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Autonomic Self-Control of Clinical Relaxation as a Function of Imagery

Dean G. Allen

Utah State University

AUTONOMIC SELF-CONTROL OF CLINICAL RELAXATION AS A FUNCTION OF IMAGERY

by

Dean G. Allen

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Dean G. Allen

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ABSTRACT

Autonomic Self-Control of Clinical

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Dean G. Allen

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Major Professor: Dr. William R. Dobson

Department: Psychology

The purpose of this dissertation was to test the significance of objectively measured imagery ability on the learning of self-controled relaxation of autonomic nervous system activity. Imagery is discussed in terms of its interaction with Autogenic vs. Jacobsonian methods of training clinical relaxation.

Thirty-six female subjects from a college population, representing extreme highs and lows on "spatial ability" tests were given a series of three six-session sequences of Baseline, Treatment 1, and Treatment 2, which contained silent relaxation as a control, plus Jacobsonian and Autogenic relaxation. High and low spatial ability subjects were divided into split groups (A & B) which were given Jacobssonian and Autogenic relaxation treatment in different sequence orders. Skin temperature biofeedback was used to monitor the little fingers on both hands as a general indicator of autonomic clinical relaxation. Mean temperature; temperature change within sessions; and temperature change between sessions, were analyzed by different treatment periods and spatial ability groups. The data from these groups were analyzed using an ANOVA design. There were no significant differences in mean temperature data. A nearly significant two-way interaction was found between imagery ability and treatment order during Autogenic training. Also a significant interaction was found in skin temperature change between sessions for, "Sensory" vs. "Intuitive" personality types, and a nearly significant difference for Autogenic vs. Jacobsonian treatment.

It was concluded that Jacobsonian training was generally more effective than Autogenic training for inducing vascular relaxation in both high and low imagery subjects. Also it was found that Sensory perceptual types are significantly more stable in terms of day to day skin temperature variation during relaxation training, than are Intuitive perceptual types.

(140 pages)

CHAPTER I

INTRODUCTION

Understanding the interaction processes between the human perception of external sensory stimuli and the autonomic neurophysiological motor responses, has long been a problem of considerable concern and interest to phychologists, neurologists, and physiologists.

This interest is prompted by the desire to understand the processes of psychological perception, neurological excitation, and physiological response. This series of events is difficult to study in that they occur almost simultaneously, making it difficult to isolate and observe any one event without taking into account the variables which may be influencing the other two. Yet, without an adequate understanding of the mediational processes between the perception of external stimuli and autonomic neurophysiological responses, the psychologist is ill-equipped to develop the most adequate programming techniques for training an individual to assume self-control over neurophysiological rersponses. The failure to have control over these responses was referred to by the Greeks as disease.

Prior to 1960 it was generally assumed that autonomic nervous system (ANS) functioning was only conditioned by classical techniques.This conclusion was based on the assumption that the ANS did not interact directly with the environment due to the fact that the ANS is "composed entirely of visceral motor (efferent) neurons" (Spence & Mason, 1979, p. 369). Thus the ANS was thought not to be subject to environmental manipulation (McCanne & Sandman, 1976). Kimble (1961) cited several studies suggesting that environmental control over autonomic body activity was however possible, but he speculated that such control was mediated by intervening skeletal muscle responses. More recently, however, research has shown that the ANS responds equally well to both operant and classical conditioning (DiCara & Miller, 1968). Numerous studies have attempted to explain the suspected mediational process by focusing on either (a) respiratory mediation (changes in pressure exerted on the pressoreceptors in the lungs), which produces bradycardia (slowing of heart rate) and tachycardia (speeding of heart rate) in both humans and animals (Neil & Heymans, 1962), or (b) somatic-muscular mediation in which operantly conditioned ANS functions may be mediated by centrally initiated muscular changes which are subject to environmental control, and (c) central mediation theory which holds that both the voluntary and the involuntary events of the body are mediated by a common central nervous system (CNS) effector (Obrist, Webb, & Sutterer, 1969). Both the respiratory and the somatic muscular explanations focus on specific neurophysiological pathways which have been shown to be sufficient to produce operant learning of ANS responses. Miller and DiCara (1968) conditioned a specific response (urine production) in a curarized rat using operant procedures. This seems to suggest that something other than somatic mediational mechanisms are responsible for the occurrence of such specific learning as urination in curarized rats.

Furthermore, researchers who have examined the influence of biochemical (rather than electrical) mechanisms have found no clear indication of how the biochemical mechanisms interact in the overall process of ANS mediation (Brown, Davis, and Carlsson, 1973). From this research it is suggested that ANS responses correlate somewhat with both biochemical and neurophysiological mechanisms. However, such research does not provide a clear explanation of how autonomic responses are mediated from the external environment to the internal environment.

McCanne and Sandman (1976), in a review of operant heart reate research, express "surprise" that investigators of mediational mechanisms have devoted so little attention to understanding how the influences of individual differences relate to neurophysiological functioning. Numerous investigations by Lacey (1967) and Elliott (1964) have consistently shown individual differences to be the greatest single influence on neurophysiological mechanisms. This finding is further supported by the fact that intersubject correlation on psychophysiological variables is almost always relatively low. This observation suggests that an adequate comprehension of ANS mediational mechanisms may not come from looking at uniform similarities across individuals, but rather, may come from understanding the differences which exist between individuals, and by researching how these differences relate to each person's individual pattern of autonomic neurophysiological functioning.

Individual differences in personality types, as defined by various bi-polar measures have been shown to correlate with an individual's ability to control autonomic functions (Dykman & Gantt, 1959; Dykman, Ackerman, Galbrecht & Reese, 1963; Dykman, Reese, Galbrecht, Ackerman & Saunderman, 1968; Ray, 1974; Lacey, 1967; and Cohen, 1967). Examples of these observable personality variables are "introversion/extroversion" (where consciousness is focused), "locus of control" (an individual's belief in the source of control over his fate), and "field dependency/independency" (degree to which an individual is influenced by his environment). These personality variables generally reflect bi-polar measurements based on self-report of one's perception of his own external behaviors. These measurements are then used to interpret internal mental processes which indicate personality types and reflect a person's perceptions, preferences, beliefs, and environmental influence. However, they do not suggest a model for understanding the nature of the underlying internal processes of consciousness, which mediate between cognitive and autonomic processes.

Theoretical Model of the Problem

Jung (Hall & Nordby, 1973) and other Jungian oriented psychologists (Myers, 1962) have proposed a theoretical model of consciousness which may provide insight into the nature of these internal mental processes that seem to mediate between sensing external stimuli and responding with internal autonomic neurophysiological processes. According to this model the external reality is perceived through sensory and intuitional (extra-sensory) receptors. Such perceptions are then judged according to our thinking (beliefs) and feelings (values). Considerable individual differences exist with respect to different individual's awareness and utilization of perception (sensing/intuition) and judgment (thinking/feeling) processes (Myers, 1980). Ray (1974) indicates a significant correlation between one's belief that control over one's own fate is within himself (internal locus of control), and one's ability to learn self-control over autonomic neurophysiological functions. In addition, field independence (not influences by the environment surrounding objects being observed) and high spatial ability (the ability to perform accurate imagery manipulations), correlate significantly with learning self-control over neurophysiological functions (Wagner, Bourgeous, Levenson & Denton 1974; Glover, 1974). In other words, (a) believing one has control over his own fate (locus of control), (b) the ability to not respond to peripheral environmental stimuli (field independence), and (c) the ability to effectively image (visualize) and manipulate visual stimuli, all represent abilities which correlate significantly with learning self-control over neurophysiological relaxation.

These three components of the mediational process enhance the learning of self-control. When we analyze these functional processes in terms of the Jungian model of consciousness, or mind processes and functions, we see that each of the two internal functions of mind (thinking & feeling) which respond to perception, correspond with other processes (believing & imaging) which mediaite self-control over neurophysiological processes and functions.

A person's thinking function may manifest itself through a belief in the attitude that control over one's fate within himself (or internally determined). One's feeling function may manifest itself through images so vividly imagined that they can be felt. In the Jungian model both thinking and feeling represent internal responses which operate at different individual levels of preference, awareness, and proficiency. Thus, the ability to focus one's conscious awareness on internal functions and processes, without distraction from the field (field independence), would be expected to enhance one's awareness, and thus enhance learning, of self-control over autonomic neurophysiological processes and functions (Hein, Cohen, & Schmavonian, 1966).

Believing, imagining, and internalizing appear to represent a chain of abilities which influence our learning of self-control over autonomic neurophysiological processes and functions. Zikmund (1972) suggests that imagery is the link most closely connected to autonomic neurophysiological functioning. If this is true then the imagery process needs to be more clearly understood so that phychologists will be better equipped to develop techniques for training more effective and efficient learning of self-control over autonomic functioning. Such self-control over autonomic functioning is the essence of learning clinical relaxation--the ability to control nervous system arousal levels. Thus, the learning of self-controlled clinical relaxation is apparently related to proper beliefs (reflecting how mind-body processes function), and proper imagination (perceiving a peaceful harmonious environment). What we believe structures what we preceive and limits our response potential to what is.

Problem

Autonomic nervous system functions have long been associated with the imagery process (Shealy, 1977). In fact, Shealy discusses how the nervous system controlling these functions was referred to by an early pioneer of self-healing (Emil Coeu' in France) as the "imaginative nervous system", prior to common acceptance of the title, "autonomic nervous system", a label which leads one to believe that these functions are beyond self-control.

In light of this discussion it seems reasonable to hypothesize that imagery may constitute the primary mediational mechanism between external sensory stimuli and ANS motor responses. The investigation of this hypothesis requires additional research on imagery, to outline more clearly the relationship between imagery and autonomic self-control.

Imagery may be defined as a subjective experiential process which creates, or responds to, one's perceptions of reality. Meanwhile, rational linear thinking processes analyze one's objective understanding of reality, programming belief systems to aid in the processing of new information. Imagery ability is measured by spatial ability tests which require visual manipulation of oneself or an object in space, to determine answers to questions which require controlled image manipulation and vivid clarity. There is research (Glover, 1974) to suggest that such measurements of imagery do correspond with autonomic neurophysiological measurements. Such research suggests that spatial ability may be used to predict neurophysiological functioning. Other research (Flemenbaum & Anderson, 1978) indicates a positive relationship between field-dependence and blood cholesterol levels, further suggesting that the way an individual perceives reality relates to the functioning of his autonomic neurophysiological systems. This indication suggests a need for more extensive research on the mediational factors which have been shown to relate to autonomic functioning.

Imagery appears as if it could possibly be the mediational factor responsible for stimulating autonomic neurophysiological functioning. For example, a person can image eating a lemon and experience an autonomic salivary gland response (if they have previously eaten a lemon). However, questions still remain concerning individual differences in ability for learning to image an appropriate perception that will produce a desired autonomic response. Do individuals vary in this ability according to their imagery ability as measured by a spatial ability test? The answer to this question would provide the clinical psychologist with greater insight into the type of clinical relaxation training which may be most effective for a particular client.

Two basic types of clinical relaxation methods are currenlty being used for clinical relaxation training. The first, Autogenic relaxation, was developed by Luthe

(1969), and focuses on smooth muscle relaxation utilizing suggested imagery as a tool for attaining self-control of nervous system relaxation. The other technique (Jacobson 1962, 1925) focuses on the voluntary (or striated) muscles, using voluntary tensing and relaxing of various muscle groups throughout the entire neuromuscular system.

Each of these methods for training clinical relaxation of the nervous system focuses on different subdivisions of the peripheral nervous system (autonomic vs. somatic), which are functionally (involuntary vs. voluntary) different (Teyler, 1975). However, the apparent underlying assumption for both of these approaches to training clinical relaxation is that, even though the observable techniques (imagery vs. voluntary tensing & relaxing) focus on different nervous system divisions and functions, they are both intended to meet the same basic objective--overall clinical relaxation of the body's entire neuromuscular system.

Clinical relaxation of the body's nervous system may be expressed through various autonomic neurophysiological functions which can be measured with biofeedback equipment--skin temperature, electrical activity of skeletal muscles (EMG), sweat gland responses (GSR), and respiration. These neurophysiological functions exhibit various states of arousal, of which clinical relaxation represents a low state of arousal (Girdano & Everly, 1979).

The measurement of these arousal states may be done with biofeedback equipment and may be fed back to the individual for the purpose of teaching clinical relaxation. Each of these neurophysiological functions operates independently with respect to° their level of arousal (Hassett, 1978). Consequently, the more simultaneous measurements of these different functions that can be obtained, the more accurately an overall state of clinical relaxation (or arousal) may be identified. The measuring of an individual's state of arousal (or clinical relaxation) while engaged in designated research activities is widely used and accepted as a dependent variable for research on neurophysiological functioning. Although there are a number of these variables that can be measured, it is generally agreed (Green & Green, 1977) that skin temperature is one of the best single indicators of overall neurophysiological arousal or clinical relaxation, because peripheral vascular constriction is a primary sympathethic nervous system response.

Purpose

The purpose of this study was to determine if individual differences in objectively measured imagery ability may be used to better determine the most effective technique for a particuar client to use in learning self-controlled clinical relaxation. Learning self-control over autonomic neurophysiological functioning is one of the most critical elements of maintaining preventative health. It is being realized that the cause of more and more diseases (Shontz, 1975), is defined by the word itself (dis-ease: being without ease), and therefore, more appropriate methods need to be found for dealing more effectively with such health problems.

Clinical relaxation as a self-health skill has not been researched long enough to understand all the problems, let alone to have developed creative solutions to those problems. This study, then, is an effort to focus research on attaining a better understanding of the imagery process and how it correlates with the learning of autonomic self-control for clinical relaxation. This understanding is critical to the ultimate development of more adequate methods for training self-control over autonomic neurophysiological arousal.

The imagery process may be measured by a variety of methods (Space Relations, Spatial Orientation, & Spatial Visualization) ranging from, mental manipulations of objects, to mental manipulation of self to obtain a visual perspective from different points in space. Such measurement devices seem to share the central characteristic of requiring some type of visual manipulation of visual stimuli. However, little, if any, research has been done on the predictive validity of these imagery tests for specifying an individual's ability to effectively use a particular method of relaxation training (Jacobsonian vs. Autogenic) for learning control over neurophysiological functions. Thus, this study will examine imagery ability (from three different perspectives) to determine if any significant relationship exists between imagery ability and responses to these different methods of relaxation training.

Personality type is another variable which has received considerable attention with respect to how personality relates to neurophysiological functioning. Personality type refers to a persons preferences for, (a) where awareness is focused (internal/external), (b) what perceptual content it is focused on (sensory/intuitional), (c) why certain judgments are made (thinking/feeling), and (d) how life is approached (judgmental/perceptual). In order to measure these factors and determine if there is any apparent relationship between these processes and neurophysiological functioning, this study will use the Myers-Briggs Personality Type Inventory. This instrument has been widely researched (over 600 studies) and is gaining acceptance as an instrument for determining individual preferences of mental processes and functions which seem to relate to neurophysiological responses (Wilson, 1981).

