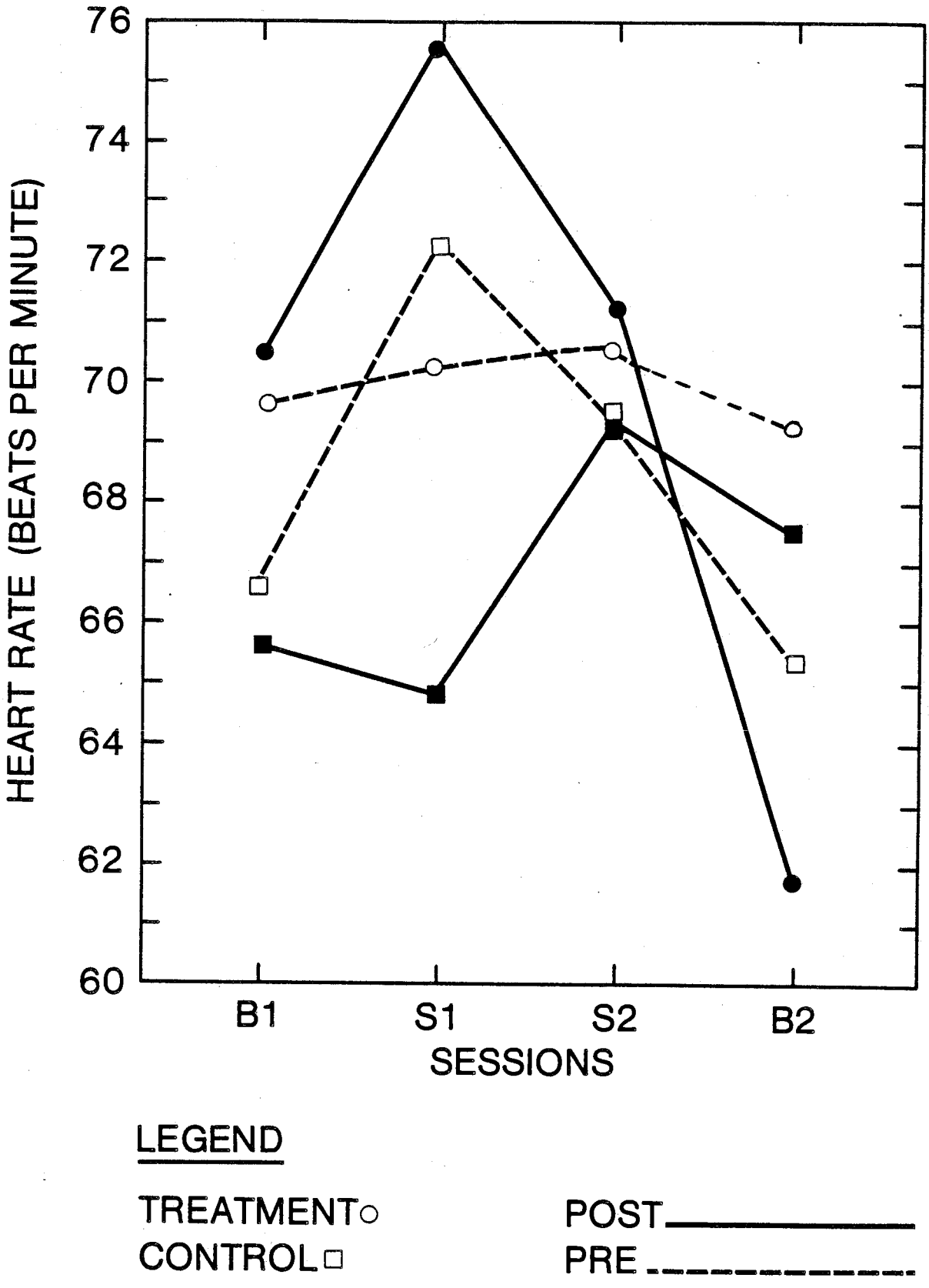

Figure 6. Heart rate across conditions and time for 16 anxious subjects.

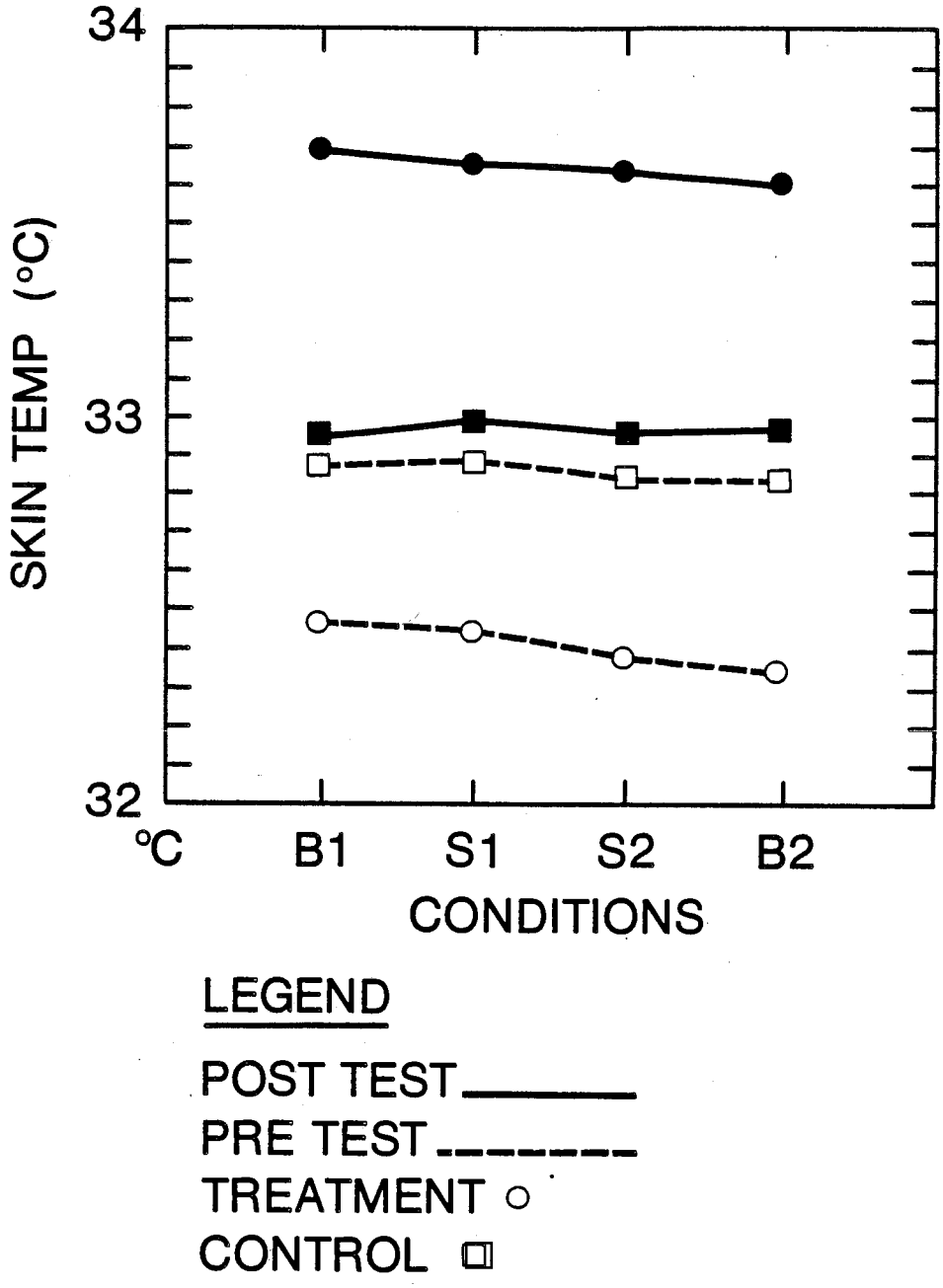

Figure 7. Skin temperature across conditions and time for 16 anxious subjects.

