THE RELATIVE EFFICACY OF PROGRESSIVE MUSCLE RELAXATION, EMG BIOFEEDBACK AND MUSIC FOR REDUCING STRESS AROUSAL OF INTERNALLY VS. EXTERNALLY CONTROLLED INDIVIDUALS

by
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Abstract

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The Relative Efficacy of Progressive Muscle Relaxation, EMG Biofeedback and Music for Reducing Stress Arousal of Internally vs. Externally Controlled Individuals

Iris J. Prager-Decker, Doctor of Philosophy, 1978

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The purpose of this study was to test the relative efficacy of four relaxation techniques (music listening skills, progressive muscle relaxation (PMR), EMG biofeedback and EMG facilitated PMR) in reducing tension levels of internally or externally controlled individuals who were experimentally exposed to a psychosocial stressor.

The study utilized 81 college aged males randomly assigned to one of four relaxation training groups or to a control group based on their locus of control - (Rotter's I-E Scale). EMG pre-training baseline measurements were taken via an ASI A1700 and all training groups were given seven 20 minute relaxation training sessions. Three days later each subject was exposed to the six repetitions of a 92 second segment

of It Didn't Have to Happen (an industrial accident film). Baseline EMG levels were obtained prior to and following the exposure to the stressor. Data was also collected during the six repetitions. STAI (state) and MAACL (today form) were administered before, after the second exposure to the film and following the post stressor relaxation period.

The results of the statistical analyses indicated that the film was able to elevate EMG levels, that biofeedback training produced significantly lower EMG levels during a resting period than music or PMR training, that externally controlled subjects trained with biofeedback reduced their resting EMG levels more than their internal counterparts, that externally controlled individuals trained with biofeedback reduced their EMG levels at a faster rate than internals and that initial muscle tension during exposure to the stressor seemed to be uneffected by the type of relaxation training the subject received or whether he received training at all.

Dedication

This dissertaion is dedicated with deep gratitude to my husband, William Allen Decker, who has been more than a life's companion, but also a soul mate, a colleague and a teacher.

April, 1978

Iris J. Prager-Decker

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INTRODUCTION

Chronic anxiety and the usually accompanying high levels of physiological arousal such as increased heart rate, increased respiration, elevated blood pressure and increased muscle tension are seemingly commonplace in our highly urbanized society. Studies in the urban centers of New York City and Chicago have estimated that as many as twenty-seven percent of the residents of those cities are experiencing enough stress to impair their level of behavioral functioning (Levy & Rowitz, 1973). Urban sociologists have attributed at least some rise in psychosomatic disease, chronic illnesses, neurotic disorders, insomnia and "immoral and sinful acts" over the last three decades to difficulties in coping with the demands placed on individuals by rapid social change. Clearly, for the first time in recorded history stress has been identified as the major cause of death and disease reflecting a change from a predominance of infectious to chronic diseases (Pelletier, 1977). Dodge and Martin (1970) stated,

> "These diseases which are very characterisitic of our times, namely the chronic diseases, are etiologically linked with excessive stress and in turn this stress is the product of specific socially structured situations inherent in the organization of modern technological societies."

No one living in industrial, urbanized communities can avoid stress, and indeed it is not desirable to eliminate all stress. The majority of individuals react to stress with an initial physiological arousal. After the initital physiological arousal they return to a normal level of activity relatively quickly. The normal stress reaction is referred to as the

return to a homeostatic balance (Pelletier, 1977). Pelletier (1977) and others have noted that when a stressor is ambiguous, prolonged or from several sources at once the body often does not return to a homeostatic balance in an appropriate period of time. This prolongation of the stress reaction may lead to psychosomatic and chronic illnesses. For example, elevated blood pressure during stress is expected and considered normal, but when prolonged it becomes hypertension. Heart-rate acceleration if continued turns into a disorder called tachycardia. Reversing these conditions and returning to one's homeostatic condition (a balanced state) is imperative if the incidence of chronic disease is to be reduced.

The first step in the restoration of homeostasis might be an intervention in the anxiety-stress-disease continuum. This might be accomplished by changing the society in which one lives, or by urging people to avoid societal stressors without anxiety. Either step requires great commitment, power and freedom of choice. On the other hand a more attainable intervention step within the grasp of most people, requires experiencing stress (for to "live" is to experience some degree of stress) and then focus upon altering the physiological arousal period during which the individual is stressed. From this perspective each contact with a stressor provides an opportunity to strengthen one's ability to cope with future stressors more successfully. Selye (1976) defined stress as "the non-specific response of the body to any demand"; therefore, stress may come from a positive as well as a negative experience. Selye has often remarked that one man's stress is another man's pleasure, consequently, one's perception of the situation must also be considered in determining the extent of stress involved in an experience. If we accept the notion that

individuals are repeatedly undergoing short-term physiological arousal (causing wear and tear of the body) due to the continual exposure to a stressful environment, the definition of "under stress" should then suggest one is experiencing an elevated level of stress. What is required then, in restoring homeostasis is to focus our interventions upon the physiological arousal so as to reduce the effects of excess stress, thereby reducing psychological arousal as well. Thus one can mediate the anxiety experience with a physiological dampening technique.

Dampening techniques are those techniques that can check or diminish the activity associated with stress reaction. In a theory developed by Ronald Melzack of McGill University and Patrick Wall of the University of London - The Gate Control Theory arousal,it was found that two very different techniques, hypnotism and acupuncture, can be used to diminish impulses to and from the brain. This theory suggested that impulses can be blocked from reaching the brain by closing a hypothetical gate located below the brain stem on the spinal cord (Melzack and Wall, 1965). Two methods of closing the "gate" have been observed; one method originiates centrally and the other originates peripherally. In the centrally controlled method (e.g., using meditation or hypnosis) the dampening stimulates nervous impulses originating in the cortex, which in turn travel to the gate and stimulate larger nerve fibers closing the gate. Since Melzack and Wall postulate that only a specific amount of nerve impulses can pass through the gate at a given time, peripheral impulses are blocked from further travel. The peripheral theory suggests that stimulation of small nerve fibers, (e.g., using progressive muscle relaxation or acupuncture) sends impulses through the open gate that registers in the cortex trigger-

ing counter impulses that travel down the spinal cord and close the gate (Melzack and Wall, 1965). In the reports of Melzack and Wall, there is reference to "higher" cortical activity such as anxiety that influence the outcome of control gate successes. Anxiety is a psychological label which describes emotional arousal which can interfere with normal social problem solving (Lachman, 1972).

Jacobson (1938) suggested that deep muscle relaxation had a dampening effect on the physiological components of anxiety. He hypothesized that a state of muscular relaxation was incompatable with anxiety and that tensing one's muscles was a part of emotional behavior; (muscle tension being the common denominator of the emotion). He was also in agreement with Cannon (1953) that muscle tension was an indicator of stress and anxiety. Jacobson provided evidence suggesting that anxiety levels were decreased by training in what he called progressive muscle relaxation (PMR). Jacobson theorized that even when muscles are apparently at rest, they may still be residually tense. The PMR technique necessitated deliberate contraction of voluntary muscles followed by the release of muscle tension moving from one specific muscle group to another until the individual had completely and deeply relaxed all groups. In such a relaxed state Dr. Jacobson reported one cannot feel anxious (Fink, 1966). After having studied Jacobson's research Wolpe (1958) and Wolpe and Lazarus (1966) reasoned that when one learns anxious behaviors and thoughts in unpleasant or stressful situations he/she is also experiencing excessive muscle tension. Thus, anxiety and muscle tension are classically conditioned to the same stimuli. Wolpe, viewed relaxation as the physiological opposite of not only tension but also of anxiety. He wanted a method of

speeding up his systematic desensitization technique for treating anxiety and reasoned that if skeletal relaxation can be promoted, the autonomic relaxation (e.g., decreased heart and respiration rate, blood pressure and increased skin temperature) will result and anxiety will be reduced due to reciprocal inhibition. Specifically, while working with phobics who were imagining phobic scenes,he found that muscle relaxation neutralized the anxiety, i.e., muscle relaxation induced by Jacobson's technique was incompatible with and an antagonistic response to the anxiety response. Speilberger (1975) reported evidence suggesting that the effectiveness of desensitization is not generally impaired when muscular relaxation is omitted. However, findings that muscular relaxation brings about reduced mental anxiety and reduced neurophysiological functioning (Davidson, 1971; Coursey, 1976; Pelletier, 1977) support the theory of "reciprocal inhibition" and suggest the effectiveness of generalized relaxation techniques for reducing psychological as well as physiological arousal.

There are numerous techniques of relaxation that can produce decreased physiological arousal and these effects can be measured by electromyography. These self-regulatory techniques include: massage, yoga, meditation, autogenic training, progressive muscle relxation and electromyograph biofeedback (EMG BFT).

With the expert assistance of another person, massage can be an excellent relief from the daily build up of muscle tension. This is perhaps why businessmen are often devotees of massage - "the relief from muscle tension helps to keep their emotions in check" (Brown, 1974). Yogic exercises in which the mind mediates bodily awareness, thereby "willing" muscle relaxation through complete self-discipline has been

practiced for centuries in the Eastern cultures. In Hatha yoga the body is reported to experience calmness, sensitivity and lightness. As one performs the asanas (positions) one moves very slowly and gently, listening carefully to the information that the body relates. An important element in Hatha yoga is the individual's state of mind as he/she performs the asanas. One merely "watches" the body move, keeping one's mind in a place inside oneself, where nothing is happening at all (Ram Das, 1971).

Altered states of consciousness such as the one described above are being examined in relation to relaxation. Meditation is another yogic exercise which allows for complete relaxation via a specific discipline of working with the mind. According to the yogic principles, the mind is concentrated on one point, bringing to a complete halt the "turning" or thought processing(Ram Das, 1971). According to Harvard Cardiologist, Dr. Herbert Benson (1975), the physiological benefits from meditation can be achieved by meeting four conditions: meditating in a quiet environment, sitting in a comfortable position, maintaining a passive attitude and using a mental device (such as a word or sound).

An equally productive technique for producing deep muscle relaxation is Autogenic Training (AT) a method which evolved from a form of self hypnosis. It is so named because control of the muscles was developed almost entirely by self-generating means. It has been found that even a little time spent each day practicing "autohypnotic" exercises gave relief from fatigue and tension (Brown, 1973). Shultz in the 1920's identified two types of body sensations as characteristic of hypnotic subjects; a feeling of heaviness in the extremities and an associated feeling of warmth. He developed a technique employing mental exercises to produce warm and

heavy sensations. The technique involved a series of specific exercises, each directed toward a specific body part (i.e."my right arm is heavy"). These verbal formulas were practiced daily for one or two hours applying the commands to all body muscle masses. This technique requires from four to ten months of practice to master. After these exercises were mastered meditation using visual imagery was begun with the ultimate goal being communication with the unconscious. Autogenic Training may take as long as two years to complete (Luthe, 1963).

While Shultz was developing A.T. in Germany, Edmund Jacobson was working on his relaxation method in America. Jacobson's technique, PMR, was based on the individual's ability to become aware of minute muscle tension. The learner first experienced muscle tension by having his/her wrist hyperextended. When the learner was able to describe the tension in the muscles of the upper forearm as "mild soreness" or "tenderness" the wrist was allowed to relax. The individual was then asked to try to feel the difference between the tension and the relaxation and to remember the feeling of "no tension". This procedure, repeated only two or three times in ten minutes, was then followed by 50 minutes of rest. Afer several sessions with that same muscle, the individual began work with another muscle group. After weeks or months of controlling tension in large muscle systems, Jacobson recommended isolation of muscle tension more and more finely (Jacobson, 1938).

The reason for the lack of popularity of both AT and PMR in America is probably the long time commitment to therapy involved in the treatment. Our technological society demands quick results and this is probably one of the reasons for the increasing popularity of relatively quick bio-

feedback. Electromyograph (EMG) biofeedback training requires the patient to relax while certain muscles are monitored (via electrodes) by an electromyograph (EMG) instrument. As the energy produced by nervous innervation stimulates the muscle fibers being monitored, the patient receives auditory or visual signals. The more tension in the muscle (increased neural stimulation), the more intense the signal; the more relaxed the muscle, the less intense is the signal. The patient gets immediate "feedback" regarding the success or failure of his/her relaxation attempt.

Prior to electronic biofeedback, therapists had no method available for measuring muscle relaxation. Individuals who "felt" relaxed often were experiencing residual tension in their muscles as described by Jacobson. Biofeedback allows the therapist and learner to record even low tension levels and see a progression in relaxation skills. After short periods of training with the biofeedback machines, individuals develop an awareness of their muscle tension, and soon after that awareness, therapy with the machine can be terminated. PMR and AT techniques have been used successfully in conjunction with biofeedback training in treatment of stress related conditions and relaxation training (Davis, 1973; Brown, 1974).

The aforementioned studies show that each of these techniques can be effective, however, that effectiveness is somewhat dependent upon certain characteristics of the learner and the interaction of the learner with the technique. Since it has been determined that these techniques depend upon learning, it is important to examine some criteria necessary for learning to occur. Learning is multifactorial, incorporating at least two variables; the technique used and the character of the learner. Before any determination can be made as to the generalized effectiveness

of the aforementioned treatments, it is necessary to examine some personality variables known to effect learning.

Introversion and extraversion are dimensions or poles of a personality variable affecting conditionability (Eysenck, 1968). In a study by Stoudemire (1972) introverts and extraverts were used to determine the effect of muscle relaxation training on state and trait anxiety. According to Eysenck's personality theory, extraverts condition poorly and need more time to learn new behaviors due to their biologically determined tendency to rapidly develop reactive inhibitions (decremental effect on ability to respond; independent of reinforcement). Introverts, on the other hand, condition rapidly, build up reactive inhibitions slowly and dissipate these inhibitions quickly. The results of Stoudemire's study were consistent with Eysenck's theory. There was a significant decrease in the state anxiety measures from pre-treatment to post-treatment for introverts but not for extraverts. There was no decrease in trait anxiety scores for either group.

Type A and Type B behavior patterns can also be classified as a personality variable. Rosenman and Friedman (1974) first identified Type A behavior as a complex of emotional reactions which they believed was a major cause of coronary artery and heart disease. The Type A Behavior Pattern is observed in an individual who is "aggressively" involved in a "chronic, incessant" struggle to achieve more and more in less and less time. In our society this condition is a socially accepted and rewarded form of behavior and in fact outside approval may reinforce Type A's behavior. The Type B behavior pattern is the opposite of the Type A individual. Type B's are rarely engaged in trying to obtain in-

creasingly larger numbers of things or trying to engage in numerous events in decreasing amounts of time. They seem not to be affected by societal approval (Friedman and Rosenman, 1974; Yarian, 1976). It was the conclusion of Friedman and Rosenman that Type A individuals were experiencing an increased amount of stress and anxiety due to their characteristic personality attribute and these unique characteristics could be responsible for further damaging health factors such as increased cholesterol levels and increased blood pressure. Yarian (1976) found that indeed, Type A's had significantly higher muscle tension levels (pre-treatment, resting mean EMG levels) than did Type B's; also Type A's receiving EMG biofeedback were able to reduce their mean baseline EMG levels significantly more than did Type B's. Yarian suggested that Type A's excell in specific task oriented skills due to their need for outside approval. Also, even though Type A's become more anxious than their Type B counterparts during times of relaxation, the visual feedback of their progress in EMG biofeedback served as an indicator of "work being done", even though that work was relaxing further and further.

The above studies suggest the importance of two personality constructs previously known to effect conditioning for muscle biofeedback training. It seems clear that more personality attributes need to be studied. Rotter (1972) has suggested that one's locus of control (an individual's perception of whether or not one has control over what happens to him/her) is important to consider in situations where individuals need to solve problems. He argued that people develop generalized expectancies in problem solving situations. The general expectancy is that success in these situations is either dependent upon their own behavior or upon external forces such as luck or chance. A series of studies

(Rotter, Chance, Phares, 1972) support the hypothesis that the individual who is labelled internal (scored below the median on the I-E scale) is likely to:

1. Be more alert to those aspects of the environment which provide useful information for future behavior.
2. Take steps to improve his environmental condition.
3. Place greater value on skill or achievement reinforcement and be generally more concerned with ability, particularly his/her failures.
4. Be resistive to subtle attempts to influence him.

One recent study substantiates these characteristics in a biofeedback setting. Schneider, Sobol, Herrman and Cousins (1977) studied the relationship between locus of control and biofeedback mediated voluntary heart rate change. Their results showed that "internals" proved to be significantly better than "externals" during heart-rate speeding trials taking better advantage of feedback information when provided. Rotter (1966) mentions that internals are more aware of environmental cues which may be useful in the future and it is likely that the internals attempted to gain increased awareness of their internal milieu via the provided biofeedback - anticipating the usefulness of this information for heart rate control.

This evidence suggests that individuals with an internal locus of control should be able to accelerate learning when appropriate cues are presented, however, learning may be retarded when such cues are not presented. In general, the construct of locus of control may predict individual success at a given relaxation technique. It will be the purpose of this study to determine whether or not relaxation techniques such as EMG biofeedback, PMR, or EMG facilitated PMR (EMG/PMR) can effect reduced

muscle tension and to what extent do the differences between these treatments effect the learning of internally and externally controlled subjects. Furthermore, it will study the ability of these subjects to return to a relaxed state after having been exposed to a psychosocial stressor on a subsequent day.

Statement of Problem

The purpose of this study will be to investigate the relative efficacy of four relaxation techniques for reducing two specific stress reactions, muscle tension and anxiety. The four techniques are: (1) listening to music; (2) training in modified progressive muscle relaxation (PMR) skills; (3) the use of EMG biofeedback to facilitate training in PMR (EMG/PMR) and, (4) the use of EMG biofeedback alone (frontalis muscle group connection) to enhance relaxation.

The study will further investigate the importance of the trainee's perceived locus of control in determining one's ability to benefit from the experimental technique. Since one of the important variables operating in any learning situation seems to be the trainee's generalized expectation for solving problems, the experimental training techniques will be applied to two groups of subjects; one group known to have internalized expectations for problem solving (internally controlled) and the other group who externalize control in problem solving situations (i.e., attribute control to the environment).

Hypotheses

1. Subjects provided with music to enhance relaxation will report more anxiety and experience more tension during the post training exposure

to the stress evoking film than subjects in the other three training groups.

2. In the music training group reported state anxiety will be reduced less following the exposure to the stressor film than in the other three training groups.

3. Internally controlled subjects trained with EMG biofeedback will be more successful in reducing tension than externally controlled subjects.

4. Subjects trained in PMR will report more anxiety and more tension during the post training exposure to the stress evoking film than (1) subjects trained in EMG biofeedback facilitated PMR and (2) subjects trained in EMG biofeedback.

Definition of Variables:

A. Independent variables

1. Locus of control - (as measured by Rotter's I-E Scale). The degree to which an individual perceives that the reward follows from his or her own behavior, as opposed to the degree to which he or she believes the reward is controlled by forces outside of oneself.

a. External control - The person perceives that a result is due to luck, chance, fate or under the control of powerful others.

b. Internal control - The person perceives that the event is contingent upon his or her own behaviors or his or her own rela-

tively permanent characteristics.

2. Progressive muscle relaxation (PMR) - A technique of relaxation based on Jacobson's method (1938), using deliberate release of muscle tension moving from one large muscle group to another until the individual is completely relaxed. Techniques used in this study were developed by Wolpe and Lazarus (1966).