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

This review of literature is intended to give an overview of the various considerations relevant to ANS activity. It begins with a look at the importance of Individual Differences in autonomic functioning and moves from there into a review of Personality Variables which appear to influence the control of ANS functions. Next Imagery is discussed in terms of its definition and how it may relate to autonomic activity. The different types of Relaxation Training are then reviewed, as well as the Skin Temperature Research which leads up to a Statement of the Problem and the Hypotheses.

Individual Differences

The differences in individuals with respect to ANS functioning has been extensively investigated by the Laceys and their colleagues (Lacey, Bateman & Van Lehn, 1952, 1953; Lacey & Lacey, 1958, 1970; Lacey& Van Lehn, 1952). Their studies demonstrate that individuals respond to stressful situations with patterns of autonomic responses that are highly idiosyncratic; over-responding in some modalities and under-responding in others. The research further suggests that there may be innate fundamental differences between individuals in their ability to control neurophysiological responses to stress. The nature of these individual differences with respect to ANS functioning has been investigated by Hein (1969) in research examining the physiological responses of cats subjected to classical heart-rate conditioning. Hein demonstrated large individual differences in the number of training trials required to reach a stable heart-rate response to a conditioned stimulus. Individual differences in conditioned stimulus responses were also noted by magnitude of heart-rate, pupillary dilation, respiratory apnea, skin potential, muscle tension, and EEG activity. These responses were all assumed to be either sympathetic or parasympathetic ANS functions. Such response differencess as these raise important questions like which response is the most effective for training an individual to aquire autonomic self-control.

Other researchers (Dykman et al., 1963, 1968; Dykman & Gantt, 1959) have further demonstrated an idiosyncratic nature in the development of conditioned ANS response patterns. By mapping out several patterns of physiological responses associated with personality dimensions, Dykman's team described four basic personality patterns (alternating, closed, open & nonresponsive), each of which characterized different physiological response patterns. These patterns call attention to the fact that the subjects' level of functioning at the time of stress; the levels of stress; and personality variables (especially defensiveness) influence autonomic functioning. All of this research raises additional questions which may help to clarify the nature of individual differences, and their influence on various psychophysiological functions and processes.

Personality Variables

"Locus of control" is one example of a personality variable which is related to autonomic functioning in terms of operant heart-rate changes (Ray, 1974). Locus of control refers to an individual's perception of the source of control which exists over his own fate. This is defined in terms of whether that control is viewed as being either internally or externally imposed. In other words, does the individual believe that he has internal control over his own fate, or does he believe that control over his fate depends upon what happens in the external world (Lefcourt, 1976).

Ray's research indicates that subjects with an internal locus of control are more able to accelerate operant heart rate than those subjects with an external locus of control. However, the reverse of this is true for control over heart rate deceleration. These results are consistent with Lacey's research which indicates that heart rate deceleration is associated with tasks which demand attention to the environment (external), whereas heart rate acceleration is associated with the tasks which require minimal environmental attentions (internal)(Lacey, 1959; Lacey, Kagan, Lacey & Moss, 1963; Lacey & Lacey, 1970). This suggests that individuals who believe they have control over their own fate and those who are engaged in tasks which require minimal environmental attention, both provide conditions which either allow for self-control over sympathetic nervous system stimulation, or produce a situation where sympathetic nervous system activity is more likely to be stimulated. This suggests that an individual's <u>internal perception of reality</u> controls sympathethic nervous system activity, while the individual's <u>perception of external reality</u> controls parasympathetic nervous system activity.

Since our "belief systems" provide the structure for our internal perception of reality, and sympathetic nervous system activity is the primary cause of degenerative diseases, this may explain why Eastern philosophies insist that our internal beliefs and perceptions of reality are the essential quality of health.

"Field dependency/independency" is another variable which seems to differentiate between various patterns of neurophysiological activity. This variable differentiates between those who are very much influenced by the environment surrounding objects being obseved (field dependent), and those not influenced by the environment surrounding objects being observed, or field independent (Holtzman, 1964 , 1965; Witkin, 1950, 1962). Such research indicates that <u>field</u>

<u>independent</u> subjects display autonomic patterns which are more quickly conditioned in a classical conditioning paradigm (Hein et al., 1966); have greater autonomic stability (Block, 1957; Hustmeyer & Karnes, 1964); have greater and more prolonged galvanic skin responsivity to external stimuli (Cohen, Silverman & Schmavonian, 1962); and have better tactile localization and laterality discrimination (Cohen, 1967) than do field dependent subjects. Therefore, it would appear that autonomic functions are very much influenced by individual differences in consciousness of internal and external realities.

Research suggests that an internal focus of consciousness enhances control over various ANS functions (Ray, 1974; Wagner, Bourgeous, Levenson & Denton, 1974; Johnson & Meyer, 1974). However, such research generally focuses on measurements such as locus of control or field dependence/independence which only provide bi-directional assessments of whether consciousness is primarily focused internally or externally. It appears that little research emphasis has been focused on the nature and content of internal mind processes and how they may functionally relate to imagery and autonomic self-control.

Imagery

According to Michael, Guilford, Fruchter, and Zimmerman (1957) imagery ("spatial ability" if objectively measured) is the composite of three basic factors: (a) The K factor (Kinesthetic), considered "highly tentative" (& thus not applicable to this study), merely represents a "left/right discrimination of movement" as when determining which direction to screw a bolt, (b) the SR-O factor (Spatial Relations & Orientation), characterized as representing "empathic participation" through "manifestations of bodily movements", usually apparent to the participant and (c) the Vz Factor (Visualization) which represents mental manipulation of visual objects, through a specified sequence of movements, which are usually done in a somewhat detached manner with little apparent effort.

Mental imagery according to Richardson (1969) refers to:

> (1) all those quasi-sensory or quasi-perceptual experiences of which (2) we are self-consciously aware, and which (3) exist for us in the absence of those stimulus conditions that are known to produce their genuine sensory or perceptual counterparts, and which (4) may be expected to have different consequences from their sensory or perceptual counterparts. (p.2)

These two descriptions summarize imagery from both the objective measurable, and the subjective experiential point of view. The objective assessments of imagery are generally referred to as spatial ability tests, while the subjective assessments are usually referred to as imagery ability, however, the latter tool is a self-report measure rather than a performance indicator.

There seems little doubt that imagery is an internal process, and that an internal focus of consciousness enhances autonomic self-control. However, questions remain concerning the specific nature of these internally focused processes as they relate to imagery and ANS functioning. According to Zikmund (1972) most neurophysiological studies of mental imagery have been based on the experiential similarity which exists between "imaging and perceiving," which according to Oswald (1962) both produce similar neurophysiological responses. This relationship suggests that the ability to control and direct imagery may be used to guide ANS functions into a state of clinical relaxation.

Michael et al. (1957) suggests that the Vz factor represents the most complex form of imagery, while the SR-O factor represents a mid-range of complexity, and the K factor represents only the simplest form of imagery. Additionally, Zikmund (1972) indicates that the more vividly an image is experienced, the more impact it has on ANS functioning. Thus, the measuring of varying levels of spatial ability may suggest the level of clarity (or vividness) with which imagery is consciously experienced.

The relationship between imagery and autonomic self-control appears to be a two-part function; first, the ability to produce imagery, and then followed by the ability to control the content of the imagery by producing images (of being warm, heavy, & feeling peace), which in turn produce autonomic relaxation.

In other words, imagery ability alone would not ensure autonomic self-control. For example, certain images may elicit a fear response, stimulating sympathetic nervous system activity to produce fight or flight energy. The end product of this response is distress and tension throughout the body when the energy being stimulated is not used. Whereas, the ability to produce imagery, combined with the ability to control the content of that imagery, allows for the production of imagery which stimulates parasympathetic activity and brings the body into a state of clinical relaxation (Selye, 1974). Thus, it would seem that an individual's ability for autonomic self-control may vary with individual differences in imagery ability.

Research by Sandman (1975) indicates that subjects with field independence are less influenced by novel stimulation. This factor may account for the considerable individual variation in stable physiological responses during orientation to a new environment (Hein, 1969). Killman and Howell (1974) go a step further and show research indicating that individuals with an internal focus of consciousness are generally better therapeutic risks regardless of the type of therapy. Other research by Olsen (1976) indicates that imagery plays an important role in all therapeutic processes by providing the tools for internally conceptualizing a solution to one's problems, which then may result in programming the mind for that solution.

Relaxation Training Methods

There are two basic methodological types of relaxation training generally used in scientific research. One was developed by Jacobson (1925; 1962) and is commonly known as Jacobsonian or Progressive Relaxation. This method is the somatic (or kinesthetic) type, which focuses on active manipulation (tensing & relaxing) of the body to induce the feelings of relaxation, specifically in the voluntary muscles. These exercises take an individual through the entire body, alternately tensing and relaxing various muscle groups to attain deep relaxation.

The other most commonly used method is called Autogenic therapy (Luthe, 1969). This method represents the passive type of relaxation training where the individual mentally affirms the presence of physiological conditions associated with nervous system relaxation--such as "my arms and legs feel warm and heavy." Variations of these two approaches comprise the majority of all relaxation methods used in scientific relaxation training. Another area closely associated with relaxation training methods is imagery and its role in these various methods (DiGuisto

& Bond, 1979). Imagery in this sense has to do with the mental pictures which an individual produces in relation to various life events. The content, intensity, vividness, duration, and frequency of various images influence ANS functioning (Grossberg & Wilson, 1968) and thus become extremely relevant variables in this type of relaxation training. LeBoeuf and Wilson (1978) point out that maintenance of feedback assisted relaxation is significantly more successful in individuals who used an imagery strategy to relax, rather than one of "passive concentration" or "defocussing of attention". Subjects in this research showed no differences in their ability to relax with frontalis EMG biofeedback--but, when baseline EMG relaxation levels were taken, two and seven days after training, significant differences were found between subjects using an imagery strategy and those using other strategies. This data indicates that imagery strategies are significantly more effective than non-imagery strategies for maintaining nervous system relaxation.

Blizard, Cowings, and Miller (1975) did a full scale physiological analysis of heart rate, respiration, brain waves, and finger temperature--in response to opposite types (cool vs. warm) of Autogenic suggestions. They found that significantly reliable and different responses occured in heart rate and respiration, to suggestions of coolness and warmth, but not in alpha brain waves or finger temperature even though temperature tended to move down in response to the cool suggestion. Although such research may be suggestive of physiological changes it should be pointed out that training with naive subjects using six sessions of 16 alternating one-minute periods of cool and warm suggestions may not be the most effective strategy for training physiological control. The authors apparently realized this fact and their final suggestion was that "specific training in imagery, may be useful as one means of helping to gain control over autonomically mediated responses" (p. 54).

Keefe, Surwit, and Pilon (1980) did a study with 21 females suffering from Raynaud's Disease, to determine if differential training outcomes occured among Autogenic training, Progressive Relaxation, and a combination of Autogenic training and skin temperature biofeedback. They found that all patients significantly improved and that no significant differences between the three treatment procedures occured. This data suggests that with clinical subjects any of the accepted treatment procedures will significantly improve their symptoms.

Skin Temperature Research

Peripheral skin temperature reflects peripheral blood flow which is controled by the ANS. Skin temperature is widely used as an index of sympathetic nervous system arousal, because such arousal constricts the peripheral vascular system to force blood into the internal organs in preparation for the fight or flight response to fear or danger (King & Montgomery, 1980). Low skin temperature has a symptomatic relationship to migrain headaches and Raynaud's disease, making biofeedback an appropriate treatment tool for training individuals to warm digital temperature and reverse the effects of these disorders (Surwit & Fenton, 1980).

According to King and Montgomery (1980) research on peripheral skin termerature has revealed that with the use of biofeedback, small magnitude changes are more prevalent, and decreases in hand and skin temperature are generally greater than increases. Also, large individual differences exist in the magnitude of response control. King and Montgomery (1980) further point out that there has been little research on the effectiveness of somatic strategies in temperature control training, as well as little research on temperature control without the use of external feedback.

Other findings of skin temperature research indicate that reliving anxiety producing experiences through verbal discussions, significantly lowers skin temperature (Crawford, Friesen, & Tomlinson-Keasey, 1977). Relaxation strategies for controling skin temperature with Autogenic imagery were tested by Blizard, Cowings, and Miller (1975). They found that finger temperature tended to lower during "cool imagery", but it was not statistically significant and there were no reliable changes during "warm imagery". However, successful hypnotic control of skin temperature (Maslach, Marshall, & Zimbardo, 1972) suggests that such negative studies may only reflect inadequate focus of attention by undisciplined and/or unmotivated subjects. This suggestion may be supported by the fact that Roberts, Kewman, and MacDonald (1973) found that some individuals were able to achieve a high degree of voluntary skin temperature control--possibly indicating individual differences in consciousness focusing ability. Further research by Roberts and Tellegen (1973) indicates that high hypnotic susceptability does not significantly improve subjects' ability to control skin temperature, showing that even a predisposed ability to become hypnotized is not sufficient to make any differences in performance.

In summary these findings indicate that the focusing of consciousness on anxiety producing experiences easily lowers skin temperature. However, raising skin temperature appears more difficult and has only been reliably done under research conditions using hypnosis. Since a lowered skin temperature is associated with a fear response in anticipation of 'fight or flight', all this may only tell us that 'fear' is more present in the undisciplined/unfocused mind, than other more calming thoughts and images which reliably produce warm hands under hypnosis. Taub and Emurian (1976) report on a study of bidirectional (higher & lower)temperature training where mean change per session was 2.2 degrees fahrenheit, and learning was usually evident by the fourth session, with some changes of from 9 to 14 degrees fahrenheit per 15 minute session. They further stated that one-third of their population "demonstrated self-regulated temperature changes of sufficient magnitude to have potential use in clinical or practical situations (p. 162). These subjects reported a variety of different strategies for inducing these changes (ie. imagery, relaxation exercises, self-suggestion, passive volition, & direct commands to hands and feedback lights), but the more proficient they became at controlling hand temperature, the less able they were to tell their strategy.

Hunter, Russell, Russell, and Zimmerman (1976) found that children with learning disabilities were significantly better at controlling skin temperature than so-called normal normal children. Additionally, younger children did better than older ones, and girls did somewhat better than boys.

Keefe and Gardner (1979) reported on a comparison of short vs. long term biofeedback training of skin temperature, in which they found that subjects reached their peak levels of performance early in training (usually by session 3) and more extended training did not produce larger change increases during sessions.

