THE INFLUENCE OF PROGRESSIVE RELAXATION ON PHYSIOLOGICAL AROUSAL IN A PERCEIVED RISK SITUATION

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THE INFLUENCE OF PROGRESSIVE RELAXATION ON PHYSIOLOGICAL AROUSAL IN A PERCEIVED RISK SITUATION

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DECLARATION

I the undersigned hereby declare that the work contained in this dissertation is my own original work, both in conception and execution and has not previously in it's entirety or in part been submitted at any university for a degree.

W. C. SKINNER

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SUMMARY

Activities in which people perceive risk, arouses a certain measure of anxiety. The heightened anxiety level becomes pathological if it overcomes the natural coping abilities of a person for an extended period of time. In this study a perceived risk situation was created in which heightened physiological arousal was induced, observed and managed. Direct signs of heightened physiological arousal were observed by monitoring changes in heartbeat, skin temperature, skin conductance, electromyographic activity and blood volume pulse using a biofeedback system.

The 11 member experimental group were introduced to a three day progressive relaxation training programme prior to participating in the stationary perceived risk activity. The experimental group experienced a lowering of sympathetic nervous system arousal, supported by the measurement of significant changes of physiological symptoms during the brief anxiety eliciting situation. Results were statistically compared with an 11 member control group which received no relaxation training.

Significant changes in heart rate, skin conductance and blood volume pulse measured on subjects of the experimental group supported the hypothesis that a progressive relaxation training programme therapeutically changes physiological arousal.

OPSOMMING

Wanneer mense aan aktiwiteite deelneem waarin hulle bewus raak van risiko, word 'n sekere mate van angs opgewek. Die verhoogde angsvlak raak patologies wanneer dit die persoon se natuurlike aanpassings-vermoe vir 'n langdurige tydperk oorskry. In hierdie studie word 'n waarneembare risiko situasie geskep waarin verhoogde fisiologiese opwekking veroorsaak, gemeet en beheer word. Direkte tekens van verhoogde fisiologiese opwekking is deur 'n bioterugvoer-apparaat waargeneem. Mates van die persone se polsslag, veltemperatuur, velgeleiding, elektromiografiese aktiwiteit en bloed volume pols het die fisiologiese veranderinge aangedui.

'n Eksperimentele groep van 11 lede was onderwerp aan 'n drie dae lange progressiewe ontspannings-oefenprogram en daarna het hulle beweginloos 'n waarneembare risiko aktiwiteit ervaar. Die eksperimentele groep het 'n verlaging in die opwekking van die simpatiese senuweestelsel ervaar. Die meting van beduidende veranderinge in fisiologiese simptome gedurende die kortstondige risiko situasie het hierdie bevindinge ondersteun. Hierdie resultate is statisties met die resultate van 'n kontrolegroep van 11 lede vergelyk wat geen ontspannings-oefening ervaar het nie.

Beduidende veranderinge in hartklop, velgeleiding en bloed volume pols wat in die eksperimentele groep gevind is, ondersteun die gestelde hipotese, dat 'n progressiewe onspannings oefenprogram terapeutiese veranderinge in fisiologiese opwekking veroorsaak.

CHAPTER 1

1. STATEMENT OF THE PROBLEM

"We see then that the brain
under stress not only alters
the chemistry of the body it controls,
but also,
indirectly,
it's own function" Graham (1990:540)

1.1 INTRODUCTION

Unconsciously the body is constantly fighting against a zoo of bacteria, viruses, parasites and other negative influences from the environment. These aliens or stresses are forever trying to weaken the natural coping skills of the body, and if they are successful, they use the body's own mechanisms to destroy body cells, resulting in serious health problems.

When stress causes a prolonged breakdown of the psychological coping skills in the human body it negatively affects its physical coping mechanism, the immune system, and psychophysiological health problems like generalized anxiety, panic attacks, phobias, hypertension, heart ailments and peptic ulcers, may develop.

In our competitive urbanized society the mismanagement of anxiety is mostly responsible for the rapid increase of psychophysiological disorders. The helping profession is increasingly called upon to reactively and proactively intervene to help people recognize and manage abnormal anxiety levels.

In the quest to find a non-invasive, pro-active and self initiated anxiety control intervention, many psychotherapeutic techniques have been developed. Most of the successful techniques are rooted in behaviour therapy and this study investigates the anxiety control potential of a behaviour therapy technique called progressive relaxation training.

1.2 RATIONALE

This study focuses on recent developments in using progressive relaxation as a therapeutic technique which is successfully used before or during anxiety eliciting situations to decrease arousal levels below the pathological. This technique is rooted in behaviour modification theory and is seen by Goldfried (1979) as a "pro-active, coping self-control skill that clients are taught to employ across diverse anxiety eliciting situations" (Rachman & Wilson, 1980:124).

1.3 DESCRIPTIVE PROBLEM STATEMENT

It is the hypothesis of this study that anxiety reduction can be achieved by using progressive relaxation in situations where pathological levels of anxiety are experienced. It is further proposed that progressive relaxation training can be used psychotherapeutically to enhance the natural coping skills of people in anxiety eliciting situations.

1.4 RESEARCH HYPOTHESIS

This study is based on the research hypothesis that a progressive relaxation programme significantly changes physiological arousal in a perceived risk situation.

According to the T-statistic used (Huysamen, 1989) the stated research hypothesis transforms to the following statistical hypothesis:

$H_0: \mu_d = 0$

Where $\mu_d = \mu_1 - \mu_2$

μ_1 is the estimated population mean of the rest/risk index of each physiological variable measured in the control group (Table 2).

μ_2 is the estimated population mean of the rest/risk index of each physiological variable measured in the experimental group (Table 2).

Measurement of heart rate, skin temperature, skin conductance, electromyographic activity and blood volume pulse supply information to statistically evaluate the stated research hypothesis.

1.5 DELIMITATION OF STUDY FIELD

1.5.1 Population:

The total number of enrolled students at the Department of Human Movement Science at the University of Zululand in 1992 were voluntary assigned as the population of subjects for this study. 22 subjects representing 55% of the population, were randomly drawn from the student population. Random numbers were generated with a random number generator program on an IBM compatible computer.

1.5.2 Independent variable:

A progressive relaxation training programme developed by the Thought Technology Company in Canada (1990) served as the independent variable (Appendix A).

Developed originally by Jacobsen (1938) progressive relaxation training is a technique based upon the premise that neuromuscular relaxation training is effective in reducing anxiety. Exercise in muscle tension/release and controlled breathing form basis of this technique.

1.5.3 Dependent variables:

Physiological changes at different anxiety levels were measured and changes in heart rate, skin temperature, skin conductance, electromyographic activity and blood volume pulse served as dependent variables in this study. Measurements of anxiety symptoms at rest and during the perceived risk situation were utilized to verify or refute the hypothesis in the study.

1.5.4 Perceived risk situation:

Subjects from both the experimental group and the control group individually experienced the following perceived risk situation in an indoor setting.

Subjects were blindfolded and asked to stand in the middle of a high gymnastics balance beam whilst verbal instuctions to elicit anxiety were given (see Assessment Procedure, p.23). Physiological arousal measurements were taken during the three minute perceived risk situation.

CHAPTER 2:

2. THEORETICAL FOUNDATIONS

2.1 BEHAVIOUR THERAPY

According to Liberman and Bedell (1989) behaviour therapy is fast becoming one of the most successful therapies for anxiety disorders and it is frequently more effective than alternative psychosocial or medical intervention. Since the late seventies, behaviour therapy has been on the forefront in treating and understanding the various anxiety related behaviours. Systematic desensitization, flooding, exposure in vivo, progressive relaxation training, biofeedback training, role play and cognitive behaviour therapy are some of the most successful behaviour therapies in use (Slaikeu, 1991).