3. EMG Biofeedback Training - An electrical system designed to monitor and then display to the individual immediate and/or continuous electrical signals which represent the muscular activity.

B. Dependent variables

1. Muscle tension - The amount of electrical energy generated by muscle fibers during contraction.

2. Subjective anxiety level - Self-reports of anxiety as measured by the Multiple Affect Adjective Check List (MAACL) and the State-Trait Anxiety Inventory (State-anxiety felt at the moment of testing; trait-anxiety felt in general).

3. The average EMG levels (measured in mean microvolts) during exposure to stress inducing film.

C. General

1. Muscle relaxation - A reduction of quantity of electrical energy generated by muscle fibers during contraction.

2. Stress inducer - An experimentally developed stressor situation facilitated by the use of the film, It Didn't Have to Happen.

Chapter II

REVIEW OF LITERATURE

This chapter presents a review of the current literature concerning the relationship between anxiety, psychosomatic disease and methods of individual stress reduction including meditation, progressive muscle relaxation and electromyograph biofeedback.

A. Stress and Anxiety in Modern Times

It seems to be generally accepted that there is a specific relation between stress and anxiety, on one hand, and modern life, on the other. New therapeutic techniques, especially those in behavior therapy and recent research findings on psychosomatic medicine might be thought of as reflecting the relationship between stress and anxiety, and modern life. The twentieth century with all its technological advances, is sometimes referred to as "the age of anxiety". Anxiety, whether it be fear, apprehensiveness, or mental anquish has been a central explanatory concept in theories of personality and psycho-pathology and is regarded as a principal cause of such diverse behaviors as insomnia, psychological and psychosomatic disorders, immoral and sinful acts, and even creative self-expression (Speilberger, 1976a).

Anxiety

Spielberger (1965) simplified the definition of anxiety by observing two different conditions which researchers generally labelled as anxiety. One of these was the state of anxiety which is manifested by such

symptoms as rapid heartbeat, dry mouth, hot flashes, chills, sweating, excessive urination, sleep loss and loss of appetite. This is called state anxiety and it is a physical condition which usually appears when an individual is under stress and has clear-cut symptoms which demonstrate its presence. The other condition, labelled trait anxiety, on the other hand, is a personality characteristic of relatively long standing which pre-disposes the individual to manifest state anxiety in even moderately stressful situations. Anxiety is an adaptive mechanism which is a human emotion, fundamental in coping with danger (Speilberger, 1976a). However, constant use of this adaptive mechanism can cause "anxiety states", which are classified as a form of psychiatric illness termed neurosis. Using this definition of neurosis, Fraser (1947) found during a six month period of World War II, that neurotic illnesses caused between a quarter and a third of all absences from work in Great Britain. Absenteeism represented a per annum work loss of three days for all men and six days for women. Furthermore definite correlations between unsatisfactory social relationships, work dissatisfaction in the factory and neurotic illness was reported. In another British study Finlay, Gillison, Hart, Mason, Mond, Page and O'Neill (1954), found that one out of five patients seen in an urban practice was suffering from stress disorders. Studies done in Canada and the United States substantiate the British studies. In the Stirling County study (Leighton, Harding, Macklin, Huges and Leighton,1963), trained researchers administered a structured interview to over 1,000 head of households or their wives in an Atlantic Canadian provence. Psychiatric review of the interviews resulted in 577 out of 1,000 people being judged as "genuine psychiatric cases" (neurotic type). The Midtown Manhattan Study

(Srole, Langner, Michael, Opler and Rennie, 1962) suggested that 23% of the population could be regarded as suffering from serious psychiatric symptoms and some degree of impaired functioning.

A large scale study germane to an examination of anxiety in the community was undertaken by Taylor and Chave (1964). It involved recording the prevalence of various types of mental illness in the community at large, in general practice and in the hospital practice of a newly erected residential community, an established suburban community and of a decaying area of London. The purpose was to delineate the influence of environment on mental health. The results showed that clearly one out of three individuals interviewed showed above average "nervous symptoms", this figure being approximately the same for the three environments sampled. What was overwhelmingly apparent was the high prevalence for mental ill health, with anxiety being an important component.

More recently a study with equally disturbing results was reported. Salkind (1973), dissatisfied with current rating scales for anxiety, developed the Morbid Anxiety Inventory (MAI). The instrument was a 21 question survey dealing with various aspects of anxiety (i.e. self-assessment of worry, shaking of hands, headache, sweating). The MAI was validated in several ways including against the physiological concomitants of anxiety (i.e. palmer sweat-gland activity). The inventory was found to be sensitive to changes in anxiety levels. Forty-four interviewers obtained full data on 450 subjects. Taking an MAI score of 14 (clinical validation studies suggested that a score of 14 was adequate to differentiate between non-anxious and anxious subjects), as the criterion, 44% of the adult population were anxious. If a more conservative criterion of 17 was used,

31% fell into the anxious group. Scores increased with advancing age in lower social groups and male groups, and there was no difference between anxiety levels of the urban and rural population samples. It appears that the environment of the individual might not be as important a stressor as the situational experience of the individual, males, elderly and the poor reporting higher MAI scores.

Toffler (1970), Dodge and Martin (1970), Holmes and Rahe (1967), and others have suggested that rapid social change and problems in coping associated with it (e.g. advancing age, status incongruity and increased stressful life events) are responsible for high incidence of anxiety as well as the tremendous increase of chronic diseases. In today's highly technological and changing environment, problems such as air and water pollution, overcrowding, high crime rates, escalating unemployment and inflation have forced many doctors and health authorities to examine human ecology and its impact upon individual needs as part of the total system for health maintainence.

Pelletier (1977) in studying the acute degree of continuous change in modern life has identified at least eight areas which he describes as "stress triggers." Although Pelletier is in accord with others who suggest that many of the environmental triggers of stress are readily apparent, he suggests there are other stressors which affect people equally strongly, but which are not evident on a conscious level. Briefly, Pelletier's unobtrusive stress triggers include:

1. developmental stresses - events usually regarded as normal milestones occuring during a telescoped period of time.

2. social disorganization - i.e., moving from one geo-

graphic area to another, no matter how similar in nature, which tends to overburden the adaptive capacities of an individual, leading to illness (Moorman, 1950; Wolffe, 1968).

3. economic recession.

4. socially acceptable addictions - i.e., alcohol, self-administered tranquilizers or coffee as a stimulent and anti-depressant.

5. idolization of youth/devaluation of the elderly.

6. no clear belief system - devaluation of spiritual concerns in contemporary society.

7. job stress - lack of harmony between the individual and his work environment; boredom on the job.

8. technological innovation - technology which has greatly increased the necessity for rapid and frequent adaption.

Pelletier proposes that these psychosocial correlates are responsible for increasing psychosomatic disease.

Stress and Psychosomatic Disease

Prolonged stress, chronic anxiety and increasing changes in the environment can be linked to other diseases and physiological problems; such disorders are usually called psychosomatic illnesses. The term psychosomatic indicates a relationship between psychological processes and bodily organs (Psyche=soul or mind, some=physical organism; Greek) (Lachman, 1972). Psychosomatic, therefore, points up the wholeness of the individual and the relationship that exists between the psychological and somatic aspects of the individual. In a disease that is psychosomatic

there is no external toxin, no penetrating inanimate object and no disease agent such as a virus or bacteria. What is evident though, is a significant emotional stimulus or long term exposure to an aggravating situation (Lachman, 1972).

However, diseases other than those typically referred to as psychosomatic in nature can be linked to stress. According to Selye (1976), in trying to maintain a homeostatic balance during stress, the body becomes "worn-out" in the prolonged process and becomes suceptable to various infections, he calls these diseases "diseases of adaption." Top (1964) feels that this stress concept serves to explain the occurrence and reoccurence of infections, and observes that germs only multiply and invade when host resistance has been lowered by environmental stress.

The work of Harold Wolffe (1968), showed that the health of the individual is closely tied with the adaptive demands placed on him/her by the environment. In his most classic work on the gastro-intestinal system, instructive findings based on a patient with a gastric fistual (an artificial opening through which the stomach can be directly seen), showed that during a period of prolonged emotional conflict involving hostility and resentment, the lining of the stomach became engorged with blood and eventually began to bleed through ulcerations which formed on its surface. He concluded that constant stress may contribute to high incidence of psychosomatic disease (i.e., ulcers).

Harburg (1970) studying "high stress" inner city neighborhoods found that individuals living there had significantly higher blood pressure than matched controls who lived in low stress neighborhoods. Cochrane

(1971) presented a review of the literature, firmly establishing that perceived stressors were a major factor in the etiology of hypertension. An important aspect of his work was the establishment of four criteria which have to be met before hypertension can be considered of psychosomatic origin. First, the physiology of hypertension must not be incompatible with the psychosomatic explanation; secondly, the case would be strengthened if hypertension could be produced experimentally by manipulating variables, also, there needs to be a relationship between experimental factors and the onset of hypertension, and lastly, a difference between susceptable individuals and those who are not susceptable is expected. Cochrane concluded that hypertension could be produced experimentally and its incidence was highly correlated with psychosocial stress (i.e., felt stress in the environment). Cochrane's four criteria for determining that hypertension is of a psychosomatic origin can be equally applied to other presumable stress related disorders. Some of these stress related disorders include:

1. coronary artery disease - it has been suggested that various stressful conditions, including time pressure demands lead to emotional reactions that provoke coronary disease. One study (Dublin and Spiegelman, 1947) found one fourth of all physician deaths between ages 45 and 65 were reported as due to coronary artery disease, while Enos (1953) reported gross evidence of coronary artery disease in autopsies of U.S. soldiers killed during the Korean conflict (mean age=22).

2. Bronchial asthma - The role of suggestibility in the symptoms of asthmatics has been demonstrated by Philipp (1970),

when his subjects were presented with a neutral substance but were informed they would experience breathing difficulties, Philipp obtained asthmatic responses. His subjects also reacted less intensively to a known bronchospasm-inducing drug, when told that it was a neutral substance.

3. Raynaud's Disease - Mittelmann and Wolf (1943) measured skin temperature in known Raynaud's sufferers. They found consistant relationships between emotional circumstances and skin temperature. Vaso-constriction tended to be associated with increases in conflict, while vasodilation was associated with emotional security. The researchers demonstrated that blood vessels of the skin are highly sensitive to emotional situations.

It was a colleague of Wolffe, Dr. Thomas Holmes, who developed the idea that change itself, whether negative or positive that was one of the important environmental factors in stress. This position is based in part upon Selye's notion that "stress is the state manifested by a specific syndrome which consists <u>of all the nonspecifically-induced changes</u> within a biologic system" (Selye, 1976, p. 64). Holmes expanded the notion of a specific syndrome to include patterns of behavioral coping which are taxed by rapid social and interpersonal change. Thus, stress (non-specifically induced biological changes), as well as increased psychological tension (i.e., anxiety) are triggered by rapid social change.

Relationship Between Environment and Stress

When rapid, intense, or unexpected change in the environment is

encountered many physiological changes occur almost instantaneously. The pupils of the eyes dilate, hearing becomes more acute, muscles "involuntarily" direct one's senses toward the new or different stimulus (e.g., leaning toward a sound or squinting), skeletal muscle tension is increased, brain wave patterns change, blood is shunted from the extremities to the internal organs of the body and the brain and sweating occurs on the palms, while breathing and heart rate increases. Neurophysiologically, individuals will experience excess secretions of epinepherine and norepinepherine which are responsible for the effects of increased heart-rate,cold hands, increased muscle tension and even tremors. These events have been defined as "stress arousal" by Selye (1956), and Cannon (1929), but also share an identical definition with the physiological events which are correlates of what some psychologists have called the orienting response. The orienting response is a response to a change in environment but it also seems to play a key role in anxiety neurosis. The orienting response is designed to enable the individual to see and hear better and readies the muscles for sudden movement. It appears to be physiologically equivalent to the triggering response initiating what Cannon (1929) referred to when he described the "fight or flight" syndrome. It also appears that these same fight or flight reactions triggered the stress which Selye (1976) referred to as the constant wear and tear on the body.

Selye (1976) further suggested that it is impossible to be alive and not experience stress daily. Most people are able to meet the constant daily events (that trigger the orienting response) with adequate coping mechanisms most of the time. There are clearly individual differences in

tolerance for orienting response triggers as there are individual differences in the stress patterns which follow. Thus, many will only occasionally experience what Selye (1976) referred to as "distress", whereas others may experience distress almost continuously to the same environment stimulus. On the other hand, if as Lubin (1965) suggested overloading the environment with stressors will produce an equivalent of the orienting response in anyone (if the overload is sufficient) then all of us are vulnerable to stress and disorders of stress.

Ideally, the internal products of stress are dissipated, consumed, or subside before we encounter another stressful situation. In our highly competitive and production oriented urbanized culture such is less likely to be the case. Thus, stress and stress arousal become health problems when for one reason or another the increased heart-rate, elevated blood pressure, increased muscle tension or the orienting response do not subside. If stressors are strung together, prolonged, or are too intense the body cannot maintain a homeostatic balance and illness or death can occur. The work of Hans Selye is regarded as the classic in the study of stress. Selye (1976) has divided the stress reaction into three stages, called the General Adaptation Syndrome (G.A.S.). The first stage, or alarm reaction, is instigated by the orienting response. According to Selye, during this alarm reaction the adrenal cortex (having been stimulated by ACTH produced in the pituitary) becomes hyperactive, overproducing hormones that help the body cope with the stressor. The usual result is the restoration of homeostasis (inner body balance). No living organism can be maintained continuously in a state of alarm and if the body is confronted with

a stimuli so powerful that continuous exposure to it is incompatible with life, then death occurs during this alarm reaction within several hours or days. If survival is to occur the reaction is necessarily followed by a second phase which Selye called the stage of resistance. In this stage a new level of physiological balance is achieved and many of the occurances in the first stage are reversed. For example, during the first stage cells of the adrenal cortex were depleted of their hormones and hormone secreting granules. In the stage of resistance the cortex accumulates a reserve of secretory granules. However, after more prolonged stress, this new adaptation ability of the body is lost. The individual enters the third phase, the stage of exhaustion, where the symptoms resemble those of the first stage. Under conditions of prolonged exposure to the stressor, resistance cannot be maintained and the bodily resources are depleted. If the stressor persists for sufficient time, death will occur (Lachman, 1972; Selye, 1976).

This adaptive response (G.A.S.) can be set into action not only by shifts and changes in the physical environment but also by the psychosocial climate. Thus, even anticipation of change can trigger this response when there may be no real threat to the individual at all. For example, filmed violence is of no direct harm to the audience yet the G.A.S. has been documented in the viewers. In a study by Levi (1969) a group of Swedish male medical students were shown film clips depicting murders, fights and torture. The amount of stress these scenes produced, measured by urinalysis, revealed that subjects' epinepherine rose an average of 70 percent (as measured pre and post stressor exposure) and nor-ephinepherine rose an average of 35%. Another study by Levi (1969) demonstrated the non-specific stress effect of seemingly innocuous films. A group of female office

workers were shown four different types of films on successive nights (a travelog; Kubrick's Paths of Glory, bringing about anger and excitement; a comedy; a thriller). After the travelog the catecholamines fell, however after each of the other three films, the catecholamine levels were significantly elevated eventhough they represented differing types of emotions.

Levi's studies seem to suggest that by living in modern technological communities one places oneself under changeful circumstances that can cause profound changes in one's hormones. Competitive situations, living in a crowded environment or merely contact with the complex human situation almost automatically causes stimulation of the endrocrine system. A study by Calhoune (1963) examining overcrowding (crowding defined as a high level of interaction) resulted in findings that showed a lower fertility rate and high infant mortality rate for the sample crowded rat population as opposed to a non-stressed uncrowded population. He also noted that stressed rats tended to change their pattern of interaction. This behavior continued until the population was reduced to a more comfortable number. Calhoune's study reinforced Selye's report that under stressful situations menstruation ceases or becomes irregular, lactation may be insufficient for the offspring, and in men, the sexual urge and sperm formation are diminished.

Clearly, anxiety has both psychological and physiological effects on humans. The list of physical disorders which have been related to chronic anxiety include chronic tension headache, functional bowel trouble, migraine headaches, some forms of dermatitis (Lazarus, 1971), nervous peptic

ulcers, spastic colon, hypertension, and coronary heart disease (Wolffe, 1968; Jacobson, 1957). The last disorder on the list is of particular interest. Jacobson presented preliminary data supporting the notion that chronic anxiety among soldiers in the Korean Conflict apparently was responsible for high levels of arteriosclerosis which is known to be a major factor in heart attacks.

More recently Friedman and Rosenman (1975) presented strong evidence showing long term chronic anxiety can have serious deleterious effects on the heart and circulatory system. They also stated that chronic anxiety can advance arteriosclerosis and increase the probability of heart attack.

Chronic anxiety and tension are disorders which adversely affect both the mental and physical health of a significant portion of the general population. Considering this impact, it is purposeful then to study how individuals can intervene in this vicious cycle of events to reverse the stress arousal or diminish and neutralize life's stressors. It may be the role of health education and health counseling to support and aid in society's struggles to handle its stress.

B. Intervention to Reduce Anxiety

If all normal living causes wear and tear on the body, and excessive or prolonged stress can exacerbate psychological problems the question now becomes, how can one learn "to handle" stress? or how can one maintain a healthy condition? The word health is derived from the Old English word "hoelth", meaning a status of being safe and sound. After World War II the World Health Organization (1947) redefined health as "a state of complete physical, mental and social well-being and not merely

the absence of disease or infirmity" (Sorochan, 1968).

The Presidents' Commission on the Health Needs of the Nation (1953) suggested the following view of health:

> "Implicit in the expression promotion of health is the idea that there are gradations of health, that everyone is affected by a specific disease or disability is not equally healthy....At present, gradations of health in this positive sense are not measureable, but the concept has definite, understandable meaning.... Health is not a condition; it is an adjustment. It is not a state but a process. That process adapts the individual not only to our physical but also to our social environment." (Sorochan, 1968).

The definition of health has advanced from a condition of survival, to that of "free from disease", to a process of well being or "high level wellness". In this process of wellbeing it is necessary to make adjustments and adaptations to the environment so that one's homeostasis can be kept in balance. Earlier it was suggested that Holmes and Rahe (1967) were successful in predicting illness by examining the changes individuals experienced during short periods of time. Accepting the notion that stressful life events lead to illness, an individual can intervene in this syndrome by acting to eliminate many social stressors by rearranging one's life or personal life-style; a process called social engineering. The changes or events listed on Holme's Schedule of Recent Events (S.R.E.) are normal life events that disrupt daily routine. The most disruptive event on the scale is the death of a spouse, with the mid-point anchor being marriage and less disruptive events such as vacations and Christmas as minimal disruption anchors. Holmes found that the greater number of such events and the more disruptive the events to the individual, the more likely he/she was

to become ill. In another study Rahe (1972) found that as the scores on the SRE increased, so did the severity of the disease.

Significantly changing one's life-style to reduce stress requires great latitude in one's responsibilities at home and at work, a freedom many of us are unwilling or unable to exercise. However, another intervention into the anxiety-stress-disease continuum which seems a less threatening step is to allow the stressor to remain, but personally alter the perception of that particular occurrance. The importance of perception is paramount in discussing psychosocial, emotional and even physical stressors. Selye (1956), has reported repeatedly that what might be one man's stress, is another man's pleasure. The cortical analysis of the stimulus determines whether or not an interpersonal or psychological event is perceived as a stressor. Thus, one may be able to engineer their own perceptions of the stressor or its subsequent effect and palliate the stress response.