At this point in skin temperature research each study adds an additional bit of information which may some day fit into a larger gestalt of understanding. However, this review of research did not reveal a clear explanation for how all the various data may fit into a complete picture of skin temperature functioning. It also appears that basic descriptive data such as ranges, means, and standard deviations of skin temperature during and between a number of standard length training sessions, is missing from the literature. Such baseline data is usually missing from most research, and when present it typically covers from one session--to as little as one reading (McDonagh & McGinnis, 1973).

Statement of the Problem

The problem being investigated in this study is whether or not significant deviations in imagery ability (as measured by an objective test of spatial ability) correspond with variations in measures of peripheral skin temperature across Baseline, Jacobsonian, and Autogenic treatment. The purpose of this investigation is to gain additional insight into the relationship between imagery ability and self-control over autonomic neurophysiological functioning, in terms of two different procedures for training clinical relaxation.

Since self-control over the arousal levels of autonomic neurophysiological indicators appears to be one of the most basic solutions to stress related degenerative diseases (such as high blood pressure, diabetes, peptic ulcer, arteriosclerosis, etc.), such research on factors which relate to the training of clinical relaxation seems worthy of considerable attention. The outcome of this research will provide an analysis of the functional relationship between imagery ability, autonomic neurophysiology and the two most noted treatment procedures for training clinical relaxation.

The four basic questions which this research is designed to help answer are:

1. Do measures of skin temperature vary significantly <u>between</u> high and low imagers during different methods of treatment?

2. Do different methods of relaxation training result in significantly different skin temperature variances within homogeneous groups of imagery ability?

3. Does the interaction of imagery ability and relaxation training method significantly relate to the variance of skin temperature?

4. Do measures of skin temperature vary significantly between four polar measures of personality type?

Hypothesis

There is no difference within or between high spatial ability subjects and low spatial ability subjects on mean skin temperature, temperature change during sessions, or temperature change between sessions, for Baseline, Jacobsonian, or Autogenic treatment.

The significance of attempting to answer these questions is to help determine if imagery ability is an important clinical consideration for enhancing a therapist's insight and understanding into more effective and efficient procedures for training clinical relaxation of autonomic functions.

CHAPTER III

METHOD

Introduction

This research focused on the effectiveness of different clinical relaxation procedures on individuals who deviated significantly from one another on a measure of spatial ability (see Appendix A).

The design exaggerated the influence of imagery ability by choosing half of the subjects from females whose spatial ability scores were lowest among the more than 500 students screened; and the other half of the subjects from those whose spatial ability scores were highest. This selection was made on the basis of the "Space Relations" subtest from the Differential Aptitude Test (DAT). That measurement served as the discriminative independent variable for determining each subject's imagery ability.

The intent of this research was to observe programmed relaxation in two groups of subjects whose performance opposed one another on a measurement of imagery ability.

Design

The overall focus of this design was to test the possibility that imagery as measured by spatial ability, may reflect a key mental process serving as a mediator of perceptual content between external stimuli and internal ANS responses.

This design used treatment procedures (Jacobsonian & Autogenic) which appear to differ greatly in their use of imagery. Autogenic treatment utilizes passive imaginal suggestion (I feel heavy, warm & comfortable; I am at peace with myself, etc.) as the primary tool for inducing clinical relaxation, while Jacobsonian procedures utilize active contracting of various muscle groups as the means for focusing one's attention on the induction of clinical relaxation. The use of treatment variables which differ in their utilization of imagery, provides an examination of how visual imagery ability may relate to different procedures for learning control over ANS relaxation.

Skin temperature biofeedback was used to monitor subject's autonomic functioning during three two week periods of Baseline, Treatment I, and Treatment 2. There were six 25-minute sessions spread over each of these two-week periods (see Appendix B).

This study examined two independent variables (treatments x groups) using a 2 x 2 ANOVA design. The treatment variables (Jacobsonian & Autogenic relaxation) were examined for differences <u>within</u> the high and low imagery groups. Differences <u>between</u> high and low imagers, as well as the <u>interaction</u> among these variables, were also examined.

The dependent variable was skin temperature and was monitored on four randomly assigned subgroups in a 2 x 2 interaction of imagery ability (high & low) and ordered treatment groups (see Appendix A). This design served to control for the effects of <u>exposure order</u> to different relaxation treatment methods.

<u>Subjects</u>

Female subjects (36) were choosen to control for any variation in ANS functioning due to sex-linked characteristics. Undergraduate classes at Boise State University were visited by the experimenter, who gave (a) a brief description of the research being done (imagery as it relates to autonomic self-control for clinical relaxation), (b) the selection procedures for subjects, and (c) asked for volunteers to take a 25-minute screening test of spatial ability.

High and low performance on the DAT "Space Relations" subtest determined which individuals were chosen as subjects. Appointments were then made with all females who met either the high or low criterion (above the 90th percentile or below the 35th percentile) but they were not told which group they were in. These potential subjects were then asked to read an outline of what their participation would entail, as well as an "Informed Consent" form which they signed if they chose to become a subject (see Appendix C).

Measurement Instruments

Differential Aptitude Test (DAT). The validity of the DAT "Space Relations" subtest to discriminate neurophysiological variation was confirmed by Glover (1974). Glover found this subtest to be an effective tool for predicting individuals who produce higher amplitude and more continuous Alpha rhythms under controlled conditions. In addition, other validity studies on the DAT "Space Relations" subtest indicate high predictability for success in geometry, mechanical design, and engineering (Bennett, Seashore, & Wesman, 1966)--all of which reportedly rely on imagery ability. This subtest provides a highly reliable instrument (males .94 & females .93) for measuring the spatial ability factor using simple testing and instructional procedures.

Thus, the DAT "Space Relations" subtest was chosen as the independent measure for identifying high and low imagers--whose scores were above the 90th percentile for highs, and below the 35th percentile for lows. The "Space Relations" subtest consists of 60 items (see Appendix E) with exactly 25-minutes for completion.

Guilford-Zimmerman Aptitude Survey. Two other measures of spatial ability were administered to subjects to obtain comparative measures of imagery ability on tests requiring different levels of vividness. Hughes (1976) indicates that this quality of imagery can be measured with the Guilford-Zimmerman subtests (Vz, SR-O, & K) which focus on three levels of imagery complexity. However, only VZ and SR-O seemed relevant to the focus of this study.

The Guilford-Zimmerman "Spatial Orientation" test is suggested by Michael, et al. (1957) as an instrument which serves well as a measure of the SR-O factor.

They also recommend the Guilford-Zimmerman "Spatial Visualization" test as being an excellent measure for the Vz factor. However, due to the complicated verbal nature of the instructions for this test, its ability to isolate and measure spatial ability has been questioned by Buros (1953). This criticism may or may not be justified, nevertheless the ability to translate from verbal language to visual imagery, seems related to controlling the content of imagery, and thus seems relevant to the purpose of this study.

Two subtests from the Guilford-Zimmerman Aptitude Survey were therefore used as additional measures of imagery, to allow for additional comparisons between level and type of imagery ability, and its correspondence with neurophysiological functioning.

"Spatial Orientation" is the first of these two subjests, consisting of 60 items with 10-minutes of working time and requiring:

> an ability to appreciate spatial relations of things with reference to the body of the observer. The awareness of whether one object is to the right or left, higher or lower, or nearer or farther than another, seems to be the essential nature of this factor (Guilford & Zimmerman, 1956, p. 2)

Alternate from reliability on this subtest is .88. In addition both practical and factorial validity were examined. Factorial validity indicates the extent to which this subtest measures the SR-O factor. The "approximate factorial-validity coefficient" for this relationship is .60 (Guilford & Zimmerman, 1956).

The practical validity of the "Spatial Orientation" subtest was determined by "correlations between its score and selected criteria of performance in some area of everyday life" (Guilford & Zimmerman, 1956). Using an academic criterion, "Spatial Orientation" was significantly valid (.05 level) as a predictor of college grades in English Composition and Accounting. Other positive correlations with college grades from other research were in Art (r = .26) and Engineering (r = .27). Occupations in which this factor is considered important are: aircraft pilot, blueprint reader, costume designer, draftsman, steam-shovel operator, surgeon, truck driver, and winch operator. All of these occupations rely on an orientation in space.

"Spatial Visualization" is the other Guilford-Zimmerman subtest used here. It consists of

40 items with a 10-minute time limit, requiring:

> The process of imagining movements, transformations, or other changes in visual objects. It is a dynamic kind of visualization, whereas another factor identified as visual memory is a static or reproduction visualization. The dynamic visualization factor is represented in tests of mechanical movements, mechanical comprehension, and in paper-folding tests of the Binet type (Guilford & Zimmerman, 1956, p. 2).

The reliability of the "Spatial Visualization" subtest, using the Kuder-Richardson formula 21 method for finding internal consistency, was .94 for men and .93 for women. Validity for the "Spatial Visualization" subtest was done by using both a factorial, and a practical method. The validity of this subtest for measuring the vz factor was estimated to be .60. The practical validity of this subtest for predicting academic performance was significantly related (.05 level) to college grades in the sciences (r = .25) in this one study (Guilford & Zimmerman, 1956). However, another study shows elevated correlationss with Art (r = .28), Engineering (r = .27), Psychology (r = .27), and Biology (r = .26)(Guilford & Zimmerman, 1956). Occupations in which this factor is considered important are: aircraft pilot, architect, decorator, dentist, designer, electicieran, engineer, inventor, mathematician, navigator, and surgeon.

Myers-Briggs Type Indicator. This test was designed as a measure of personality type, indicating individual preferences for different consciousness processes, such as (a) Locus of Focus (internal/external), (b) Perception (sensing/intuition), (c) Judgment (thinking/feeling), and (d) Attitude (judging/perceiving). This assessment was given to determine if any significant relationship existsbetween these personality type preferences and the learning of control over neurophysiological functioning. This assessment consists of 166 multiple choice items, which require preference choices for one behavorial activity over another. No time limit is observed, and estimated time for completion is between 40 and 50 minutes (Mendelsohn, 1965).

The author (Myers, 1962) of this test indicates that the reliability of this instrument is directly related to the maturational development of the consceiousness processes being measured. Thus, the more mature an individual is, the more reliable this instrument is. This being the case she suggests that, "it seems more realistic not to attempt to derive "the" reliability of this test from item statistics" (p. 19). However, split-half reliability was done for various groups: males, females, junior high school, high school, and college. These reliability coefficients ranged from a high of .94 (for advanced female high school students, on the Attitude polarity: judging/predeiving), to a low of .60 (for non-prep male, high school students, on the Judgment polarity--thinking/feeling). The Judgment polarity had "strikingly lower reliability" than the other processes, which according to the author is because, "the development of Judgment (thinking or feeling) is one of the slowest and most reluctant achievements in the process of growing up" (Myers, 1962, p. 20a).

The validity of this instrument is significant for predicting vocational compatibility, academic achievement, intelligence (IQ), values, personality, and faculty ratings. One or more of the eight basic polarity processes in this test were used to determine these validities. the author suggests that this wide range of validity strengthens the more general validity of Jung's overall theory that consciousness is a reflection of process preferences. The Myers-Briggs was used in this research to see how these variables relate to the other variable in the study. Support for the Myers-Briggs being a valid instrument for physiological research is given by Lees (1976) in a study which indicated that Introverts were significantly more effective at controling brain wave frequency than Extroverts.

Apparatus

Biofeedback. An Autogenic Systems, Inc., Feedback Skin Temperature Model 2000B was used to monitor the dependent variable in this research. This unit is equipped with a front panel meter with variable sensitivity per meter units.
This machine is also equipped with multiple temperature inputs which allow for temperature averaging from two or more locations.

Tape Recorder. A Sony Superscope Model C-106 was utilized to give auditory instructions to the subjects for Jacobsonian and Autogenic treatment to induce clinical relaxation.

<u>Clinical Relaxation Tapes</u>. Jacobsonian and Autogenic clinical relaxation procedures (by Alan R. Rappaport, Ph.D) were played on tape for each subject during the treatment phase of this research. These tapes were the standard procedures for both of these approaches to clinical relaxation, arranged to cover a 23-minute time period. Jacobsonian relaxation utilized alternating voluntary contractions and relaxations of various muscle groups throughout the body. Autogenic relaxation utilized imaging feelings of being heavy, warm, calm, and at peace.

<u>Experimental Situation</u>

After subjects had been identified and given three 30-minute appointment periods per week, each subject was then introduced to the Experimental site where the subject was seated in a recliner chair in a semi-reclined position facing the back wall (see Appendix F) of the experimental room (10' x 15') with a one-way mirror on their right. The floor of the room was covered with grey utility carpet and the walls were a light pastel with no windows. To promote an atmosphere of relaxation, lights were kept low and subject's hands were placed in a relaxed position on their lap. Two thermistor probes were secured with paper tape to the palmer surface of the litle fingers on both hands. These probes were connected to the skin temperature biofeedback machine, located in the adjacent room on the other side of the one-way mirror. The experimenter, after giving appropriate directions and attaching the probes, remained in the adjacent room collecting data until the end of the session, and then removed the probes, reminded them of their next appointment and excussed them.

Temperature of the experimental room did not deviate more than 1 degree from 71 degrees fahrenheit during the research.

Procedure

Prior to final subject selection, subjects were asked to carefully reconsider their commitment as outlined on the Informed Consent Form (see Appendix C). If they were still in agreement they were then given their appointment schedule
for three 30-minute sessions per week at the Boise

State University, Student Counseling Center. Also, arrangements were made with subjects to take the Guilford-Zimmerman, Spatial Orientation and Spatial Visualization subtests, and the Myers Briggs Type Indicator.

After these arrangements were made, Phase I (Baseline) of Series I (first six-week session for the first half of the subjects) of the research began (see Appendix B). Subjects were asked to come to the Counseling Center and sit quietly for at least five minutes prior to beginning each session, in order to acclimate to the research environment.

Phase I. Baseline began with orientation to the biofeedback equipment and the research procedures during the first session at the assigned time. The two primary groups of subjects (high & low imagers) were subdivided into secondary groups(A & B; see Appendix A) in order to control for treatment sequence effects between Treatment I and II. It was attempted to have "high imagery A' and "low Imagery A' groups follow a Monday, Wednesday, and Friday schedule while having "high imagery B' and "low imagery B" groups follow a Tuesday, Thursday, and Saturday schedule.

The first session began by seating the subject in the reclining chair and connecting the probes to the little finger on both hands. The research assistant then began recording subject's skin temperature on the Data Collection Form (see Appendix G) from the biofeedback machine in the adjacent observation room, while subjects observed a videotaped orientation to biofeedback and neurophysiological functioning by Elmer and Alyce Green (Green & Green, 1977) on the NBC Tomorrow Show with Tom Snyder. This interview dealt with the relationship between skin temperature and ANS activiy, and how different procedures of clinical relaxation may influence this activity. This interview was used to provide a simple explanation of these nervous system processes by two of the most noted researchers in this area, using the medium of a well-recognized national talk show. This video tape lasted 20 minutes, then subjects were asked to relax for five minutes before being disconnected from the probes and excused.