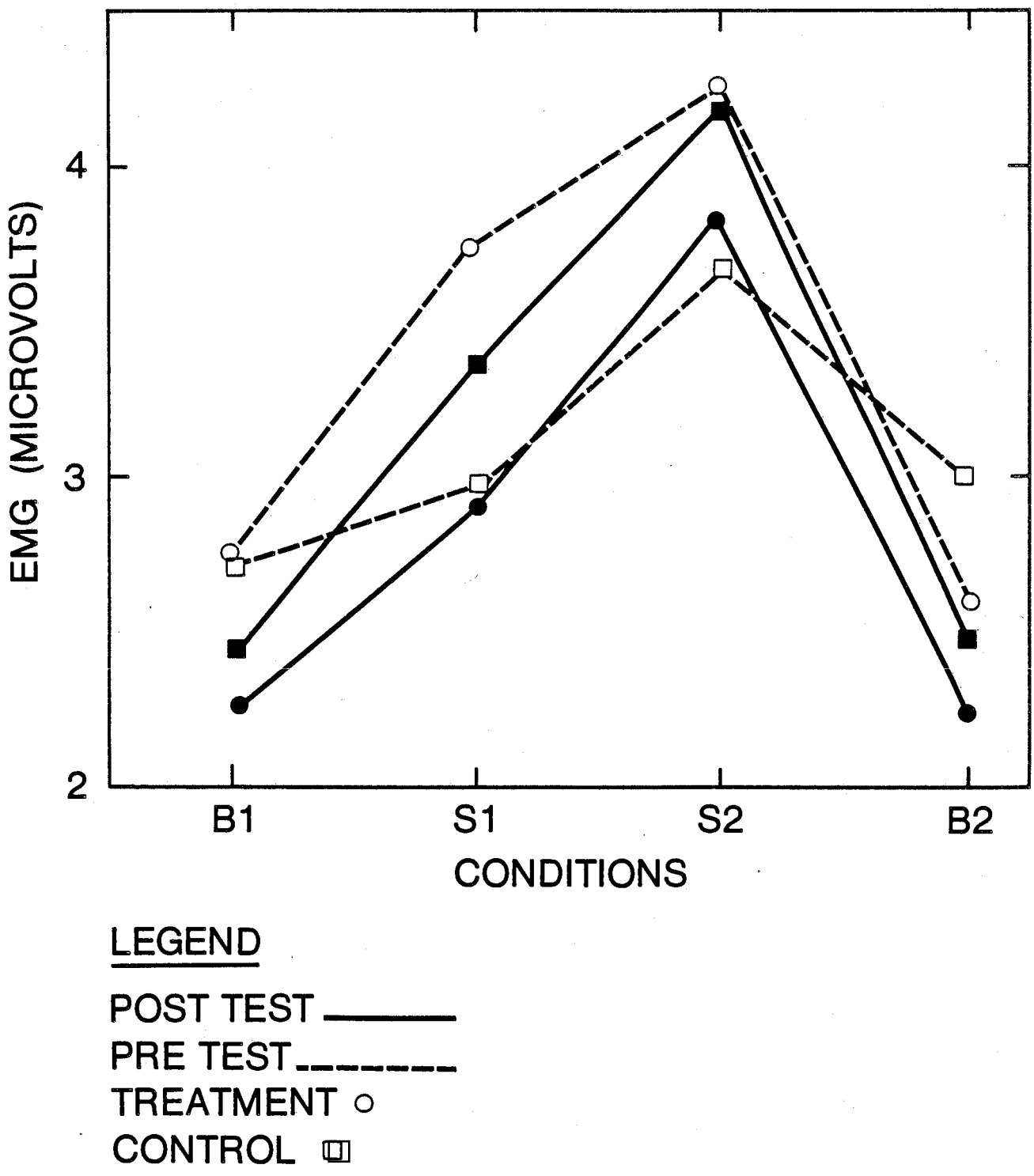

Figure 8. EMG across conditions and time for 16 anxious subjects.

for the lack of statistically significant effects for Time on skin temperature (i.e., the lines are approximately parallel). However, the consistent performance of the control group contrasted with the substantial increase in peripheral skin temperature for the treatment group at posttest, is obvious. The reason for this discrepancy may be lack of power due to the small sample size.

Conclusions . The main effect for conditions on electromyography, heart rate, and peripheral skin temperature indicates that the stressors were indeed functioning as stressors. The significant group x time interaction effect for electromyography indicates that the treatment group demonstrated lower electromyography levels at posttest while the control group remained unchanged. This was not so for heart rate and peripheral skin temperature. The result was not surprising as 11 of 16 treatment subjects were trained in electromyography. However, there were some treatment effects found for heart rate and peripheral skin temperature. Treatment subjects recovered from the stressors during baseline 2 of posttesting to substantially lowered levels of heart rate. Treatment subjects showed a substantial increase in peripheral skin temperature at the posttest. Consequently, there were treatment effects found for electromyography, peripheral skin temperature, and heart rate, indicating support for Hypothesis 4.

Hypothesis #5

There will be a positive relationship between efficacy expectations and physiological self-control skill acquisition.

Results . This hypothesis was addressed in two ways: first by analyzing the relationship between efficacy expectations and physiological self-control skill acquisition at pretest and posttests; second by analyzing the relationship between efficacy expectations and physiological

self-control skill acquisition during training. Self-efficacy measures of relaxation, anxiety, and life in general, were used as measures of efficacy expectations in this study. Physiological measures were muscle tension as measured by electromyography, heart rate, and peripheral skin temperature. Pearson product moment correlations were computed on these seven measures. As shown in Table 9, there was a significant negative correlation between self-efficacy of life in general scores at pretest and electromyography levels at Baseline 1, Stressor 1, and Baseline 2. As shown in Table 10, self-efficacy of life in general scores at posttest correlated significantly with electromyography levels at Stressor 1. There were no other significant correlations between efficacy expectations and physiological measures at pretest or posttest.

When training data were examined, sessions two, four, six and eight were considered. This was done because some subjects did not receive all the odd numbered treatment sessions due to reaching the training criterion early. In sessions two and four, there were no significant correlations between efficacy expectations and physiological measures (see Table 11). In session six, there was a significant negative correlation between heart rate and self-efficacy of anxiety, and between heart rate and self-efficacy of life in general. In session eight, there was a significant negative correlation between electromyography and self-efficacy of life in general.

Conclusions . There is insufficient support to place much confidence in affirming Hypothesis #5.

Additional Analyses

Changes in Physiological Measures Across Treatment Sessions

Electromyography, heart rate and peripheral skin temperature data were analyzed to determine whether they changed during or across sessions. Each session was divided into 10 segments, each of 2 minutes duration. For the

Table 9

Intercorrelations Between Pencil & Paper Measures

and Physiological Measures at Pretest

	SOSI	STAIS	STAIT	SER	SEA	SEL
EMGB1	.12 (33)	.25 (32)	.21 (30)	-.10 (33)	-.13 (33)	-.59* (33)
EMGS1	-.12 (32)	-.01 (31)	-.02 (29)	-.04 (32)	-.07 (32)	-.31* (32)
EMGS2	-.21 (30)	-.14 (29)	-.37* (27)	.00 (30)	-.13 (30)	.07 (30)
EMGB2	.05 (33)	.21 (32)	.09 (30)	-.07 (33)	-.10 (33)	-.53* (33)
HRB1	-.24 (33)	-.12 (32)	-.34* (30)	-.07 (33)	.01 (33)	-.10 (33)
HRS1	-.07 (32)	-.04 (31)	-.21 (29)	-.15 (32)	.03 (32)	-.12 (32)
HRS2	-.28 (31)	-.16 (30)	-.41* (28)	-.08 (31)	-.02 (31)	-.03 (31)
HRB2	-.14 (32)	-.06 (31)	-.16 (29)	-.08 (32)	.08 (32)	-.07 (32)
STB1	-.11 (32)	.18 (31)	-.02 (29)	.05 (32)	.06 (32)	-.22 (32)
STS1	-.11 (31)	.18 (30)	-.02 (28)	.08 (31)	.09 (31)	-.21 (31)
STS2	-.10 (32)	.19 (31)	-.01 (29)	.04 (32)	.06 (32)	-.22 (32)
STB2	-.09 (32)	.19 (31)	-.01 (29)	.04 (32)	.05 (32)	-.23 (32)

n equals the numbers in parentheses in this table and in subsequent tables.