There are numerous paths that may lead to perception change. Chemotherapy is one such pathway. According to Goleman (1976a) Librium and Valium, popular anti-anxiety drugs, comprise the number one prescription written in America today. Both these drugs are tranquilizers, useful in the symptomatic relief of tension and anxiety states resulting from stressful situations, but this relief does not touch on the solution for a reduction of stress. Much chemotherapy may be self-prescribed. An example of this is alcohol consumption, uncontrolled and not monitored, the drug of choice for ten million alcoholic adults. As a central nervous system depressant, alcohol mediates the perception of events at the cortical level. Barbara Brown (1974) discussed drug use among the young and acknowledged the prevalence of tension in the "hang-loose" generation. She drew a para-

llel between the young people and their parents, suggesting that the popular use of marijuana (a drug which distorts perceptions as it affects the integrative centers of the brain) is a means of relieving tensions, mirroring their parents use of alcohol.

Drugs first used to alter awareness or consciousness can be used in greater quantities to dull or depress responses to a stressor. The use of chemical strategies for reducing arousal have major disadvantages. These disadvantages include the temporary condition of relief and dependency upon these chemicals during extended stressful situations leading to addiction (alcohol, barbituates, opiates). Under chemically altered states of consciousness, one is operating, often times, under a "fogged" or "drugged" state which may impair daily functioning. Due to the disadvantages of anti-stress drugs, (both medically and self-prescribed), much research has begun to find effective non-chemical ways of dealing with stress (Goleman, 1976a).

Meditation

Eastern cultures have valued the ability of man to determine his inner being for centuries. Yogis and Zen Masters suggest that discovering "inner" awareness is within the power of everyone and can be used to discover "spiritual awareness...communion and unity with the all and nothing of the universe" (Brown, 1974). It is during this state of altered consciousness that physiological arousal can be diminished. Specifically, skills such as meditation produce self-induced altered-states which dampen physiological stimulation. As discussed earlier (Chapter I, pg.3) the Control Gate Theory (CGT) can be used to explain this phenomenon.

Meditation applies the central theory of the CGT where stimulating the gate from the cortex, closes it, barring impulses from reaching the cortex from other parts of the body and visa versa. Physiological events during meditative states constitute a configuration opposite to that of a hyper-arousal reaction to stress. In other words, during this state of altered consciousness, one's heart rate is decreased, oxygen intake is reduced, blood pressure decreases, and changes occur in brain waves patterns; increased alpha and theta waves (Wallace and Benson, 1972). This pattern of response suggests generalized sympathetic nervous system inhibition.

Consequently, meditators might be expected to cope more effectively in stressful situations. Goleman (1976a) reported a study where this hypothesis was tested, using beginning and experienced meditators and a control group. His subjects were compared on life changes (Holmes and Rahe, SRE Scale) and illness reports. The meditators had higher SRE scores, but had less illness than the controls. Also, the experienced meditators had the highest scores and the least reported illnesses, suggesting that the ability to handle stress increased with the practice of meditation. In order to study specific physiological changes (heart rate and skin conductance) in meditators under stress, Goleman (1976b) selected 30 experienced meditators and 30 people interested in meditation (but not experienced) as subjects. One of three treatments was randomly assigned to each subject. The subjects were asked either to meditate with eyes closed (new meditators were taught to meditate in the experimental setting), to sit with eyes open and relax, or to sit with eyes closed and relax. After a four minute baseline and a 20 minute treatment session

the subjects saw the twelve minute industrial accident film, It Didn't Have to Happen. (This film is a standard way of inducing stress in laboratory studies. See Davidson (1971) and Lazarus (1968)). The subjects were then asked to relax for five more minutes. The results of the study indicated that experienced meditators underwent significantly higher heart-rate acceleration and increased sweating prior to the depicted accidents than did the non-meditators, but as soon as each accident scene was over the meditators recovered more quickly than did their counterparts. During the five minute relaxation period the meditators were more relaxed (slower heart-rate; increased skin conductance) than the non-meditators. According to Goleman (1976a) rapid recovery from stress is a typical trait of meditators. Even the subjects who meditated for the first time in the laboratory, were less anxious (measured by the State-Trait Anxiety Inventory) after the film and recovered more quickly than the non-meditators. This study may explain the lower incidence of anxiety and psychosomatic disorders among meditators.

As was mentioned earlier, most individuals that suffer from stress related disorders, have something in common when reacting to stress; their bodies mobilize to meet the challange, then fail to stop reacting when the problem is over (Goleman, 1976a). All the initial physiological changes are necessary to enable the individual to react to the stressor, but continuous arousal even after the stress has passed does not allow for the relaxation and recouping of energies necessary to meet the next stressor.

It is beginning to appear from the review of literature that meditation is an invaluable skill in alleviating physiological arousal. Simple

relaxation skills such as those used by French (1974) also have been found successful in dealing with stress related problems of sleep disturbance and anxiety states. The subjects sat in a chair and experienced a brief one minute muscle relaxation process followed by the use of a pleasant, relaxing memory used as the center of attention for meditative concentration. This method appeared to be useful in the management of patients with serious medical problems. The use of specific exercises designed to promote muscle relaxation and thereby reduce anxiety (much in the same way meditation works, only using the peripheral theory of the C G T - Chapter I, pg. 3) have been under research scrutiny for years. It is necessary then to review the literature on muscle relaxation.

Progressive Muscle Relaxation (PMR)

The history of progressive muscle relaxation (PMR) training can be seen in two phases. The first phase began with the conception of the model by Dr. Edmund Jacobson, and the second phase was initiated by Dr. Joseph Wolpe who modified Jacobson's procedures and used them in a desensitization problem (Bernstein, 1973).

According to the early studies of Jacobson, muscle tension (shortening of muscle fibers) was reported in patients that were diagnosed as "anxious" and that anxiety in these patients could be eliminated by the reduction of the muscle tension (Jacobson, 1938). He found that by systematically tensing and releasing various muscle groups, and by learning the feelings associated with tension and relaxation a person may eliminate the muscle contractions and feel deep muscle relaxation (Jacobson, 1938). As of 1962 the basic relaxation procedure involved fiften muscle groups.

Each group was dealt with for from one to nine hours daily before proceeding to the next group for a total of 56 sessions of systematic training (Jacobson, 1963).

The second phase in the development of PMR began with Wolpe's work in the counterconditioning of fear responses. He demonstrated that a conditioned fear reaction could be eliminated by evoking an incompatible response, such as deep relaxation, while presenting the feared stimulus (reciprocal inhibition). However, due to the lengthy training period of Jacobson's PMR, Wolpe was forced to modify the relaxation training so it would fit into the constraints of a therapy session (Wolpe and Lazarus, 1966; Bernstein, 1973). The resulting modification of the original 56 session Jacobsonian PMR, involved six 20 minute sessions with two fifteen minute daily practice sessions at home.

Much research has been completed in the area of relaxation training. Jacobson (1939, 1940) produced decreased blood pressure and pulse rate in subjects following relaxation training. It was later shown (Drvota, 1962; Clark, 1963; Wolpe, 1964) that skin resistance increases and respiration becomes slower and more regular during relaxation. Mathews and Gelder (1969) reported that although no significant differences were found in heart and respiratory rates, relaxation training resulted in significantly lower muscle tension and skin conductance.

In a study by Paul (1969a) PMR was compared to hypnotic suggestion and control procedures in regards to reduced physiological arousal and subjective distress. Sixty female college students were exposed to two half-hour experimental sessions, seven days apart. Twenty subjects were

trained in PMR, twenty received direct hypnotic suggestion (designed to produce relaxation), and the remaining twenty were told to sit quietly and relax. Pre and post assessment was made on self-reported anxiety, muscle tension, heart-rate, skin conductance, and respiration rate. During the first session the PMR group showed greater relaxation by all measures than did the control group. The PMR group also significantly reduced heart-rate and muscle tension compared to the hypnotized group. During the second session the results were replicated. Paul concluded that PMR is superior to hypnotically induced or self induced relaxation.

Another study, using the same subjects, (Paul, 1969) attempted to measure the success of PMR in decreasing physiological arousal to stressful imagery. Pre and post imagery data was collected, as was a composite response to the stress-imagery. Arousal in response to the post imagery increased for the control group and decreased for both PMR and hypnotically induced relaxation groups. The relaxation group evidenced the greatest reduction of arousal. The author concluded that relaxation (PMR or hypnotic) produces inhibition of physiological arousal to stressful visualization.

By using a visual stressor (the film It Didn't Have to Happen), Davidson and Hiebert (1971) investigated the efficacy of two relaxation procedures, abbreviated PMR and simple instructions to relax. Twenty-seven female student nurses were randomly assigned to three treatment groups, relaxation training (PMR), relaxation instruction (RI) and a control group. The subjects in the PMR group were given two training sessions prior to the experimental session. Tapes were used for training which followed the instructions given by Wolpe and Lazarus (1966, pp.

177-180). The subjects in the RI group were given no training in relaxation but were told to relax as much as possible during each film showing. The control group was not trained or instructed to relax.

All subjects were shown a 92 second film section from the stressor film which was repeated ten times (two minute break between each showing). Prior to the film and after the first, second, sixth and tenth showings the subjects were asked to complete Zuckerman's Affect Adjective Check List. Measurement was taken on skin conductance.

The results indicated that subjective anxiety decreased over showings for all three groups. Physiological arousal decreased significantly across showings for both groups PMR and RI but not for the control group. There also was no significant differences on any of the measures between PMR and RI. An interesting outcome of the study was the need for repeated exposures to the stressor prior to observable changes due to treatment. Had the data been compiled after only an initial exposure to the film it would have been concluded that relaxation training or relaxation instruction was not capable of reducing physiological arousal and subjective distress under stress conditions. However, the conclusion after 10 showings was a qualified "yes". Another interesting finding was that contrary to Lazarus' (1968) suggestion habituation to the film did occur on the subjective anxiety measure and on skin conductance for two of the three groups. Davidson and Hiebert's major conclusion supported the findings of Paul and Trimble (1970) that taped relaxation training may be no more effective in reducing physiological arousal than simply asking a person to relax. However, Donner and Guerney (1968) found it was the presence of the experimenter that was significant in desensi-

tizing subjects using taped relaxation instructions. Sessions where the experimenter remained, produced expected relaxation results.

Recently, tape recorded relaxation instructions have been included in several successful relaxation training programs (LeBoeuf, 1974; Reinking and Kohl, 1975; Townsend, House and Addario, 1975).

Edelman (1970) studied a music assisted relaxation group in comparison with a taped PMR group (Wolpe and Lazarus, 1966), a group hearing only the statements from the PMR tape which provided direct suggestions to relax (i.e. contained the word "relax" in any of its grammatical forms), and a group which heard via tape, instructions for movement (at the same temporal intervals as the Wolpe tape) without alluding to actual relaxation. Measurements of autonomic activity (blood pressure, heart-rate) occurred at set breaks in the taped instructions. Results from this experiment did not support the contention that PMR was particularly effective in altering autonomic reactions. Edelman reported a second experiment where pre-post experimental measures of state anxiety were obtained as an independent indicator or relaxation (based on the assumption that relaxation and anxiety are inversely related). Forty male students chosen on the basis of their high or low anxiety scores (STAI), were instructed in the same manner as in the first experiment. Again the results cast doubt on the hypothesis that PMR exerts any unique effect upon autonomic function, although significant decrements in both state and trait anxiety were obtained. The most significant finding of the study was a greater decrease in trait anxiety in the high anxious subjects who received PMR, than any of the other groups.

Findings such as Edelman's (1970) and Davidson's (1971) imply that PMR can be used to decrease physiological arousal and decrease trait anxiety.

However, Lazarus (1970) suggested that relaxation training has a more general value and in 1971 Lazarus himself produced a set of progressive relaxation tapes. In this series he presents the ability to relax as a generally valuable skill, not just a step in systematic desensitization, or chronic anxiety treatment.

Another advocate of systematic desensitization who has reached similar conclusions is Marvin Goldfried. He presented data (1974) to imply that the training of an individual to use relaxation skills in everyday life was the critical aspect of systematic desenitization. He suggested that relaxation techniques are active coping skills, rather than passive re-pairing of relaxation to formerly learned stimuli (the systematic desensitization model).

Very similar views on the nature of relaxation training are presented by Johann Stoyva and Thomas Budzinski (1975). They contended that highly stressed people will show physiological arousal in one or more bodily systems and that over time they lose the ability to relax well. Stoyva and Budzinski further observed (using known successes of systematic desensitzation and experiments on biofeedback induced muscle relaxation as evidence) that response to stress, the stress arousal, can be modified. They contended that relaxation training teaches subjects a technique for actively responding to stressful situation by working to relax.

Biofeedback

According to Barbara Brown (1974) the expression "feedback" was developed in the engineering field to define control systems that operate

via feedback mechanisms; those systems which operate by their ability to detect changes in the environment of their operation, then to make internal adjustments so that their functions remain optimal and continuously appropriate to the demands of the environment.

Biological feedback systems have been identified over the years as they work within the body. Information about the external environment can be sensed by the body and relayed to the brain where it is integrated with other necessary information, and when the information becomes significant the body responds with appropriate changes. Pupil accomodation for near and far vision, perspiration and sneezing are some example of feedback control systems.

A new technology developed after World War II dramatically improved the efficacy of relaxation training by imitating biological feedback systems in that immediate information feedback on the individuals tension levels could be observed. In its present state electromyograph biofeedback (EMG) operates by employing simple electrical devices to detect signs of inner physiological activity, in this case muscle tension, and then feedback this information to the individual. The most common form of EMG feedback is through a constant volume tone whose frequency falls as muscle activity declines (Budzinski, Stoyva, 1969).

Frontal Muscle Tension

Most tension researchers studying EMG feedback have preferred to collect data from the frontalis muscle group for several reasons. The frontalis muscle is an easily accessible muscle which is not involved in maintaining bodily posture. The muscle moves very little under the skin

as its tension level changes and so it is relatively easy to locate electrodes over the same approximate muscle region consistantly. Finally, attachment of electrodes can be achieved quickly and easily using a headband or adhesive disks and there is little risk of electrodes being dislodged by body movement. The research completed in assessing the relationship of lowered frontalis tension and reduction of tension in other skeletal muscles is substantial.

Stoyva and Budzinski (1975) presented evidence in a study determining whether some muscles are better than others for promoting general muscle relaxation. They trained three groups of normal college students in a ten session experimental program which included one habituation session, two baseline sessions, five relaxation training sessions and two post-training follow-up sessions. Group A received EMG feeback from the frontalis muscle group. Group B received EMG feedback from the forearm extensor muscle and Group C received false feedback. The results showed only the Frontalis EMG feedback subjects produced a decline in EMG levels of both the forehead and the forearm.

In another study testing the assumption that EMG biofeedback readings of the frontalis muscle activity will generalize to other muscles of the body, Glaus and Kotses (1977) studied 30 male subjects. Each subject was randomly assigned to one of three groups. The first group, the Frontalis-Increase (FI) group, received reinforcement contingent upon increases in frontalis muscle activity, whereas the second group, the Frontalis-Decrease (FD) group was reinforced for frontalis muscle decreases. The third group, the non-contingent (NC) group received reinforcement not contingent on frontalis muscle tension. All subjects were also monitored

on the brachioradialis muscle simultaneously during three training sessions of twenty minutes each.

FI subjects were instructed to listen to the clicks and to increase the rate at which they occurred. FD subjects were told to lower the rate of feedback clicks. Half the subjects in the NC group were given each of the above sets of instructions. The results showed that the highest brachioradialis muscle tension levels occurred in the FI group, the next highest in the NC group and the lowest in the FD group.

The study concluded that both conditioned increases and decreases in the frontalis muscle tension did generalize to other muscles.

Clinical Use of Biofeedback

It has been documented that tension headache patients tend to react to stress by increasing muscle tension in their neck muscles (Malmo and Shagass, 1949). It seemed that one beneficial use of EMG biofeedback might be the retraining of tension headache sufferers.

Studies by Wickramasekera (1972) and Budzinski, Stoyva, Adler and Mullaney (1973) demonstrated that chronic tension headache patients can reduce frequency and intensity of headaches when given true analog feedback enabling them to lower their EMG levels as opposed to groups given false analog feedback. The Budzinski, et. al. study showed a dramatic decline in reported use of headache and anti-anxiety medication by the EMG feedback group with little change in drug usage for the false feedback group.

Decker and McCann (1978) found similar results in another tension headache study. Eight male and fourteen female tension headache sufferers

were treated once per week for seven weeks with EMG biofeedback. The results showed that the frequency, duration and intensity of subject logged headaches and average daily pain decreased as treatment progressed; likewise treatment session EMG levels lessened for all groups.

Blanchard and Young (1975) in a summary and evaluation of clinical applications of biofeedback, determined that the work with tension headaches is one of only three areas where research data supports the effectiveness of EMG feedback. (The other two areas are the retraining of damaged muscles and the elimination of subvocal speech as an aid to faster reading.) A study by Davis (1973) however, supports the use of biofeedback as a supplemental treatment in bronchial asthma. Davis studied 24 non-severe asthmatics, using three experimental groups with eight subjects in each group. Group 1 received modified Jacobsonian relaxation training assisted by EMG biofeedback while Group II received only the Jacobsonian relaxation training (without EMG feedback). The control group, Group III were provided assorted reading material and told to relax. Instructions for Groups I and II were recorded on an audio tape. All the subjects attended five 30 minute treatment sessions. The results of the study showed significant reduction in airway resistance for the subjects in Group I compared to the control group. Group II also showed slight improvement in airway resistance, but not to the extent as Group I.

Dentistry is another area where clinical biofeedback has proved to be effective. Miller, Murphy, Miller and Smouse (1976), examined the effectiveness of EMG biofeedback versus PMR in the reduction of stress reactions in dental patients. Miller, et.al. found the EMG biofeedback and PMR were equally effective in reducing muscle tension and lowering the

Dental Anxiety Scores. However, EMG biofeedback also produced significant Trait Anxiety (STAI) reductions, whereas the changes following PMR were not significant. The data suggests that either biofeedback or PMR is effective in reducing stress reactions in dental patients and implies that the decline in the trait anxiety of the biofeedback group could mean generalization of stress reduction to other areas through use of this technique.

EMG Biofeedback and Generalized Relaxation

The review of literature up to 1976 did not produce conclusive evidence for or against the effectiveness of EMG biofeedback as a general relaxation training technique for anxious subjects (Blanchard and Young, 1975). Several studies in this area have been completed since 1975, and new support for the effectiveness of EMG biofeedback has been found.

In order to test whether or not the outcomes of EMG relaxation training are due to the training itself or not just the product of sitting comfortably in a chair listening to a restful tone, Coursey (1975) tested several alternatives to the explanation that EMG feedback is in fact the cause of improvement in tension levels of individuals given such training. He trained three groups of 10 subjects each using differing instructions. Each group was given a baseline session plus six training sessions and one follow-up session within a two week period. The EMG feedback subjects were told that they would be hearing a tone which would indicate their levels of frontalis muscle tension and they were instructed to lower the tone thereby reducing muscle tension. The second group heard a constant frequency tone which they were told would aid their relaxing by masking noise. The third group received a tone like the second group

but were also given cognitive instructions for relaxation (i.e. close their eyes, try not to blink, feel heavy and sagging, etc.). The results showed that the EMG feedback technique was more effective than the other two training techniques.