Sessions two through six of Phase I (Baseline) proceeded as follows: Subjects entered the biofeedback area and were seated in the recliner. The experimenter then attached the thermistors to the subject's hands and asked them to "sit quietly and become as relaxed as possible". At the end of the 25-minute exercise subjects were aroused by the experimenter and asked to sit up and have the probes removed from their fingers Each day subjects were reminded of the next appointment before they left.

Phase II. Phase II (or Treatment I) encompassed the third and fourth weeks of the research design procedures. During the six sessions of this phase, the "high imagery A" and "low imagery A" groups received Jacobsonian relaxation training, while the "high imagery B" and the "low Imagery B" groups received Autogenic relaxation training. Both of these training procedures utilized Rappaport's audio-taped relaxation exercises. Each of the six sessions during this phase proceeded as follows: After subjects were seated and probes were attached, they were asked to follow the suggestions for mental or physical exercises, which were outlined on the tape. At the end of the session subjects were disconnected from the probes and excused.

Phase III. Phase III (or Treatment 2) encompassed the fifth and sixth weeks of the research design procedures. During the six sessions of this phase, the "high imagery A" and "low imagery A" groups received Autogenic relaxation training, while the "high imagery B" and the "low imagery B" groups received Jacobsonian relaxation training. The remaining procedures in this phase were identical to those described in Phase II.

Data Collection

Skin temperature was hand recorded on Data Collection Forms (see Appendix G) by a research assistant from the front panel meter at 15-second intervals during each 25-minute session of this research. The research assistant was unaware of the subject's spatial ability performance, and was checked prior to these sessions to ensure that data collection reliability exceeded .90.

Analysis of Data

An analysis of variance (ANOVA) design was used to analyze three different measures of skin temperature data in terms of; (1) Jacobsonian and Autogenic rlaxation treatment, (2) high or low spatial ability on the DAT, and (3) personality type variables. The three measures of skin temperature data analyzed were: (1) mean temperatures, (2) temperature changes during sessions, (3) and temperature changes between sessions. These measures look at skin temperature changes in relation to imagery ability and treatment method. Table I and 2 outline the main effect and two-way variables by groups and treatment conditions for these three dependent measures.

Table 1

N's for Main Effect Variables Analyzed for Three Dependent Measures of Skin Temperature

	Baseline	Autogenic	Jacobsonian	Treatment-Periods 1	Treatment-Periods 2
High Imagery	n=18	n=18	n=18	n=18	n=18
Low Imagery	n=18	n=18	n=18	n=18	n=18
Extroverts	n=18	n=18	n=18	n=18	n=18
Introverts	n=18	n=18	n=18	n=18	n=18
Sensors	n=13	n=13	n=13	n=13	n=13
Intuitors	n=23	n=23	n=23	n=23	n=23
Thinkers	n=8	n=8	n=8	n=8	n=8
Feelers	n=28	n=28	n=28	n=28	n=28
Judgers	n=22	n=22	n=22	n=22	n=22
Perceivers	n=14	n=14	n=14	n=14	n=14

Table 2

N's for Two-Way Variables Analyzed

by Three Dependent Measures of Skin Temperature

Treatment Ordered Groups	Baseline Ja/Au	Baseline Au/Ja	Treatment 1 Ja/Au	Treatment 1 Au/Ja	Treatment 2 Ja/Au	Treatment 2 Au/Ja
High Imagery	n=9	n=9	n=9	n=9	n=9	n=9
Low Imagery	n=9	n=9	n=9	n=9	n=9	n=9
Extroverts	n=9	n=9	n=9	n=9	n=9	n=9
Introverts	n=9	n=9	n=9	n=9	n=9	n=9
Sensors	n=7	n=6	n=7	n=6	n=7	n=6
Intuitors	n=11	n=12	n=11	n=12	n=11	n=12
Thinkers	n=4	n=4	n=4	n=4	n=4	n=4
Feelers	n=13	n=14	n=13	n=14	n=13	n=14
Judgers	n=11	n=11	n=11	n=11	n=11	n=11
Perceivers	n=7	n=7	n=7	n=7	n=7	n=7

CHAPTER IV

RESULTS

This study investigated the following four questions to determine the interaction of imagery ability with two different treatments for inducing clinical relaxation. Skin temperature was used as the dependent variable measuring ANS arousal levels.

1. Do measures of skin temperature vary significantly between high and low imagers during different methods of treatment?
2. Do different methods of relaxation training result in significantly different skin temperature variances within homogeneous groups of imagery ability?
3. Does the interaction of imagery ability and relaxation training methods significantly relate to the variance of skin temperature?
4. Do measures of skin temperature vary significantly between four polar measurments of personality type?

The hypothesis of this study states that no significant differences exist between (1) high and low imagers or (2) the four polar measurements of personality type, in measures of skin temperature during Baseline, Jacobsonian, or Autogenic relaxation.

Also it states that there are no interaction effects between imagery ability and relaxation treatment methods.

Analysis of Mean
Skin Temperatures

A 2X3 ANOVA (Imagery X Treatment Methods) was computed to test the first research hypothesis which looks at Baseline, Jacobsonian, and Autogenic treatment without regard for treatment order. The results of this analysis are presented in Tables 3 and 4. These results indicate that variance in mean skin temperatures across different treatment methods and periods is not significant.

Table 3

Analysis of Variance between Imagery

and Baseline, Jacobsonian, and Autogenic Treatment

Source	df	ms (Full Model)	F
Baseline	1	1.0 (34.54)	0.03
Jacosonian	1	7.7 (28.18)	0.27
Autogenic	1	0.6 (37.57)	0.01
Error	34	(above for each analysis)	

Note. n=18 each group
F value @ .05 level = 4.13

Table 4

Mean Skin Temperatures for Baseline, Jacobsonian, and Autogenic Treatments

	Baseline	Jacobsonian	Autogenic
High Imagery	85.8 degrees (high)	85.6 degrees (low)	85.7 degrees (middle)
Low Imagery	86.2 degrees (middle)	86.3 degrees (high)	86.0 degrees (low)

A 2X2 ANOVA (Imagery X Treatment Order Groups) was computed to test the second and third research hypothesis by looking at variance within homogeneous imagery groups by treatment method, plus the interaction of imagery and treatment. No significant variance in mean temperature was found for either of these hypotheses. The reason for this lack of significance is apparent from the small mean temperature differences outlined in Table 4.

An additional 2x2 ANOVA (imagery x treatment) was computed to check for significant variance across Baseline, Treatment Periods 1 and 2. Skin temperature variance was not significant by either imagery, treatment, or their interaction, during any of the three periods of observation.

Figure 1 provides a picture of overall mean temperature changes by imagery, treatment method, and treatment periods.

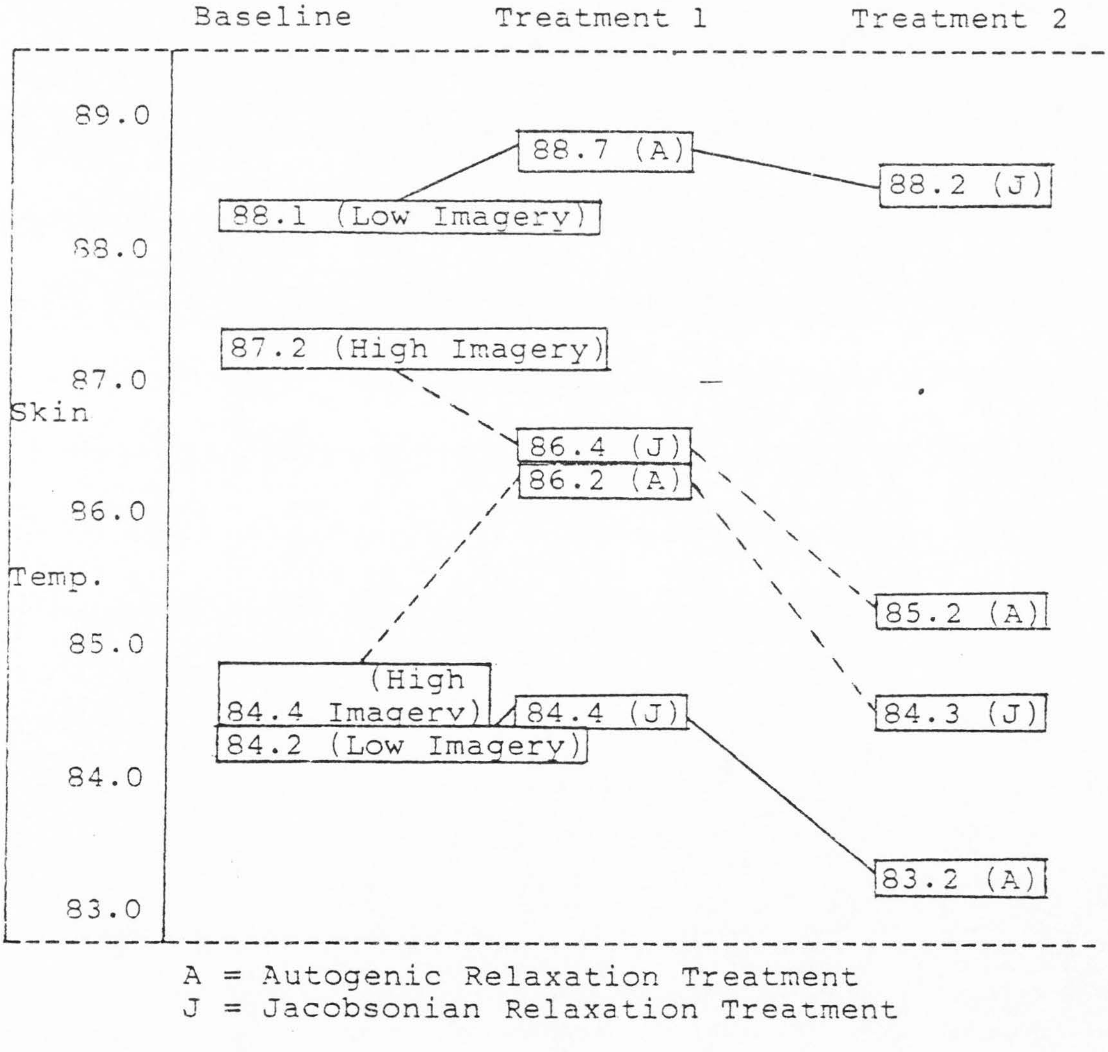

Figure 1. Skin temperature means by imagery, treatment method, and treatment periods.

Figure 1 indicates that skin temperature change for the combined high imagery groups was 5.7 degrees (.8 + 1.2 + 1.8 + 1.9) as compared with 2.5 degrees (.6 + .5 + .2 + 1.2) degrees of change (up or down) for the combined low imagery groups. This data indicates that high imagery ability subjects respond more in terms of mean skin temperature changes across Baseline, and Treatment Periods.

Covariance of Treatment Periods by Mean Skin Temperature

A Covariant ANOVA between Baseline, Treatment Period 1, and Treatment Period 2, was computed to examine variance across the three treatment periods. This analysis examined the Covariance of; Baseline and Treatment Period 1, Baseline and Treatment Period 2, and Treatment Period 1 and 2. All three of these analyses indicated that a significant portion (.005) of the variance in one period was accounted for by the variance in the other period--indicating that the variance of skin temperature by Treatment Periods was consistently similar.

Nevertheless, Figure 1 shows that all subgroups except high imagery Jacobsonian increased skin temperature during Treatment 1, showing a combined real increase of +1.8 ; while all subgroups during Treatment 2 showed a combined decrease of -4.8 degrees.

ANOVA of Personality Types by Mean Skin Temperature

A Covariant ANOVA for eight independent bipolar measures of Personality Type (see Table 1) was done to test for significant patterns of distribution between these scores by imagery groups, treatment groups, or the interaction of all these groups. None of these personality variables showed any significant relationship to imagery or treatment groups, nor the interaction of these groups.

ANOVA for Imagery Measures by Mean Skin Temperatures

A Covariant ANOVA for the Guilford-Zimmerman "Spatial Orientation" and "Spatial Visualization" subtests was done to test for significant differences between these spatial ability scores by imagery or treatment groups, and the interaction of these groups. The patterns of distribution for these auxiliary °measures of imagery was significantly related to the DAT imagery groups but were not significantly related to treatment groups, or the interaction of DAT imagery and treatment groups.

Analysis of Skin Temperature Change During Sessions

To gain additional clairity for skin temperature changes during treatment sessions, other ANOVA were done on skin temperature changes during selected treatment sessions (2nd & 3rd session of each period). A two-way analysis of covariance by treatment order and imagery ability revealed that when Baseline variance was removed, there was a nearly significant interaction (.058) between treatment order and imagery ability during Autogenic treatment. A similiar analysis of this interaction during Jacobsonian treatment revealed no significant interactions. This data indicates that skin temperature change during sessions was greater for low imagers who received Autogenic treatment first (+2.9), and least for high imagers who received Autogenic treatment last (+1.3).

Table 6 outlines mean skin temperature changes during sessions by imagery and treatment methods.

Table 5

Mean Changes in Skin Temperature During Sessions

by Degrees of Fahrenheit

	Baseline	Autogenic	Jacobsonian
High Imagers			
Group A	+1.4	+1.3 (2nd)	+4.4 (1st)
Group B	+3.4	+1.6 (1st)	+4.6 (2nd)
(Mean)	(+2.4)	(+1.45)	(+4.5)
Low Imagers			
Group A	+1.7	+2.1 (2nd)	+4.3 (1st)
Group B	+1.5	+2.9 (1st)	+3.0 (2nd)
(Mean)	(+1.6)	(+2.5)	(+3.65)
Total Mean Changes	+2.0	+2.0	+4.1

The data in Table 5 suggests that Autogenic treatment is a more effective inducer of vascular relaxation than Jacobsonian treatment, and that high imagers are more prone to vascular tension during Autogenic training, than are low imagers. Table 6 shows the results of an analysis of Autogenic treatment, by treatment order and imagery ability groups with Baseline variance removed. This analysis was ran separately on the main effect variables, and then were combined to test for a two-way interaction.