One of the basic assumptions underlying behaviour therapy is that it focuses on behaviour in it's broad, multimodal phenomenology and thus makes behavioural affects, cognitions, imagery and physiological processes more definable targets for intervention and research. This allows for an empirically based and operational approach to address symptoms of abnormal behaviour. " More often than not, the attack on signs and symptoms of a disorder is indirect rather than direct; that is, positive goals are targeted that strengthen the individual's adaptive repertoire, thereby protecting the individual from stress-related or organically induced symptoms." (Liberman & Bedell, 1989:1463).

From this behavioural perspective the research question of this study was developed. Is it possible that behaviour therapy in the form of progressive relaxation training could positively influence the anxiety related symptoms in the human body?

2.2 PSYCHOPHYSIOLOGICAL AROUSAL

2.2.1 Stress response:

It is important to realize that the stress response of the body has a direct impact on the metabolism and basic functioning of the body. Normally a stress response is initiated by stimuli that are novel, intense, rapidly changing, unexpected, persistent, fatiguing, incongruent, frustrating, complex and/or noxious (Holahan, 1982). One's reaction to a surprise appearance of a shark in the water while having an enjoyable swim could serve as an example of a stimulus worthy of a stress response.

The body reacts to this aversive stimulus by heightened awareness and rapid changes on emotional, behavioural, autonomous and neurochemical levels (Garfield and Bergin, 1986). Aversive stimuli elicit initial behavioural stress responses such as orientation, identification, cessation of activity and increased psychological arousal. Concurrently the physiological responses are marked by potentially reversible increases in the activity of the sympathetic nervous system, which result in an increase in physiological arousal. Combined psychophysiological arousal is further influenced by previous experience, demands of the environment and personal biases (Pasnau & Fawzy, 1989).

A speed-boat-like exit from the water in the above mentioned example would be an acceptable stress response behaviour.

2.2.2 Chemistry of arousal:

Situations in which risk is perceived stimulate the awareness of real or imaginary danger and/or fear. The human body responds with anxious emotions and these are tied "... to the internal environment of the body by the hypothalmus." (Graham, 1990:156). Initial physiological arousal is characterized by an increased secretion of catecholomine from the adrenal medulla and if the stimulus is intense or prolonged the adrenal cortex releases glucocorticoids in an attempt to uphold the homeostatic integrity of the body. If the body's natural defence mechanisms are unable to return bodily function to its original steady state the resulting acute stress situation causes the homeostatic and defense responses to be associated with distress and disregulation (Graham, 1990).

2.2.3 Symptoms of stress:

Many people are unable to cope effectively in stress situations that heighten their arousal significantly (Sutherland and Cooper, 1990). Every person has an optimum level of stress with which he/she can safely cope and at this level of arousal the person is able to function well in his/her environment. If stresses in the environment overcome the coping abilities of an individual for long enough, it causes abnormal psychological and physiological anxiety (Garfield and Bergin, 1986).

Some psychological symptoms such as, lack of assertiveness, abnormal fears and phobias, learned helplessness, anxiety and depression, are directly linked to prolonged and acute stress situations (Graham, 1990).

Physiological symptoms of the abnormal reaction to stress are frequently found to be high blood pressure, bruxism, stomach ulcers, migraine headaches, panic attacks and asthma (Kaplan & Sadock, 1989).

2.2.4 Physiological reaction to stress:

Physiological reactions to intense anxiety eliciting stimuli form the basis of this study. Many of the physiological changes in the human body happen without obvious detection. The importance of bringing negative influences of anxiety to the attention of the sufferer or to professionals in the helping field has led to sophisticated measurements of physiological reactions to anxiety (O'Brian and Woody, 1989). Measurements of physiological indicators of anxiety such as blood pressure, heart rate, skin conductance, small muscle activity, skin temperature and breathing rate, supply valuable information on how the body reacts to stress.

This information feedback has become an integral part of behaviour therapy techniques and modern electronic technology is able to supply valid situational information to patients, therapists and researches. The use of biofeedback equipment (Appendix C) has made the measurement of many previously unnoticed physiological changes in the body possible. In this study, measurements of heart rate, skin temperature, skin conductance, small muscle activity and blood volume pulse were taken to observe the physiological reaction to a stressful situation.

2.2.4.1 Heart rate:

Heart rate is one of the most direct measures of the body's reaction to its environment (Buck, 1989). The significance of the heart in all biopsychosocial pathology is echoed in a statement made by William Harvey in the early 1600's: "Every affection of the mind that is attended with either pain or pleasure, hope or fear, is the cause of an agitation whose influence extends to the heart" (Hackett, Rosenbaum and Cassem, 1989:1186)

It is estimated by Croog et al. (1986) that anxiety symptoms accounted for up to 15 % of patient complaints in cardiology practices and that 5% of the general population suffers from anxiety disorders. The heart rate is directly affected by psychophysiological arousal and this allows cardiologists, psychiatrists and psychologists to agnostically overlap in their helping efforts.

Heart rate is controlled by hormonal and autonomic nervous system fluctuations. Increases in vagal activity decrease the heart rate, while increase in sympathetic activity increases heart rate, stroke volume and peripheral resistance (Lown and De Silva, 1978). Heart rate is measured as the amount of heart beats per minute and changes in heart rate are directly proportional to changes in arousal of the sympathetic nervous system (Hackett and Rosenbaum, 1984).

Emotional arousal causes sympathetic activation and myocardial irritability and the danger of life threatening arrhythmias and pre-mature ventricle contractions have occurred in conjunction with acute anxiety (Hackett, Rosenbaum and Cassem, 1989). In one of their studies 20% of patients with life threatening ventricle arrhythmias were experiencing prolonged high levels of anxiety without having premorbid signs of cardiac illness.

Studies employing biofeedback monitoring revealed tachycardia occasionally exceeding 140 beats per minute in people driving in traffic and people engaged in public speaking (Croog, et al., 1986). These researchers feel that the effect of acute emotional experiences without muscular activity is detrimental to the healthy functioning of the heart. They found that beta-adrenergic agents and psychotherapeutic interventions that diminish sympathetic arousal will protect the heart against anxiety induced arrythmias.

The use of progressive relaxation training as a psychotherapeutic intervention to lower sympathetic arousal is well documented (Rachman and Wilson, 1980). This study uses progressive relaxation training as a treatment regimen in an anxiety eliciting situation to observe its effect on heart beat and its indirect effect on the sympathetic arousal level.

2.2.4.2 Skin temperature

Changes in skin temperature are measured with heat sensitive microprobes to indicate changes in peripheral activity and changes in sympathetic arousal (Hatch, Fisher and Rugh, 1987). The sympathetic nervous system innervates the smooth muscles surrounding the arterioles which supply the peripheral tissue with blood. Under conditions of sympathetic arousal, the muscles constrict, causing vasoconstriction, thus reducing the amount of blood flowing to the peripheral tissues. The temperature of the peripheral tissue decreases with increase in sympathetic arousal (Crosson, 1980).

Research has shown this inverse relationship between skin temperature and sympathetic arousal also to be true when heightened anxiety levels bring about changes in psychological arousal (Piedmont, 1981). This means that high levels of anxiety arouse the sympathetic nervous system which in turn initiates a physiological process to reduce skin temperature. Decrease in peripheral blood flow weakens the body's coping mechanisms and it becomes prone to various peripheral vascular disorders. The Raynaud syndrome with vasospasm of fingers and toes is an example of such a disorder. (Raynaud et al., 1984).

Studies on skin temperature biofeedback and progressive relaxation exercises done by Turner and Chapman (1982) revealed up to 50% reduction in peripheral vascular disorder symptoms after training, with increases in basal digital temperature of three to four degrees Celsius. According to Liberman and Bedell (1989:1474) these results "... parallel the best medical and clinical effects of many medical and surgical interventions for these disorders"

There is agreement among researchers like Raynaud et al. (1984) that any therapeutic intervention, like progressive relaxation training, which is able to reduce pathological levels of sympathetic arousal successfully, causes skin temperature to rise. The higher skin temperature is indicative of better blood flow to the body's peripheral tissues and this offsets the negative effects of over-arousal (Raynaud et al., 1984). A reduction in sympathetic activity, causes the smooth muscle to relax which, in turn, allows vasodilation of the arterioles. This is responsible for the better blood flow in peripheral regions with a rise in tissue temperature.