EMG biofeedback has been shown to be effective in reducing chronic anxiety in a well controlled study by Townsend, House and Addario (1975). The study compared EMG biofeedback to group psychotherapy treatment in a group of 30 subjects judged to be chronically anxious. Those patients in the feedback group received EMG relaxation training daily for two weeks with a two week self-practice period. Those patients in group therapy met regularly four times a week for four weeks. The group receiving EMG biofeedback was found to have a significant decrease in muscle tension, mood disturbance, trait-anxiety and state anxiety following training. There were no comparable decreases in the group receiving psychotherapy.

In a study where normal college students were experimentally exposed to stress (It Didn't Have to Happen - film stressor) Shepherd (1977) reported that following EMG biofeedback training the muscle tension of the trained subjects was significantly lower after exposure to the stress film and while at rest than a comparable group of untrained subjects. Shepherd found that EMG biofeedback relaxation training enabled subjects to decrease their resting muscle tension levels which was also reflected in lowered muscle tension during stress arousal.

Recently other studies have compared EMG feedback with other relaxation techniques under controlled conditions.

An extensive study comparing different varieties of relaxation training has been completed by Reinking and Kohl (1975). The authors used

50 normal subjects who were randomly assigned to five different relaxation training groups. All subjects participated in three habituation sessions followed by 12 relaxation training sessions. The Jacobson-Wolpe relaxation training group heard a 12 minute tape of verbal instructions and were asked to sit quietly after that for 15 minutes while EMG levels were recorded. The EMG feedback subjects heard auditory EMG feedback for 15 minutes and were asked to lower the tone as much as possible. (EMG levels were recorded throughout the session.) A group comprised of both Jacobson-Wolpe instructions and EMG feedback heard the 12 minute tape and then practiced relaxing with the EMG feedback for 15 minutes while their EMG levels were recorded. Another group heard EMG feedback for 15 minutes but were also rewarded one dollar for each 20% reduction in their EMG levels. The control group was told to relax in each session but were not given any training. All subjects were asked to report subjective relaxation (pre and post each session) on a scale from 1-10 with 10 being the most tense. The results showed all four experimental groups produced significantly lower EMG levels at the end of training than did the control group. Furthermore, the three groups which utilized EMG feedback did not produce significantly different EMG levels but the levels of all three were significantly lower than that of the Jacobson-Wolpe relaxation group. All five groups reported a significant reduction in subjective tension by the end of the experimental sessions. It was noted that other forms of relaxation training did not enhance the power of EMG feedback relaxation training but it does note the EMG training is more effective in reducing EMG levels than the Jacobson-Wolpe training.

Breeden (1975) conducted a study in which he compared EMG biofeed-

back and PMR in the treatment of patients with chronically high levels of muscle tension. Six patients were divided into one of two groups, the EMG feedback group or the PMR group where they received ten, 20 minute relaxation training sessions. Patients given the EMG training learned to decrease their EMG levels to a greater degree than patients who practiced PMR. Also, pre and post training symptom checklists revealed that the latter group may have obtained greater relief from anxiety.

Investigating the efficacy of several relaxation techniques to bring about generalized relaxation Fee (1977) compared EMG biofeedback, meditation and PMR. He discovered significant alterations in muscle tension related to type of treatment, where EMG relaxation training and meditation both elicited significant muscle tension reduction. He also noted that PMR alone was able to produce signficant decreases in the respiration rates.

While studies relating muscle tension to other autonomic arousal signs are not conclusive (Balshan, 1963; Edelman, 1970; LeBoeuf, 1974; Fee, 1977) they seem to indicate that training in relaxation of the skeletal musculature has a strong influence on several aspects of autonomic arousal and reactivity. Stoyva and Budzinski (1973) suggest that with sufficient relaxation training the beneficial effects of a low arousal state in stressful situations can become habitual, with hyperactivity to stress being supplanted by a new pattern marked by a lessening of sympathetic arousal in the face of threat. These relaxation techniques share the induction of generalized low arousal patterns of response which are characterized by sympathetic inhibition.

C. Possible Influence of Personality characteristics in Reducing Anxiety

The question of whether or not various personality characteristics play a role in predicting an individual's responsiveness to particular relaxation techniques has been raised in the literature. In a study by Paul (1969b) the Pittsburgh Social Extraversion-Intraversion and Emotionality Scales (Bendig, 1969) were administered to 60 college women prior to two half-hour experimental sessions where one-third of the subjects were trained in PMR, one-third received direct hypnotic suggestion designed to produce relaxation and the remaining one-third was simply told to sit quietly and relax. These personality scores were later correlated with the subjective anxiety and physiological measures of arousal (muscle tension, heart-rate, skin conductance and respiration rate). Additionally, prior to and immediately following each of the two experimental sessions the subjects were asked to visualize a neutral scene and then an anxiety producing scene. The purpose of this was to assess the effects of the treatment on physiological responsiveness to stressful imagery.

Correlations of the personality scales with self reported anxiety, physiology during training and physiology during stressful imagery were not significant within each of the treatment groups nor over all groups. Paul concluded that responsiveness to relaxation or hypnotic procedures is not related to the personality dimensions of extraversion or emotionality.

Contradicting evidence was reported in a study by Stoudenmire (1972) in which he suggested that introverts learn muscle relaxation skills and condition more quickly than extraverts. Thirty-six anxious female undergraduate students served as subjects in an experiment to test the hypothesis that anxiety can be reduced following muscle relaxation training. The 36

subjects were seen in six equal groups. Within each group there was an equal number of intraverts and extraverts.

The intraverts and extraverts were matched on the pre-treatment scores of state and trait anxiety measures, and then each group received three sessions of muscle relaxation training (Lazarus, Learn to Relax, a recorded course in muscular relaxation). The state and trait anxiety measures were administered again at the end of the third relaxation session. There were significant decreases in state anxiety measures for intraverts but not for extraverts, but there were no significant decreases in either group on the trait anxiety measures. These results are consistant with Speilberger's (1966) state-trait anxiety theory, and Eysenck's personality theory, which were previously noted. Briefly, state anxiety is characterized by subjective, consciously felt periods of tension and autonomic activity as opposed to trait anxiety which is a predisposition to manifest anxiety under any given stress situation. Extraverts, remember, condition poorly and need more time to learn new behaviors, while intraverts condition quickly.

According to Stoudenmire relaxation training involves learning and conditioning and is apparently affected by such personality variables as extraversion. He also suggested more research in the exploration of other personality correlates that may affect anxiety reduction.

One such personality correlate is "locus of control" which Rotter (1972) explains is an expectancy variable whereby factors determining a persons behavior in a given situation focus on his/her expectancy that his/her action will provide the available reinforcements or that there are no alternatives within the person's means to enable him/her to achieve his/

her goal. Rotter's theory relates to the individual's perception of whether or not he/she has control over what happens to him/her. According to Rotter's scale a person who has the generalized expectancy that he/she personally has control over a wide range of situations would be considered to possess an "internal" locus of control, whereas one who perceives his/her reinforcements as being controlled by forces outside of oneself would be labelled "external".

Differences in behavior between internals and externals have been examined in studies by Liverant and Scodel, 1960; Sechrest, 1962; Franklin, 1963; Seeman, 1963; Gore and Rotter, 1963; Rotter and Mulry, 1965; and Strickland, 1965, all of which showed significant differences in behavior between personalities. In a review of these studies by Rotter (1971) he suggests persons who believe they can control their environment also believe they can control themselves. Studies have shown that non-smokers are significantly more internal than smokers (Straits and Sechrest, 1963) and that after the Surgeon General's report on smoking was published, male smokers who successfully quit smoking were more internal than other male smokers who believed the report but did not quit (James, Woodruff and Werner, 1965).

In order to study the assumption that internals can control themselves more effectively than externals Jordan and Schallow (1975) examined the role of locus of control in EMG feedback training and brief PMR. Fifty-seven female subjects were divided into one of three treatment groups; Group I was trained with EMG biofeedback, Group II was given PMR training and Group III was given no training. Each group was exposed to a baseline period and then one session of training. After the training session an affect rating scale and a strategy questionnaire was administered. A follow-up session five to seven days later was used to determine

retention of skills. The results show that internals in both experimental treatment groups were able to decrease frontalis EMG levels over trials, while only externals in the PMR group were able to do so. Neither externals in the EMG feedback group or the control group were able to significantly decrease their EMG levels. It was also noted that only internals in the experimental groups were able to maintain lowered frontalis EMG levels (below baseline) after the treatment session. In the subjective analysis, internals rated themselves as more relaxed, less tense and less anxious than externals in both training groups.

A number of researchers have attempted to differentiate subjects with the way they are able to voluntarily control their heart-rate (HR) using biofeedback and their locus of control. Early studies (Fotopolous, 1970; Ray and Lamb, 1974; and Ray, 1974) suggested that there may be differences between internals and externals with their ability to facilitate heart rate increases and that internals are better able to increase while externals are better able to decrease their H R. Blankstein and Egner (1976), however, obtained data which is more consistant with what would be predicted from I-E theory. (I-E theory see Chapter I, pg.10) As did previous investigators, they found internals were better able to increase HR than externals. Unlike previous studies, the Blankstein study revealed no significant difference between I-E groups during decrease trials. There was, however, an apparent trend indicating slightly better decreasing control by the internals. Due to the brevity of the training trials (one session) it is unknown if the internal group would have eventually surpassed the external group on subsequent slowing sessions. As Lang and Twentyman (1974) suggested, it is possible that HR slowing is close to "true viceral learning" which may require more exten-

sive reorganization of cardiovascular functioning, which is unlikely to be achieved in a few brief sessions. Therefore it is possible that given enough time internals might have out-performed externals.

Rotter's Internal-External (I-E) locus of control theory and Speilberger's Trait Anxiety personality dimension are factors which seem important variables in influencing the effectiveness of biofeedback training. Each is active in influencing learning in complex tasks. Since biofeedback is a complex task requiring fine bodily discrimination and information processing, Reinking, Margret and Tamayo (1976) studied the influence of I-E control and trait anxiety on acquisition of EMG control. Briefly their hypothesis was that "internal-mid trait anxiety" subjects would condition most rapidly to EMG biofeedback and that "external-high trait anxiety" subjects would condition most slowly to EMG control.

The results showed that all groups reduced their EMG levels but that the internal subjects lowered their EMG levels significantly more than did the external subjects and that the mid-trait anxiety group was significantly more successful than either of its counterparts. The interaction effect of internal and mid-trait anxiety was also significant in that this group acquired the greatest degree of EMG control while both external-high trait anxiety and external-low trait anxiety acquired EMG control equally poorly.

In a study by Carlson and Feld (1978) investigating incentives and locus of control in EMG biofeedback an interesting finding was discussed. Although there were no major differences in EMG levels attributable to locus of control, it was discovered that locus of control scores of some externally controlled subjects shifted significantly in the internal direction due to, the authors suggested, training with biofeedback.

Holliday and Munz (1978) designed their study to measure change of locus of control with successful control of physiological functions (EMG feedback training). The subjects were divided in psychosomatic and non-psychosomatic groups. Each subject was seen for eight one hour sessions and practiced muscle relaxation daily at home. Both groups were able to significantly reduce their frontalis EMG levels but only the non-psychosomatic group showed a significant change toward internality even though the psychosomatic group was able to abort 44 percent of their psychosomatic attacks. There was also a significantly high correlation between the Rotter pre-test score and percent reduction from baseline in frontalis EMG for the non-psychosomatic group but there as a non-significant correlation for the psychosomatic group suggesting that the Rotter I-E scale is a good predictor of biofeedback control for "normals" but not for those with psychosomatic problems.

Summary

The literature has supported the hypothesis that we live in a more technological and urban environment than did our forebearers which has been responsible for prolonged stress and the development of chronic anxiety for entire populations. Along with the new technology came a need for rapid and frequent adaptation both psychologically and physiologically inorder to maintain one's feeling of well being or good health. It was back in the late 1920's that Dr. Walter Cannon defined the"fight or flight" syndrome as the physiological reactions to disturbing or alarming occurances which affected the individual. Hans Selye advanced this theory in the 50's by suggesting the normal physiological response to stress (G.A.S.) placed constant wear and tear on the system and that if the stressor was not overcome the system would eventually enter the stage of exhaustion

where either disease or death was inevitable. It has been found that in our competitive, production oriented, urbanized culture internal products of stress are not given a chance to subside before another stressful situation is encountered. Thus, in our times stress and stress arousal have become health problems. We have seen in the twentieth century a dramatic decline in deaths caused by infectious diseases largely in part due to the medical advances in prevention of these diseases, and just as dramatic an increase in deaths due to chronic diseases. Heart disease, cancer, hypertension, asthma, and arthritis are just a few diseases known to be exacerbated by stressful life situations. Faced with evidence such as this, health authorities are now examining human ecology and its impact upon individual needs as part of a total health care system.

It is up to each individual at this point in time to discover his/her own form of intervention into the anxiety-stress-disease continuum. Many pathways and panaceas are being offered. Medical and non-medical use of drugs has skyrocketed, and there are at least ten million adult alcoholics in our country alone. However, because of the disadvantages associated with drug use, people are experimenting with altered states of consciousness through yoga, transendental meditation, Zen meditation, and Benson's (1976) relaxation response. It has been reported that meditators are better able to cope more effectively in stressful situations and that in fact there is a lower incidence of anxiety and psychosomatic disorders among meditators.

Another form of intervention into the anxiety-stress-disease continuum is progressive muscle relaxation. The principle thought in this discipline is that deep muscular relaxation is incompatable with anxiety. In the mid 1960's Wolpe and Lazarus modified the original model developed

by Jacobson so the entire learning process could take place in six-twenty minute sessions. Wolpe used this technique successfully during systematic desensitization and research reported during the 60's and early 1970's confirmed the hypothesis that progressive muscle relaxation inhibited physiological stress arousal.

In the 1960's, with the advent of accurate electronic biofeedback, research was carried out which suggested that EMG biofeedback was a rapid technique for teaching muscle relaxation. In a study by Reinking, et.al. (1975) it was noted that other forms of relaxation training did not enhance EMG biofeedback training, and it was also noted that EMG training was more effective in reducing EMG levels than the Jacobson-Wolpe training . It should be noted that no attempt to stress the subjects was reported in any of this research.

Much interest has been raised as to the importance of personality characteristics in the learning of relaxation skills. In a study by Paul in 1969 it was reported that the personality trait of extraversion was not related to relaxation skills. However Stoudenmire in 1972 found that introverts learn and condition more quickly than extraverts in acquiring relaxation skills. Another personality correlate that has been given attention in the recent literature is that of locus of control. It has been suggested that internals should be able to accelerate learning when appropriate cues are presented in order to improve their environmental condition.

The literature has supported the hypothesis that progressive muscle relaxation and EMG biofeedback can produce relaxed conditions in normal and in some cases anxious subjects. However, there has been no systematic study of these two techniques when the element of psychosocial

stress and the corresponding physiological arousal have been introduced. Also, the personality component of locus of control has never been a variable when learning took place prior to the introduction of a psychosocial stressor. It would be interesting to observe which techniques, alone or in combination would produce significant relaxation after the introduction of a psychosocial stressor to subjects who were either internally or externally controlled.

Chapter III

METHODS AND PROCEDURES

The purpose of this study was to investigate the relative efficacy of four muscle relaxation techniques (music, PMR, EMG/PMR and EMG) in the reduction of two specific stress reactions (muscle tension and anxiety) for college males characterized by either internal or external locus of control. This chapter describes the selection of subjects, training of subjects, methods of measurements, instrumentation, treatment of data and limitations of the study.

Procedureal Overview

The procedure followed in this study included: administration of Rotter's Internal-External Scale (I-E Scale) to all new students at the Capitol Campus; selection of subjects; assignment to experimental groups; measurement of baseline EMG levels; experimental relaxation training (seven-twenty minute training sessions); pre-stressor measurement of anxiety; measurement of pre-stressor EMG levels; two exposures to stressor film; assessment of anxiety; instructions to relax during four more exposures to stressor film; complete relaxation period; post-stressor assessment of anxiety; and, post-test measurement of locus of control.

Selection of Subjects

In September, 1976, all incoming male juniors (N=373) at the Pennsylvania State University's Capitol Campus were administered Rotter's I-E Scale. In order to determine the locus of control, the median of all the students who completed the scale was computed (Md=8.72). The scores

falling below the median were considered internally controlled; the scores falling above the median were considered externally controlled (Rotter, 1972). The sample size was eighty-one with forty-four internally controlled subjects and thirty-seven externally controlled subjects. Only males were used in the study due to an extreme imbalance in the sex ratio at the Capitol Campus and the researcher's desire to make the experimental groups as homogeneous as possible. The subjects (mean age=23) were assigned to be run by one of two experimenters and were randomly assigned to one of four groups: a music group (N=18); a PMR group (N=20); an EMG BFT group (N=18); an EMG facilitated PMR training group (N=18); and, a control group (N=7).

Each group was comprised of ten internally controlled subjects (those who scored 8 or below on the I-E scale) and 8 externally controlled subjects (those who scored 10 or above on the I-E scale). Exceptions to this were Group 2 where there were ten internally controlled subjects and ten externally controlled subjects and the control group where the internally controlled subjects equalled four and the externally controlled subjects equalled three.

Instrumentation

The electromyograph feedback training instrument used in this study was the Autogenic Systems, Inc. (ASI) feedback myograph, model A1700 in the auditory feedback mode. Pulsating analog audio feedback was used; AN 1 setting on the A1700. The ASI A1700 emitted an increase in audio feedback, both pitch and frequency, when the frontalis muscle group (site of attachment) presented an increase in muscle electrical activity. Like-

wise, a decrease in the frontalis muscle group electrical activity caused a decrease in the audio feedback.

The EMG activity was obtained via three silver/silver chloride cup electrodes. The two active electrodes were placed one inch above the midpoint of each eyebrow and the ground electrode was placed conveniently between the two active electrodes. The electrodes were held in place with the use of Beckman surface electrode collars and recording gel. The band-pass setting of the instrument was set at 100-200 Hz with the feedback scale set at 1.0. When a subject's average EMG level with a particular training session fell below 1 u the feedback scale was changed from 1 to .3 in order to provide the subject with continuous feedback. The ASI 5100 Digital Integrater was used for data acquisition. Output from the A1700 was obtained from the "instantaneous averaged" EMG readout jack travelling a standard four-foot shielded cable to the f2 input jack of the A5100. The integration interval was set at 2 minutes during training with a time-out period of 5 seconds following each integration.

Rotter's I-E Scale was used as a measure of the subjects' locus of control. The scale consists of a twenty-nine item, forced-choice questionnaire. Six of these items were "fillers", the other twenty-three offered choices between internal and external belief statements. Scores range from 0 (the consistant belief that the individual can influence the environment and that rewards come from internal forces) to 23 (the belief that all rewards come from external forces). The score is computed by adding the number of external beliefs endorsed. This instrument has been subjected to numerous tests of reliability. Franklin (1963) reported that in a national stratified sample, the locus of control yielded a reliability co-

efficient of .69 using the Kuder-Richardson formula. Other more homogeneous samples from the Ohio State University demonstrate even higher Kuder-Richardson correlation coefficients (r=.73). When the Spearman-Brown correction was used, Rotter (1972) reported internal consistency at .79. Test-retest reliability coefficients range from .49 over a two month period with the Ohio State University males to .78 over a one-month period with a population of Colorado State Reformatory prisoners. The average of the test-retest correlations reported among seven groups was .65 (Rotter, Chance, Phares, 1972).