*p<.05

Table 10

Intercorrelations Between Pencil & Paper Measures

and Physiological Measures at Posttest

	SOSI	STAIS	STAIT	SER	SEA	SEL
EMGB1	.17 (35)	.03 (35)	.14 (31)	-.08 (35)	-.08 (35)	-.23 (34)
EMGS1	.31* (35)	.06 (35)	.21 (31)	-.26 (35)	-.26 (35)	-.32* (34)
EMGS2	.25 (35)	.02 (35)	.27 (31)	-.10 (35)	-.11 (35)	-.13 (34)
EMGB2	.25 (35)	.05 (35)	.19 (31)	-.11 (35)	-.10 (35)	-.28 (34)
HRB1	.03 (35)	-.28* (35)	-.19 (31)	.05 (35)	.10 (35)	.06 (34)
HRS1	-.02 (34)	-.23 (34)	-.13 (30)	.00 (34)	.08 (34)	-.05 (33)
HRS2	.05 (35)	-.12 (35)	-.01 (31)	-.09 (35)	.05 (35)	.05 (34)
HRB2	-.14 (34)	-.09 (34)	-.05 (30)	.04 (34)	.16 (34)	.08 (34)
STB1	-.10 (34)	.08 (34)	.19 (30)	-.09 (34)	-.20 (34)	-.22 (33)
STS1	-.11 (33)	.08 (33)	.19 (29)	-.07 (33)	-.19 (33)	-.22 (32)
STS2	-.10 (34)	.09 (34)	.20 (30)	-.10 (34)	-.21 (34)	-.23 (33)
STB2	-.10 (34)	.09 (34)	.20 (30)	-.10 (34)	-.21 (34)	-.24 (33)

n = ( )
*p<.05

Table 11

Intercorrelations Between Self-Efficacy Measures and Physiological Measures During Training

	HR	ST	EMG
Session 2			
SER	.09 (12)	-.11 (16)	-.14 (16)
SEA	.16 (12)	-.03 (16)	-.11 (16)
SEL	.12 (12)	.02 (16)	-.25 (16)
Session 4			
SER	.05 (12)	-.51 (13)	.44 (13)
SEA	.24 (12)	-.29 (13)	.20 (13)
SEL	-.01 (12)	.02 (13)	.15 (13)
Session 6			
SER	-.42 (12)	-.47 (15)	-.03 (15)
SEA	-.59* (12)	-.31 (15)	-.01 (15)
SEL	-.50* (12)	-.19 (15)	-.11 (15)
Session 8			
SER	-.27 (11)	-.23 (14)	-.17 (13)
SEA	-.19 (11)	-.10 (14)	-.29 (13)
SEL	-.11 (11)	.03 (14)	-.44° (13)

n = ( )
°p<.06 *p<.05

purpose of the analysis, the ten segments were averaged into periods 1, 2 and 3. Period 1 was an average of segments 1, 2 and 3. Period 2 was an average of segments 4, 5, 6 and 7. Period 3 was an average of segments 8, 9 and 10. Of the eight treatment sessions, sessions two, four, six and eight were analyzed for reasons outlined in the previous section.

Due to missing data, heart rate training data was available for only seven subjects. Consequently, there were not sufficient subjects to do a multivariate analysis and univariate analyses were performed. The results for electromyography showed significant main effects for session, F (3,42) = 4.05, p = .01 (see Table 12 and Figure 9). There was no significant main effect for period. There was a significant period by session interaction effect, F (6,84) = 2.90, p = .01. The results for heart rate showed no significant main or interaction effects (see Table 13). The results for peripheral skin temperature showed no significant main or interaction effects (see Table 14). The conclusion for these analyses is that subjects reduced their electromyography readings over the sessions and that some combination of periods and sessions was significant in the reduction of electromyography. Thus, the results indicate that the subjects learned to control electromyography during the course of training.

Intercorrelations of Physiological Measures

Pearson product moment correlations were computed among the physiological measures (electromyography, peripheral skin temperature, heart rate) both at the pretest and the posttest (see pretest-Table 15, posttest-Table 16). Generally, the physiological measures correlated significantly within the modality across conditions but not across modality. That is to say that the electromyography (or peripheral skin temperature or heart rate) readings during B1, S1, S2 and B2, correlated highly with each other but that electromyography, peripheral skin temperature, and heart rate

Table 12

Group Means and Standard Deviations for Training

EMG Period X Session (n=15)

	Session 2	Session 4	Session 6	Session 8	Total
Period 1	2.58 (1.37)	2.51 (1.55)	2.00 (1.17)	2.20 (1.39)	2.32 (1.37)
Period 2	2.64 (1.80)	2.22 (1.64)	2.18 (1.52)	2.35 (1.62)	2.35 (1.65)
Period 3	2.51 (1.95)	2.16 (1.75)	2.24 (1.78)	2.26 (1.62)	2.29 (1.78)
Total	2.58 (1.71)	2.30 (1.65)	2.14 (1.49)	2.27 (1.54)	2.32 (1.60)

Table 13

Group Means and Standard Deviations for Training

HR Period X Session (n=7)

	Session 2	Session 4	Session 6	Session 8	Total
Period 1	82.63 (20.89)	71.60 (14.32)	64.02 (4.68)	70.37 (13.64)	72.16 (13.38)
Period 2	75.82 (20.47)	70.88 (22.77)	61.96 (4.61)	67.98 (20.06)	69.16 (16.98)
Period 3	70.81 (19.47)	67.25 (26.15)	59.56 (9.57)	72.04 (21.78)	67.42 (19.24)
Total	76.42 (20.28)	69.91 (21.08)	61.85 (6.29)	70.13 (18.49)	69.58 (16.53)

Table 14

Group Means and Standard Deviations for Training

Skin Temperature Period X Session (n=16)

	Session 2	Session 4	Session 6	Session 8	Total
Period 1	33.43 (3.28)	32.55 (2.28)	32.74 (3.95)	31.84 (4.62)	32.89 (3.53)
Period 2	33.44 (3.24)	33.59 (2.27)	32.80 (3.83)	31.88 (4.57)	32.93 (3.48)
Period 3	33.41 (3.23)	33.58 (2.27)	32.79 (3.79)	31.87 (4.56)	32.91 (3.46)
Total	33.42 (3.25)	33.57 (2.27)	32.78 (3.86)	31.86 (4.58)	32.91 (3.49)