Table 6

ANOVA of Autogenic Treatment

by Treatment Order and Imagery Ability

Source	df	Mean Square	F
Baseline Covariate	1	3221.9	14.11
Main Effects			
Treatment Order	1	808.3	3.54
Imagery Ability	1	24.5	0.11
2-Way Interaction			
Treatment Order X Imagery Ability	1	886.2	3.88
Error	30	228.42	

Note. n = 9 for 2-Way; 18 for main effect, groups
F value @ .05 level = 4.17

This analysis approached significance on the main effect between those subjects who received Autogenic treatment first and those who received it last (see Table 5), and with the interaction of imagery ability the significance level was increased somewhat (.058).

Analysis of Skin Temperature Change Between Sessions

Another analysis (see Table 7) was done on the change in mean skin temperature between individual sessions. Nearly significant differences (.051) were found in this data between Jacobsonian and Autogenic treatment during Treatment Period 1. The data suggests that Autogenic treatment produced a significantly higher mean of cumulative change in skin temperature than did Jacobsonian treatment during Treatment Period 1. What this indicates is that the change in mean skin temperature from one session to the next was significantly lower during Jacobsonian treatment than during Autogenic.

Table 7

Analysis of Skin Temperature Change between Sessions by Treatment Method During Treatment Period 1

Source	df	ms	F
Treatment Method	1	638.44	4.12
Error	32	155.09	

Note. n = 9 each group
F value @ .05 level = 4.15

ANOVA by Personality Type

This data was also examined in terms of the Myers-Briggs Personality Types. The "perceptual" variable (sensing vs intuition) on this analysis indicated near significant levels of difference during Baseline (.084) and Treatment Period 1 (.065), and significant differences during Treatment Period 2 (.034). The data suggests that Sensors have a significantly lower cumulative change in mean skin temperature over the six sessions of Treatment Period 2 than do Intuitors. These results indicate that Sensors are more stable in day to day skin temperature changes, while Intuitors are more variable. Table 8 outlines cumulative mean skin temperature changes by Baseline and treatment periods for Sensors vs Intuitors.

Table 8

Cumulative Change in Daily Mean Skin Temperatures for Treatment Periods by Perceptual Type

Treatment Periods	Perceptual Types		Significance Levels
	Sensors	Intuitors	
Baseline	21 degrees	31 degrees	.084
Treatment 1	23 degrees	31 degrees	.065
Treatment 2	23 degrees	33 degrees	.034

These results suggest that even though the absolute differences in cumulative mean skin temperature differences between Sensors and Intuitors remains approximately the same, the increased significance levels across time indicates that the variance become greater as time in treatment increases.

CHAPTER V

DISCUSSION

Introduction

The scope of this chapter is to discuss the conclusions, implications, limitations, and future research considerations suggested by this study. This discussion initially focuses on the empirical data, then extrapolates from this framework to a more philosophical perspective of how mediational processes may act as translators of external reality experiences, into the internal reality experience of feelings associated with ANS response functions.

Conclusions from Mean Skin Temperature Data

The data indicated a combined real increase of +1.8 degrees in skin temperature between Baseline (1st six sessions) and Treatment Period 1; and then an overall decrease of -4.8 degrees between Treatment Period 1 (2nd six sessions) and Treatment Period 2 (3rd six sessions.). Other variance patterns in Table 5 suggest how visual imagery ability may interact with skin temperature change during different methods of training nervous system relaxation.

Jacobsonian treatment utilizes voluntary muscle contraction to allow the person to kinesthetically experience the feelings of tension contrasted with relaxation. Autogenic treatment utilizes auditory messages to cue images of conditions associated with ANS relaxation. If we assume that high imagery ability indicates a preference for a visually oriented representational system of reality, then we may expect high imagery subjects when exposed to their preferred representational stimuli (visual), to respond with greater autonomic response to the suggestion of relaxation. On the contrary, they may be expected to respond adversely to relaxation suggestions from what may be their least preferred representational stimuli (kinesthetic).

The mean skin temperature data supports this reasoning since skin temperature means in high imagers during Autogenic training were higher (+1.8 degrees) than for any other subgroup of subjects. Also skin temperature means in high imagers during Jacobsonian training was considerably less (-1.9 degrees) than for any other subgroup.

However, this dramatic increase and decrease occurred only in the high imagery group which was exposed to Autogenic training immediately following Baseline, and then Jacobsonian training during the last six treatment sessions (Treatment Period 2). The other group of high imagers had Jacobsonian training first, resulting in a decrease of -0.8 degrees followed by Autogenic training during the last six sessions which resulted in a further decrease of -1.2 degrees. This latter decrease is felt to be mostly due to subject burn-out, since the data shows a substantial combined decrease (-4.8 degrees) in all subgroups during the last training period.

The matching of representational stimuli with an individual's preferred sensory intake mode is discussed in considerable detail by Bandler and Grinder (1975, 1979) (Grinder and Bandler, 1976), as a model for what they call "Neurolinguistic Programming". Simply put their theory suggests that all communcation is a function of matching representational stimuli with an individual's preferred representational mode (kinesthetic, auditory, or visual). This theory seems applicable to the understanding of this research, since Jacobsonian and

Autogenic relaxation training apparently utilize different representational modes.

The empirical results of this research tend to conform with what would be expected from neurolinguistic programming theory. Also, this theory may be expected to explain high imagery performance better than low imagery performance, because high imagery subjects were selected on the basis of a representational mode (visual) which they utilized well--whereas, low imagery subjects were selected on the basis of a representational mode (visual) which they did not utilize well. Thus, high imagers were a more select group with respect to their ability to utilize a specific representational mode (visual) related to one of the treatment modes (Autogenic).

Thus, we may expect a more dramatic change in skin temperature from high imagers responding to the relaxation oriented stimuli (Autogenic vs. Jacobsonian) being tested for effectiveness at communicating nervous system relaxation. These indications, although inconclusive, do conform with the expectations of neurolinguistic programming theory.

Conclusions from Skin Temperature Change During Sesssions

Empirical conclusions based on skin temperature change during sessions indicate that Autogenic treatment had the greatest relaxation effect (+2.9 degrees) on low imagers who received such treatment immediately following Baseline (see Table 6), while Autogenic treatment had the least relaxation effect (+1.3 degrees) on high imagers who received it during Treatment Period 2. A two-way analysis of covariance adjusted for pretreatment differences indicates these treatment differences were unlikely to have occurred by chance, indicating nearly significant differences between high and low imagers during Autogenic training.

A further observation of this data however indicates that skin temperature change during sessions for all subjects combined during Baseline were the same (+2.0 degrees) as during Autogenic treatment (+2.0 degrees). But Jacobsonian treatment produced a mean change in skin temperature during sessions of +4.1 degrees for all subjects combined. Looking at this same data in terms of treatment periods, we find that the first treatment period produced a combined mean increase of +3.3 degrees, while the second treatment period produced a combined mean increase of only +2.8 degrees. Neither of the two treatment periods nor Jacobsonian treatment showed any significant differences between high and low imagers in terms of change during sessions. What this data suggests is that individuals respond differentially to Autogenic treatment according to imagery ability, but not to Jacobsonian treatment. However, as seen in Table 6, mean temperature increases were more than double for Jacobsonian (+4.1 degrees) as compared with Autogenic (+2.0 degrees).

Another simple observation of this data by session increases vs. decreases in skin temperature, indicates that of 36 selected sessions from high and low imagers during; Baseline, 24 highs and 22 lows showed an increase; during Treatment Period 1, 21 highs and 32 lows showed an increase; and during Treatment Period 2, 29 highs and 25 lows showed an increase. A closer look at this data suggests that low imagers generally relax to either treatment method, while high imagers seem to relax better during Baseline or Jacobsonian than they do during Autogenic treatment (see Appendix M).

Conclusions from Skin Temperature Change Between Sessions

Empirical conclusions based on skin temperature changes betweem sessions indicates a nearly significant (.051) differences between Jacobsonian and Autogenic treatment for Treatment Period 1. This data suggests that differences in day to day mean skin temperature changes may exist between Jacobsosnian and Autogenic treatment. This data also suggests that subjects respond to Jacobsonian treatment in a more consistent manner than they do to Autogenic treatment. The reasons for these differences do not seem to be readily apparent although it would seem that since an imagery treatment method such as Autogenic training is more abstract than Jacobsonian training (which uses more concrete exercises), this difference may account for some of the difference in skin temperature change between sessions (See Appendix O).

One variable which was significant for session to session variance in mean skin temperature was the perceptual variable (Sensors vs. Intuitors) of the Myers-Briggs Personality Type test. This variable was highly significant (.034) during Treatment Period 2 and was only near significance during Treatment Period 1 (.065) and Baseline (.084). The data from this variable indicates that Sensors are significantly more stable in terms of session to session variance in mean temperature, than are Intuitors. These findings suggest that Sensor types tend to hold a more consistent skin temperature under Baseline, Jacobsonian, and Autogenic conditions, while Intuitors under the same conditions tend to exhibit a wider range of skin temperature variation.

Implications

The implications of this study must be seen in light of the current understanding for how external stimuli from the environment are mediated through the human nervous system to effect ANS motor responses.

At this point the processes which mediate between sensory stimulation, and ANS motor responses are not clearly evident. Research on ANS responses to sensory stimulation, using monitoring of various neurophysiological functions, indicates that individual differences are by far the greatest single consistency of these findings. This suggests that we are presently unable to fully understand , and therefore predict, how a given individual will respond neurophysiologically to a given stimulus. In other words, each individual seems to respond in his own unique manner without regard for any known theories which would explain or predict such ANS behavior.

Research has generally shown individual differences to be the most consistent finding of neurophysiological research. This fact obscures the answers to many questions such as the one concerning the mediation of external stimulation into ANS responses. Therefore the present research was an exploratory attempt to more clearly understand these processes which mediate sensory stimulation into ANS motor responses. The three different types of data used to do this were; mean skin temperatures during Baseline and Treatment Periods; mean skin temperature differences between the first and third five minute periods of the second and third sessions for Baseline and Treatment Periods; and the cumulative session to session differences in mean skin temperature from Baseline through the Treatment Periods.

The analysis of these three types of data indicated no significance in mean skin temperature differences; a nearly significant (.058) two-way interaction between treatment groups and imagery ability on skin temperature changes during Autogenic treatment sessions; and a nearly significant (.051) difference between session to session changes in mean skin temperature during Autogenic vs. Jacobsonian treatment; plus significantly (.034) higher session to session changes in mean skin temperature for Intuitors when compared with Sensors.

The implications of the nearly significant two-way interaction between treatment groups and imagery ability on skin temperature increases during Autogenic treatment sessions, are that high imagers appear to not respond in terms of vascular relaxation as much as do low imagers. However, both high and low imagers seem to respond better with vascular relaxation, during Jacobsonian training (see Table 8).

The practical implications of these results seem to suggest that Jacobsonian treatment is generally more effective for vasuclar relaxation with high and low imagers, while Autogenic treatment is least effective with high imagers.

The implications of a significantly higher session to session changes in mean skin temperature during Autogenic as compared with Jacobsonian treatment are that Jacobsonian treatment is responded to in a more consistently stable manner than is Autogenic treatment. Further implications of this particular variable in terms of individual, rather than treatment, characteristics suggest that sensory oriented individuals generally respond in a more consistently stable manner than do intuitive oriented individuals in terms of vascular responding. The practical implications of these results suggests again that Autogenic treatment is a less consistent and dependable method for achieving vascular relaxation than is Jacobsonian treatment--especially it seems if the individual is intuitively oriented.

Considerable research (Zikmund, 1972) suggests that imagery is closely connected to ANS response functions, but how imagery may be used more effectively as a tool for controlling ANS responses is much less understood. An anlaysis of the four pairs of cerebral cortex lobes (frontal-motor, parietal-kinesthetic, temporal-auditory, and occipital-visual) indicates that the occipital-visual lobes are the last to develop and mature--while the motor and kinesthetic lobes are the first to develop (Montagu, 1978; Bruce, 1977).

Thus, the lobes which appear to be the most effective at controlling the ANS are also the last to develop and mature. For whatever reason the present research indicated that in this college population there were at least four high imagers for every one low imager. Also, high imagery subjects in general seemed more organized, conscientious, and responsible in their research commitments. Their low imagery counterparts apparently found it more difficult to follow through on their commitment to this research (see Appendix I).

In summary the implications from this area of research are that imagery may be a potentially powerful tool for attaining self-control of autonomic neurophysiological functions. However, at this point in time more adequate parameters of this imagery quality are needed to better understand it's potential usefulness for training autonomic self-control. Also, imagery and ANS functions need to be better understood in relation to the perceptual-motor processes of the mind and brain.

These conditions create many unanswered questions which suggest that this is the present "state of the art" for research on ANS self-control as a function of imagery.

Limitations

The limitations of this research fall into four categories: (1) The exclusive use of objectively oriented imagery measurements, (2) the exclusive use of skin temperature as the only neurophysiological measurement of clinical relaxation, (3) the exclusive use of college students, and (4) the relatively small sample size.

Imagery, for the purpose of ANS self-control, is an extremely complex variable to measure, because objective measurement of visual imagery ability usually means testing for spatial ability. These tests introduce other non-imagery variables which directly influence one's imagery ability score. The variables which allow one to score high on these tests are 'imagery production', and 'imagery manipulation', as well as 'low anxiety', and 'accurate judgements' of the imagery productions and manipulations.

Of these variables, anxiety and judgement play crucial roles in determining objective imagery ability scores, but for the purpose of this research it is the subjective imagery experience that is most relevant to ANS activity. Thus, the first limitation to research on the relationship between imagery ability and ANS self-control, is how to appropriately measure imagery without contamination from secondary variables.

While these objective measures do offer a valid perspective on imagery ability, the elements which appear to be most relevant to neurophysiological functioning relate more to 'experiential vividness and intensity', than to 'visual clarity and manipulation'. These areas define the differences between subjective and objective imagery measurements, and also suggest the more obvious problem with using subjective imagery tests for scientific research. Namely, reliance on a personal subjective evaluation of the vividness and intensity experienced from a particular image. However, even though the nature of this process is subjective, so is the experiential nature of ANS functioning. Thus, it is felt that one of the major limitations of this study was the exclusion of subjective imagery measures, for evaluating the potential relationship of that factor on neurophysiological functioning and control.

Another perceived limitation of this study is the exclusive use of skin temperature as the only measure of neurophysiological functioning and clinical relaxation. Even though skin temperature is considered to be the best general measure of ANS arousal, it is also true that in any particular individual, skin temperature may not be the neurophysiological system which best reflects that person's state of clinical arousal or relaxation. Thus, using skin temperature as the only measure of neurophysiological parameters, leaves potential gaps in the monitoring of nervous system activity. The most obvious gap is the failure to monitor arousal in the voluntary muscles with electromyography (EMG) biofeedback, since Jacobsonian relaxation specifically focuses on relaxing this neurophysiological system. The effect of this monitoring gap (and others) leaves a void of information about nervous system activity which may have been influenced by Jacobsonian or Autogenic training. Thus, no data is available to determine if clinical relaxation ocurred in other neurophysiological systems than the peripheral vascular. This situation therefore limits the knowledge and conclusions which can be drawn from this study.