The validity of the I-E Scale is derived from predicted differences in behavior for respondents above and below the median score. Rotter (1972) suggests that important data in assessing the construct validity of the I-E control measurement involves the attempts of individuals to better their life conditions and to control their environment in important life situations. He reports findings from the following validity studies which are consistent with the above assertion: (1) James, 1957; Liverant and Scodel, 1960--performance in controlled laboratory tasks: (2) Seeman and Evans, 1962; Seeman, 1963; Gore and Rotter, 1963; Strickland, 1965; Phares, 1965; Sechrest, 1963--attempts to control the environment; (3) Franklin, 1963; Efran, 1963; Rotter and Mulry, 1965--internal-external control and achievement motivation; and, (4) Liverant, 1963--internal-external control and resistance to subtle suggestion.

The State-Trait Anxiety Inventory (STAI) was used to measure the subject's anxiety. The STAI consists of two twenty item self report scales devised by Speilberger et al. to measure "anxiety-proneness" (trait) as well as the current level of tension and apprehension (state) (Consult-

ing Psychologists Press, 1976). The test-retest reliability measures for the trait anxiety sub-test for males ranges from .84 after one hour to .86 after twenty days to .73 for 104 days. For females, the range is from .76 after one hour, .76 after twenty days and .77 after 104 days. The state anxiety sub-test for males measures reliability by test-retest with a coefficient of .33 after one hour, .54 after twenty days and .33 after 104 days. The results for females range from .16 after one hour to .27 after twenty days to .31 after 104 days. The test for validity included a comparison of the STAI and IPAT (anxiety scale), the Taylor Manifest Anxiety Scale (TMAS) and the Multiple Affect Adjective Check List (MAACL). The resulting coefficient correlations were as follows:

.75--IPAT

.80--TMAS

.52--MAACL

The Multiple Affect Adjective Check List Anxiety Scale (Today form) was used as an additional brief, reasonably valid self report state anxiety measure. The instrument consists of 132 words that reflect moods and feelings. The individual is asked to check the box beside each word that describes how she/he feels at this moment. The scale measures the negative affect condition. The split-half reliability of both forms (the General and Today forms) of the MAACL anxiety scale is .68 when items are divided by the odd-even method. To establish validity, investigators have tested students before and after examinations, military personnel during basic training and actors before they go on stage. Hypnotically induced mood states, sensitivity training and stress inverviews have been used to alter mood states with resulting changes in the MAACL. Stress typically

raises the scores on the anxiety scale significantly. All the studies mentioned demonstrated significant group differences, statistically analyzed with "F" tests (Buros, 1972).

Procedure and Measurements

Each experimental subject was required to commit five hours to the study. A Pennsylvania State University Capitol Campus Faculty Research Grant of $500.00 was awarded the researcher for subject reimbursement.

The first session of the study was used to collect baseline EMG levels, randomly assign the subject to his experimental group and expose the subject to the first twenty minute training period.

All subjects were escorted into the training room and asked to sit in the recliner chair. Their participation in the study was explained and the informed consent slip signed. The Personal Data Form (PDF) was administered and the subject was prepared for EMG baseline measurement. The subject was asked to relax to the best of his ability without falling asleep. Data was collected for twenty minutes at two minute intervals. Following this twenty minute period, the subject was given a ten minute break where he was instructed to watch a ten minute excerpt from The Incredible Machine (via video-tape). During this break the subject was randomly assigned to one of the four experimental groups or the control group, irrespective of his locus of control. This procedure was followed for each subject until all groups had a complete complement of I-E subjects.

During the last twenty minutes of the first session the subject was acquainted with one of four relaxation techniques. If the subject was assigned to the control group or could not commit his time for the entire five hours, he was instructed to return to the experimental room one week

after the baseline measure was taken for the final session. Those individuals assigned to Group 1 were asked to listen to classical music (Brahms Piano Concerto No. 2, 2nd Movement; Mozart, 2nd Movement Piano; Vivaldi Guitar Concerto No. 1, 2nd Movement) through headphones and to relax as completely as possible without falling asleep. Individuals assigned to Group 2 were instructed (via tape recording) to relax using progressive muscle relaxation (PMR) techniques (Wolpe, Lazarus, 1966). EMG measurements were recorded every two minutes but no feedback was given to subjects in Groups 1 or 2.

Students who were assigned to Group 3 were given identical instructions as those students in Group 2. The audio component of the ASI A1700 was switched on so the subject was able to receive audio feedback. The experimenter allowed the subject approximately ten seconds to experience feedback while contracting and relaxing facial muscles. Each subject was asked to follow the directions on the tape while trying to make the audio tone lower and slower. Subjects assigned to Group 4 were trained only via the EMG BFT. They were instructed by taped directions on how the EMG worked and allowed a short practice trial. (Scripts for each group can be found in Appendix A).

Sessions 2, 3, 4, 5, 6, and 7 were all training sessions for the experimental groups. The following procedures were used: the subject entered the experimental room and was seated in the recliner chair. The EMG electrodes were placed into position in order to monitor the frontalis muscle activity. Brief instructions were reviewed and the recliner chair positioned. The subject was given his particular twenty minute training session. Sessions 2 and 3, 4 and 5, and 6 and 7 occurred as paired train-

ing sessions given every other day. As in the first session, a ten minute break occurred after the first twenty minute period and the subject was again asked to watch the video-tape.

Three days after the last training session, the subject returned for the final test session. The subject was seated in the recliner chair and was given the PDF, the STAI and the MAACL (Today-Anxiety Scale). After the electrodes were placed into position the subject was allowed to recline the chair and was asked to rest for ten minutes while pre-stressor EMG levels were recorded at one minute intervals. The subject was then asked to watch two repetitions of the ninety two second video-taped segment of the film, It Didn't Have to Happen (Crawley Films Limited). The film of a man being impaled through the abdomen by a wooden board was used because Davidson and Hiebert(1971) Lazarus (1968), and Folkins, (1968), found this segment stress producing during repeated exposures. Lazarus (1968) cited evidence to indicate that the film continues to be stressful over repeated showings and he speculated that "such emotional-producing stimulus material will never fully habituate, however often it is seen" (p. 252). After the second showing the subject was asked to complete the MAACL and the "state" sub-scales of the STAI while trying to recapture his feelings as he saw the man get hit with the board. The subject was then told to relax and to view the segment several more times (four more times). He was also asked to remain relaxed after seeing the film until the experimenter told him to stop (ten minute period). At the end of the relaxation phase the subject completed the MAACL, the "state" sub-scale of the STAI and Rotter's I-E Scale.

Collection of data was accomplished as follows: during the pre-

stressor resting period the EMG readings were taken at one minute intervals, during the viewing of the film the data was collected every fifteen seconds and during the final ten minute relaxation time the data was collected at one minute intervals.

Treatment of Data

1. In order to determine if subjects in the music relaxation training group report more anxiety and experience more tension during the exposure to the film than subjects in the other three training groups the following analyses were made:

A. For reported subjective anxiety a comparison was made between all four groups on the three administrations of the STAI-State and the MAACL-Today.

1. A 4X2X3 repeated measures ANOVA was run to compare the "pre", "during" (after second film exposure) and "post" stressor subjective anxiety for the eight groups (Internal music, external music, internal PMR, external PMR, internal EMG/PMR, external EMG/PMR, internal EMG, external EMG.)

2. A planned comparison followed comparing the three repetitions of reported anxiety between the music group and the other three active relaxation groups.

B. For the tension measure, a comparison was made of the mean EMG levels averaged over the six exposures to the stressor film.

1. A 4X2 ANOVA was run to compare the mean EMG levels of all training groups during the six exposures to the stressor film.

2. This was followed by the planned comparison comparing the mean EMG levels of the music group averaged over the six exposures to the film and the mean EMG levels of the other three relaxation training groups.

2. Inorder to determine if the music trained subjects experience less reductions in reported state anxiety following the exposure to the film, the following analyses were made:

A. An analysis of covariance was run to elicit the mean reduction in reported anxiety scores from "during" the exposure to the stressor film to the post-relaxation reported anxiety score. Pre-stressor reported anxiety scores served as the covariate.

B. This was followed by a planned comparison comparing the reduction of scores for the music group with the scores of the other three groups.

3. Inorder to determine if internally controlled subjects trained with biofeedback are more successful in reducing EMG levels than externally controlled subjects, a comparison was made between internals and externals across the two biofeedback groups. Two dependent variables were analyzed separately.

A. The first dependent variable used was the reductions in the EMG scores from pre-training to pre-stressor trials.

1. A 4X2 ANOVA was run to compare the over-all pre-training EMG levels to the pre-stressor EMG levels of the four biofeedback groups. (Internal EMG/PMR, External EMG/PMR, Internal EMG, External EMG.)

2. A planned comparison was then run to compare the mean EMG change scores of the internal subjects and the mean EMG change scores of the external subjects.

B. The second dependent variable used was the reductions in the EMG scores from pre-stressor to post-stressor trials.

1. A 4X2 ANOVA was run to compare the overall pre-stressor resting mean EMG levels to the post-stressor relaxation mean EMG levels of the four biofeedback groups.

2. A planned comparison was then run to compare the mean EMG levels of the internal subjects and the mean EMG levels of the external subjects.

4. Inorder to determine that subjects trained in PMR report more anxiety and more tension during the exposure to the stressor film than subjects trained in either of the biofeedback methods the following analyses were made:

A. For reported subjective anxiety a comparison was made between the PMR, EMG/PMR and EMG groups on the three administrations of the STAI-State and the MAACL-Today.

1. A 3X2X3 repeated measures ANOVA was run to compare the three reported subjective anxiety scores for the six groups (internal PMR, external PMR, internal EMG/PMR, external EMG/PMR, internal EMG, external EMG).

2. This was followed by a planned comparison comparing the average of three repetitions of reported anxiety between the PMR group and the other two active relaxation groups.

B. For the tension measure, a comparison was made of the mean EMG levels averaged over the six exposures to the stressor film.

1. A 3X2X3 (blocks of exposure) ANOVA was run to compare the mean EMG levels of the PMR, EMG/PMR, and EMG groups during the six exposures to the stressor film.

2. This was followed by the planned comparison comparing the mean EMG levels of the PMR groups averaged over the six exposures to the film and the mean EMG levels of the other two active relaxation training groups.

Newman-Kuels posteriori analysis was used to explore unhypothesized differences among means.

Limitations of the Study

1. Circadian rhythms were not controlled for while taking resting EMG measurements.

2. Numerous repetition of subjective anxiety scales may cause unwanted change in responses due to subjects' own feelings having to do with the experimental condition.

3. Necessity of utilizing two experimenters. However, this strengthens the external validity of the study.

4. Length of collection of data over two terms and over a seasonal change.

CHAPTER IV

ANALYSIS OF DATA AND DISCUSSION

Analysis of Data

To investigate the relative efficacy of the four relaxation techniques in the reduction of two stress reactions (muscle tension and anxiety) the following measures were used: pre-training I-E Scores, I-E change scores; frontal EMG in microvolts obtained, pre-training, pre-stressor, during training and test situations; pre-stressor trait anxiety score (STAI); and pre-during-post stressor state anxiety scores (STAI and MAACL today form). Both raw scores and transformed scores were used in the analysis of the data. All ANOVAS and COVAS were run via the BIOMEDICAL COMPUTER PROGRAM (BMDP2V) developed by the Health Sciences computing faculty of the University of California, Los Angeles and revised July 7, 1975.

This chapter will present the statistical analysis of the data and discuss the findings in the following order: Experimenter Differences, Pre-training EMG Differences, Changes in EMG Following Relaxation Training, and Analysis of Hypotheses.

Experimenter Differences

As different experimenters were responsible for training and testing it was appropriate to test for experimenter differences. The numbers of subjects run by the two experimenters within each training group are presented in Table 1. Figure 1 shows the similarity in EMG patterns obtained by the two experimenters during the training trials. Analyses

of variance at each trial block failed to reveal any main effect for experimenter. A repeated measures analysis, one allowing an analysis of overall trend, also failed to show a main effect for experimenter nor for any experimenter interaction.

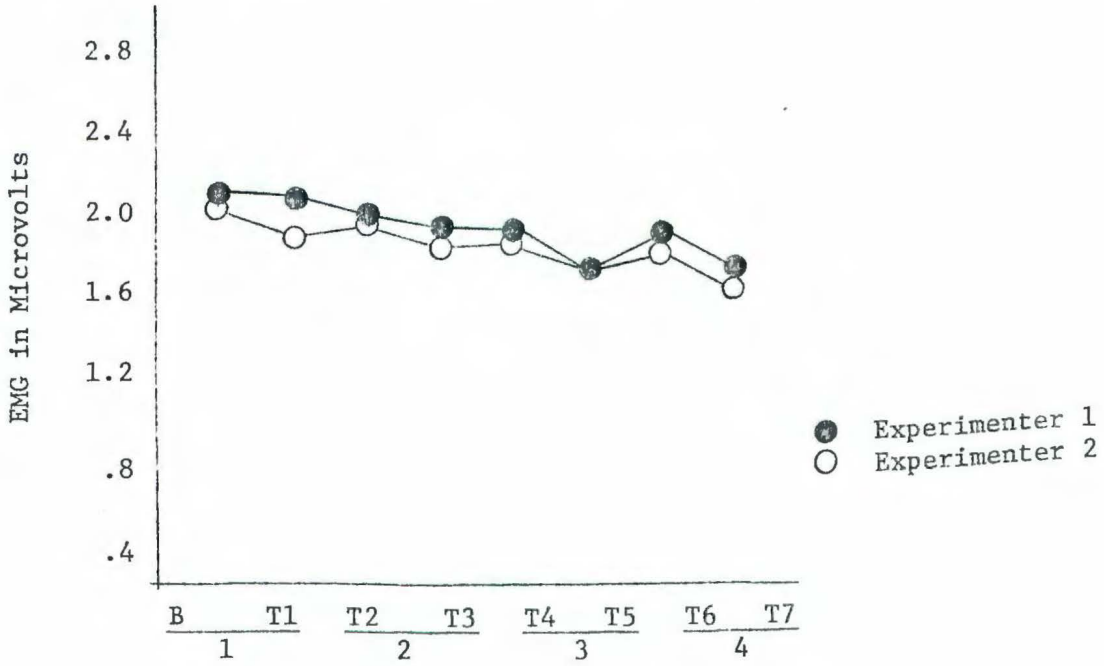
Table 1

Number of Subjects Run by Each Experimenter

	INTERNALS				EXTERNALS				
	MUSIC	PMR	EMG/ PMR	EMG	MUSIC	PMR	EMG/ PMR	EMG	
Experimenter 1	7	7	7	6	6	4	6	7	50
Experimenter 2	3	3	3	4	2	6	2	1	24
	10	10	10	10	8	10	8	8	74

Figure 1

Mean EMG Levels During Training Sessions By Experimenter (Collapsed over all groups)



Baseline and Training Trial Blocks

Yet, some significant variation between experimenters was found during the last two trial blocks. By then significant interactions emerged involving the experimenters and the method of relaxation they were training. For trial six the experimenter by training method interaction was $F=3.81$; $df=3/66$; $P<.05$, and by trial seven it was $F=4.00$; $df=3/66$; $P<.05$. Inspection of mean EMG's for those trials, Tables 2 and 3, showed that experimenter two's subjects had comparatively higher microvolt levels than her counterpart's subjects only within the EMG/PMR method. This reversal in trend clearly accounts for the interaction and it suggests that she may have been less effective in carrying out that training method. Figure 2 displays the EMG differences by experimenter for the EMG/PMR training method. These data show a difference in trend for the two experimenters; specifically showing less overall muscle tension reduction obtained by experimenter two.[1] It was noted on the otherhand that the same experimenter's subjects consistently showed lower EMG scores during the second block of the last three training sessions. While examining individual subjects training curves it was noted that one of the five subjects trained by experimenter two in this method had atypically high EMG readings from baseline through training and exposure to the stressor.

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[1] One must be cautious about concluding that less learning occurred for this experimenter because the training involved both biofeedback providing information regarding actual EMG levels and PMR in which subjects were instructed to alternately contract and relax specific muscle groups. Consequently, experimenter two's subjects may have focused more upon contraction and thus a flat training curve.

Table 2

Experimenter difference for All Trained Subjects in Mean EMG Microvolts for Training Trial 6

	MUSIC	PMR	EMG/ PMR	EMG
Experimenter 1	1.785	2.880	1.615	1.359
Experimenter 2	1.216	2.463	2.688	1.044

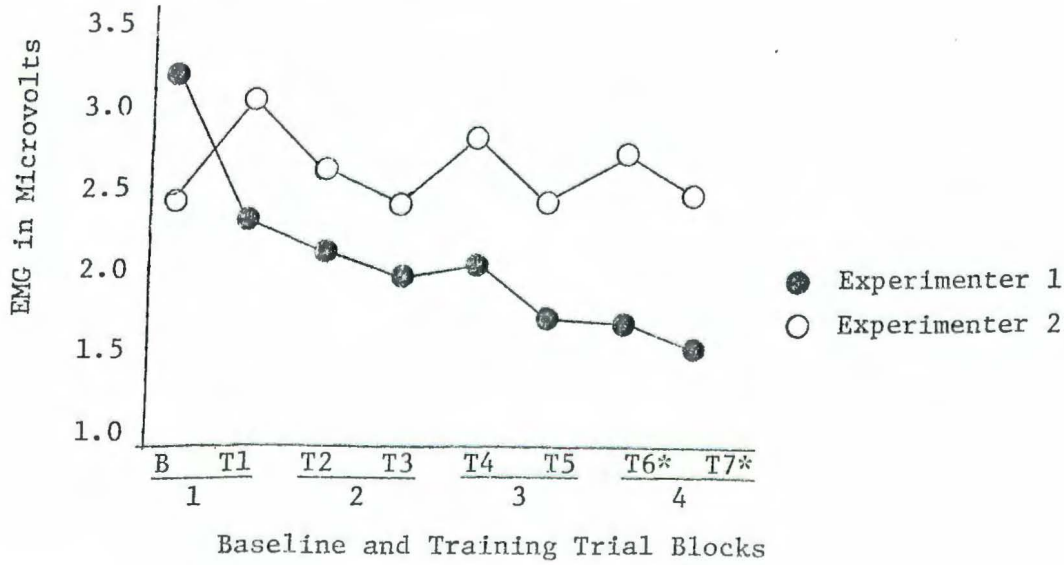
Table 3

Experimenter Difference for All Trained Subjects in Mean EMG Microvolts for Training Trial 7

	MUSIC	PMR	EMG/ PMR	EMG
Experimenter 1	1.893	2.608	1.457	1.170
Experimenter 2	1.014	2.256	2.342	.950

Figure 2

Mean EMG Levels for EMG Facilitated PMR Group Over Training Sessions by Experimenter



*Significant difference

In examining the EMG levels during the sessions of exposure to the stressful film, a repeated measures analysis of covariance (pre-training baseline as the covariate) was performed and the same interaction between experimenter and training method emerged ($F=4.38$; $df=3/66$; $P < .01$). Table 4 showed that the interaction was due to the crossover in magnitude of EMG scores for the two experimenters' subjects trained in the EMG/PMR method.