This study uses progressive relaxation training as a treatment regimen in an anxiety eliciting situation to observe its effect on skin temperature and its indirect effect on the sympathetic arousal level.

2.2.4.3 Skin conductance

Skin conductance is the ability of the skin to conduct a small electrical current and it is measured in micromohs. Changes in skin conductance are directly proportional to changes in arousal of the sympathetic nervous system. Skin conductance is believed to be a function of sweat gland activity and the skin pore size which is controlled by the sympathetic nervous system. Activation of the sweat glands occurs when the sympathetic nervous system is aroused in response to stressful or anxiety provoking stimuli. The activation of sweat glands increases the skin's capacity to conduct electrical current. The changes in skin conductance, like heart rate and skin conductance also serve as an indicator of the sympathetic arousal level (Turner and Chapman, 1982). The research in this field is scarce and many of the studies that exist, lack proper scientific controls (Udolf, 1987).

Measurement of the skin conductance levels in this study serve as an indicator of sympathetic arousal levels in a stressful situation.

2.2.4.4 Electromyographic (EMG) activity:

The electrical activity in a muscle is recorded to indicate the amount of tension present in the specific muscle. A normal muscle is electrically silent at rest and when it is stimulated to contract it manifests action potentials measured as fast moderate-voltage well-modulated bursts of electrical activity (Solomon and Masdeu, 1989). Changes in electromyographic activity are directly proportional to changes in arousal of the sympathetic nervous system. In biofeedback monitoring the state of relaxation of the muscle can be observed by measurement of the electromyographic activity.

Muscles respond to perceived fear or emotionally stressful situations with increases in tension. This natural heightening of arousal is seen to be part of man's "fight or flight" response in the face of aversive stimuli. Jacobson (1938) used electromyographical activity data to show that more relaxation in a muscle resulted in a more relaxed psychological condition. Jacobsen's hypothesis has generated much research and it is generally accepted that muscle relaxation forms an important role in anxiety control measures (Davis et al., 1991). The muscles most commonly used for measurement are: the frontalis muscle on the forehead, the masseter muscle in the jaw and the trapezius muscle in the shoulder region. This study measured the changes in the frontalis muscle during the perceived risk situation.

2.2.4.5 Blood volume pulse:

Blood volume pulse is a relative measure of blood flow in peripheral surface areas of the body with a sensor that is sensitive to the peripheral resistance in blood vessels. These observations are transformed in absolute percentage values and only used in research projects to observe relative changes in peripheral resistance (Thought Technology Company, 1992).

The measurement of blood volume pulse is done through a process called photoplethysmography in which a light source and light sensor are applied to the surface of a finger or an earlobe to measure the amount of light reflected by the skin. At each contraction of the heart blood is forced through the peripheral vessels, producing engorgement of the vessels under the light source thereby modifying the amount of reflected light to the photosensor. The resulting pressure waveform is used to determine heart rate as well as pulsatile blood volume. Since vasomotor activity is controlled by the sympathetic nervous system the blood volume pulse observations reflect changes in sympathetic arousal.

An increase in the value on the 0-100% scale indicates increased blood volume pulse and thus a decrease in both the peripheral resistance and sympathetic nervous system activity. Higher values of blood volume pulse indicate increased relaxation and blood flow. Changes in the blood volume pulse are inversely proportional to changes in arousal of the sympathetic nervous system.

The Thought Technology Company (1992) is certain that this heartbeat to heartbeat monitoring of sympathetic arousal gives better results than the slower reactive measures like skin temperature. Little research material is available on this measure.

2.2.5 Psychophysiological disorders:

If psychophysiological arousal overcomes the coping capability of an individual for long enough and if the symptoms are not treated, various disorders are created which require serious therapeutic intervention.

The classic notion that prolonged negative emotions can adversely affect the physiological well-being of a person, is in essence the definition of psychophysiological disorders (Coleman et al., 1980). Modern views on these disorders have a more holistic approach towards cause and effect of disease. Psychophysiological disorders "... might be thought of as end products of biopsychosocial processes" (Sarason and Sarason, 1989:182). In the DSM-IV of the American Psychiatric Association (1994) many of the anxiety related disorders, the somatoform disorders, and psychological factors affecting medical conditions could be grouped in a psychophysiological disorder category.

The importance of therapeutic intervention at any level of a disorder or a symptom related to psychophysiological arousal should be realized to effectively help people cope with anxiety.

2.2.6 Therapeutic intervention:

To be able to recognize and reduce the effect of anxiety eliciting situations is a very important skill to ensure optimal physiological and psychological functioning in modern society.

Various biopsychosocial therapies have been developed to combat the symptoms of anxiety and stress. Most of these therapies are reactive and crisis orientated (Schacht & Strupp, 1989). As an example pharmacological intervention with tricyclics, MAO inhibitors, antihypertensive agents and benzodiazepines are reactively administered to inhibit cortical arousal. Managing anxiety in this way has been found to be a short term solution and behaviour therapists like Adams (1989) promote proactive cognitive-behavioural therapy for longer lasting anxiety control.

This is the main reason why psychologists are trying, with various degrees of success, to develop proactive non-invasive, self-controlled anxiety control therapies.

Some of the widely used psychotherapies (Slaikeu, 1990) are: anger control training, assertiveness training, autogenic training, behavioural rehearsal, bibliotherapy, biofeedback training, cognitive restructuring, problem-solving training, deep muscle relaxation, meditation, empty chair exercises, therapeutic relationship building, guided self dialogue, hypnosis, imagery implosion, meditation, modelling, pain control training, paradoxical techniques, rational emotive therapy, role playing, self-help, systematic desensitization, thought stopping, and yoga.

2.3 PROGRESSIVE RELAXATION TRAINING (PRT)

Developed originally by Jacobsen (1938) the technique uses muscle tension/relaxation exercises, focused attention on controlled breathing, and imagined warmth or heaviness to bring about heightened neuro-muscular relaxation. Many behaviour therapists believe that anxiety can be reduced by training the muscles of the body to relax (Dickman, 1988). Wolpe (1958) states that progressive relaxation training produces a response that is physiologically incompatible with anxiety. Benson (1975: 125) calls this response the "relaxation response" and it seems to lower physiological arousal in stressful situations.

A further advantage highlighted by Borkovec and Hennings (1978) is that the focused attention on neutral and/or pleasant repetitive stimuli like breathing and/or a feeling of warmth and/or a feeling of heaviness seems to reduce the negative effects of disturbing cognitive intrusions. However, they agree that the most important therapeutic value of progressive relaxation therapy is in its anxiety lowering potential.

Originally much of the research concentrated on progressive relaxation training as an adjunct to systematic desensitization and it was found that although it contributes to successful outcomes in an indirect manner by facilitating the non-reinforced exposure to anxiety eliciting stimuli it was not a prerequisite for treatment success (Gillian & Rachman, 1974). With the recent focus shift in behaviour intervention from clinician controlled therapies to client self-control therapies progressive relaxation training is being used as a therapy in its own right. This follows Jacobsen's 1938 recommendation that progressive relaxation training should be an active, coping self-control skill used in various anxiety eliciting situations.

Progressive relaxation training (PRT) has therapeutic properties which have been successful in treating, anxiousness (Benson, 1975), hypertension (Taylor, et al., 1977), tension headaches (Cox et al., 1975) and insomnia (Borkovec et al., 1979).

Progressive relaxation training has further been successfully used as treatment in anxiety disorders and somatoform disorders with heightened physiological arousal symptoms (Borkovec & Sides, 1979) and (Barsky, 1989). In progressive relaxation therapy, exercises and suggestions (Appendix A) are introduced to reduce physiological over-arousal. This study focuses on the anxiety reduction potential of progressive relaxation training in an anxiety eliciting situation.