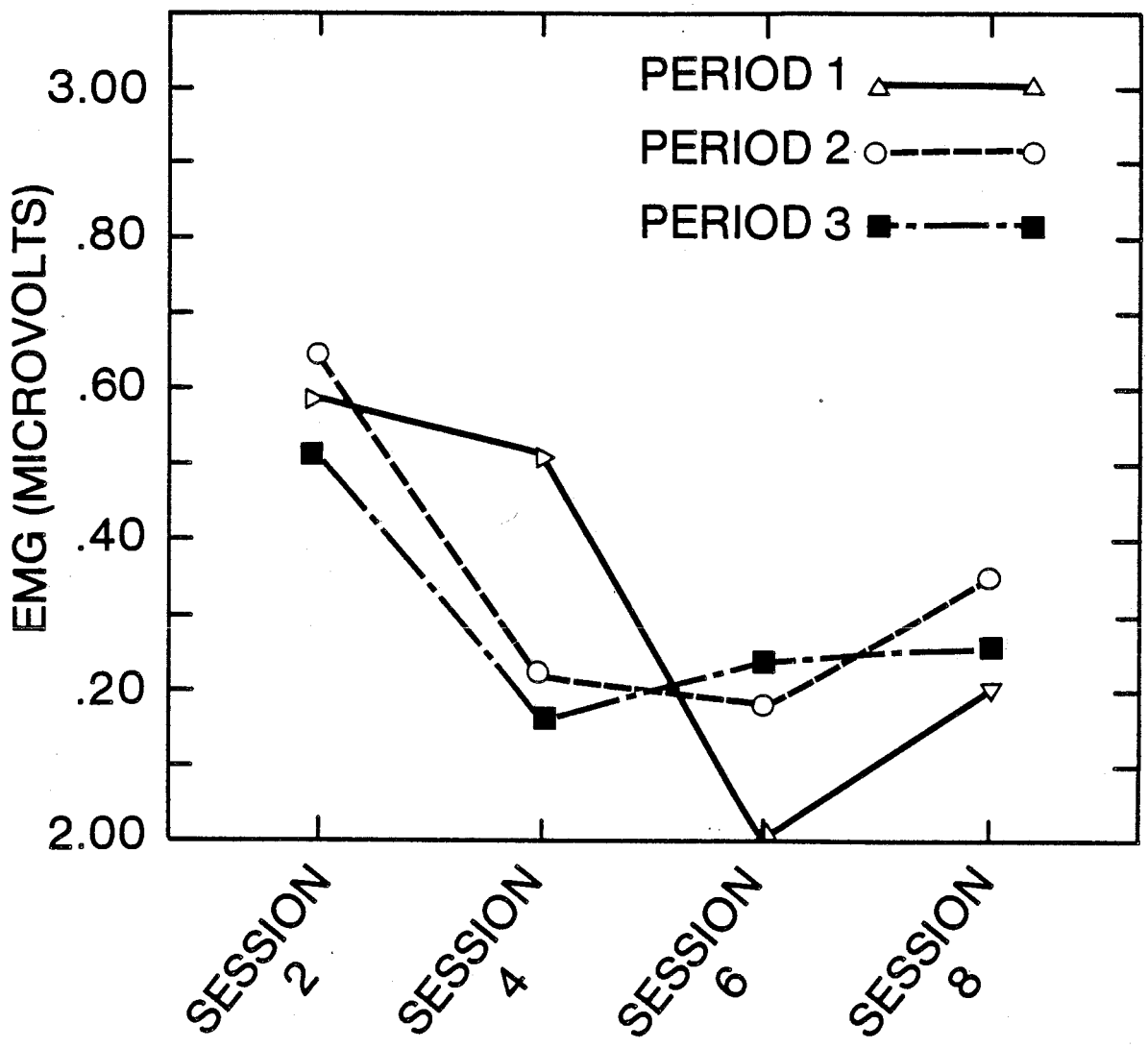

Figure 9. EMG training data (period by session).

did not correlate highly with each other at B1, or S1, or S2, or B2.

Intercorrelations for Pencil and Paper Measures

Pearson product moment correlations were computed among the six pencil and paper measures (Symptoms of Stress Inventory, State-Trait Anxiety Inventory, State scale, and Trait scale, self-efficacy of relaxation, self-efficacy of anxiety, self-efficacy of life in general) at both pretest (see Table 17) and posttest (see Table 18). Symptoms of Stress Inventory, State-Trait Anxiety Inventory, State scale and State-Trait Anxiety Inventory, Trait scale were significantly correlated both at the pre- and posttests. There was a significant negative correlation between the efficacy measures, self-efficacy of relaxation, self-efficacy of anxiety, self-efficacy of life in general and State-Trait Anxiety Inventory, State scale, State-Trait Anxiety Inventory, Trait scale and Symptoms of Stress Inventory at the pre- and posttests. In conclusion, there was a positive relationship between anxiety scores and symptoms of stress scores and a negative relationship between these scores and self-efficacy scores suggesting that anxiety and symptoms of stress are related; and that as anxiety and symptoms of stress decrease, self-efficacy increases.

Self-Monitored Physiological Data

Participants in the treatment group were instructed in relaxation sessions to practice daily at home. Participants were instructed to measure heart rate, rate of respiration, and peripheral skin temperature, before and after each relaxation session and to record these data in spaces provided on the monitoring sheet. Participants were also requested to determine and record the difference between the prepractice and postpractice measures. The self-monitored physiological data were analyzed using a 2X4 MANOVA (see Table 19). Only 7 subjects were included in the analysis due to missing data. Nine subjects failed to monitor or record all requested data. The

Table 15

Intercorrelations Among Physiological Measures at Pretest

	EMGB1	EMGS1	EMGS2	EMGB2	HRB1	HRS1	HRS2	HRB2	STB1	STS1	STS2	STB2
EMGB1												
EMGS1	.63** (32)											
EMGS2	.13 (30)	.36* (30)										
EMGB2	.95** (33)	.58** (32)	.19 (30)									
HRB1	.23 (33)	.06 (32)	-.02 (30)	.22 (33)								
HRS1	.22 (32)	-.09 (31)	-.20 (29)	.24 (32)	.78** (32)							
HRS2	.04 (31)	-.06 (30)	.01 (29)	.04 (31)	.80** (31)	.79** (31)						
HRB2	.10 (32)	-.12 (31)	-.29 (29)	.11 (32)	.81** (32)	.69** (32)	.73** (31)					
STB1	.19 (32)	.19 (31)	-.26 (29)	.20 (32)	.24 (32)	.04 (31)	.08 (30)	.13 (31)				
STS1	.20 (31)	.17 (30)	-.26 (28)	.22 (31)	.25 (31)	.04 (30)	.06 (29)	.15 (30)	1.00** (31)			
STS2	.18 (32)	.20 (31)	-.25 (29)	.19 (32)	.23 (32)	.03 (31)	.08 (30)	.13 (31)	1.00** (32)	1.00** (31)		
STB2	.18 (32)	.19 (31)	-.26 (29)	.19 (32)	.23 (32)	.03 (31)	.08 (30)	.14 (31)	1.00** (32)	1.00** (31)	1.00** (32)	

NOTE: B1 = Baseline period one, S1 = Stressor one (Serial 7's task), S2 = Stressor two (Reading task), B2 = Baseline period two, in Tables 15 and 16.

n = ( )

*p<.05 **p<.01

Table 16

Intercorrelations Among Physiological Measures at Posttest

	EMGB1	EMGS1	EMGS2	EMGB2	HRB1	HRS1	HRS2	HRB2	STB1	STS1	STS2	STB2
EMGB1												
EMGS1	.89** (35)											
EMGS2	.45** (35)	.55** (35)										
EMGB2	.96** (35)	.86** (35)	.44** (35)									
HRB1	.31* (35)	.24 (35)	-.03 (35)	.31* (35)								
HRS1	.20 (34)	.10 (34)	-.23 (34)	.22 (34)	.81** (34)							
HRS2	.08 (35)	.11 (35)	-.12 (35)	.10 (35)	.67** (35)	.78** (34)						
HRB2	.22 (34)	.18 (34)	.01 (34)	.20 (34)	.55** (34)	.43** (33)	.75** (34)					
STB1	.11 (34)	.12 (34)	.27 (34)	.12 (34)	-.05 (35)	-.14 (33)	-.21 (34)	-.16 (33)				
STS1	.11 (33)	.10 (33)	.27 (33)	.13 (33)	-.05 (33)	-.15 (32)	-.25 (33)	-.16 (32)	1.00** (33)			
STS2	.09 (34)	.12 (34)	.27 (34)	.10 (34)	-.07 (34)	-.16 (33)	-.22 (34)	-.17 (33)	1.00** (34)	1.00** (33)		
STB2	.10 (34)	.12 (34)	.28 (34)	.11 (34)	-.07 (34)	-.16 (33)	-.22 (33)	-.16 (33)	1.00** (34)	1.00** (33)	1.00** (34)	

*p<.05 **p<.01

Table 17

Intercorrelations Among Pencil & Paper Measures

at the Pretest

Measure	SOSI	STAIS	STAIT	SER	SEA	SEL
SOSI						
STAIS	.61** (32)					
STAIT	.55** (30)	.32* (29)				
SER	-.38* (33)	-.45** (32)	-.33* (30)			
SEA	-.26 (33)	-.38* (32)	-.34* (30)	-.84** (33)		
SEL	-.41** (33)	-.56** (32)	-.53* (30)	.49** (33)	.61** (33)	

n=( )
*p<.05 **p<.01

Table 18

Intercorrelations Among Pencil & Paper Measures

at the Posttest

Measure	SOSI	STAIS	STAIT	SER	SEA	SEL
SOSI						
STAIS	.57** (35)					
STAIT	.63** (31)	.74** (31)				
SER	-.47** (35)	-.56** (35)	-.61** (31)			
SEA	-.46** (35)	-.54** (35)	-.62** (31)	.94** (35)		
SEL	-.48** (34)	-.41** (34)	-.55** (30)	.81** (34)	.85** (34)	

n=( )
**p<.01

factors were Pre/Postpractice and Time (4 weeks). There was no significant main effect for Time. However there was a significant main effect for Pre/Postpractice. Subsequent univariate *F* tests showed significant decrements in heart rate and a significant increase in peripheral skin temperature during home practice. There was no significant interaction effect between Pre/Post practice and Time. The conclusion to be reached from these results is that physiological activity was reduced during relaxation but that these changes did not accentuate over time.