An additional limitation of this study is the homogeniety of the sample population, since college students are not representative of the population as a whole. Also the limited number of subjects who participated in this study adds further limitations to the validity of any interpretations which can be made from these results. Nevertheless, these limitations suggest future research considerations which may enhance our clarity for understanding how the mind and brain process external stimulation, and produce internal ANS responses.

Future Research

This study suggests many ideas relating to imagery and neurophysiological functioning which may be applicable to future research. What follows are some specific and general thoughts which may be helpful to those further researching imagery, neurophysiological functioning, and the learning of self-control over the mind and body. This field of study even though endless in possibilities is not well defined or understood by Western society, possible because it borders on the more metaphysical realms of reality. However, as our knowledge stretches the limits of our old paradigms, new paradigms make these areas more significant and reasonable for providing insight into the workings of the mind, the brain and the body. Learning to control nervous system arousal as a function of the brain's manipulation of imagery, seems to have great potential for solving considerable human problems, beginning with pain and disease, and moving through fulfillment, and happiness.

The limitations of this study identify some areas which could improve future research. The first major limitation of this study was the use of only objective imagery tests. The problem with this measure of imagery is that it does not focus on the experiential aspects of emotionally charged images in terms of how vividly they are experienced. An approach of this type may not be measuring the processes most responsible for controlling ANS activity. This limitation may be overcome by using one or more subjective imagery tests reviewed by Richardson (1969). The Betts QMI Vividness of Imagery Scale objectively quantifies the subjective vividness of one's imagery using a seven point rating scale ranging from "perfectly clear and as vivid as the actual experience" to "no image present at all, only knowing that you are thinking of the object". Tests of this nature would provide a contrast between neurophysiological functioning as it relates to both subjective and objective imagery ability.

Another consideration for future research relates to the number of neurophysiological systems being monitored as dependent variables. It is recommended that as many of these systems as possible be simultaneously monitored. The different systems which may be monitored are heart rate, blood pressure, skin moisture (GSR), muscle tension (EMG), respiration (rate, depth, & pattern), brain waves (EEG amplitude & frequency) and skin temperature. Only by using the widest possible range of neurophysiological measures can we gain adequate insight into how the different processes and functions of the mind and body relate to each other.

The final specific recommendations are to increase the sample size and obtain subjects from a more diverse nonclinical population than college students in order to obtain a better representation of the total population. This may make it easier to find low imagery subjects and provide a better representation of the population as a whole.

Other questions which may be appraoched in the future relate to whether or not imagery ability itself can be enhanced through the training of relaxation exercises. If imagery is as valuable a tool as it appears to be, then we need to know how and why it develops or fails to develop, in order to use it more effectively for the enhancement of personal and cultural development.

Also more research is needed to relate the diffferent representational systems (visual, auditory, & kinesthetic) with the effectiveness of communicating nervous system relaxation. This would allow for a more sophisticated matching of people with methods of learning clinical relaxation.

Another area of research which may prove interesting is to assess the impact of imagery on an individual's ability to 'see' direction in their life, as well as their motives in terms of Selye's (1974) altruistic/egotistic view of life. Personality variables and representational system preferences may also be used to determine more specifically how imagery ability manifests itself in the perceptual consequences of life.

Summary and Conclusions

A summary of these results suggests that objectively measured imagery ability may be related to how individuals respond to Autogenic treatment in terms of skin temperature changes during sessions. Low imagers respond to Autogenic treatment with greater vascular relaxation than high imagers, when examined in terms of a two-way interaction between imagery ability and treatment order. An analysis of change in mean skin temperature between sessions revealed that Autogenic treatment approached significantly greater changes than during Jacobsonian treatment. The most significant finding from the data on skin temperature changes from one session to the next, was the one done in terms of the Myers-Briggs on the perceptual personality variable (Sensors vs. Intuitors), Intuitors showed significantly greater session to session skin temperature changes than Sensors.

These results and observations of the data suggest that low imagers respond with more vascular relaxation to Autogenic treatment than high imagers, but that both high and low imagers respond with more vascular relaxation to Jacobsonian treatment. Also, it was found that Autogenic treatment seems to produce more session to session changes in mean skin temperature than Jacobsonian treatment. Such results are somewhat difficult to interpret with any confidence, although a close examination of the variables in this research reveals that for whatever reason high objectively measured imagery ability does not seem to enhance vascular relaxation using an imagery relaxation technique (Autogenic treatment). In fact an examination of Baseline data on skin temperature changes during sessions indicates that high imagers decrease from +2.4 degrees during Baseline to +1.4 during Autogenic treatment. With low imagers, however, the reverse was true--Baseline was +1.6 with an increase during Autogenic treatment to +2.5. This reversed pattern between high and low imagers during Baseline and Autogenic treatment may suggest that high imagers are more able to relax using their own images rather than the ones being suggested, which they seem to respond to with decreased relaxation.

Looking at the changes in skin temperature means between sessions, Autogenic treatment again appears to be a consistently less stable influence on vasscular relaxation than Jacobsonian treatment. These results may suggest that Autogenic treatment is a more difficult technique for consistent effectiveness, because it may be more subject to subtle mental influences than is Jacobsonian. The reasoning for this perspective being that an individual's mental state at the time of the treatment may have less influence on a physical technique (Jacobsonian) than on a mental one (Autogenic). If this were the case, it may explain the less consistent responses from Autogenic treatment in terms of skin temperature changes between sessions, as well as accounting for why high imagers have the lowest gain in vascular relaxation during the treatment method using mental imagery. This may be accounted for because they are high imagers using their preferred mental representational system (visual), thus increasing competition for space in this system. Without adequate motivation this competition may be greater in high imagers, than in low imagers whose preferred representational system may not be visual, and consequently may be more receptive to imagery suggestions.

The final significant finding relating to the perceptual personality types of Sensors and Intuitors, for skin temperature changes between sessions, seem to indicate that Sensors are more stable in terms of day to day ANS activity and that Intuitors are less stable. This would seem to fit well with the relative perceptual parameters of these two types--Sensors being more oriented to the stable facts of physical reality, while Intuitors are more oriented to the relative possibilities of a mental abstract reality. Thus, Intuitors may be expected to display more day to day changes in ANS activity than Sensors. This would seem reasonable since ANS activity appears to directly reflect an individual's perception of reality.

The facts from this research generally suggest that Autogenic treatment in a nonclinical, low motivated population is not as likely as Jacobsonian treatment to produce vascular relaxation. And also it appears that a person's method of perception has a significant influence on day to day ANS activity.

Interpretations of the data from this research are not clear cut due to the current state of the art for understanding these processes and how they relate to phychological functioning. This fact may be appreciated more clearly by an examination of the raw data in Appendices J, K, L, M, and N.

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APPENDICES

Appendix A

Research Design Model

Appendix A

Research Design Model

Phases	I - Baseline	II - Treatment 1	III - Treatment 2
25 Minute Sessions	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
High Imagery Group A N = 9	Baseline	Jacobsonian Relaxation	Autogenic Relaxation
High Imagery Group B N = 9	Baseline	Autogenic Relaxation	Jacobsonian Relaxation
Low Imagery Group A N = 9	Baseline	Jacobsonian Relaxation	Autogenic Relaxation
Low Imagery Group B N = 9	Baseline	Autogenic Relaxation	Jacobsonian Relaxation

N = 36

Appendix B

Time Line of Research

Appendix B

Time Line for Experimental Procedures

Outline of Two Six-Week Series of 18 Daily Sessions

Days of the Week	M	T	W	Th	F	S	M	T	W	Th	F	S	M	T	W	Th	F	S	M	T	W	Th	F	S
High & Low Imagery . . . . Groups A	1		2		3		4		5		6		1		2		3		4		5		6	
BASELINE																								
High & Low Imagery . . . . Groups B		1		2		3		4		5		6		1		2		3		4		5		6
Weeks 1&2																								
. . . .	7		8		9		10		11		12		7		8		9		10		11		12	
TREATMENT 1																								
. . . .		7		8		9		10		11		12		7		8		9		10		11		12
Weeks 3&4																								
. . . .	13		14		15		16		17		18		13		14		15		16		17		18	
TREATMENT 2																								
. . . .		13		14		15		16		17		18		13		14		15		16		17		18
Weeks 5&6																								
	1st Six-Week Series												2nd Six-Week Series											

Appendix C

1. Participants Outline

2. Informed Concent Form

Appendix C-1

TO: Potential Research Subjects

FROM: Dean Allen

SUBJECT: Outline of Participation in Research Project

The most basic question you should be asking yourself concerning the decision of whether or not to participate in this research is "What will I get out of participating in this study?"

These are the answers to that question:

- Three different measures of your ability to image and a basic understanding of how these abilities relate to your functioning.

- A measure of your personality type on four separate polar dimensions:

  Internalization - Externalization
  Sensing - Intuition
  Thinking - Feeling
  Judgment - Perception

- Observe a recorded interview from NBC's _Tomorrow Show_ between Tom Snyder and top researchers at Menninger's Clinic on biofeedback, self-healing, and the science of parapsychology.

- Biofeedback information on how your autonomic nervous system functions when you try to relax alone.

- Biofeedback information on how your autonomic nervous system functions in response to a relaxation procedure which focuses on cues from _muscle tension_.

- Biofeedback information on how your autonomic nervous sytem functions in response to a relaxation procedure which focuses on _imagery_.

- Awareness for how your autonomic neurophysiological system responds to stress and what you can do about learning to deal with these responses in a positive healthy manner.

- Individual consultation (with me) at the end of the research to pull both the research and personal information together in a manner which should help you to understand yourself better.

Appendix C -2

Informed Consent Form

I hereby consent to an initial evaluation for becoming an experimental subject in a study of the relationship between imagery and self-control of the autonomic nervous system function of skin temperature. I understand that I will be required to take a 60-item "Space Relations" subtest (25 min.) and that if my results meet the defined requirements of this study, I will have the opportunity to choose to participate as a subject. If at this point I do choose to become a subject, I agree to take three additional pencil-paper tests ("Spatial Orientation", "Spatial Visualization", & "Personality Type Indicator"), and to identify a 30-minute period which can be schedualed for experimental participation at the same time of day three days a week for six consecutive weeks. I understand that my experimental participation as a subject will consist of 18 thirty minute sessions spread over six weeks, in which I will establish a baseline skin temperature and practice two different clinical procedures for attaining clinical relaxation (Jacobsonian & Autogenic relaxation). I am also aware that during all of the above sessions I will have skin temperature thermisters attached to my fingers for the purpose of monitoring my skin temperature.

I also understand that my name and other identifying information will remain anonymous in any written or oral communication of this research. I further understand that there is no danger of accidental shock or any negative side effects which may result from my participation as a subject.

My agreement to participate as a subject does not obligate me to continue should I decide to withdraw. But since such a decision would greatly impede this research, I will seriously consider my situation before making a commitment to become a subject. Should an unforeseen situation arise which conflicts with this commitment, I will discuss it with the experimenter as soon as possible to see what can be worked out.

Signature________________________

Appendix D

Criterion for Subjects

Appendix D

Criterion Conditions for Subjects

1. Meet high or low criterion on D.A.T. "Space Relations" subtest.

2. Willing to make a six-week commitment for 18 twenty-five minute appointments.

3. Willing to take four hours of different types of tests.

4. No impending myocardial infarction.

5. No diabetic condition.

6. No hypoglycemic condition.

7. No glaucoma.

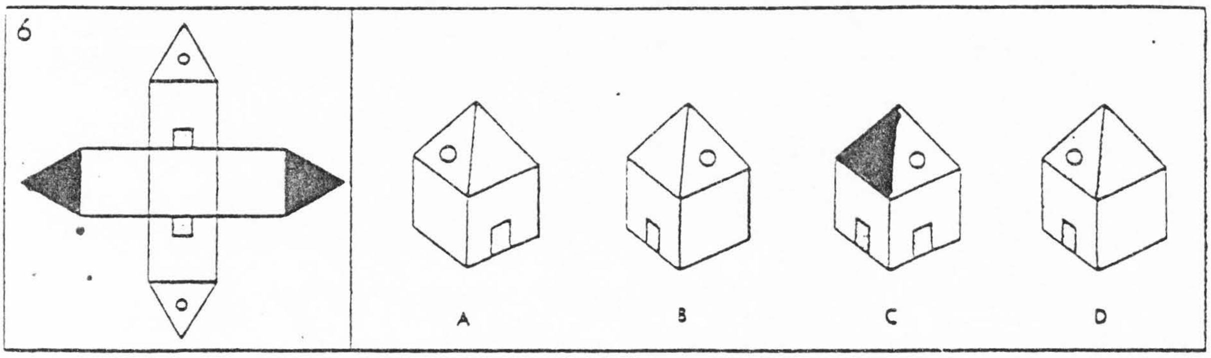
Appendix E

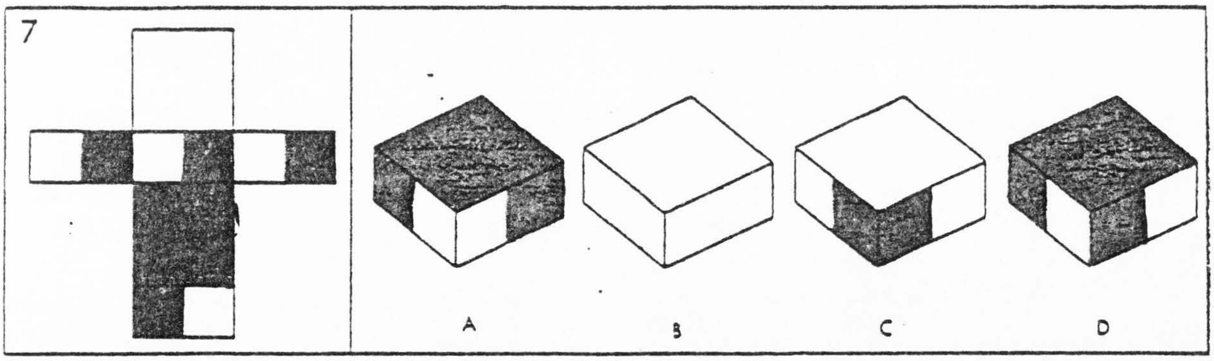
"Space Relations" Subtest

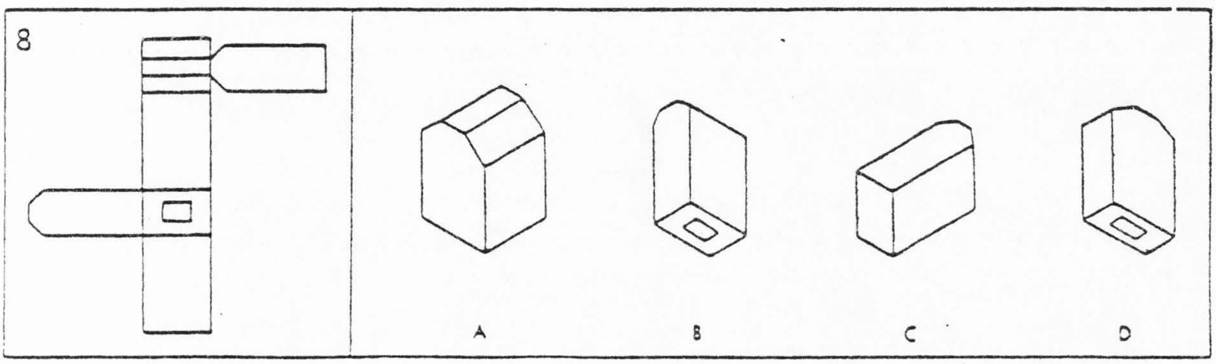
Appendix E

Sample D.A.T. - Space Relations Subtest

Ability to visualize, to "think in three dimensions" or picture mentally the shape, size, and position of objects when shown only a picture or pattern. Drafting, shop courses, some kinds of mathematics and some kinds of art or design courses are among those demanding this sense. It is needed by carpenters, architects, machinists, engineers, dentists, dress designers, and others whose work requires them to visualize solid forms or spaces.