Research done by Brauer, Horlick, Nelson, Farquhar and Agras (1979) shows that a therapist administered progressive relaxation training programme is significantly more successful than a self-administered audio-cassette programme. Reduction in anxiety symptoms were immediately observed with the therapist administered programme and the changes lasted longer after a six month follow-up evaluation. The researchers concluded that there is no substitute for relaxation administered by a skilled therapist.

Locke and Gorman (1989) have a word of warning regarding the available research data on successes of behavioural interventions like progressive relaxation training. Regarding the immune system it seems likely that psychological and behavioural factors do influence the onset and course of immune related diseases. They stress that the mixed findings, small number of studies, scarcity of well controlled research designs and virtual lack of replications in this field should be taken into account when conclusions are reached regarding treatment success. They do however find increasing evidence that behaviour therapy is directly or indirectly responsible for lowering the risk of immune system disorders. In this regard progressive relaxation training forms an important part of physiological arousal lowering therapy.

A therapist-administered progressive relaxation training programme augmented by audio cassette instruction was used to lead subjects to better anxiety awareness and self-relaxation. The aim of the non-specific nature of the programme was to help subjects to recognize and lower anxiety in stressful situations.

CHAPTER 3:

3. METHOD

3.1 STUDY AREA

The total number of enrolled students at the Department of Human Movement Science at the University of Zululand in 1992 were assigned as the population of subjects for this study. 22 subjects representing 55% of the population, were randomly drawn from the student population. The individual nature of the measurements, the potential for injury, the sensitivity of the biofeedback equipment and the unique psychophysiological responses to stressful stimuli was taken into account in selecting the size of the research sample. Each student completed an informed consent form before participating in the research experiment (APPENDIX B).

3.2 EXPERIMENTAL DESIGN

The research project followed a related experimental group design (Huysamen, 1989:134) to minimize the effect of confounding variables. Preceding the introduction of relaxation training 22 subjects were randomly assigned to the control and experimental groups of equal size. Both groups were matched on perceived risk and the research was conducted in a controlled indoor setting lasting five days.

3.3 INDEPENDENT VARIABLE

A progressive relaxation training programme developed by the Thought Technology Company in Canada (1990) served as the independent variable (Appendix A). The subjects in the experimental group experienced a three day training programme before being subjected to the perceived risk situation. The control group experienced no intervention before their assessment in the perceived risk situation.

The progressive relaxation programme (APPENDIX A) included psychological intervention on both group and individual levels and the subjects were prepared for non-specific anxiety eliciting situations.

3.4 DEPENDENT VARIABLES

Physiological changes in the perceived risk situation served as the dependent variables. Heart rate, skin temperature, skin conductance, electromyographic activity and blood volume pulse were physiological changes monitored during rest and in the perceived risk situation for both the experimental and the control groups.

The following measurements were taken with the Biofeedback system developed by Lafayette Instruments in Indiana, USA (1991) for the Thought Technology Company in Canada. For specifications refer to Appendix C.

Added information on physiological variability and the relationship with arousal in the sympathetic nervous system is based on the research done by the Thought Technology Company (1990). Results shown in Table 1 show similar trends.

3.4.1 Heart rate:

Heart rate was measured with a photoplethysmographic process in which a light source and a light sensor are attached to the surface of the forefinger and the light reflected by the skin is measured. With every heart beat the engorgement of vessels under the sensor produces a change in reflected light and a monitor calculates the beats per minute. Change in heart rate are directly proportional to change in arousal of the sympathetic nervous system.

3.4.2 Skin temperature:

Skin temperature was measured with a sensor placed on the soft part of the middle finger and the displayed temperature in degrees Fahrenheit indicated the activity of the peripheral vascular system and levels of sympathetic arousal. Changes in skin temperature are inversely proportional to changes in arousal of the sympathetic nervous system.

3.4.3 Skin conductance:

Skin conductance was measured by placing two metal electrodes, one each on two adjacent fingers, and then observing changes in the electrical current displayed in micromohs. Changes in skin conductance are directly proportional to changes in arousal of the sympathetic nervous system.

3.4.4 Electromyographic activity:

Electromyographic activity was measured by placing three electricity sensitive sensors on the frontalis muscle and observing the muscular activity changes displayed in microvolts. Changes in electromyographic activity are directly proportional to changes in arousal of the sympathetic nervous system.

3.4.5 Blood volume pulse:

Blood volume pulse is a relative measure of blood flow in the peripheral vessels of the finger and is also measured with the photoplethysmograph process. The sensor on the forefinger measures peripheral resistance and it is displayed in an absolute percentage. Changes in the blood volume pulse are inversely proportional to changes in arousal of the sympathetic nervous system.

3.5 ASSESSMENT PROCEDURE

3.5.1 Pre-risk procedure:

3.5.1.1 Experimental group

The 11 member experimental group participated in a three day progressive relaxation training programme (Appendix A).

Day 1: The programme included a general lecture on the research project to secure informed consent from the subjects, a structured group relaxation exercise and a supervised self-relaxation exercise with a script.

Day 2: The programme included a lecture on anxiety and relaxation, a supervised group relaxation session with the Thought Technology audio tape and a supervised individual relaxation session without a script.

Day 3: The programme focused on supervised individual relaxation, one session for partners relaxing each other with the help of a script and the last session for individual relaxation with the audiotape. Subjects were reminded of the perceived risk situation assessment of the following day and asked to practise one session of progressive relaxation before the assessment.

3.5.1.2 Control group

The 11 member control group were not subjected to any intervention and they only attended the general research lecture on day one. After the lecture their informed consent was obtained and their appointment for the perceived risk situation assessment was confirmed.

3.5.2 Perceived risk procedure:

a. Subjects of both the experimental group and the control group experienced the same procedure during the perceived risk situation.

b. Subjects of both the experimental group and the control group were individually isolated from the rest of their group during and after experiencing the perceived risk situation. This was done to preserve the novelty of the experience for each subject and to eliminate learning as a confounding variable.

c. Rest values of all physiological variables were taken immediately prior to the risk situation while the subjects were comfortably lying on their backs, blindfolded and relaxed. The rest values of heart rate, skin temperature, skin conductance, electromyographic activity and blood volume pulse were used as baseline values for each subject.

d. Subjects were helped up on a gymnastics balance beam and led to the middle. They were still blindfolded, coupled to the biofeedback system and were asked to maintain balance in a stationary position.

e. Subjects were verbally prompted with the following script to elicit anxiety:

"I am going to test your ability to balance. Please concentrate not to fall since I am going to remove the safety mats now (the safety mats are shifted around to create the perception that they are removed while in fact they are not). Listen carefully to the following instructions. I am going to take some measurements and on my command I want you to make a full circle turn on the beam. Do not do the turn now, please concentrate on your balance since any loss of balance can result in an injury. I am taking the measurements now."

f. After the measurements were taken, the blindfold and the biofeedback equipment were removed. The subject was then asked to do the exercise and finally helped off the beam.

g. After the assessment subjects were given immediate feedback on the physiological changes that took place between the rest and risk situations.

3.6 SAFETY PROCEDURES

Although the assessment procedure, in all probability, was a safe one and the anxiety was induced by creating a perceptual illusion of imagined danger, there was still a possibility of real physical injury and/or psychological trauma. The following safety measures were regarded as important to minimize the probability of trauma:

3.6.1 Knowledge and experience:

All subjects were physical education students and they knew the apparatus well.

3.6.2 <u>Assistants:</u>

Two physical education teachers were assisting during the assessment.

3.6.3 <u>Safety equipment:</u>

Thick safety mats were placed at the same level as the beam and covered all possible danger areas.

3.6.4 <u>Informed consent:</u>

Subjects were well informed of the aim and procedure of the research project and each subject completed an informed consent document before participating in the project (Appendix B).

3.6.5 <u>First aid:</u>

A trained first aid helper was present during the assessment.

3.6.6 <u>Debriefing:</u>

Directly after the perceived risk situation assessment a debriefing and feedback session was held with each subject.