Table 4

Experimenter Difference for all Trained Subjects During the Stressor Session in Mean EMG Microvolts

	MUSIC	PMR	EMG/ PMR	EMG
Experimenter 1	2.433	2.374	1.858	1.947
Experimenter 2	1.799	1.839	3.176	1.688

No other experimenter effects were obtained during the stressor session for EMG levels, any of the subjective anxiety measures, nor the post-experimental questionnaire.

Pre-Training EMG Differences

Despite random assignments of subjects to training groups, pre-training EMG differences were obtained. A 4 (methods of training) X 2 (locus of control) X 2 (experimenter) analysis of variance summarized in Table 5 revealed both a main effect for training method and an interaction involving training method and locus of control. Table 6 showed that the highest pre-training EMG levels were obtained by externally controlled subjects subsequently provided EMG/PMR training. Simple effects tests were performed for training method on internally controlled subjects

($F=1.32$; $df=3/58$; $P < .25$) and on externally controlled subjects ($F=2.74$; $df=3/58$; $P < .05$). Consequently, it is concluded that method of training differences on baseline EMG hold on only for externals. Due to this finding and the interaction of training method and locus of control, these differences, if uncontrolled, could rival the experimental hypotheses as explanations of subsequently reported training and exposure to stressor results. The only form of control available has been statistical adjustment of subsequent scores on the basis of their least squares regression with these pre-training EMG levels. Thus, all subsequently analyzed data included covariance analysis with the pre-training EMG levels serving as a baseline.

Table 5

Pre-Training EMG Levels by Experimenter, Treatment and Locus of Control

	Mean Square	F	Tail Probability
Experimenter (E)	.34514	.27	.604
Training Method (T)	4.37210	3.44	.022*
Locus of Control (I-E)	2.23799	1.76	.189
E X T	1.40578	1.11	.353
E X I-E	.00043	.00	.985
T X I-E	3.56065	2.81	.048*
E X T X I-E	.13161	.10	.958
Error	1.26923		

* Significant at the .05 level

Table 6

Pre-Training EMG Means and Standard Deviations
for All Groups by Treatment and Locus of Control

Group	Mean	S. D.
Music		
Internal	1.817	.6885
External	1.665	.7181
PMR		
Internal	2.278	.7363
External	1.837	.4490
EMG/PMR		
Internal	1.921	.6620
External	3.507	2.5258
EMG		
Internal	1.718	.5892
External	2.268	1.2924

Changes in EMG Following Relaxation Training

Training effects were obtained by computing the differences between the pre-training EMG levels and the resting EMG levels obtained just prior to exposure to the stressful film. The pre-stressor resting level was used as the post-training indicator because the training procedure did not allow for a final EMG measurement un-confounded by the influence of the PMR exercises for the two that used it. Figure 3 displays the distortion which would result if training EMG levels had been used.

As can be seen in Table 7, the greatest reduction in resting EMG levels existed among those subjects in the biofeedback facilitated PMR and in the biofeedback groups.

Figure 3

Mean EMG Profile of the Training Sessions

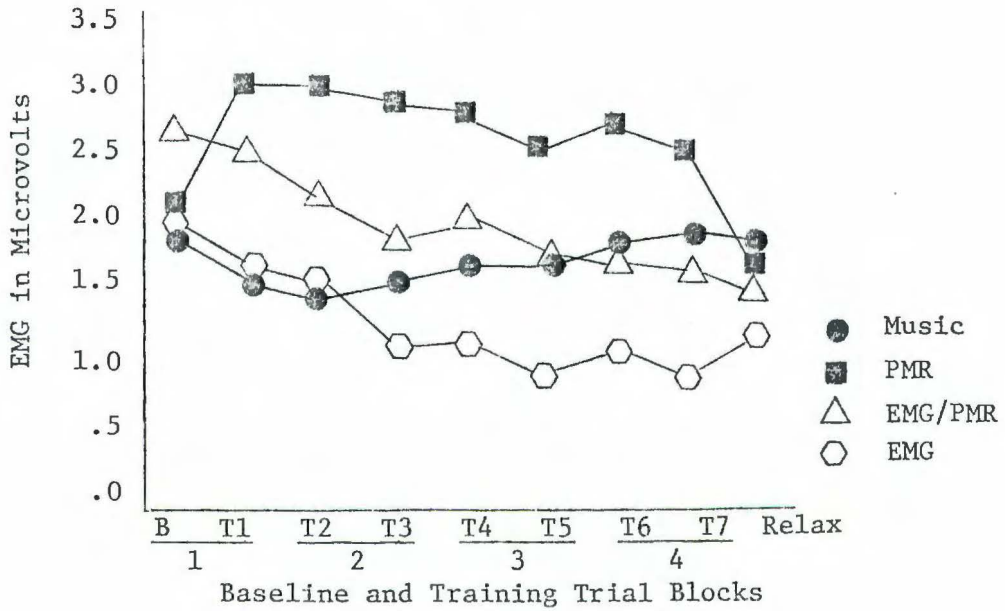


Table 7

The Mean Microvolt Changes in EMG Levels
from Pre-Training to Pre-Stressor

	MUSIC	PMR	EMG/ PMR	EMG	
Internal	+.176	-.136	- .328	-.371	-.162
External	-.030	-.062	-1.290	-.604	-.497
	+.073	-.086	- .809	-.482	-.329

The analysis of variance preformed upon the change scores showed that the training methods differed in their effectiveness of reducing rest-in EMG levels (see Table 8).

Table 8

Summary of the Analysis of Variance
for Training Change in EMG Mean Levels

	Mean Square	F	Tail Probability
Training Method (T)	2.814	5.05	.003
Locus of Control (I-E)	2.042	3.67	.060
T X I-E	.090	1.61	.195
Error	.557		

A Newman-Kuels posteriori test revealed that to the EMG/PMR trained subjects changed their EMG levels significantly more than subjects receiving music or subjects receiving PMR alone. The biofeedback only trained subjects decreased their EMG levels by .482 microvolts, but this reduction was not significantly different from any of the other groups. Regrouping the relaxation training into either biofeedback or non-biofeedback trained subjects revealed that biofeedback trained subjects reduced their EMG more than non-biofeedback trained subjects ($F=12.46$; $df=1/66$; $P < .01$).

Table 7 also showed more overall change for externally controlled subjects than internally controlled subjects. However, the analysis of variance summarized in Table 8 revealed only a tendency for externally controlled individuals to change more. In order to determine if the personality tendency was significant among those trained with biofeedback subsequent

analyses comparing only the two biofeedback focused relaxation techniques was performed. That analysis showed externally controlled subjects exposed to biofeedback training reduced their resting EMG levels (from pre-training to pre-stressor) significantly more than their internal counterparts ($F=7.30$; $df=1/32$; $P<.1$), and there were no biofeedback method differences.

As reported earlier pre-training differences in group EMG levels suggested that baseline EMG covariance analysis would be appropriate for determining the effectiveness of the relaxation training. That analysis, summarized in Table 9, showed reduction in the size of training effect differences and effectively eliminated systematic locus of control variation.

Table 9

Summary of the Analysis of Covariance* for Training Change in EMG Mean Levels

	Mean Square	F	Tail Probability
Training Method	0.99996	3.52	0.020
Locus of Control	.38800	1.36	.247
Interaction between training Method & I-E	.07290	.26	.857
Error	.28435		

*Covaried on the Pre-training baseline.

A second measure of training effectiveness is the absolute magnitude of EMG levels during rest when adjustments have been made for pre-training EMG levels based upon their covariation. This measure provides

an indication of the degree to which the relaxation training has generalized to a non-stressful situation. The ten minute rest period prior to the stress induction provided such a measure. The mean EMG levels for all experimental conditions are provided in Table 10. The analysis of covariance on those means showed a significant relaxation method difference among means ($F=2.64$; $df=4/70$; $P < .05$).

Table 10

Mean Microvolt EMG Levels at Rest Prior to Stressor Film Adjusted for Regression with Pre-Training Baseline

	MUSIC	PMR	EMG/ PMR	EMG	
Internal	2.121	2.034	1.668	1.536	1.839
External	1.840	1.893	1.48	1.562	1.693
	1.981	1.964	1.575	1.549	1.766

As expected the biofeedback methods produced lower EMG's prior to viewing the stressor film. A planned comparison of these same differences showed a highly significant biofeedback effect ($F=10.98$; $df=1/70$; $P < .01$).[2]

Analysis of Hypotheses

Hypothesis 1 - This hypothesis states that subjects provided with music relaxation training will report more anxiety and experience more tension during exposure to the stressor than all other trained subjects. Subjective anxiety data are reported first. The STAI-state and the MAACL

[2]For subsequent analyses of the effects of the stress inducing film it would not be inappropriate to combine the biofeedback alone and the biofeedback facilitated PMR groups as an effective class of relaxation methods for coping with the stressor. The music method and PMR alone might be combined as representing a class of relaxation methods which might be expected to have less effectiveness for coping with the stressor.

today scales were used as measures of subjective anxiety. No significant differences for either of the subjective anxiety measures were observed, necessitating the rejection of this hypothesis for subjective anxiety.

In order to examine the second part of this hypothesis it was necessary to test the validity of the film as a stressor. The pattern of EMG reactivity while viewing the repeated segment of It Didn't Have to Happen clearly demonstrated its stressor characteristics. Figure 4 shows the average EMG profile obtained from seven control subjects just prior to, during and after exposures to the 92 second video-taped segment. A repeated measures analysis of variance indicated highly significant and systematic fluctuations in frontalis muscle group EMG levels during the stressor session ($F=5.60$; $df=4/20$; $P < .01$). Newman Keuls posteriori analysis showed that the EMG levels during repeated exposures to the film were all higher than previous resting states, substantiating the appropriateness of the film as a stressor. The hypothesis stated that physical tension levels as measured by microvolts of EMG would have been higher for music trained subjects during exposure to the film. Mean EMG profiles displaying the stressor characteristics of the film can be seen in Figure 5. A planned comparison analysis showed that the music trained subjects overall showed similar EMG levels over the six exposures of the stressor film to the subjects trained with the more active relaxation methods ($F < 1.$). However, looking at the total tension levels over the six exposures to the film indicated that the external music trained subjects, versus all other groups, showed a significantly higher EMG level ($F=6.43$; $df=7/65$; $P < .001$) see Figure 6. A planned comparison between externally controlled music subjects and externally controlled subjects

in the actively trained relaxation groups also resulted in significantly higher EMG levels among the music group ($F=2.5$; $df=7/65$; $P<.05$). Examining this finding more closely, the EMG levels were aggregated into blocks of exposure to the stressor film. During the first and second exposure to the film no differences were found between external music subjects and all other externals ($F<1.0$); however, during the third and fourth viewing a trend was observed ($F=1.987$; $df=7/65$; $P<.1$) and by the final two viewings a significant difference was seen ($F=6.163$; $df=7/65$; $P<.01$), suggesting that externally controlled subjects trained to relax by listening to music were less successful in controlling their responsiveness during a stressful laboratory situation.

Figure 4

Mean EMG Levels of Control Subjects During Exposure to the Stressor Film

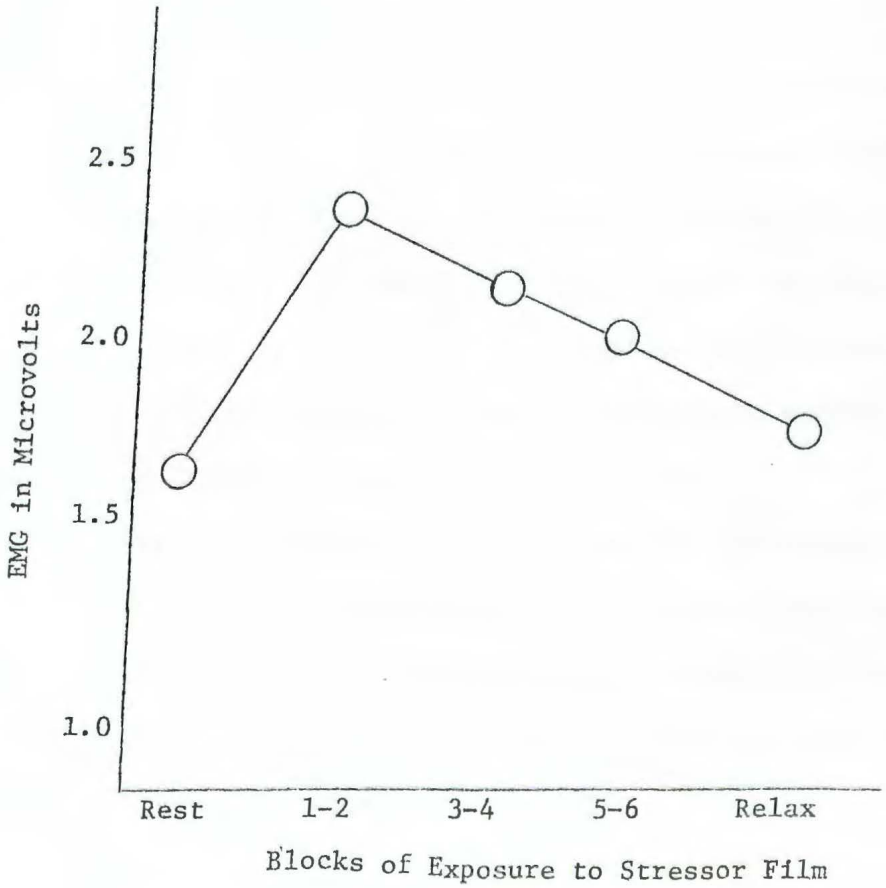
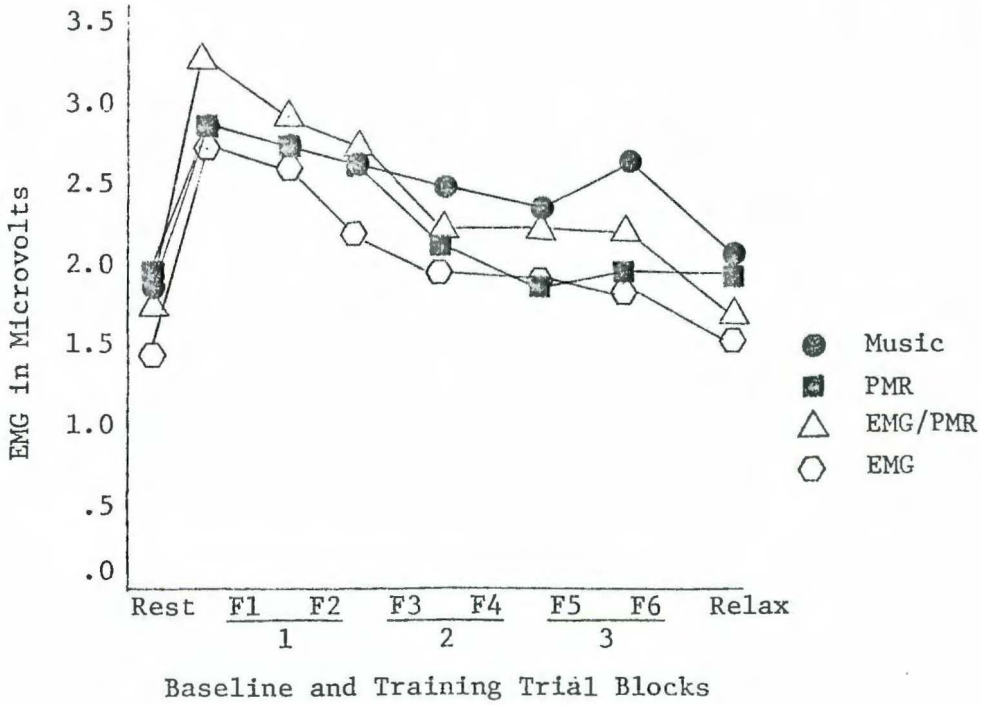


Figure 5

Mean EMG Profile of the Stressor Characterisitic of
It Didn't Have to Happen for Experimental Groups



Examining external subjects further it was found that externally controlled subjects (with no training what so ever) tended to evoke higher EMG levels when exposed to the stressor film than the other actively trained externals ($F=1.607$; $df=9/70$; $P<.1$). Also, when external control and external music trained groups were combined and compared to the external active relaxation training groups the difference between them was found to be significant ($F=5.552$; $df=9/70$; $P<.01$).

Similar comparisons among internally controlled subjects failed to show any difference in the EMG pattern of stress responsiveness between training methods. Music trained subjects compared to all other internally controlled subjects in active relaxation training groups showed no signifi-

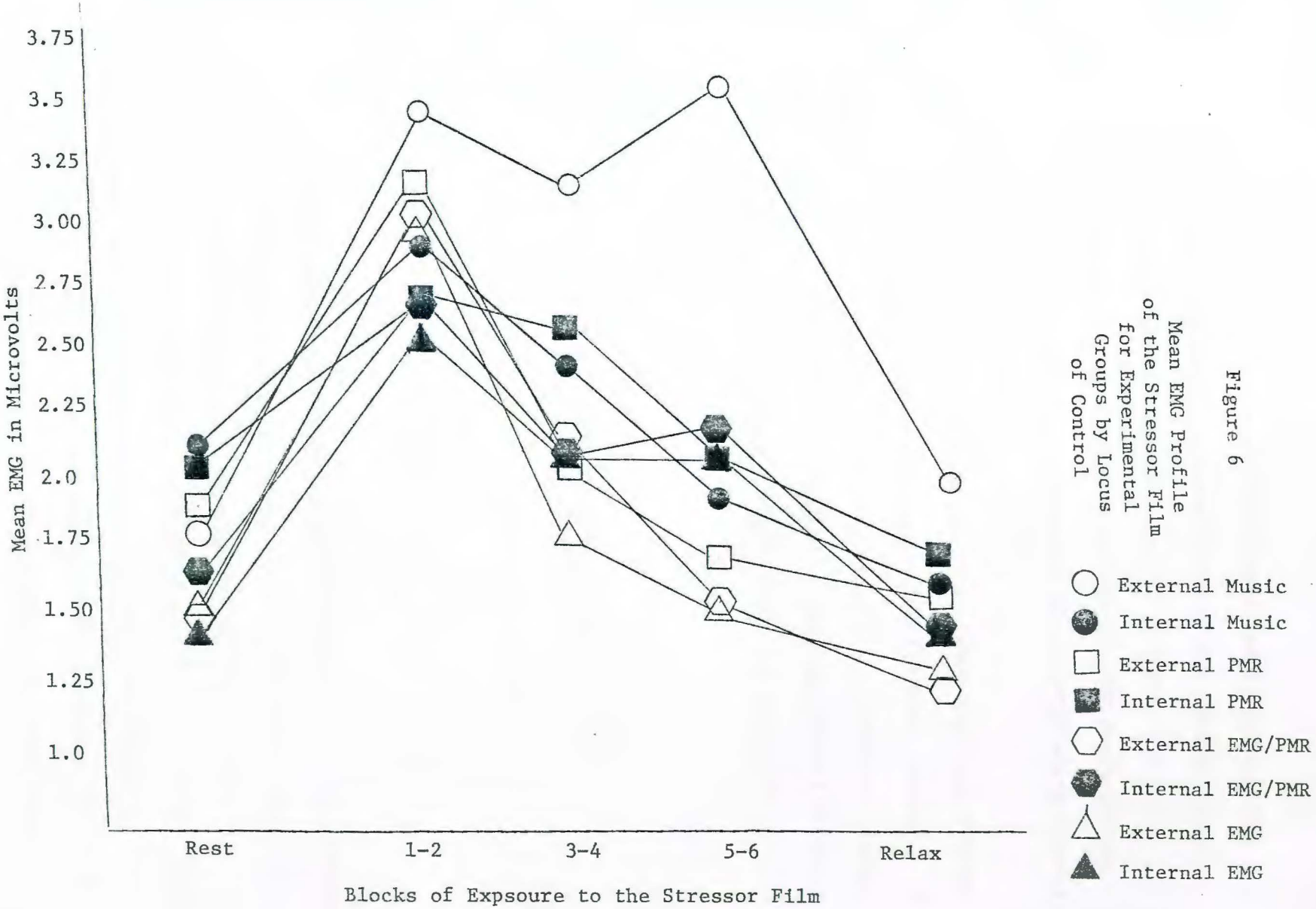


Figure 6

Mean EMG Profile of the Stressor Film for Experimental Groups by Locus of Control

cant differences ($F < 1.0$) in the overall responsiveness to the film. Inspection of Figure 6 showed that a comparison of the internal music group with all groups would surely have the same outcome.