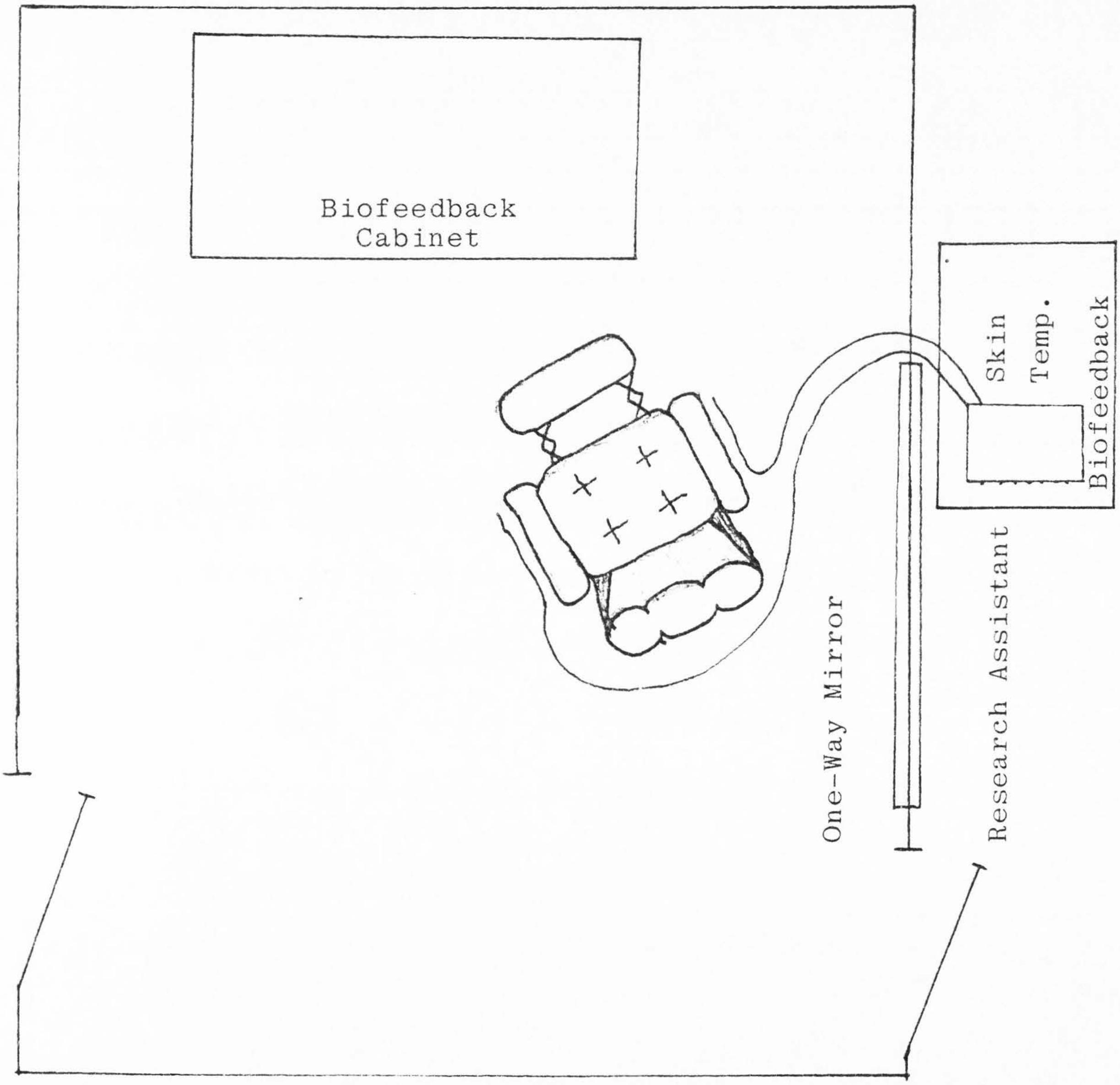


Appendix F

Biofeedback Laboratory

Appendix F

Biofeedback Laboratory



Appendix G

Data Collection Form

Appendix G

Daily Skin Temperature

Data Collection Form

Subject #_________ Date_________

Session #_________ Time_________

	15 Seconds	15 Seconds	15 Seconds	15 Seconds
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

Mean Temperature for this Session_____________

Appendix H

F Values of Main Variables

Appendix H

Statistical Design Model
For F Values of Main Variables

	Baseline	Treatment 1	Treatment 2
Imagery Groups	.03	.03	.20
Treatment Groups	.09	1.52	1.05
Inter-action	3.05	1.77	2.11

F value @ .05 level = 4.15

Appendix I

Subjects' Attrition Profile

Appendix I

Subject Attrition Profile

	1st 6-week Series		2nd 6-week Series	
Subjects Begining	13 Highs	14 Lows	11 Highs	14 Lows
Dropouts	-2 Highs	-7 Lows	-2 Highs	-2 Lows
Total Finishing	11 Highs	7 Lows	9 Highs	12 Lows
Subjects Finishing by Treatment Sequence	4 A-B	3 A-B	3 A-B	6 A-B
	7 B-A	4 B-A	6 B-A	6 B-A
	11 Highs	7 Lows	9 Highs	12 Lows

Total =	11 Highs	7 Lows
	+9 Highs	+12 Lows
	20 Highs	19 Lows

Grand Total = 39 Finishing

Random Elimination -3

Final N = 36 Statistically Analyzed Subjects

Appendix J

Subject's Data Profiles

Figure 2

Mean Daily Skin Temperature and Cumulative degrees of Change for Baseline, Treatment 1, and Treatment 2, on Subject LW

Group = High A

Subject = LW

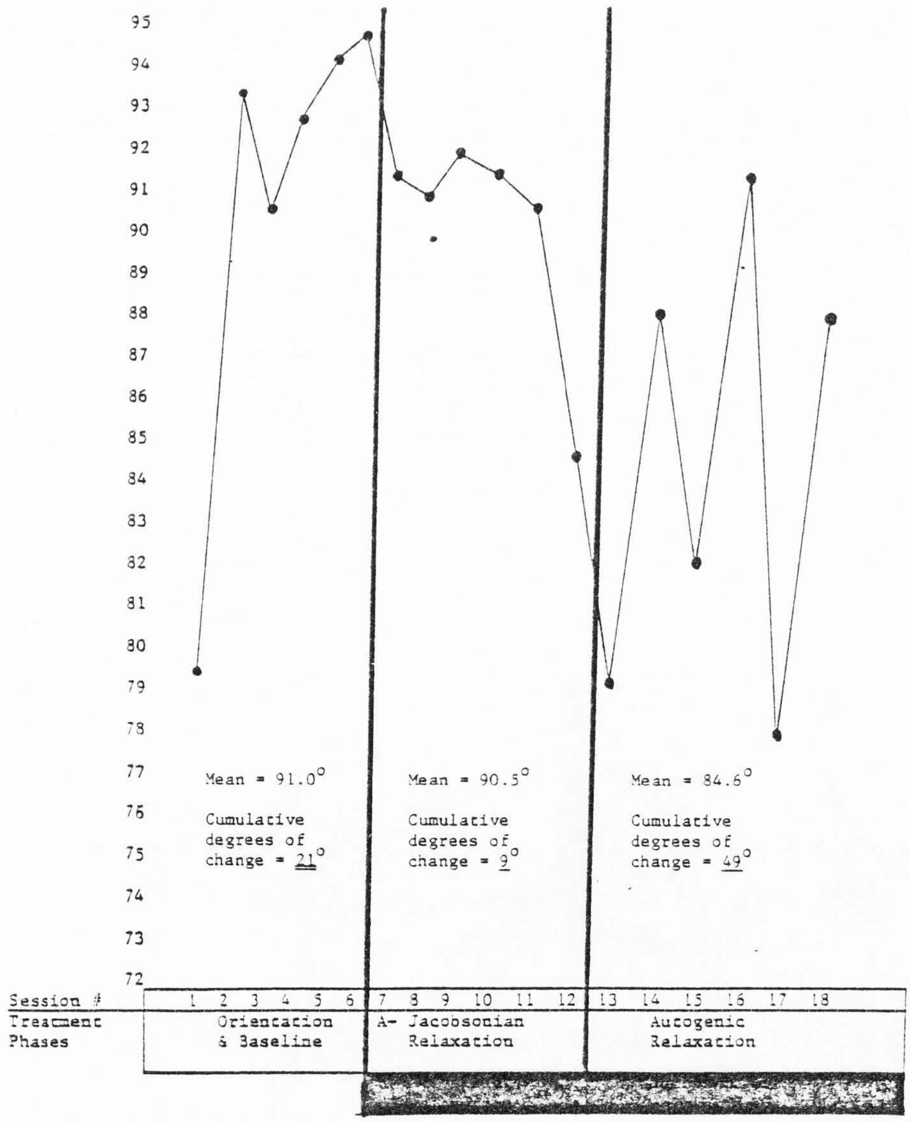


Figure 3

Mean Daily Skin Temperature and Cumulative degrees of Change for Baseline, Treatment 1, and Treatment 2, on Subject DE

Group = High A

Subject = DE

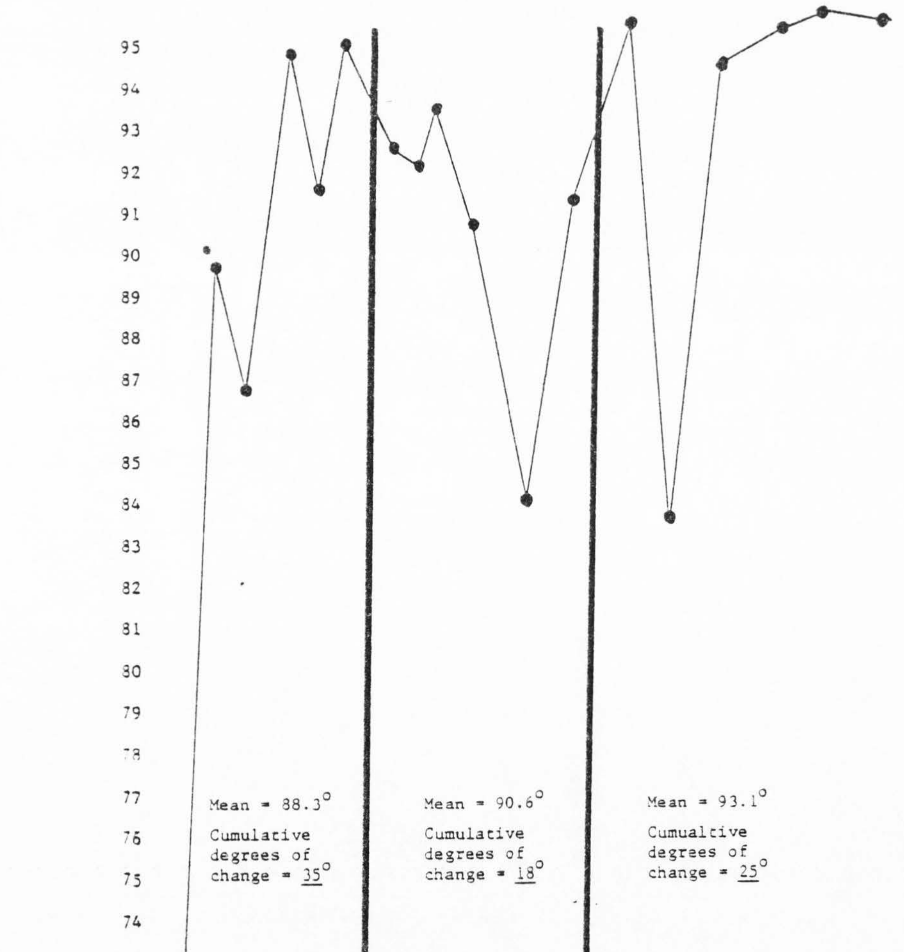


Figure 4

Mean Daily Skin Temperature and Cumulative degrees of Change for Baseline, Treatment 1, and Treatment 2, on Subject SD