Anecdotal Data

Participants reported various improvements in their lives during the course of training. A few of these reports are mentioned here. A number of participants in this study were students. One student who usually became tense while studying for exams was able to be more relaxed during studying and was able to retain more information than he had previously. When he was in the middle of the exam, he felt his tension rising so he practiced his relaxation cue and became more relaxed. His marks were higher on this exam than they usually were.

Another student who usually became quite anxious in exams was able to utilize the cue and scored 100% on an exam. One participant whose anxiety and anger level was very high (10 out of 10 on the Self-Assessed Anxiety Scale) commented that after training he was less likely to blow up at every day irritations. Another participant, who owned a business, was experiencing difficulty in dealing with unreasonable customers. He frequently argued loudly with these customers. After biofeedback training he was able to use the cue, remain calm and reason with the customer. This anecdotal data indicates ways in which some subjects were able to gain control over their anxiety.

Table 19

Group Means and Standard Deviations for Self-Monitored Heart Rate over a Four-week Training Period

	n	Week 1	Week 2	Week 3	Week 4	Total
Prepractice	7	62.92 (6.80)	65.45 (6.60)	65.77 (7.15)	63.10 (8.04)	64.31 (7.15)
Postpractice	7	60.37 (5.29)	61.65 (5.93)	61.31 (5.83)	59.84 (6.27)	60.79 (5.83)

Group Means and Standard Deviations for Self-Monitored Respiration Rate over a Four-week Training Period

	n	Week 1	Week 2	Week 3	Week 4	Total
Prepractice	7	15.14 (4.24)	13.23 (2.63)	12.84 (2.74)	12.99 (3.05)	13.55 (3.17)
Postpractice	7	13.19 (4.95)	10.65 (3.11)	9.69 (3.25)	10.56 (3.34)	11.02 (3.66)

Group Means and Standard Deviations for Self-Monitored Finger Temperature over a Four-week Training Period

	n	Week 1	Week 2	Week 3	Week 4	Total
Prepractice	7	90.90 (1.60)	91.11 (3.35)	90.23 (4.20)	89.33 (6.44)	90.39 (3.90)
Postpractice	7	92.51 (1.77)	93.67 (1.73)	93.31 (1.85)	93.09 (2.46)	93.15 (1.95)

Summary

Data were collected in this study which assessed the treatment effects of biofeedback. The results indicate that there is no evidence that treatment subjects showed greater changes than control subjects in self-report measures, i.e., anxiety, symptoms of stress, and self-efficacy. However subjects in the study generally showed improvement over time in these self-report measures regardless of whether or not they were receiving treatment.

On the physiological level, results indicate that treatment subjects demonstrated greater reductions in electromyography, less electromyography reactivity under stressor conditions, lower heart rate recovery levels, and greater increases in peripheral skin temperature than control subjects in pretreatment-posttreatment comparison. However during training, subjects only showed reductions in electromyography readings. There were no significant changes in heart rate or peripheral skin temperature. Anecdotal reports corroborate the significant physiological findings.

There is no evidence of a positive relationship between efficacy expectation and physiological self-control skill acquisition. Finally, there was a significant negative relationship between self-efficacy scores and state-trait anxiety and symptoms of stress scores.

CHAPTER 5

DISCUSSION

Summary of Findings

Hypotheses 1, 2 and 3

In these hypotheses it was stated that treatment subjects would demonstrate greater reductions in State-Trait Anxiety Inventory, State scale and Trait scale scores, Symptoms of Stress Inventory, and Self-Efficacy scores than control subjects. The findings were that subjects in both treatment and control conditions showed improvement across time in these self-report measures.

Some possible explanations for these results are discussed below. First most client problems are cyclical in nature. At the low point in the cycle people seek treatment. There is a tendency for the problem to ameliorate with time whether or not treatment is applied (Miller, 1978). Therefore, this may account for both treatment and control subjects showing improvement across time. A second possible explanation for these results is what has been termed the Hawthorne Effect (Roethlisberger & Dickson, 1940). This term refers to "any situation in which the experimental conditions are such that the mere fact that the subject is participating in an experiment or is receiving special attention tends to improve performance" (Borg & Gall, 1979). The subjects in the control condition, as well as the treatment condition, received attention from the experimenters. Control subjects attended an initial screening and information session. Then they received the psychophysiological stress profile and were asked to complete three self-report measures. Perhaps this special attention accounted for improvement in the self-report measures across time.

A third possible explanation for the results is that since most of the subjects in the control group were a delayed treatment group, it could be

that expectation of treatment improved their self-report scores. Frank (1961, 1971) has shown that any course of action which arouses hope may effect results.

Finally, since the self-report measures are indicators of cognitive changes and the treatment was physiological, it may be that the cognitive measures were not sensitive to physiological changes and that the change in these measures was due to the passage of time, attention and/or the arousal of hope.

Hypothesis 4

In this hypothesis it was stated that treatment subjects would demonstrate greater reduction in the psychophysiological stress profile measures than control subjects in pretreatment-posttreatment comparison. Treatment effects were found for electromyography, heart rate, and peripheral skin temperature. Specifically, the treatment group demonstrated larger reductions in electromyography levels than controls. Control subjects were more reactive to the stressors in heart rate at the posttest than they were at the pretest but the treatment group demonstrated substantially greater reduction in heart rate during recovery from the stressors compared to controls. Further, the treatment group showed a substantially greater increase in peripheral skin temperature than controls.

Thus, there were treatment effects found for biofeedback training in most reactive modality across the different modalities but the effects were not synchronous, i.e., not consistent across all physiological modalities. This lack of synchrony was also found on analysis of the intercorrelations of physiological measures. Generally, the physiological measures correlated significantly within the modality but not across modalities. Thus, generalization of treatment effects across physiological modality did not occur. This result is consistent with Gatchel, et al.'s (1978) finding that

when subjects were exposed to stress-induction conditions following training, they maintained their physiological reduction only in the modality in which they were trained. Thus, the present study provides further evidence to support Petersen and Hiebert's (1984) contention that it is important to train individuals in their most reactive physiological response channel.

Analysis of changes in physiological measures across treatment sessions showed treatment effects over sessions for electromyography. Also, some combination of periods and sessions was significant in the reduction of electromyography. However, there was no treatment effect for heart rate or peripheral skin temperature. Thus, subjects learned to reduce their electromyography across training sessions and this learning is undoubtedly responsible for the differential treatment effect for electromyography demonstrated at Posttest.

One issue remains to be explained. Treatment effects were found for peripheral skin temperature in pretreatment- posttreatment comparison but no significant changes were found in this physiological measure during treatment sessions. These effects cannot be explained as generalization effects because the physiological measures do not correlate across modalities. However, it is possible that the effects of training are aggregate effects rather than incremental effects.

Hypothesis 5

In this hypothesis it was stated that there would be a positive relationship between efficacy expectations and physiological self-control skill acquisition at pre- and posttest. This hypothesis was addressed in two ways: first by analyzing the relationship between efficacy expectations and physiological self-control at pre- and posttests; second by analyzing the relationship between efficacy expectations and physiological

self-control skill acquisition during training. Findings indicate that there is insufficient evidence to accept this hypothesis. Thus treatment expectation was not related to the physiological changes which did occur as a result of biofeedback training.

A number of plausible explanations for this result are discussed below. One possible explanation is that most of Bandura's work with self-efficacy has examined the relationship between self-efficacy and behavioral outcomes rather than physiological outcomes. It may not be appropriate to generalize Bandura's findings from behavioral to physiological outcomes. Lazarus (1977) has commented that each of the three components of anxiety (cognitive, physiological and behavioral) marches to its own drummer. Lazarus (1977) states further that, "the three components correlated very poorly with each other. An individual might report no distress yet exhibit strong physiological reactions" (p. 69). The data from this study supports this contention. Changes in the physiological and cognitive components of anxiety may not be as directly linked as theories of the cognitive mediation of anxiety would suggest. Changes in self-efficacy or other cognitive factors may not automatically produce changes in the physiological component of anxiety or vice-versa, that change in the physiological component of anxiety may not automatically produce changes in the individual's perception of self-efficacy. Two participants in this study illustrate this possibility. One participant was a pessimistic man who did not believe biofeedback training would be helpful to him although he did comply with the treatment program. By the end of treatment he had exceeded training criterion. His electromyography readings were the lowest in the study. However, his self-efficacy ratings improved only marginally. Another participant was enthusiastic and hopeful about reducing his anxiety. Following treatment, his self-efficacy score was much improved but there was

no consistent improvement in his electromyography readings. This underscores the importance of monitoring multiple components (physiological, cognitive and behavioral) in anxiety studies.