Hypothesis Two - This hypothesis stated that the music trained subjects would experience the least reductions in reported state anxiety following exposure to the film.

The changes in STAI-state form and MAACL-today form from between exposures to following relaxation was used as the dependent variable. A covariance analysis (covarying on the pre-stressor state anxiety levels) was preformed on each instrument and failed to show any overall differences for either variable. The mean change scores are presented in Table 11.

Table 11

Mean Change Scores for Subjective Anxiety from Exposure to the Stressor Film to Post Relaxation Period

	MUSIC	PMR	EMG/ PMR	EMG
STAI-State	-19.778	-17.200	-15.278	-13.722
MAACL-Today	- 4.722	- 6.700	- 6.611	- 4.722

Hypothesis Three - This hypothesis stated that internally controlled subjects training in either of the biofeedback groups will be more successful in reducing tension than externally controlled subjects. Hypothesis three was rejected also. As was noted earlier externals tended to reduce their EMG levels during training more than internals.

Adjustments were made for pre-training differences in EMG by an analysis of covariance using only the two biofeedback trained groups. A

2(Biofeedback method) X 2(locus of control) analysis of adjusted pre-training to pre-stressor change in EMG resulted. Summary Table 12 is remarkable not because of the lack of group differences but for the significance of the regression coefficient (r=.59) and the resulting uniformly low F ratios for the experimental treatments.

Table 12

Summary of Analysis of Covariance (Adjusted by Pre-Training Baseline) for Mean EMG Level Change from Pre-Training Baseline to Pre-Stressor Rest

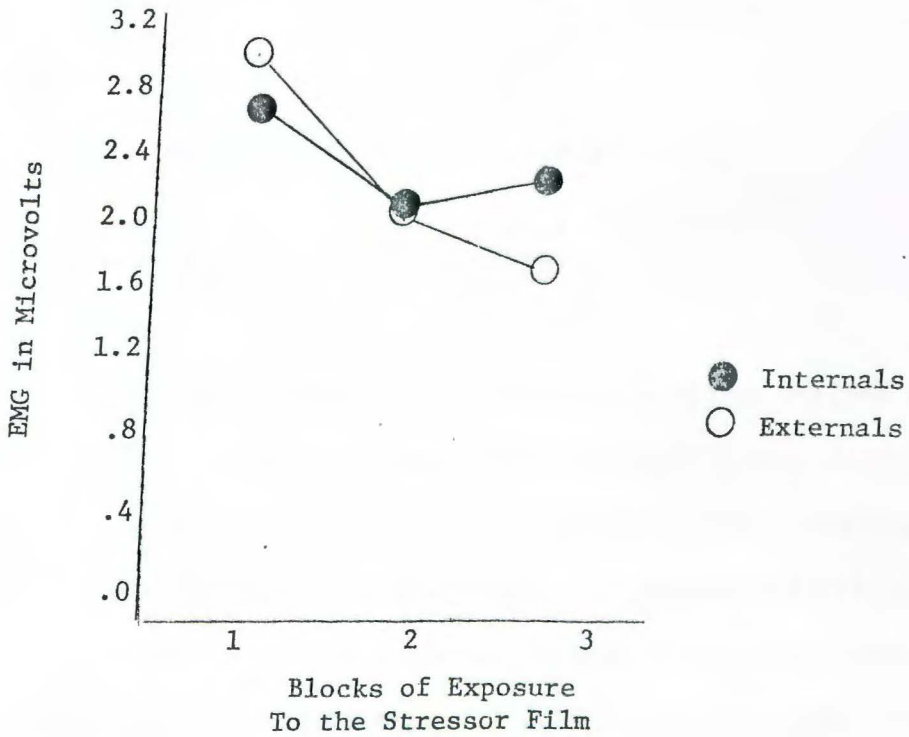
	Mean Square	F	Tail Probability	Beta Estimated
Training Method	.08476	.44	.510	
Locus of Control	.00772	.04	.842	
Interaction between training & I-E	.002345	.12	.728	
Error	.19055			0.59340

Another indicator of tension reduction effectiveness is the ability of the subject to lower his elevated EMG levels while still exposed to the stressor film and then to reduce the EMG microvolt measurement to the pre-stressor level. In a 2 X 2 analysis of covariance of change scores from pre-stressor to post-stressor it was noted that all biofeedback trained subjects were able to lower their EMG levels sufficiently so that no significant differences were observed between the pre and post-stressor relaxation scores. In order to see what importance locus of control played in the reduction of the EMG levels during exposure to the film a 2 X 2 X 3 repeated measures analysis of covariance(adjusted by pre-training and pre-stressor EMG levels) was performed. A significant interaction was discov-

ered between locus of control and blocks of exposure to the stressor film ($F=3.63$; $df=3/96$; $P < .05$), with externals exhibiting lower scores (see Figure 7).

Figure 7

Mean EMG Levels for Biofeedback Trained Internals vs. Externals Over the Exposure to the Stressor Film



An interesting phenomonon was uncovered while examing locus of control. A movement from externality to internality was found for externals ($F=6.65$; $df=3/66$; $P < .05$). Change results (see Table 13) clearly show the training groups involving EMG biofeedback had greater variability in their change scores than the non-biofeedback groups and that the change was toward externality.

Table 13

Pre to Post Changes in Locus of Control by Treatment Group

Group	Change in Locus of Control	S.D.
Music		
Internal	+.7	2.162
External	0	1.603
PMR		
Internal	+.4	2.716
External	-.2	2.347
EMG/PMR		
Internal	+ .8	4.077
External	-2.875	6.034
EMG		
Internal	+ .8	3.135
External	-3.0	4.566

Hypothesis Four - It stated that subjects trained in PMR alone would report more anxiety and show higher EMG levels during the stressor film than subjects in both the biofeedback groups. The hypothesis was rejected for subjective anxiety since no significant differences were found in either STAI-State anxiety scores or the MAACL-Today scores for all experimental groups after two exposures to the film. Planned comparisons failed to show any EMG differences between the PMR and EMG/PMR or EMG trained subjects between viewing the film (refer to Figure 5).

Discussion

Introduction

The present study sought to identify the extent to which active (PMR, EMG/PMR and EMG biofeedback) versus passive methods (no training and music exposure) of relaxation were effective in lowering the physiological stress reactivity of internally and externally controlled individuals when they were placed in a psychosocial stress situation.

EMG Biofeedback Training

The findings for the pre-training baseline session indicated that eventhough a careful randomized selection of subjects was performed, externally controlled subjects exhibited higher pre-training EMG levels than their internal counterparts. This finding was not surprising as Rotter (1972) defines externals as believing their rewards are controlled by forces outside of themselves suggesting that generally externals would not be relying on their inner skills to aid in bringing about desired outcomes. Rotter referred to this as generalized expectancy. Rotter also states that in novel situations or where the individual has little experience, that specific expectations for rewards in that situation are going to play a greater role in determining his/her behavior than generalized expectancy. Yet studies by Liverant and Scodell (1960), Sechrest (1962), Franklin (1963), Seeman (1963), Gore and Rotter (1963), Rotter and Mulry (1965), and Sechrest (1965), all indicated differences in behavior suggesting that internals who believe they can control their environment also believe they can control themselves. However, these findings were not in studies where specific expectancies were measured.

The importance of this finding to the study lies in the fact that externals in the EMG/PMR group specifically were more tense (anxious) individuals than any other subjects in the study. Such differences are not a direct threat to the study unless initial anxiety levels interact with either training effectiveness or reactivity to the stressor film. If so these initial differences in EMG levels may compete with the hypotheses as possible explanations of the external subjects data.

After going through the relaxation training sessions it was found

that for both internals and externals the greatest ability for lowering resting EMG levels occurred in the two biofeedback groups. However on subsequent analyses of the two biofeedback groups alone it was found that externally controlled subjects reduced their resting EMG levels significantly more than their internal counterparts, independent of which biofeedback group they were in. These findings are in direct contradiction with the findings of Jordan and Schallow (1975), Blackstein and Egner (1976), and Schneider, et al. (1977). In the Jordan and Schallow study for example, it was reported that internals were able to decrease EMG levels more effectively after biofeedback trainings than externals. Schneider, et.al. (1977) and Blackstein and Egner (1976) reported internals were better able to increase heart rate biofeedback training. Schneider suggested that the internals were better able to take advantage of the feedback information since according to Rotter (1972) internals are more alert to aspects of their environment which may be useful for future behavior and might improve his/her condition.

In similar heart rate studies by Fotopolous (1970), Ray and Lamb (1974) and Ray (1974), although it was found that internals were better able to increase heart rate it was also noted the externals were better able to decrease heart rate. In most of these studies the training period was extremely abbreviated, with as little as one baseline session and one training session before testing was performed. It is suggested by the present study that initially (pre-training baseline) internals appear to be more relaxed, but however, once training began, those externals who were trained with biofeedback techniques began to realize that indeed they were capable of producing changes within their body. This research sup-

ports Rotter's (1972) theory that expectancies change to a more specific task expectancy when the individuals are presented with data confirming their role in the demonstrated change. Further evidence to support this claim can be found in the significant change in locus of control from pre to post experiment. Although regression to the mean cannot be ruled out, it must be noted that the change from externality toward internality in the EMG/PMR and EMG groups suggest that being aware of controlling one's body changed external expectations of success.

EMG Changes While Viewing a Stressor Film

EMG Changes for Untrained Subjects--The pattern of EMG reactivity while viewing the repeated segment of It Didn't Have to Happen clearly demonstrates its stressor characteristics. Analysis showed that the EMG levels during repeated exposures to the film were all higher than previous resting states, substantiating the appropriateness of the film as a psychophysiological stressor as suggested by Lazarus (1968), Folkins (1968), Davidson and Hiebert(1971), and Shepherd (1977). However, unlike Lazarus' report that due to the emotional stimulation produced by the film, subjects will not habituate no matter how many times it is viewed, habituation to the film was indicated (in this sample)by the significant drop off in EMG levels during the 5th and 6th viewing of the film. Davidson and Hiebert (1971), noted that contrary to Lazarus' suggestion, habituation to the film did occur on the subjective anxiety measure and on skin conductance.

EMG Change for Experimental Groups

A summary of the stressful viewing effect upon EMG profiles is provided in Figure 5. The findings suggest that all experimental groups reacted similarly during the exposure to the film. It was not until the

groups were examined by locus of control that treatment differences became apparent. Externally controlled music trained subjects produced significantly higher EMG levels than any other training group, and even more specifically externally controlled music subjects were significantly more reactive than all other externally controlled subjects. Inorder to determine that the decrease in EMG levels for the actively trained externals was not due to habituation the untrained control externals and the external music subjects were combined and compared with the external active relaxation training groups. A significant difference was observed. This finding that music relaxation was not as effective as the active relaxation method in reducing EMG levels for externals is contrary to the findings of Edelman (1970). Edelman suggested that music assisted relaxation groups were equally as effective in reducing autonomic activity as subjects trained in taped PMR sessions. Perhaps differences in experimental design between Edelman's study and the present study are responsible for this contradiction. In the present study the subjects were placed in a stressful laboratory situation, whereas, in Edelman's study only pre and post training session measurements were analyzed. Indeed, even during the first block exposure to the film in the present study, no differences were noted between external music subjects and the actively trained subjects. It was not until the third block of exposure to the film that significant differences were seen: substantiating what Davidson and Hiebert (1971), discovered, that after the initial exposure to the film, no decrease in physiological arousal was found. Had their design not included repetitions of the stressor the results might have been very different.

Subjective Anxiety Analyses

The STAI State and Trait questionnaires and the MAACL Today form were used as measures of subjective anxiety. Examining the state anxiety measures there were no significant differences found during administration of the questionnaires for either treatment method or locus of control. The only reliable changes occurred over trials, with the anxiety score dramatically rising during the exposure to the stressor film, giving further validation to the question of whether or not the film was a stressor.

There were also no significant differences over treatment group or locus of control for the reduction of subjective anxiety from the time during exposure to the film to post stressor relaxation.

Analysis of post training trait anxiety (STAI) also failed to show any systematic differences in general anxiety attributable to the treatment or locus of control. (It is speculated that trait anxiety at the time of pre-training scores was also negligible.)

Post Experimental Questionnaire

A post experimental questionnaire (See Appendix H) based on subjective analysis of the training as well as the testing sections of the experiment presented interesting data. When asked whether or not the subject found the film clip stressful (question three) a significant difference was noted for locus of control ($F=7.15$; $df=1/66$; $P < .01$). External subjects rated the film lower in stressful quality than did the internal subjects. Possibly this phenomenon may be attributed to the inability of the external personality to identify with the film and therefore, internalize the material being presented. If so, this factor may have been significant in the externals ability to become more relaxed while viewing

the stressor film. It should be noted that eventhough externals felt they were under less stress they were more physiologically reactive during the first two exposures of the film than their internal counterparts. Recall this evaluation was given at the end of a ten minute relaxation period following the stressor film. There is not a high correlation between their subjective view of anxiety and actual tension levels across the entire stress experience. A significant analysis of covariance for pre to post stressor EMG level change with subjective anxiety the covariate would show that subjective experience of anxiety was not the only factor influencing their greater ability to relax to the stressor film. Unfortunately, the analysis of covariance failed to reveal any treatment or locus of control differences. Consequently, it is conceivable that the externals' tendency to view the film as less of a stressor than the internals may have been the primary reason for the low scores of the external active relaxation subjects. None-the-less the analysis of covariance assumes that the correlation between the subjective anxiety and tension levels is the same across all external groups regardless of treatment. Thus, lower external subjective anxiety scores cannot account for the difference in lower EMG levels for the external actively trained individuals than the external music trained and control individuals.

Question one is the only other question where a significant difference was reported. This question asked if the individual understood what the relaxed state felt like. The EMG/PMR group had the highest mean score of 4.175 (suggesting good understanding) followed by the PMR group with 4.000. The mean for all groups was 3.770 ($F=2.74$; $df=3/66$; $P<.05$). Coursey (1976), reported similar findings. This suggests that subjects

felt they were better able to understand what the relaxed state felt like only after they had experimented with tension and could compare the kinestheic differences.

Reviewing this discussion, it can be seen that the major finding of this study is that externally trained subjects in the active relaxation techniques (PMR, EMG/PMR and EMG) were able to recover from the stressor at a faster rate than their untrained or music exposed external counterparts.

Chapter V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

In this study, four relaxation techniques were examined as to their relative efficacy in reducing physiological arousal during exposure to a psychosocial stressor. The personality dimension of locus of control was an added variable in the study. More specifically the following questions were examined: will subjects provided with music relaxation training report more anxiety and experience more tension during exposure to the stressor than all other actively trained subjects; will the music trained subjects experience the least reductions in reported state anxiety following the stressor film; will internally controlled subjects trained with biofeedback be more successful in reducing tension than their external counterparts; will subjects trained in PMR alone report more anxiety and show higher tension levels during the stressor film than subjects in both the biofeedback groups?

The present study involved 81 male college students and randomly assigned them to the four experimetnal training groups or the control group - based on their locus of control. EMG pre-training baseline measurements were taken and all training groups were given seven 20 minute relaxation training sessions. Three days after training was completed each subject was exposed to six repetitions of a 92 second segment of a stressor film. Baseline EMG levels were obtained prior to and following this exposure. Data was also collected during the film clips. Before the film, after the second exposure to the film and following the post-stressor

relaxation period subjective anxiety scales (STAI and MAACL) were administered.

Data was initially analyzed using ANOVAS, repeated measures analyses and analysis of covariance. Planned comparisons then followed to more specifically identify differences between groups. The results of these analyses indicated that the psychosocial stressor was indeed able to raise all subjects' EMG levels, that biofeedback training produced significantly lower EMG levels during a resting period than music or PMR training, that externally controlled individuals trained with biofeedback reduced their resting EMG levels more than their internal counterparts, that externally controlled individuals trained with biofeedback reduced their EMG levels at a faster rate than internals and that initial muscle tension during exposure to the stressor seemed to be uneffected by the type of relaxation training the subject received or whether he received training at all.

Conclusions

The findings of this study warrent the following conclusions:

1. The film, It Didn't Have to Happen, (more specifically the 92 second segment) is an effective laboratory stressor technique, although contrary to previously reported studies, habituation to the film occurs.

2. Individuals trained with either one of the biofeedback methods produced lower muscle tension in a resting state following the training trials than individuals trained with music or PMR. This suggests that EMG biofeedback training whether alone or in conjunction with PMR is a more effective technique for bringing about a relaxed condition than

listening to music or being trained in PMR alone.

3. Contrary to the proposed hypothesis, internals were not able to benefit more from biofeedback training as a means of reducing their stress reactivity to the stressor film than externals. Furthermore biofeedback was no more effective than music or PMR in reducing the reactivity of internals.

4. Externally controlled individuals trained with either of the biofeedback techniques reduced their resting muscle tension more effectively than their internally controlled counterparts.

5. Externally controlled individuals trained with biofeedback skills reduced their muscle tension at a faster rate during exposure to the stressor film than their internal counterparts.

6. Externally controlled music subjects were the least effective group in the reduction of stress arousal during exposure to the stressor film.

7. Initial muscle tension during exposure to this stressor seems to be uneffected as to whether or not the subject received relaxation training or the type of training received. All previously reported findings suggested the effects of training begin to emerge after initial exposure to the stressor.

Recommendations

After reviewing this study and examining the findings the following recommendations are made:

1. Any study providing relaxation training will benefit from including more baseline measurement on more than one occasion inorder to

minimize the novelty of the experimental situation prior to collecting data.

2. Studies providing relaxation training would benefit by providing a post training non-feedback period immediately following the last relaxation training session.

3. Future studies need to investigate other physiological dimensions of the stress response, i.e., heart-rate, respiration rate and electro-dermal response.

4. More studies be conducted for the purpose of assessing the efficacy of relaxation techniques in combating real life stressor situations. Too few studies include a stressor component.

5. Further research is needed to investigate how specific expectancies for self-regulation mediate the effectiveness of relaxation techniques for externally or internally controlled individuals. It may be that expectancies effective for internals and externals may differ.

6. Studies investigating the efficacy of these relaxation techniques need to be explored with female subjects and with both sexes so comparisons can be obtained.

7. Health educators need to attend to personality variables and to the nature of the stressor which people are exposed to, when planning stress intervention programs.