CHAPTER 4

4. RESULTS AND DATA ANALYSIS

4.1 RESULTS

Measurements of the physiological variables, heart rate, skin conductance, skin temperature, electromyographic activity and blood volume pulse were taken for each subject at rest and immediately afterwards during the perceived risk situation. A summary of the observed biofeedback values for each of the physiological variables is presented in Table 1.

The values from Table 1 were used to calculate the rest/risk index in Table 2. The individual rest values from Table 1 were divided by individual risk values also from Table 1 to calculate the index.

This was done to facilitate statistical comparison between the control group and the experimental group. In this way individual raw scores for each physiological variable in Table 1 were standardized in a proportional index of rest/risk values (Table 2). The rest value for each subject is divided by the corresponding risk value and this calculated rest/risk proportion is used to statistically evaluate the different hypotheses.

Table 1 is a summary of data collected at rest and in a perceived risk situation.

TABLE 1

Physiological variables measured at rest and risk

Subjects	Heart rate (Beats/min)				Temperature (°F)				Skin (μ Mhos) conductance				EMG (μ V)				Blood Volume Pulse I % I			
	GROUP A		GROUP B		GROUP A		GROUP B		GROUP A		GROUP B		GROUP A		GROUP B		GROUP A		GROUP B	
	REST	RISK	REST	RISK	REST	RISK	REST	RISK	REST	RISK	REST	RISK	REST	RISK	REST	RISK	REST	RISK	REST	RISK
1	50	65	66	80	84	80	84	78	6,5	36	24	35	7	15	13	18	58	15	40	20
2	56	81	60	80	90	84	92	85	8	35	20	36	10	15	20	35	45	15	60	25
3	80	105	58	80	89	87	84	81	4,5	30	6	40	6	10	10	15	53	18	60	30
4	79	135	49	68	92	87	86	83	11,7	21,5	17	32	9	15	9	15	50	14	60	20
5	54	84	58	75	90	86	78	73	6,6	26	14	20	10	15	11	18	55	20	65	25
6	78	118	80	95	92	87	85	82	10,5	25,5	17	21	11	17	8	13	45	20	50	25
7	70	120	60	70	89	86	85	80	15,2	28,5	30	45	15	19	15	19	42	15	65	20
8	50	72	68	82	78	74	91	85	11,1	27	11	35	9	24	6	12	41	10	50	20
9	53	80	88	100	85	82	87	83	13,4	30	13	25	15	20	9	13	64	20	50	20
10	68	100	68	105	80	77	91	87	11	22	17	37	14	18	11	16	51	16	75	30
11	70	109	76	92	91	84	87	82	7	26	9	31	11	18	8	15	46	12	55	20

Group A : Control group

Group B : Experimental group (PRT)

°F : degrees Fahrenheit

μ Mhos : micro omhos (relative measure)

μ V : microvolts

I%I : relative percentage

For the following explanation of the calculation of the rest/risk index it is important to take both the values of Table 1 and Table 2 into account.

To understand the proportional index values it is necessary to use the index value of 1,0 as a starting point. A subject with an index value of 1,0 for any of the psychological variables was scored the same for the specific variable during rest and during the risk situation. Using Table 2 as an example: all the index values of skin temperature for both the control group and the experimental group show a tendency towards 1,0. This means that the skin temperature measured at rest and skin temperature measured in the risk situation do not differ much. The explanation for this is that subjects in both groups showed little change in their individual skin temperature response whilst they were subjected to different levels of anxiety.

Subjects with individual rest/risk index values significantly more or less than 1,0 show a marked difference between their rest and risk values for that specific variable. Heart rate index values in Table 2 show a tendency of being lower than 1,0. This shows that the subjects experienced a marked change in heart beat from the rest situation to the risk situation. Here it is obvious that a heightened anxiety level influences the heart rate significantly.

TABLE 2

Rest/Risk proportional index (A: Control group

B: Experimental group with relaxation)

Subjects	Heart rate		Temperature		Skin conductance		EMG		Blood volume Pulse	
	A	B	A	B	A	B	A	B	A	B
1	0,77	0,83	1,05	1,08	0,18	0,68	0,47	0,72	3,8	2,0
2	0,69	0,75	1,07	1,08	0,23	0,55	0,67	0,57	3,0	2,4
3	0,76	0,70	1,02	1,04	0,15	0,15	0,60	0,67	2,9	2,0
4	0,59	0,72	1,06	1,04	0,54	0,53	0,60	0,60	3,6	3,0
5	0,64	0,77	1,05	1,07	0,25	0,70	0,67	0,61	2,8	2,6
6	0,66	0,84	1,06	1,04	0,41	0,81	0,65	0,62	2,3	2,0
7	0,58	0,85	1,04	1,06	0,53	0,67	0,79	0,79	2,8	3,3
8	0,69	0,82	1,05	1,07	0,41	0,31	0,38	0,50	4,1	2,5
9	0,66	0,88	1,04	1,05	0,45	0,52	0,75	0,69	3,2	2,5
10	0,68	0,65	1,04	1,05	0,50	0,66	0,78	0,69	3,2	2,5
11	0,64	0,82	1,08	1,06	0,27	0,29	0,61	0,53	3,8	2,8

4.2 HYPOTHESES TESTING

The proportional rest/risk values for each dependent variable (Table 2) were used to make the statistical comparison between the control and the experimental group. A related group design (Huysamen, 1989), for analyzing differences between population means, was used to evaluate the hypotheses that follow. According to this T-statistic the stated research hypothesis transforms to the following statistical hypothesis:

H_0: $\mu_d = 0$

Where $\mu_d = \mu_1 - \mu_2$

μ_1 is the estimated population mean of the rest/risk index of each physiological variable measured in the control group (Table 2).

μ_2 is the estimated population mean of the rest/risk index of each physiological variable measured in the experimental group (Table 2).

The statistical formula for testing this hypothesis is:

$$t_{\bar{d}} = \frac{\Sigma d}{\sqrt{\frac{N \Sigma d^2 - (\Sigma d)^2}{N - 1}}}$$

where:

$t_{\bar{d}}$ is the T-value of differences between means

Σd is the sum of risk/rest index differences

N is the total amount of subjects in each group

The following decision rule applied:

If $|t_{\bar{d}}| > t_{1-\alpha}$ with N-1 degrees of freedom the H_0 can be rejected. Where $t_{1-\alpha}$ is the critical cumulative probability value(p) extracted from standard statistical tables (Huysamen, 1989: 164). In this study the value of α is set at 0,05 with 10 degrees of freedom.

4.3 DISCUSSION OF RESULTS

4.3.1 Heart rate:

Raw data gathered in Table 1 indicates that most subjects experienced a marked increase in heart rate from measures taken at rest and measures taken during the perceived risk situation. This is an indication that subjects experience heightened sympathetic nervous system arousal in the anxiety eliciting situation. This subjective inference is in line with research findings that increased anxiety levels result in heightened sympathetic arousal which in turn causes an increase in heart rate (Clark, 1992b).

Statistical comparison between the control group and the experimental group using rest/risk proportional index values in Table 2 resulted in a rejection of the null hypothesis:
$|t_{\bar{d}}| > p_{0,95}$ with 10 degrees of freedom ($|t_{\bar{d}}| = 4,91$ and $p_{0,95} = 1,812$). This indicates that relaxation training is instrumental in significantly lowering the heart rate of subjects in the perceived risk situation (Group B) when compared to subjects without relaxation training (Group A). Progressive relaxation training indirectly lowers the arousal level of the sympathetic nervous system by significantly lowering heart rate in a situation where heightened arousal causes the heart rate to increase.

4.3.2 Skin temperature:

Raw data gathered in Table 1 indicates that all individual skin temperatures measured in the perceived risk situation showed a very small decrease compared to measures taken at rest. The slight decrease in skin temperature indicates vasoconstriction of peripheral blood vessels but the change is not significant enough to make any objective inferences. The explanation for this small non-significant decrease in skin temperature is offered by the relatively short duration of the stress situation. Rachman and Wilson (1980) believe that significant changes in skin temperature can only occur if anxiety levels are above the natural coping abilities of the individual for a prolonged period of time. Skin temperature in this study was measured within two minutes of the onset of the perceived risk situation and the stress situation lasted for three minutes. The small changes in skin temperature observed are probably due to the short duration of the perceived risk situation and greater change could be expected in prolonged anxiety eliciting situations.