Intercorrelations of Pencil and Paper Measures

Results indicated that there was a significant negative correlation between the efficacy measures, self-efficacy of relaxation, anxiety, and life in general, and State-Trait Anxiety Inventory, State Scale, State-Trait Anxiety Inventory, Trait scale and Symptoms of Stress Inventory, at the pretest and posttest. Thus, there is an inverse relationship between the self-efficacy measures and anxiety and symptoms of stress measures, as is to be expected. This finding provides some concurrent validity for the self-report measures used in this study.

Self-Monitored Physiological Data

Subjects in this study practiced relaxation daily at home and monitored their heart rate, rate of respiration, and peripheral skin temperature. Results indicate that subjects were able to reduce their physiological activity by the process of relaxation but these changes did not accumulate over time. A possible explanation for this result is that 11 of 16 subjects were electromyography reactive and therefore trained in electromyography, not in modalities they were able to self-monitor. Although heart rate, peripheral skin temperature, and breathing rate are good ways of measuring general relaxation, it is not possible to measure electromyography without biofeedback equipment. The lack of significant effect for Time would indicate that the self-monitored measures were insensitive to the physiological changes occuring during training.

Suggestions for Future Research

Research which involves both training in biofeedback and the collection of physiological data can be arduous in a variety of ways. First of all, a

large amount of time is required for training subjects and collecting data. In this study it was necessary to have eight 50 minute training sessions per subject plus a 90 minute pretest and posttest. Secondly, fastidiousness in treatment procedures is required so as to prevent error. Equipment malfunction and recording artifact can also produce missing or clearly false data. Thirdly, this type of research yields large amounts of numerical data which can be time consuming to analyze. Finally, because of the amount of time required to do this type of research, it is often not possible to have a large sample size.

However, this type of physiological research is important. Lazarus (1977) has commented that "the biofeedback laboratory seems to offer excellent opportunities to add to our knowledge of the mechanisms of self-regulation" (p. 85). Consequently, it behooves researchers to do this type of research. Two possible remedies for the difficulties mentioned are that equipment which feeds recorded information directly into a computer would be time saving, and recruiting a number of experimenters to train subjects would allow for a larger sample size.

Summary and Conclusions

In this study the relationship was examined between efficacy expectations and training outcome in biofeedback for the treatment of anxiety. Anxiety is a pervasive problem of modern life and biofeedback has been found to be an effective method of treating anxiety (Budzynski & Stoyva, 1973; Hiebert & Fitzsimmons, 1980). The mechanisms by which biofeedback operates are not clearly understood, but cognitive mechanisms have been proposed in recent years as a plausible explanation.

Efficacy expectations (Bandura, 1977) were seen as a specific, quantifiable cognitive mechanism which could be studied. In this study, the cognitive factors were found to be largely unrelated to physiological

training outcome.

This might be due to the manner in which the cognitive variables were assessed. Future research might explore more creative attempts to tap cognitive functioning like: some variation of think aloud or stimulated recall procedures to assess client's cognitive activity while training, or attempts to probe metacognitive functions like appraisal of one's success at training. These procedures would enhance the assessments of client cognition and perhaps illuminate some further interesting relationships between cognitive and physiological variables.

An attempt was made in this study to enhance the effectiveness of training in biofeedback through training in most reactive physiological modality. Results indicate that subjects were effective in learning to control the physiological modality in which they were trained. However, this control did not generalize from the trained physiological modality to other physiological modalities.

These results suggest that biofeedback training in most reactive modality is effective in controlling the physiological component of anxiety. However, they suggest that it is not sufficient to train all subjects in one physiological modality i.e., frontal electromyography, as is usually done because the results did not generalize from the trained physiological modality to other physiological modalities.

The low correlations between efficacy expectations and training outcome may mean that the link between the cognitive and physiological components of anxiety is not as direct or perhaps not as strong as theorists have suggested. Changes in self-efficacy or other cognitive factors may not automatically produce changes in the physiological component of anxiety. On the other hand, changes in the physiological component of anxiety may not automatically produce changes in the individual's perception of

self-efficacy. If this is so, it becomes important to assess more than just the cognitive or just the physiological component of anxiety. A multimodal assessment needs to be made i.e., one which assesses the cognitive, physiological and behavioral components of anxiety. Then, treatment would involve a form of therapy which is designed to treat the component or components of anxiety which are manifested.

Appendix A

Information Sheet for Prospective Participants

INFORMATION SHEET

In the spring and summer of 1984, Dr. Bryan Hiebert and his research assistants in the Counselling Psychology program of the Faculty of Education, will be conducting a research project. The purpose of the project is to test the effectiveness of various relaxation training procedures.

Those taking part in the study will learn a method for producing deep relaxation at will. Before and after the relaxation training, physiological reactions will be measured and participants will fill out two questionnaires which will measure anxiety. At the start, instruments will measure the participant's hand temperature, muscle tension, heart rate and sweat gland activity, while participants relax and while they perform some mental tasks (reading and arithmetic). Participants will then learn a method for producing deep relaxation, and using the relaxation in their daily lives. The physiological measures will be taken again at the end of the training in order to determine how deeply participants have learned to relax.

The whole process will involve two 1 1/2 hour sessions (to record the physiological measures and fill out questionnaires), 6-8 relaxation training sessions each lasting about 50 minutes, and a daily 20 minute home practice period. At the end of the study, participants will have learned a procedure that will help them relax and control stress and anxiety.

The research project has been approved by the University Ethics Committee at Simon Fraser University.

Anyone who wishes more information may telephone Ms. Marian McLean at 581-2907, or Dr. Bryan Hiebert at 291-3389.

Appendix B

Consent Form for Participants

SIMON FRASER UNIVERSITY, BURNABY, B.C., CANADA V5A 1S6

CONSENT FORM

I, _____ have read the enclosed
student's name
information sheet and would like to participate in the stress control project.

I understand that all data collected will be confidential and that I can receive a copy of my results at any time.

I also understand that I can withdraw from the study at any time if I change my mind.

If I wish, I can receive a copy of the final report of the study by contacting Dr. Hiebert at the above address.

If I have any concerns about the study or any questions, either before or during the project I can contact Dr. Hiebert at 291-3389 or 291-3395.

signed _____
student's signature

Appendix C

Descriptive Statistics for Preliminary Analysis

Means and Standard Deviations of Symptoms

of Stress Scores of Initial Groups at Pretest

		n	TIME T_1	T_2	T_3
GROUP	Group 1	7	70.71 (29.53)		
	Group 2	7	60.50 (20.56)	38.57 (20.35)	
	Group 3	8		62.75 (36.15)	

Means and Standard Deviations of Stait-Trait Anxiety Inventory,

State Scale Scores of Initial Groups at Pretest

		n	TIME T_1	T_2	T_3
GROUP	Group 1	7	43.57 (15.39)		
	Group 2	7	39.71 (6.80)	37.00 (6.83)	
	Group 3	8		45.75 (12.81)	

NOTE: Numbers in parentheses in this and all other tables in Appendix indicate standard deviation.

Refer to Figure 3.