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APPENDICES

APPENDIX A

INSTRUCTIONS - BASELINE AND SESSION #1

If you will take a seat, I will explain what this study is about. We are comparing techniques for relaxation. You will receive one of four techniques of relaxation training. This will entail two twenty minute training periods per day for four days. On a fifth day we will show you a film and see how well you have learned to relax.

You will be attached to this EMG recording machine. It will measure the muscle activity in your forehead. There is no chance of receiving any shocks from the machine, only your energy is picked up by the instrument. The device does not generate any energy. Also, there will be no pain involved.

If you read this sheet of information, it will explain the study further. (Consent slip)

Do you have any questions?

If you will turn it over you will see that there is a consent form. Fill it in, and I will sign it.

Would you mind filling out this questionnaire as well? (PDF)

The chair you are sitting in is a recliner chair. To facilitate relaxation I'll tell you how to put it in a reclining position. Reach your right hand down on the outside of the chair, and find an upholstered pocket. Inside that pocket is a wooden lever. Pull back on the lever and the footrest will come up and the chair will lock into a reclining position. Find a position that is comfortable for you.

I am now going to wipe the excess oils from your forehead with alcohol. These discs will measure the muscle activity in your forehead. I'm putting paste on them to improve the contact between your forehead and the discs. It is water soluble and I will wipe it off when I take the discs off.

If you are comfortable, I will adjust the machine. Everything is okay?

You can wear these earphones to help keep out distracting sounds. For twenty minutes I want you to sit comfortably with your eyes closed and try not to fall asleep.

We are ready to begin. You won't have an opportunity to ask any questions for twenty minutes, so is there anything you'd like to ask? If not, we will begin. Close your eyes and I'll tell you when twenty minutes is up.

(20 minutes)

You can take a break now. I will put on a television short for you to watch.

(10 minutes)

You will now be trained in your specific relaxation technique. After I give you the directions, please put on the headphones and begin practicing.

Specific Group Instructions

Group #1 - Music group. "You are going to hear music through these headphones. How is the volume? Listen to the music and try to relax as totally as possible without falling asleep. Some people think closing their eyes helps them relax."

Group #2 - P.M.R. Group

I am going to teach you to relax far beyond the usual point, and this will enable you to "switch on" at will the greatest possible emotional effect of an "anti-anxiety" kind.

I am now going to show you the activity that is involved in obtaining deep relaxation. As I pull at your wrist I'd like you to try and resist any

movement. Notice very carefully the sensations in that muscle. Now let go gradually as I diminish the amount of pull I exert against you. Notice a decreasing sensation in your biceps muscle - it is an uncontracting of the muscle. Although the biceps will indeed become partially relaxed, try to continue the activity you felt as the biceps was coming down to rest on the arm of the chair. Continue listening to the instructions on the tape and do the activities as best you can." (Wolpe and Lazarus, 1966, pp. 61-62)

"Keeping your eyes closed may help."

Further taped instructions on the tape from Wolpe and Lazarus, 1966, pp. 177-180.

Group #3 - PMR/EMG Group

Same as for Group #2 with these further instructions:

"You will be getting two types of audio stimulation at the same time. You will be hearing a tape with directions on it with relaxation exercises and you will also be hearing a tone from the EMG machine telling you whether or not your muscles are relaxing. A slow pulse indicates a relaxed muscle whereas a fast pulse indicates tension. Try gritting your teeth (2 or 3 seconds) now relax... Lift your eyebrows... now relax... See the difference? Try to keep the pulse slow while you are in the relaxation phase of this taped technique. Don't be alarmed if the tone should increase as you contract your muscles - Just try to keep as relaxed as possible during the entire session.

Some people say keeping your eyes closed will help."

Group #4 - EMG Group

"Every muscle in your body generates electrical currents. In this experiment the electrical currents in your forehead will be amplified by an electronic instrument and converted to an audible tone which you will hear coming out of the headphones. Tensing your forehead generates large currents that will increase the pulses, relaxing your forehead produces smaller currents which slow down the pulses. Try gritting your teeth...now relax. Try wrinkling your forehead...now relax. (EMG is on and subject hears feedback.) Your task is to slow down the pulse as much as possible. The pulse is connected to your forehead because we believe the muscles there are good indicators of relaxation in the entire body.

Use whatever method works best for you to slow down the pulse, and I will give you no further instructions on how to do this.

I shall turn the tone on now and tap you on the shoulder when you are to stop relaxing.

Some people say closing your eyes will help."

Any questions.

Sessions 2 - 7 for Groups 1,2, & 4
Group 3 Wears No Headphones

Sit down and make yourself comfortable.

We are going to continue today with the training in...music, PMR, EMG/PMR, biofeedback and I will get your electrodes ready. If you would like, you can prepare your chair. I am going to clean your forehead with alcohol.

Please put the head phones on and then tell me if the volume is satisfactory.

I am going to go back to the other machine over there, and when I motion to you that I am going to begin, you can begin relaxing.

20 minutes

We will take a break now. Take your headphones off and I will turn on the television for you.

10 minutes

We are ready to begin our second part. Please put your headphones on.

When I signal you from over here, we will start.

20 minutes

Our session is over now. You can set your chair up, take off your headphones.

Your next meeting is going to be at

TEST SESSION - INSTRUCTIONS

Today you are going to fill out several questionnaires. You don't have to put your name on the paper. (PDR) For the next one I will give you a copy and then I will read it with you so that we can make sure the directions are understandable.

> "A number of statements which people have used to describe themselves are given below. Read each statement, and then blacken in the appropriate circle to the right of the statement to indicate how you feel generally, how you feel normally. There are no right or wrong answers; do not spend too much time on any one statement, but give the answer which seems to describe the feelings that you generally have." (STAI - Trait)

If you notice number 1 is almost never, and number 4 is almost always, and your answers can fall in between there, work as quickly as you can.

(Time allotted for questionnaire completion.)

This questionnaire is similar, and I will read the directions with you.

> "A number of statements which people have used to describe themselves are given below. Read each statement, and then blacken the appropriate circle to the right of the statement to indicate how you feel right now, that is at this moment. There are no right or wrong answers; do not spend too much time on any one statement. Pick out the answer which seems to describe your present feelings best." (STAI - State)

(Time Allotted)

For this one - I will read the directions to you.

> "On this sheet you will find words which describe different kinds of moods and feelings. Mark an X in the boxes beside the words which describe how you feel now. Some of the words may sound alike, but we want you to check all the words that describe your feelings. Work rapidly." (MAACL)

Now I am going to put on the electrodes as I have done before. I am going to ask you to rest, and I am going to take measurements of the muscle activity. If you would like to, you may recline the chair to a position which is most comfortable.

If you are ready, we can begin. (EMG Recording - Time intervals 1 min./5 sec. for 10 min.)

You are now going to see several repetitions of a film. I would like you to watch it and at that time I am going to be recording.

(2 rep. of film)

Would you fill out this questionnaire now, and mark an X in the block for the words that describe how you felt when the man was struck by the board. (MAACL)

Now fill this one in for how you felt when you saw the man get het by the board. (STAI-State)

(Rewind tape)

You are going to see this film several more times. As you watch the film I would like for you to try to relax, as you have done here previously in other sessions.

After the film is over you can continue relaxing until I tell you to stop. (10 min.)

(4 rep. of film)

There is one final set of questionnaires for you to fill out. This time I want you to report how you feel right now. I will remove your electrodes. (STAI-State)

Now, put an X in the box that describes how you feel right now, work rapidly. (MAACL)-post.

And finally we have two questionnaires, the first one you filled out in the fall, remember? 29 pairs of questions, and you have to answer either A or B, whatever is the best answer for you. And a post-experimental questionnaire.

APPENDIX B

INSTRUCTIONS FOR PROCTORS

1. HAVE THE STUDENTS SEATED IN THEIR SEATS AND ATTENDING TO YOU.

2. DISTRIBUTE THE PENCILS.

3. READ THE FOLLOWING EXPLANATION OF THE PERSONAL BELIEF INVENTORY:

   Before we begin the testing there is a questionnaire which we would appreciate your filling out. This survey is part of an on going research effort at Capitol Campus. Your name and address is requested so that you may be called at a later time to be a participant in this study. Your participation now and at any future time is completely voluntary. Filling out the questionnaire does not commit you to further participation, however, it will help us to determine typical beliefs of Capitol Campus students. Your individual response to the questionnaire will not be used by the University and will be held in strict confidentiality by the primary investigators, Iris Prager-Decker and William Decker. Should you desire a personal interpretation of your survey results you may contact Dr. William Decker, W164, for an appointment.

4. HAND OUT QUESTIONNAIRE AND SAY:

   This is a questionnaire to find out the way in which certain important events in our society affect different people. Each item consists of a pair of alternatives lettered a or b. Please select the one statement of each pair which you more strongly believe to be the case as far as you're concerned.

5. REMEMBER--There are 29 pairs of statements remember to turn the page over. This is your personal belief, there is no right or wrong answer. It should only take you 15 to 20 minutes to complete the survey. When you are finished please remain in your seats. All papers will be collected when everyone is finished.

APPENDIX C

Name	Local Address	Local Phone

1. a. Children get into trouble because their parents punish them too much.
   b. The trouble with most children nowadays is that their parents are too easy with them.

2. a. Many of the unhappy things in people's lives are partly due to bad luck.
   b. People's misfortunes result from the mistakes they make.

3. a. One of the major reasons why we have wars is because people don't take enough interest in politics.
   b. There will always be wars, no matter how hard people try to prevent them.

4. a. In the long run people get the respect they deserve in this world.
   b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.

5. a. The idea that teachers are unfair to students is nonsense.
   b. Most students don't realize the extent to which their grades are influenced by accidental happenings.

6. a. Without the right breaks one cannot be an effective leader.
   b. Capable people who fail to become leaders have not taken advantage of their opportunities.

7. a. No matter how hard you try some people just don't like you.
   b. People who can't get others to like them don't understand how to get along with others.

8. a. Heredity plays the major role in determining one's personality.
   b. It is one's experiences in life which determine what they're like.

9. a. I have often found that what is going to happen will happen.
   b. Trusting to fate has never turned out.

10. a. In the case of the well prepared student there is rarely if ever such a thing as an unfair test.
    b. Many times exam questions tend to be so unrelated to course work that studying is really useless.

11. a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.
    b. Getting a good job depends mainly on being in the right place at the right time.

12. a. The average citizen can have an influence in government decisions.
    b. This world is run by the few people in power, and there is not much the little guy can do about it.

13. a. When I make plans, I am almost certain that I can make them work.
    b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.

14. a. There are certain people who are just no good.
    b. There is some good in everybody.

15. a. In my case getting what I want has little or nothing to do with luck.
    b. Many times we might just as well decide what to do by flipping a coin.

16. a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.
    b. Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.

17. a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.
    b. By taking an active part in political and social affairs the people can control world events.

18. a. Most people don't realize the extent to which their lives are controlled by accidental happenings.
    b. There really is no such thing as "luck".

19. a. One should always be willing to admit mistakes.
    b. It is usually best to cover up one's mistakes.

20. a. It is hard to know whether or not a person really likes you.
    b. How many friends you have depends upon how nice a person you are.

21. a. In the long run the bad things that happen to us are balanced by the good ones.
    b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.

22. a. With enough effort we can wipe out political corruption.
    b. It is difficult for people to have much control over the things politicians do in office.

23. a. Sometimes I can't understand how teachers arrive at the grades they give.
    b. There is a direct connection between how hard I study and the grades I get.

24. a. A good leader expects people to decide for themselves what they should do.
    b. A good leader makes it clear to everybody what their jobs are.

25. a. Many times I feel that I have little influence over the things that happen to me.
    b. It is impossible for me to believe that chance or luck plays an important role in my life.

26. a. People are lonely because they don't try to be friendly.
    b. There's not much use in trying too hard to please people, if they like you, they like you.

27. a. There is too much emphasis on athletics in high school.
    b. Team sports are an excellent way to build character.

28. a. What happens to me is my own doing.
    b. Sometimes I feel that I don't have enough control over the direction my life is taking.

29. a. Most of the time I can't understand why politicians behave the way they do.
    b. In the long run the people are responsible for bad government on a national as well as on a local level.

Subject Information

Purpose of Study: The purpose of this study is to investigate the relative effectiveness of four types of relaxation techniques during a simulated stressful situation.

Procedures:

1. You will be trained in a relaxation technique. (Either listening to music, progressive muscle relaxation training or training with a muscle biofeedback technique.) In all cases your muscle tension will be recorded by an EMG device.

2. Training periods will be limited to three, one (1) hour sessions spaced two days apart. Research has indicated these techniques enable individuals to control their muscle tension.

3. Several days after the training session you will view a segment from an industrial accident film found to be stress inducing. This should take approximately ten minutes. During this time you will be asked to use your relaxation technique while we measure your muscle tension. At this time you will be asked to fill out several questionaires to determine your personal reaction.

Discomforts and risks: The EMG biofeedback device used throughout the experiment is powered by batteries so no danger of shock is present.

The content material of the film may cause an uneasy feeling do to its realistic portrayal.

Benefits: You will have the opportunity to learn a relaxation technique previously found to have tension reducing qualities.

At the end of the study you will be provided the relative effectiveness of your relaxation technique and afforded the opportunity to train further in the relaxation technique found to be most effective. Thus, it is hoped you will benefit from learning how to control your muscle tension.

APPENDIX E

PERSONAL DATA FORM

Name_____ Date_____ Group_____

1. Right now I feel... _____Very tense _____Tense _____Relaxed _____Very Relaxed

2. In general I would describe my present health status as...

_____Very Healthy _____Healthy _____Average Health _____Ill _____Very Ill

3. Last night I slept about _____ hours.

4. Have you taken any drugs or medication within the last 12 hours? _____Yes _____No
If you answered this question yes please list the drug(s) or medication(s).

_____

_____

5. Were you involved in any strenuous activity (exercise) within the last five hours? _____Yes _____No
If your answer to this question is yes please indicate what the activity was and hose long you were engaged in this activity._____

_____

6. Have you experienced any major stress today? _____Yes _____No
If yes please indicate what caused the stress._____

_____

_____

7. Circle the (X) that represents the degree of your feelings. Respond to all items.

Happy X X X X X Sad

Worried X X X X X Carefree

Anxious X X X X X Calm

Angry X X X X X Peaceful

Tired X X X X X Energetic

APPENDIX F

Number_____ Group_____ I-E_____

Program_____

Age_____

I-E scores _____(pre)

_____(post)

STAI Trait _____ State _____(pre)

_____(2nd)

_____(post)

MAACL (anxiety) _____ _____ _____

Pre 2nd Post

EMG means:

Base Line D M.	1	2	3	4	5	6	7	Rest	1	2	3	4	5	6	Relax
	2min./5sec. compute							10 m.	15 sec/.1 sec.						10 m

Training

Base	1	2	3	4	5	6	7	Rest
EMG U per 2 min./5 sec.								EMG u per 1 minute/3 sec.

Film

1	2	3	4	5	6	Relax
EMG u per 15 sec/.1						EMG u per 1 minute/5 sec.

Notes: _____

_____

PLEASE NOTE:

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SELF-EVALUATION QUESTIONNAIRE

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

STAI FORM X-1

NAME _____ DATE _____

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

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

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SELF-EVALUATION QUESTIONNAIRE

STAI FORM X-2

NAME _____ DATE _____

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

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

MULTIPLE AFFECT ADJECTIVE CHECK LIST

TODAY FORM

By Marvin Zuckerman
and
Bernard Lubin

Name..... Age..... Sex.....

Date..... Highest grade completed in school.....

DIRECTIONS: On this sheet you will find words which describe different kinds of moods and feelings. Mark an ☒ in the boxes beside the words which describe how you feel now - today. Some of the words may sound alike, but we want you to check all the words that describe your feelings. Work rapidly.

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MAA 001

A

1 ☐ active
2 ☐ adventurous
3 ☐ affectionate
4 ☐ afraid
5 ☐ agitated
6 ☐ agreeable
7 ☐ aggressive
8 ☐ alive
9 ☐ alone
10 ☐ amiable
11 ☐ amused
12 ☐ angry
13 ☐ annoyed
14 ☐ awful
15 ☐ bashful
16 ☐ bitter
17 ☐ blue
18 ☐ bored
19 ☐ calm
20 ☐ cautious
21 ☐ cheerful
22 ☐ clean
23 ☐ complaining
24 ☐ contented
25 ☐ contrary
26 ☐ cool
27 ☐ cooperative
28 ☐ critical
29 ☐ cross
30 ☐ cruel
31 ☐ daring
32 ☐ desperate
33 ☐ destroyed
34 ☐ devoted
35 ☐ disagreeable
36 ☐ discontented
37 ☐ discouraged
38 ☐ disgusted
39 ☐ displeased
40 ☐ energetic
41 ☐ enraged
42 ☐ enthusiastic
43 ☐ fearful
44 ☐ fine
45 ☐ fit
46 ☐ forlorn
47 ☐ frank
48 ☐ free
49 ☐ friendly
50 ☐ frightened
51 ☐ furious
52 ☐ gay
53 ☐ gentle
54 ☐ glad
55 ☐ gloomy
56 ☐ good
57 ☐ good-natured
58 ☐ grim
59 ☐ happy
60 ☐ healthy
61 ☐ hopeless
62 ☐ hostile
63 ☐ impatient
64 ☐ incensed
65 ☐ indignant
66 ☐ inspired
67 ☐ interested
68 ☐ irritated
69 ☐ jealous
70 ☐ joyful
71 ☐ kindly
72 ☐ lonely
73 ☐ lost
74 ☐ loving
75 ☐ low
76 ☐ lucky
77 ☐ mad
78 ☐ mean
79 ☐ meek
80 ☐ merry
81 ☐ mild
82 ☐ miserable
83 ☐ nervous
84 ☐ obliging
85 ☐ offended
86 ☐ outraged
87 ☐ panicky
88 ☐ patient

D

89 ☐ peaceful
90 ☐ pleased
91 ☐ pleasant
92 ☐ polite
93 ☐ powerful
94 ☐ quiet
95 ☐ reckless
96 ☐ rejected
97 ☐ rough
98 ☐ sad
99 ☐ safe
100 ☐ satisfied
101 ☐ secure
102 ☐ shaky
103 ☐ shy
104 ☐ soothed
105 ☐ steady
106 ☐ stubborn
107 ☐ stormy
108 ☐ strong
109 ☐ suffering
110 ☐ sullen
111 ☐ sunk
112 ☐ sympathetic
113 ☐ tame
114 ☐ tender
115 ☐ tense
116 ☐ terrible
117 ☐ terrified
118 ☐ thoughtful
119 ☐ timid
120 ☐ tormented
121 ☐ understanding
122 ☐ unhappy
123 ☐ unsociable
124 ☐ upset
125 ☐ vexed
126 ☐ warm
127 ☐ whole
128 ☐ wild
129 ☐ willful
130 ☐ wilted
131 ☐ worrying
132 ☐ young

APPENDIX I

Number _____

Post-Experimental Questionaire

1. Has your understanding of what the relaxed state feels like increased during this experiment?

   Greatly X X X X X Not at all.

2. Did you enjoy this form of relaxation.

   Greatly X X X X X Not at all.

3. Did you find the film clip stressful?

   Greatly X X X X X Not at all.

4. Did your relaxation technique enable you to relax more quickly during and/or after viewing the film clip.

   Greatly X X X X X Not at all.

5. Did your relaxation technique enable you to relax more deeply during and/or after viewing the film clip?

   Greatly X X X X X Not at all.