Statistical comparison between the control group and the experimental group using rest/risk proportional index values in Table 2 resulted in a failure to reject the null hypothesis: $|t_{\bar{d}}| < p_{0.95}$ with 10 degrees of freedom ($|t_{\bar{d}}| = 1.3$ and $p_{0.95} = 1.812$). According to the results, progressive relaxation training has a non-significant effect onchanges in the skin temperature of subjects in a brief period of perceived risk (Group B), when compared with subjects without relaxation training experiencing the same situation (Group A).

4.3.3 Skin conductance:

Raw data gathered in Table 1 indicates that most subjects experienced a marked increase in skin conductivity from measures taken at rest and measures taken during the perceived risk situation. This is an indication that subjects experience heightened sympathetic nervous system arousal in the anxiety eliciting situation. This subjective inference is in line with research findings that increased anxiety levels result in heightened sympathetic arousal which in turn increases skin conductivity (Wagner and Manstead, 1989).

Statistical comparison between the control group and the experimental group using rest/risk proportional index values in Table 2 resulted in a rejection of the null hypothesis: $|t_{\bar{d}}| > p_{0.95}$ with 10 degrees of freedom ($|t_{\bar{d}}| = 2.53$ and $p_{0.95} = 1.812$. This indicates that relaxation training is instrumental in significantly lowering the skin conductivity of subjects in the perceived risk situation (Group B) when compared to subjects without relaxation training (Group A).

Progressive relaxation training indirectly lowers the arousal level of the sympathetic nervous system by significantly lowering skin conductance in a situation where heightened arousal causes skin conductance to increase.

4.3.4 Electromyographic activity:

Raw data gathered in Table 1 indicates that individual measures of electromyographic activity undergo very little change from measures taken at rest and measures taken during the perceived risk situation. The slight increase in the electrical activity of the small muscle is not significant enough to make any objective inferences. The explanation for this small non-significant increase in muscle activity is offered by the relatively short duration of the stress situation. Adams (1989) believes that significant changes in the electrical activity of muscles occur when they are stimulated to retain tension over an extended period of time. Electromyographic activity of the frontalis muscle in this study was measured within two minutes of the onset of the perceived risk situation and the situation lasted for three minutes. The small changes in electromyographic activity observed are probably due to the short duration of the perceived risk situation and greater change could be expected in prolonged anxiety eliciting situations.

Statistical comparison between the control group and the experimental group using rest/risk proportional index values in Table 2 resulted in a failure to reject the null hypothesis: $|t_{\bar{d}}| < p_{0.95}$ with 10 degrees of freedom ($|t_{\bar{d}}| = 0.27$ and $p_{0.95} = 1.812$). According to the results, progressive relaxation training has a non-significant effect on changes in electromyographic activity of subjects in a brief period of perceived risk (Group B), when compared with subjects without relaxation training experiencing the same situation (Group A).

4.3.5 Blood volume pulse:

Raw data gathered in Table 1 indicates that most subjects experienced a marked decrease in blood volume pulse from measures taken at rest and measures taken during the perceived risk situation. This is an indication that subjects experience heightened sympathetic nervous system arousal in the anxiety eliciting situation. This subjective inference is in line with research findings that increased anxiety levels result in heightened sympathetic arousal which in turn causes a decrease in blood volume pulse (Gatchel and Barnes, 1989).

Statistical comparison between the control group and the experimental group using rest/risk proportional index values in Table 2 resulted in a rejection of the null hypothesis:

$|t_{\bar{d}}| > p_{0.95}$ with 10 degrees of freedom ($|t_{\bar{d}}| = 4,91$ and $p_{0,95} = 1,812$). This indicates that relaxation training is instrumental in significantly increasing the blood volume pulse of subjects in the perceived risk situation (Group B) when compared to subjects without relaxation training (Group A). Progressive relaxation training indirectly lowers the arousal level of the sympathetic nervous system by significantly increasing blood volume pulse in a situation where heightened arousal causes the blood volume pulse to decrease.

4.3.6 Result summary:

A summary of the main findings and related implications of this study are twofold:

Firstly, heart rate, skin conductance and blood volume pulse are sensitive and valid indicators of heightened arousal of the sympathetic nervous system and as such are good predictors of the level of anxiety that a subject is experiencing.

Secondly, the significant decrease of heart beat and skin conductance, and the significant increase in blood volume pulse during the perceived risk situation implies that progressive relaxation training can be used therapeutically to lower sympathetic arousal and significantly reduce the influence of the above mentioned physiological symptoms in other situations associated with high levels of anxiety.

CHAPTER 5

5. CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

There is conclusive evidence that prolonged pathological anxiety in people changes their physiological functioning to such an extent that normal metabolic functioning is disturbed, which in turn causes marked impairment on psychosocial levels. Potentially harmful stimuli come from many sources and it is accepted that illness is the result of the interaction of biopsychosocial factors that operate in a given environment.

Progressive relaxation training was shown to be a successful behaviour modification technique through which short term physiological anxiety symptoms could be reduced by significantly changing heart rate, skin conductance and blood volume pulse in a perceived risk situation.

The carry-over value of these findings is regarded as an important contribution to therapeutic intervention in situations where anxiety overload negatively affects the health of individuals and groups (Shomer, 1992). Progressive relaxation training has been successful in lowering pathological arousal levels of people that experienced exam anxiety, executive stress, abnormal fear, post traumatic stress and sport anxiety.

5.2 RECOMMENDATIONS

From the results of this study the following recommendations for further research are proposed:

5.2.1 Research networking:

Results of this study complement current research on progressive relaxation and findings should be incorporated.

5.2.2 Longitudinal effect:

This study focused on the short-term effect of progressive relaxation training and it would be valuable to incorporate longitudinal follow-up studies to ascertain the carry-over value of the technique.

5.2.3 Behaviour therapy techniques:

This study of progressive relaxation training as a single technique in behaviour therapy should be compared to other techniques like exposure in vivo and hypnosis in future studies.

5.2.4 Therapy control:

The therapist-controlled progressive relaxation training programme in this study was chosen because it showed the most therapeutic success in past research studies (Izard, 1991). In accordance with the objectives of psychotherapy it is important to gear efforts to self-controlled health options and therefore it would be valuable to include self-controlled relaxation programmes in future research efforts.

5.2.5 Environmental engineering:

The experimental design of this study created a surreal environment in which heightened anxiety was artificially induced to eliminate confounding variables. Future studies in real-life situations, with an ex post facto research design, should complement the validity of this study. Sport, industry, hospital and school settings are recommended environments for studies of this nature.

5.3 MULTIDISCIPLINARY INTERVENTION

It is important to realize that our environment, our attitudes, our coping capability and our perception of incoming stimuli, constantly undergo dynamic change.

Our homeostatic equilibrium or steady state is easily upset and when this happens too often, combined with pathological levels of anxiety, the body responds with destructive biopsychosocial symptoms that need treatment on a multidisciplinary level.

Behaviour therapy techniques like progressive relaxation training should form an integral part in multidisciplinary therapeutic intervention programmes for treatment of anxiety related disorders.

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6. APPENDICES

6.1 APPENDIX A:

PROGRESSIVE RELAXATION TRAINING PROGRAMME

The progressive relaxation training programme used in this study was developed by the Thought Technology Company (1992) to complement their biofeedback system (Appendix B). The programme is distributed on audio-cassette and together with the written script it was used in a three day therapist controlled progressive relaxation training programme for the experimental group. The following instructions were important to create a friendly environment before the start of the progressive relaxation programme.