Means and Standard Deviations of Stait-Trait Anxiety Inventory,

Trait Scale Scores of Initial Groups at Pretest

		TIME		
	n	T_1	T_2	T_3
GROUP				
Group 1	7	52.57 (6.27)		
Group 2	7	44.71 (8.73)	45.14 (5.11)	
Group 3	8		49.25 (12.77)	

Means and Standard Deviations of Self-Efficacy

of Relaxation Scores of Initial Groups at Pretest

		TIME		
	n	T_1	T_2	T_3
GROUP				
Group 1	7	23.00 (13.78)		
Group 2	7	62.00 (18.26)	55.29 (21.48)	
Group 3	8		47.88 (17.10)	

Means and Standard Deviations of Self-Efficacy

of Anxiety Reduction Scores of Initial Groups at Pretest

		n	TIME T_1	T_2	T_3
GROUP	Group 1	7	32.29 (20.89)		
	Group 2	7	64.57 (19.47)	54.29 (20.11)	
	Group 3	8		50.38 (17.39)	

Means and Standard Deviations of Self-Efficacy

of Life in General Scores of Initial Groups at Pretest

		n	TIME T_1	T_2	T_3
GROUP	Group 1	7	75.71 (22.25)		
	Group 2	7	83.57 (24.78)	82.86 (16.55)	
	Group 3	8		79.38 (29.69)	

Appendix D

Demographic Information Sheet

Anxiety Control Study

Demographic Information

1. Name:_____

2. Age:_____ 3. Sex:_____

4. Medication:

   name_____ _____ _____

   dosage_____ _____ _____

   length of time taking_____ _____ _____

5. List any recent or current stressful events that you have experienced.

   _____

   _____

   _____

6. List the situations or things that make you anxious.

   _____

   _____

   _____

   _____

7. Please rate your estimated current anxiety level on the scale below.

not at all anxious — Total incapacitating anxiety

0 1 2 3 4 5 6 7 8 9 10

Appendix E

Self-Efficacy Questionnaire Sample

SITUATIONS USED IN SELF-EFFICACY QUESTIONNAIRE

Phrase z = speaking in public

y = meeting new people

x = thinking about school and career plans

w = writing exams

v = interacting with men you haven't met before

u = working on difficult problems

t = calling prospective clients to make appointments

a = interacting with an unreasonable family member

b = interacting with an unreasonable customer

c = working hard to meet deadlines

d = thinking about my husband's unemployment

e = writing papers

f = thinking about security in my relationships

g = trying to get everything done in the day

h = thinking about the future of the marriage

i = being harrassed by casual acquaintances

j = in a conflict situation with a customer who owes money

k = thinking about returning to school

l = being evaluated

m = being assertive in a controversial situation

n = coping with present life situations that can't be changed

NAME: _____ DATE: _____

I.D. CODE: _____

SELF-EFFICACY QUESTIONNAIRE

In this questionnaire you will be asked to estimate how certain you are about your ability to relax, control your anxiety and to control your life in general. There are two steps involved in completing the questionnaire.

1. First, read through the questionnaire to get an idea of the way in which the items are related and the way they are different.

2. Secondly, go through the questionnaire and answer the items by placing a check mark in the appropriate space.

Instructional Psychology Research Group
Faculty of Education
Simon Fraser University

Check the number that matches how sure or certain you are that you could be slightly relaxed once in a while, while interacting with an unreasonable family member.

10	_____	very uncertain
20	_____	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_____	pretty sure
80	_____	
90	_____	
100	_____	very certain

Check the number that matches how sure or certain you are that you could be slightly relaxed frequently, while interacting with an unreasonable family member.

10 _____ very uncertain

20 _____

30 _____

40 _____ maybe

50 _____

60 _____

70 _____ pretty sure

80 _____

90 _____

100 _____ very certain

Check the number that matches how sure or certain you are that you could be slightly relaxed most of the time, while interacting with an unreasonable family member.

10	___ ___	very uncertain
20	_____	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_____	pretty sure
80	_____	
90	_____	
100	_____	very certain

Check the number that matches how sure or certain you are that you could be slightly relaxed almost all the time, while interacting with an unreasonable family member.

10 _____ very uncertain

20 _____

30 _____

40 _____ maybe

50 _____

60 _____

70 _____ pretty sure

80 _____

90 _____

100 _____ very certain

Check the number that matches how sure or certain you are that you could be almost completely relaxed once in a while, while interacting with an unreasonable family member.

10	___ ___	very uncertain
20	_____	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_____	pretty sure
80	_____	
90	_____	
100	_____	very certain

Check the number that matches how sure or certain you are that you could be almost completely relaxed frequently, while interacting with an unreasonable family member.

10	_____	very uncertain
20	_____	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_____	pretty sure
80	_____	
90	_____	
100	_____	very certain

Check the number that matches how sure or certain you are that you could be moderately relaxed once in a while, while interacting with an unreasonable family member.

10	_____	very uncertain
20	_____	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_____	pretty sure
80	_____	
90	_____	
100	_____	very certain

Check the number that matches how sure or certain you are that you could be moderately relaxed frequently, while interacting with an unreasonable family member.

10 _____ very uncertain

20 _____

30 _____

40 _____ maybe

50 _____

60 _____

70 _____ pretty sure

80 _____

90 _____

100 _____ very certain

Check the number that matches how sure or certain you are that you could be moderately relaxed most of the time, while interacting with an unreasonable family member.

10	_____	very uncertain
20	_____	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_____	pretty sure
80	_____	
90	_____	
100	_____	very certain

Check the number that matches how sure or certain you are that you could be moderately relaxed almost all the time, while interacting with an unreasonable family member.

10	___ . ___	very uncertain
20	___ ___	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_____	pretty sure
80	_____	
90	_____	
100	_____	very certain

Check the number that matches how sure or certain you are that you could be almost completely relaxed most of the time, while interacting with an unreasonable family member.

10	_ ____	very uncertain
20	_____	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_____	pretty sure
80	_____	
90	_____	
100	_____	very certain

Check the number that matches how sure or certain you are that you could be almost completely relaxed almost all the time, while interacting with an unreasonable family member.

10	____	very uncertain
20	____	
30	____	
40	____	maybe
50	____	
60	____	
70	____	pretty sure
80	____	
90	____	
100	____	very certain

Check the number that matches how sure or certain you are that you could be slightly less anxious once in a while, while interacting with an unreasonable family member.

10 _____ very uncertain

20 _____

30 _____

40 _____ maybe

50 _____

60 _____

70 _____ pretty sure

80 _____

90 _____

100 _____ very certain

Check the number that matches how sure or certain you are that you could be slightly less anxious frequently, while interacting with an unreasonable family member.

10 _____ very uncertain

20 _____

30 _____

40 _____ maybe

50 _____

60 _____

70 _____ pretty sure

80 _____

90 _____

100 _____ very certain

Check the number that matches how sure or certain you are that you could be slightly less anxious most of the time, while interacting with an unreasonable family member.

10	_____	very uncertain
20	_____	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_____	pretty sure
80	_____	
90	_____	
100	_____	very certain

Check the number that matches how sure or certain you are that you could be slightly less anxious almost all the time, while interacting with an unreasonable family member.

10 _____ very uncertain

20 _____

30 _____

40 _____ maybe

50 _____

60 _____

70 _____ pretty sure

80 _____

90 _____

100 _____ very certain

Check the number that matches how sure or certain you are that you could be only moderately anxious once in a while, while interacting with an unreasonable family member.

10	_____	very uncertain
20	_____	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_____	pretty sure
80	_____	
90	_____	
100	_____	very certain

Check the number that matches how sure or certain you are that you could be only moderately anxious frequently, while interacting with an unreasonable family member.

10 _____ very uncertain

20 _____

30 _____

40 _____ maybe

50 _____

60 _____

70 _____ pretty sure

80 _____

90 _____

100 _____ very certain

Check the number that matches how sure or certain you are that you could be only moderately anxious most of the time, while interacting with an unreasonable family member.

10 _____ very uncertain

20 _____

30 _____

40 _____ maybe

50 _____

60 _____

70 _____ pretty sure

80 _____

90 _____

100 _____ very certain

Check the number that matches how sure or certain you are that you could be only moderately anxious almost all the time, while interacting with an unreasonable family member.

10 _____ very uncertain

20 _____

30 _____

40 _____ maybe

50 _____

60 _____

70 _____ pretty sure

80 _____

90 _____

100 _____ very certain

Check the number that matches how sure or certain you are that you could be virtually anxiety free once in a while, while interacting with an unreasonable family member.

10 _____ very uncertain

20 _____

30 _____

40 _____ maybe

50 _____

60 _____

70 _____ pretty sure

80 _____

90 _____

100 _____ very certain

Check the number that matches how sure or certain you are that you could be virtually anxiety free frequently, while interacting with an unreasonable family member.

10 _____ very uncertain

20 _____

30 _____

40 _____ maybe

50 _____

60 _____

70 _____ pretty sure

80 _____

90 _____

100 _____ very certain

Check the number that matches how sure or certain you are that you could be virtually anxiety free most of the time, while interacting with an unreasonable family member.

10	_____	very uncertain
20	_____	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_____	pretty sure
80	_____	
90	_____	
100	_____	very certain

Check the number that matches how sure or certain you are that you could be virtually anxiety free almost all the time, while interacting with an unreasonable family member.