1. Build general rapport and trust with research subjects.

2. Educate the subjects on the goals, methods, procedures and safety measures of the study.

3. Organize a private venue with a pleasant interior and enough space for the PRT.

4. Supply soft carpets or gym mats to lie on.

5. Educate the subjects on the correct way to breathe.

6. Have a good audio tape deck available.

7. Motivate the subjects to adhere to the programme.

8. Two hours per day should be set aside for the programme.

The following is a verbatim written copy of the progressive relaxation training programme:

"Please find a space and lie down comfortably on your back. Look up at the roof and extend your arms, palms up by your side, and let your ankles fall over to the outside. This position is called the anatomical position and I want you to remain in this position throughout the session.

Now close your eyes and allow yourself to relax passively.....focus on your breathing......

breathe in.....and breathe out.....breathe in .....and out.....in.....and out.

Breathe in relaxation......breathe out tension.....

breathe in.....and breathe out.....

Now think about the muscles around your eyes....

and your jaw....allowing them to relax.....completely

feeling the heaviness of the relaxed muscles.....

letting your jaw drop.....and feeling very calm....

continue breathing evenly.....feel the complete relaxation in your muscles.....the muscles of your neck are relaxing.....the muscles of your shoulders are relaxing.....and your breathing is deep and even.....

now let this feeling of relaxation flow down from your shoulders into your arms.....your arms are beginning to feel heavy.....your hands are relaxing as you continue breathing deeply.....your arms are still feeling heavy....breathe evenly.....and the feeling of heaviness is growing over your facial muscles....your neck....your shoulders.....your arms.....your hands....

you are relaxing deeper and deeper still.....and now your chest.....your stomach....and your back are relaxing....you are feeling so relaxed....so comfortable.....as you continue to breathe deeply and evenly.....feeling very relaxed and heavy....

feel yourself becoming more and more relaxed....

comfortably at ease....and now you feel the muscles of your stomach relaxing and this feeling of relaxation is going down over the muscles of your thigh.....

and you are relaxing and feeling heavier and heavier still.....you are feeling so peaceful.....so calm....

so very very comfortable.....relaxed....now let the relaxation flow down into your legs....your ankles....your feet....and into every one of your toes.

making them feel heavy.....ever so heavy....and as you relax deeper and deeper you feel heavier and you feel yourself totally relaxed....and very calm....

continue breathing deeply and evenly....deeply....

and evenly....and as you do.....begin once again relaxing....your forehead....your eyes....your jaw....

your cheeks....your lips.....allow them to relax completely.....allow the feeling of heaviness to increase....let them feel heavy.....ever so heavy....and allow this feeling of relaxation to continue down into your shoulders....your arms....and your hands.....feeling heavy and relaxed.....now allow this feeling of relaxation to flow into your chest and your back....imagine your whole body relaxing....and relaxing more...and more...now let the relaxation flow into your hips....your thighs....your legs....and your feet....your toes....making you completely relaxed....

so very-very relaxed....your entire body is now relaxed....completely relaxed.....and as I stop speaking to you for the next few moments.....enjoy this relaxation quietly.....you may want to use this time to concentrate on deep and even breathing.....allowing this relaxation to fill your whole body...

*********QUIET PERIOD FOR TWO MINUTES**********

You are deeply relaxed....enjoying this inner calmness.

feeling so good and wonderful....on the count of five you will open your eyes....feeling refreshed....relaxed .....wonderful...having enjoyed this brief period of relaxation....and realizing that you are able to relax yourself....that you can learn to relax deeper and deeper with each session....

ONE: you are feeling so good....the feeling of heaviness is leaving your body....completely.

TWO: your entire body feels relaxed and wonderful.

THREE: You have enjoyed this experience of relaxation and you feel energetic.

FOUR: You are about to open your eyes and you will feel refreshed.

FIVE: open your eyes now.....take a deep breath.....you feel alert and ready to enjoy the day.

I want you to slowly roll over onto your side....any side will do. Draw up both your knees and slowly push yourself up onto your knees. Now get up slowly and walk around slowly to allow the blood circulation to return to normal.

---------------------END----------------------

Some points to remember:

1. If subjects do not come out of the relaxed state with the others, wait for everyone to leave and slowly count them out again whilst constantly reasuring them. If some persist to relax they should be left in peace and quiet and after a while they will wake spontaneously.

2. Speak slowly and softly throughout the relaxation training session, it helps to create an atmosphere for relaxation.

6.2 APPENDIX B:

INFORMED CONSENT FORM: RESEARCH PROJECT PARTICIPATION

I.......................hereby consent to participate in the research project of Mr. W.C Skinner during October 1993.

I am fully aware of the nature and procedure of this research project, I was informed of all possible dangers during the project and I realize that I can withdraw from the project at any time.

In the event of an accident or injury I will not hold any person participating in the research project, or the Department of Human Movement Science, or its staff members responsible.

Date signed: .... Place: ....

Participant: ....

Project manager: ....

Witness: ....

6.3 APPENDIX C:

BIOFEEDBACK SYSTEM SPECIFICATIONS

GSR2 BIOFEEDBACK SYSTEM Thought Technology (1992)
The biofeedback system includes three instruments monitoring five physiological arousal variables:

1. HR/BVP 100T (Heart rate and blood volume pulse)

Input: Finger photoplethysmograph
Output: Heart rate: 30-200mV = 30-200 beats/min
Blood volume pulse: 0-200mV = 0-100% (rel)

2. TEMP SC/201T (Skin temperature and skin conductance)

Input: Temperature probe
Skin conductance probe
Output: Temperature: 65,0-100,0 degrees Fahrenheit
Conductance: 0,3-199,0 micromohs

3. EMG 101T (Electromyographic activity)

Input: MyoScan-E Sensor with headband electrodes

Output: EMG: 25-200 Hz band pass
Logarithmic meter: 0-200 micro Volt

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7. BIBLIOGRAPHY

ADAMS, P.L. (1989). Anxiety disorders. In: KAPLAN, H.I. and SADOCK, B.J. (eds). Comprehensive textbook of Psychiatry (5th ed.) Baltimore: Williams and Wilkens.

AMERICAN PSYCHIATRIC ASSOCIATION (1994). Diagnostic and Statistical Manual of Mental Disorders (fourth ed. DSM IV). Washington, D.C.: APA.

BAR-ON, R. (1988). The development of a concept of psychological well-being (Completed Phd. Thesis). Grahamstown: Rhodes Univ.

BARSKY, A.J.(1989). Somatoform disorders. In: KAPLAN, H.I. and SADOCK, B.J. (eds). Comprehensive textbook of Psychiatry (5th ed.) Baltimore: Williams and Wilkens.

BENSON, H. (1975). The relaxation response. New York: William Morrow.

BORKOVEC, T.D.; GRAYSON, J.B. and COOPER, K.M. (1979). Treatment of general tension: Subjective and physiological effects of progressive relaxation. Journal of Consulting and Clinical Psychology, 46:518-529.

BORCOVEC, T.D. and HENNINGS, B.L. (1978). The role of physiological attention focusing in the relaxation treatment of sleep disturbances and specific stress reaction. Behaviour Research and Therapy, 16:7-22.

BORKOVEC, T.D. and SIDES, J.K. (1979). Critical procedural variables related to the physiological effects of progressive relaxation. (review). Behaviour Research Therapy, 17:119-126.

BRAUER, A.P.; HORLOCK, L.F.; NELSON, E.; FARQUHAR, J.W. and AGRAS, W.S. (1979). Relaxation therapy for essential hypertension: A veterans outpatient study. Journal of Behavioural Medicine, 34:28-39.

BUCK, R. (1989). Subjective, expressive and peripheral bodily components of emotion. In: WAGNER, H. and MANSTEAD, A. (eds.). Handbook of social psychophysiology. Chichester: Wiley.

CLARK, M. S. (ed.) (1992a). Emotion and social behaviour. London: Sage publications.

CLARK, M. S. (ed.) (1992b). Emotion. London: Sage publications.

COLEMAN, J.C., BUTCHER, J.N. and CARSON, R.C. (1980). Abnormal Psychology and Modern Life (6th.ed.). Glenview: Scott, Foresman and Company.