10	_____	very uncertain
20	_____	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_____	pretty sure
80	_____	
90	_____	
100	_____	very certain

Check the number that matches how sure or certain you are that you could be somewhat in control of your life in general.

10	_____	very uncertain
20	_____	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_ ___	pretty sure
80	_____	
90	_____	
100	_____	very certain

Check the number that matches how sure or certain you are that you could be moderately in control of your life in general.

10	_____	very uncertain
20	_____	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_____	pretty sure
80	_____	
90	_____	
100	_____	very certain

Check the number that matches how sure or certain you are that you could be to a large extent in control of your life in general.

10	_____	very uncertain
20	_____	
30	_____	
40	_____	maybe
50	_____	
60	_____	
70	_____	pretty sure
80	_____	
90	_____	
100	_____	very certain

Appendix F

Personalized Covert Modelling Sequence

COVERT MODELLING

OK, just continue relaxing while you listen to what I'm saying. I want you to imagine what I tell you, while I describe it. Make the imagination as real and vivid as you possibly can. Imagine every detail...

(Subjects imagined the situation they describe in the demographic information sheet)

Breathe in to the count 4..., breathe out to the count 4..., a second 4-count, breathe in..., and on the second 4-count breathe out. The wave of relaxation flows through your body and you feel more relaxed, all nervousness disappears and you feel relaxed... Just continue to relax now...

You're doing a good job of relaxing, your readings are nice and low. Now I'd like you to go through the scene I just described, once again on your own. Remember to imagine as realistically and vividly as you can. OK, that's good, just let your attention drift back to this room, our time is up.

Appendix G

Written Authorization by Copyright Holder for Reproducing Diagram

American Psychological Association

1400 North Uhle St.
Arlington, Va. 22201
(202)955-7600

Date: June 12, 1985

For: Master's Thesis

M. McLean
c/o Dr. Bryan Hiebert
Intructional Psychology Research Group
Faculty of Education
Simon Fraser University
Burnaby, BC V5A 1S6
CANADA

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COMMENTS:

Adele Schaefer, Permissions Office

Appendix H

Instructions and Tasks for The Psychophysiological Stress Profile

Initial Instructions

In this study we are investigating what happens to people's bodies when they relax and when they engage in different kinds of mental tasks. Throughout the entire procedure we will be monitoring muscle tension, skin temperature, sweatgland activity (GSR), and heart rate. We will first of all prepare and connect the recording sensors. We will then ask you to relax for 15 minutes, using whatever strategy you usually use to relax. During this time the equipment will be monitoring your body functioning while you are relaxing. Periodically you will hear some clicking sounds. This is the printer printing out the information. After your relaxation session we will be asking you to do several mental tasks. We will be monitoring your body's functioning during these tasks.

Between each task there will be a 3 minute relaxation period. After the last task there will be a 15 minute relaxation period. The first session will be mainly a recording session.

Terminate Initial Relaxation

O.K. That's fine for now. Slowly let your attention drift back to this room. I'm going to ask you to do several tasks now. In each case I will tell you what I want you to do, then give you some time to do the task. After each task I will give you 3 minutes to just relax before I present the next task. After the last task there will be a 15 minute relaxing period when you can relax again as much as possible.

Serial Sevens

In a few moments I am going to tell you a number. I want you to subtract 7 from that number, and then subtract 7 from that answer, and then subtract 7 again, and keep on subtracting 7 until I tell you to stop. Do not say your answers out loud. Do all the subtracting silently. After 3 minutes I will tell you to stop and give me the number you have reached. We have been using this serial 7's task with quite a number of people now and we are finding that the answer a person gets correlates highly with their I.Q. So I want you to do as well as you can. Are you ready? O.K. The number is 1000, go ahead and start subtracting.

Terminating Serial Sevens

Stop... Tell me your answer (write down the answer). You did very well. Just relax now for 3 minutes. Again use whatever strategy you usually use to relax... Just go ahead and relax.

Reading Task

O.K. That's fine for now. The next task is a reading task. I am going to give you two passages to read. After you finish each passage, I will ask you some questions to see how well you remember what you read.

Here is the first passage. Read it silently and then turn the card over.

. . . . . .

(After the last question of the last passage, say).

That's all for the reading task. Now I want you to relax again for 3 minutes. Use whatever strategy you usually use to relax... Just go ahead and relax.

FORM C-9

Scientific discovery and advancing technology are continuously altering the world in which Mary and Dick will work as adults. Inventions undreamed of a decade ago have become realities but these in their turn will become obsolete. If Dick, for example, prepares for the field of automobile maintenance, he will employ tools and procedures which - in their efficiency and precision - will make his father's current equipment appear quite crude. Should Mary become a stenographer, the improvement in the entire communication process will radically affect her responsibilities and the demands on her skills. Shorthand is now employed less frequently than before, and although typing may always be indispensable its use will vary with the rapid advance in dictating equipment. Mary's supervisor can, by touching a button, secure data from a central location several miles away. Telephone conversations can be processed almost instantaneously. Records are kept on microfilm rather than in the cumbersome files which were formerly used. Throughout the world of work, and indeed throughout life, machines will continue to increase enormously the accuracy, volume, and speed of work which is accomplished.

FORM C-10

Future advances in electronic communication will profoundly influence the lives of Mary and Dick. The computer which is already requiring new types of skills in industry, will revolutionize commerce, business, and education since its messages will be conveyed almost immediately to any point in the world. In the Age of Computers, the business executive will utilize microwave channels carrying visual and auditory messages across any distance; the housewife will stop via video-phone. The family radio and television will receive, almost at once, programs from any part of the world. Information of all sorts from newspapers, periodicals, and books - in fact the contents of entire libraries - will be stored in computers in world library centres which will make existing data on any conceivable subject available to teachers, scholars, scientists, professional men, and other individuals. One inevitable consequence of this instanteous communication in all likelihood will be the gradual adoption of a universal language. Although initially it will be utilized by the world's peoples as an adjunct to their native tongues, this international language should eventually supplant local tongues altogether. Conceivably this language will be English - or a derivative thereof - since approximately one fifth of the world's population already speak or comprehend English. Instant communications in a universal language should, moreover, provide one basis on which world peace can be realized. If anxiety concerning war were at a minimum, then the world's peoples would be able to devote themselves constructively to the solution of such important social problems as health, longevity, and achievement.

FORM D-9

Bob and Jane have assumed that they may eventually choose some branch of medicine as their future profession. A recent school incident indicates, however, that Bob's interest may later become absorbed in an analysis of the human mind. One day, discussing the differences between human beings and animals with his science instructor, Bob discovered that human mentality differs principally from animal mentality in its ability to deal with symbols. He learned that a symbol is a sign or word referring to something like an object, a person, or a concept; virtually all knowledge is transmitted through symbolic expression. He himself, like all other human beings, was constantly employing symbols. The latter are used in all oral and written communication as well as in the specialized fields of mathematics, music and art. Bob also learned that disturbances in human emotions are likely to affect adversely the mind's use of symbols. Subsequently, as he discussed his newly acquired insights with his sister, Bob attempted to explain a few of the mind's complex functions to her. He is beginning to realize that psychology, the systematic study of man's mind and emotions, is one of our leading sciences.

FORM D-10

If Bob and Jane study psychology in college, they will further penetrate the complexities of the human mind. Learning that the mind and the emotions are closely related, they will discover that virtually all problems which may distrub an individual are associated in some degree with his emotional life. A person's "emotional adjustment" not only affects his own happiness and stability, but also has a profound influence on that of his associates; thus it follows that emotions are a fundamental consideration in all human relationships. Psychologists have proved conclusively that harmony or discord among persons, far from occurring by chance, can be explained by the same principle of cause and effect which operates in other fields of science. There appear to be two environmental causes of difficulties among people; first, the early experiences within the immediate family and second, the culture in which the individual matures. The scholars in various areas of study such as anthropology, sociology, and statistics have joined the psychologist in investigating this complex field. The problems of human relationships confronting our present-day society are both baffling and challenging. As intelligent citizens we can contribute to their ultimate solution by trying conscientiously to understand our own behavior. Such injunctions as "Don't take yourself too seriously!" have in the past been fashionable attempts to dispose of personal problems. However, they are little more than avoidance mechanisms which ignore the real causes of behavior; in light of current psychology they may in fact be considered anachronistic.

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