COX, D.J.; FREUNDLICH, A. and MEYER, R.F. (1975). Differential effectiveness of electromyograph feedback, verbal relaxation instruction and medicine placebo with tension headaches. Journal of Consulting and Clinical Psychology, 43:892-898.

CROOG, S.H.; LEVINE, S.; TESTA, M. A.;BROWN, B.; BULPITT, C.J.; JENKINS, C.; KLERMAN, G.L. and WILLIAMS, G.H. (1986). The effects of antihypertensive therapy on the quality of life. New England Journal of Medicine, 314:1647.

CROSSON, B. (1980) Control of skin temperature through biofeedback and suggestion with hypnotized college women. International Journal of clinical and experimental hypnosis, 28(1):75-87.

DAVIS, M.; Eshelman, E.R. and McKay, M. (1991). The relaxation and stress reduction workbook. Oakland: Harbinger Publications.

DICKMAN, S.R. (1988). Pathways to wellness. Champaign: Human Kinetics Publishers.

DREYER, H.J. (1983). A manual for writing dissertations and theses. Kwadlangezwa: Univ. of Zululand.

FANNING, P. (1988). Vizualization for change. Oakland: Harbinger Publishers.

GARFIELD, S.L. and BERGIN, A.E. (1986). Handbook of Psychotherapy and Behavioural change. New York: John Wiley & Sons.

GATCHEL, R. J. and BARNES, D. (1989). Physiological self control and emotion. In: WAGNER, H. and MANSTEAD, A. (eds.) (1989). Handbook of social psychophysiology, Chichester: Wiley.

GILLIAN, P. and RACHMAN, S. (1974). An experimental investigation of desensitization in phobic patients. British Journal of Psychiatry, 124:7-20.

GRAHAM, R.B. (1990). Physiological Psychology. Belmont: Wadsworth.

GRAY, J.A. (1971). The psychology of fear and stress. London: Weidenfeld and Nicolson.

HACKETT, T.P. and ROSENBAUM, J.F. (1984). Emotions, psychiatric disorders and the heart. In: Braunwald, E. (ed.). Textbook of cardiovascular medicine, Philadelphia: Saunders.

HACKETT, T.P.; ROSENBAUM, J.F. and CASSEM, J. (1989). Cardiovascular disorders. In: KAPLAN, H.I. and SADOCK, B.J. (eds). Comprehensive textbook of Psychiatry (5th ed.) Baltimore: Williams and Wilkens.

HATCH, J.P., FISHER, J.G. and RUGH, J.D.(eds.) (1987). Biofeedback: Studies in clinical efficacy. New York: Plenum.

HOLAHAN, C.J. (1982). Environmental Psychology. New York: Random House.

HUYSAMEN, G.K. (1989). Introductory Statistics and Research Design. (Vol 2). Cape Town: H & R Academia.

HUYSAMEN, G.K. (1994). Methodology for the social and behavioural sciences. Pretoria: Southern book publishers.

IZARD, C.E. (1991). The Psychology of emotions. New York: Plenum Press.

JACOBSON, N.S. (1938). Progressive relaxation. Chicago: University of Chicago Press.

KAPLAN, H.I. and SADOCK, B.J. (eds.) (1989). Comprehensive textbook of Psychiatry (5th ed.) Baltimore: Williams and Wilkens.

KAZDEN, A.E. and WILSON, G.T. (1978). Evaluation of behaviour therapy: Issues, evidence and research strategies. Cambridge: Ballinger.

LIBERMAN, R.P. and BEDELL, J.R. (1989). Behaviour therapy. In: KAPLAN, H.I. and SADOCK, B.J. (eds). Comprehensive textbook of Psychiatry (5th ed.) Baltimore: Williams and Wilkens.

LOCKE, S.E. and GORMAN, M.S. (1989). Behaviour and immunity. In: KAPLAN, H.I. and SADOCK, B.J. (eds). Comprehensive textbook of Psychiatry (5th ed.) Baltimore: Williams and Wilkens.

LOWN, B. and DE SILVA, R.A. (1978). Roles of psychological stress and autonomic nervous system changes in provocation of ventricular premature complexes. American Journal of Cardiology. 41:979.

O'BRIAN, C.P. and WOODY, G.E. (1989). Evaluation of psychotherapy. In: KAPLAN, H.I. and SADOCK, B.J. (eds). Comprehensive textbook of Psychiatry (5th ed.) Baltimore: Williams and Wilkens.

PASNAU, R.O. and FAWZY, F.I. (1989). Stress and Psychiatry: In: KAPLAN, H.I. and SADOCK, B.J. (eds). Comprehensive textbook of Psychiatry (5th ed.) Baltimore: Williams and Wilkens.

PIEDMONT, R.L. (1981). Effects of hypnosis and biofeedback upon the regulation of peripheral skin temperature. Perceptual and motor skills. 53(3):855-862

PLUTCHIK, R. and KELLERMAN, H. (eds.) (1980). Emotion: Theory, Research and Experience. San Diego: Academic Press.

RACHMAN, S.J. and WILSON, G.T. (eds.) (1980). The effects of psychothrapy (2nd ed). Oxford: Pergamon Press.

RAYNAUD, J., MICHAUX, D., BLEIRAD, G. CAPDEROU, A., BORDACHAR, J. and DURAND, J. (1984). Changes in rectal and mean skin temperature in response to suggested heat during hypnosis in man. Psychology and Behaviour. 33(2):221-226.

SARASON, I.G. and SARASON, B.R. (1989). Abnormal Psychology (6th ed.). Englewood Cliffs: Prentice Hall.

SCHACHT, T.E. and STRUPP, H.H. (1989). Recent methods of Psychotherapy. In: KAPLAN, H.I. and SADOCK, B.J. (eds). Comprehensive textbook of Psychiatry (5th ed.) Baltimore: Williams and Wilkens.

SCHOMER, H. (1992). Psychological training techniques for athletes. In: Potgieter, J.R. (ed.), Readings in Sport Psychology. Stellenbosch: Univ. of Stellenbosh Printers.

SLAIKEU, K.A. (1991). Crisis intervention: A handbook for practise and research (2nd ed.) Boston: Allyn and Bacon.

SOLOMON, S. and MASDEU, J.C. (1989). Neurological evaluation. In: KAPLAN, H.I. and SADOCK, B.J. (eds). Comprehensive textbook of Psychiatry (5th ed.) Baltimore: Williams and Wilkens.

SUTHERLAND, V.J. and COOPER, G.L. (1990). Exercise and stress management: Fit employees-healthy organizations. International Journal of Sport Psychology. 21:202-217.

TAYLOR, C.B.; FARQUHAR, J.W.; NELSON, E. and AGRAS, S. (1977). The effects of relaxation therapy upon high blood pressure. Archives of General Psychiatry. 34:339-345.

THE MEDICAL ASSOCIATION OF SOUTH AFRICA (1992). Guide to medicines and drugs. New York: Readers Digest.

THOUGHT TECHNOLOGY COMPANY (1992). The GSR2 biofeedback system. Montreal: Thought Technology Ltd.

TOMB, D.A. (1988). Psychiatry for the house officer (3rd ed.). Baltimore: Williams and Wilkens.

TURNER, J.A. and CHAPMAN, C.R. (1982). Psychological interventions for chronic pain: A critical review: Relaxation training and biofeedback. Pain, 12:1.

UHDE, T.W. and NEMIAH, F.I. (1989). Anxiety disorders. In: KAPLAN, H.I. and SADOCK, B.J. (eds). Comprehensive textbook of Psychiatry (5th ed.) Baltimore: Williams and Wilkens.

UDOLF, R. (1987). Handbook of hypnosis for professionals (2nd ed.). New York: Van Nostrand Reinhold.

WAGNER, H. and MANSTEAD, A. (eds.) (1989). Handbook of social psychophysiology. Chichester: Wiley.

WOLPE, J. (1958). Psychotherapy by reciprocal inhibition. Stanford: Stanford Univ. Press.