Group = Low A

Subject = SD

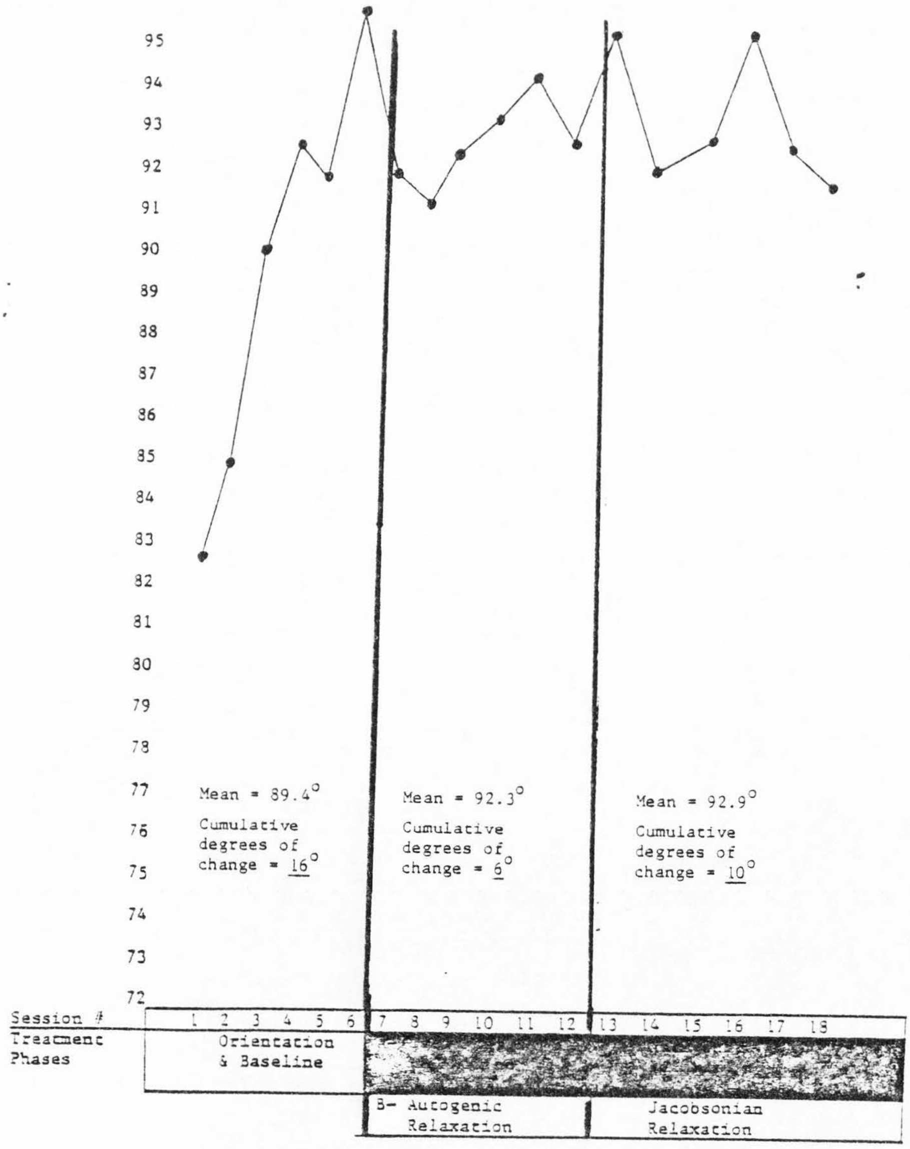
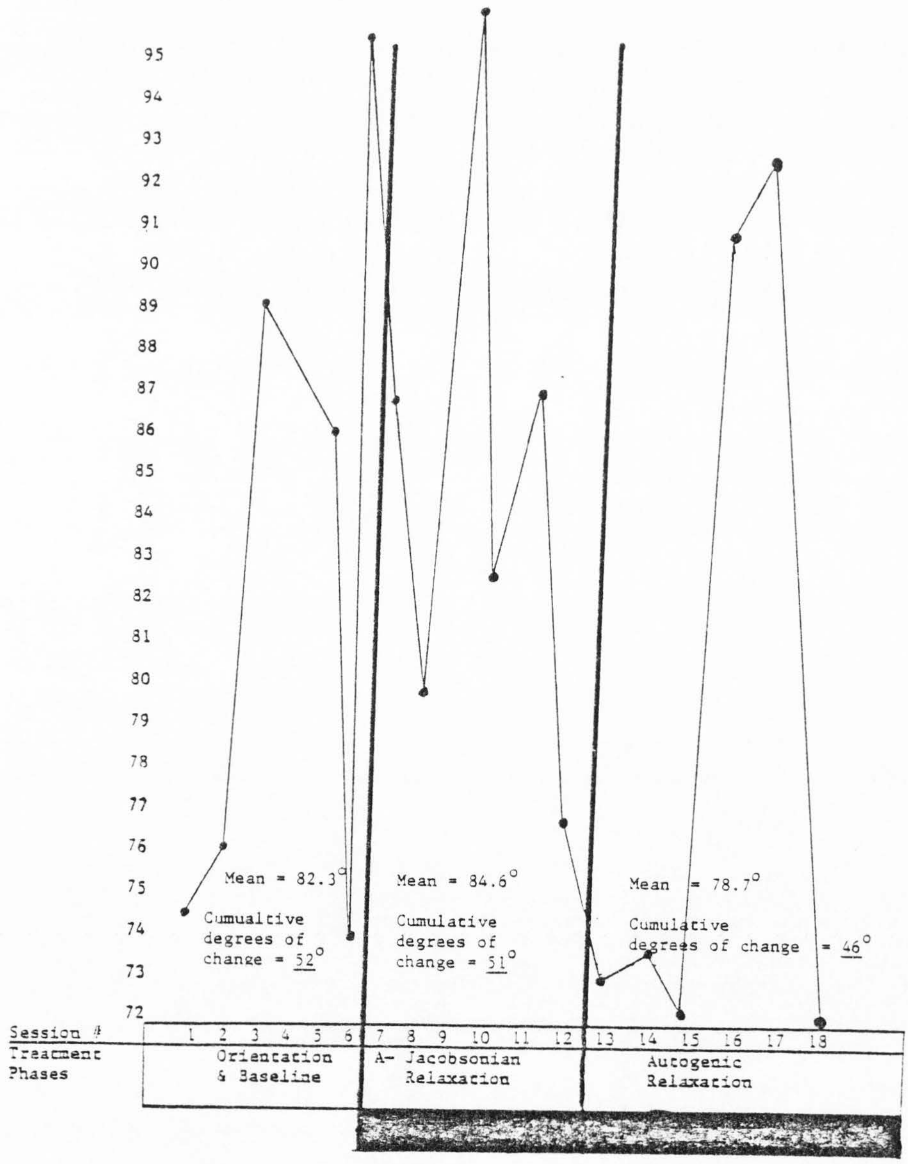


Figure 5

Mean Daily Skin Temperature and Cumulative degrees of Change for Baseline, Treatment 1, and Trearment 2, on Subject PW

Group = Low B

Subject = PW



Appendix K

Daily Mean Temperature Data by Subject and Session

Appendix K

Daily Mean Temperature Data by Subject and Session

Session	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
High Imagery Group A																		
J.O.	74.3	76.6	74.1	85.0	75.0	75.8	80.9	75.1	78.8	75.2	82.7	73.5	73.8	72.8	84.3	75.2	78.6	69.4
K.F.	72.0	73.0	74.6	75.1	74.9	77.4	86.6	89.2	87.0	76.2	80.8	77.9	74.2	72.5	77.9	78.9	75.7	76.2
P.J.	94.7	93.7	81.0	95.3	93.5	91.2	82.0	80.1	92.0	90.4	90.4	73.5	86.9	93.3	91.9	78.7	83.5	93.1
C.E.	92.9	93.9	93.2	89.3	93.3	93.8	93.9	94.2	88.7	93.9	91.1	86.6	92.0	88.6	92.9	93.2	90.0	93.8
L.W.	79.5	93.6	90.8	93.0	94.3	95.0	91.8	91.5	92.2	91.7	90.9	85.0	79.2	88.2	92.2	91.7	78.1	88.2
V.R.	91.9	94.0	91.6	89.8	92.3	88.3	91.7	93.9	93.6	88.9	91.7	91.4	91.1	84.7	83.8	89.7	75.8	86.3
S.P.	91.2	90.9	91.8	93.3	92.5	90.4	94.7	92.5	93.4	85.9	92.2	89.4	94.0	91.8	95.4	95.3	93.7	87.0
P.C.	77.8	89.4	83.9	90.7	92.3	85.7	75.4	87.6	86.3	82.3	86.2	77.3	72.1	73.2	87.3	88.3	76.5	77.0
S.S.	91.4	91.2	92.7	85.4	93.6	77.7	88.8	88.2	75.5	80.9	91.5	81.2	92.4	93.4	90.3	95.4	92.5	93.2
$\overline{X}$ =	85.1	88.5	86.0	88.5	89.1	86.1	87.3	88.0	87.5	85.0	88.6	81.8	84.0	84.3	87.3	87.4	83.0	84.9
High Imagery Group B																		
S.Y.	88.6	91.1	90.1	93.8	93.1	89.7	92.7	91.4	92.4	93.8	92.7	73.2	93.9	85.1	94.9	76.2	87.8	77.2
K.G.	92.0	89.6	89.9	91.0	89.7	91.4	92.5	87.6	93.6	86.9	86.4	88.9	89.8	82.7	83.3	91.1	77.0	75.8
K.N.	75.2	93.1	88.6	91.2	92.6	93.7	93.9	93.2	94.6	85.9	89.3	92.0	85.3	80.4	94.1	92.2	88.9	93.5
D.E.	72.1	89.4	86.5	94.8	91.4	95.5	93.3	92.2	93.1	90.5	83.1	91.6	95.3	83.5	94.5	95.0	95.3	95.0
B.K.	82.7	92.1	85.8	79.0	79.3	85.5	94.2	91.9	80.7	93.1	87.9	91.5	89.2	90.4	94.8	87.2	88.3	78.3
B.C.	72.7	88.8	72.3	75.2	70.1	90.5	76.3	71.8	77.5	71.8	89.7	72.9	72.4	80.4	70.1	72.5	72.8	71.4
C.H.	67.0	82.9	68.9	80.5	68.9	71.0	80.5	86.4	85.8	86.3	71.5	73.9	88.0	77.7	73.8	82.5	86.8	73.5
C.F.	70.9	91.0	86.8	81.3	74.4	79.8	89.6	91.9	90.0	72.9	87.9	75.6	82.1	81.1	94.5	83.8	75.5	83.1
A.M.	80.5	87.9	89.7	86.9	74.5	87.3	75.3	81.2	89.7	79.2	86.8	87.3	81.6	75.4	77.8	75.9	92.5	92.8
$\overline{X}$ =	78.0	89.6	84.3	86.0	81.6	87.2	87.6	87.5	89.0	84.5	87.7	83.0	86.4	81.9	86.4	84.0	85.0	82.3
Low Imagery Group A																		
T.S.	74.7	93.3	81.9	89.4	81.3	85.5	89.8	89.1	82.7	76.0	76.9	82.9	92.9	81.6	78.3	82.9	84.3	79.7
V.H.	85.8	90.6	86.8	81.8	91.3	91.6	77.5	86.3	95.0	90.6	82.8	86.4	89.8	91.1	93.3	91.5	82.8	85.6
D.D.	86.4	93.5	80.8	87.2	81.5	74.5	84.0	75.4	88.7	93.2	74.9	83.5	83.5	80.2	83.7	89.6	75.7	91.1
A.D.	88.5	87.2	94.0	95.8	82.3	96.1	92.9	86.7	70.3	80.8	88.7	90.3	83.6	92.7	93.4	92.2	90.5	91.8
P.W.	74.1	75.9	89.1	85.8	73.7	95.6	86.5	79.5	95.7	82.1	87.1	76.7	72.9	73.4	72.0	90.7	93.1	70.1
M.L.	75.6	88.5	70.9	86.5	70.1	83.6	74.5	87.7	90.9	90.8	92.0	74.6	89.3	92.3	78.8	72.4	71.8	70.7
A.H.	87.4	90.6	90.3	93.8	90.5	93.4	93.3	90.3	86.1	93.6	91.4	95.0	86.5	94.1	91.4	88.7	93.6	92.6
P.L.	77.7	82.9	88.7	90.3	90.1	84.2	94.1	84.4	85.7	88.8	86.7	87.4	85.1	79.6	77.0	89.3	74.4	82.2
E.A.	71.8	71.5	70.3	71.1	72.5	77.2	74.2	73.5	69.5	73.3	72.7	72.5	70.2	73.3	70.2	73.1	69.2	70.1
$\overline{X}$ =	80.2	86.0	83.7	86.9	81.5	86.9	85.2	83.7	85.0	85.5	83.7	83.3	83.8	84.3	82.0	85.6	81.7	81.7
Low Imagery Group B																		
S.A.	76.1	95.9	94.3	94.0	92.6	91.3	92.7	94.0	90.3	94.8	88.3	95.2	93.2	93.2	96.8	95.6	84.1	91.2
T.G.	73.0	78.9	90.7	85.7	79.4	90.9	74.3	88.1	72.4	70.1	74.1	81.7	71.5	70.9	89.7	76.4	88.6	69.7
J.W.	84.4	94.9	92.7	93.8	91.4	85.5	87.3	91.7	93.6	85.0	81.8	86.0	88.7	85.9	90.6	89.4	91.7	70.5
L.A.	90.9	92.2	91.2	92.2	91.6	93.5	89.6	93.8	95.7	91.6	81.6	90.9	90.3	90.8	89.9	91.2	87.8	76.9
K.O.	93.9	93.6	90.4	81.6	92.3	92.5	92.7	80.9	96.5	95.8	93.9	94.7	94.7	93.3	93.2	92.8	95.9	90.5
J.M.	91.8	90.8	90.5	86.6	88.0	87.3	94.3	94.1	91.4	84.1	88.4	95.9	96.1	87.4	88.7	91.7	96.5	87.9
S.B.	93.2	88.9	77.2	94.8	93.5	78.4	92.3	91.0	90.4	94.9	77.9	91.3	81.6	91.5	90.1	86.8	93.4	73.6
S.D.	82.1	84.5	89.8	92.5	91.6	95.9	91.6	90.9	92.0	93.2	94.0	91.9	95.0	91.7	92.4	94.5	92.1	91.7
N.B.	77.7	82.5	85.4	77.9	84.0	72.2	88.9	90.1	81.2	88.6	72.3	92.4	88.7	73.1	92.2	93.6	81.1	84.3
$\overline{X}$ =	84.8	89.1	89.1	88.8	89.4	87.5	89.3	90.2	89.6	86.5	83.6	91.1	89.1	86.4	91.5	90.2	90.1	81.8

Appendix L

Mean Temperature by Group and Treatment

Appendix L

Mean Temperatures by Group and Treatment

	Baseline	Treatment 1	Treatment 2
High Imagery			
Group A			
Mean	87.2	86.4	85.2
Median	91.0	84.7	85.7
Range	74.5-92.7	77.7-91.9	75.7-92.9
Group B			
Mean	84.4	86.2	84.3
Median	84.5	89.3	83.3
Range	73.2-91.1	76.7-91.5	73.3-93.1
Low Imagery			
Group A			
Mean	84.2	84.4	83.2
Median	84.4	85.0	83.3
Range	72.4-91.0	72.6-91.6	71.2-91.2
Group B			
Mean	88.1	88.7	88.2
Median	89.4	90.5	87.8
Range	79.9-91.9	76.8-92.5	77.8-93.4

Appendix M

During Sessions Variance Data

Appendix M

During Session Variance Data

High Imagery	Personality Type	Baseline		Treatment 1		Treatment 2	
Group A		(2)	(3)	(8)	(9)	(14)	(15)
				(Jacobsonian)		(Autogenic)	
J.O.	ISFJ	+1.1	-1.1	-.2	+1.9	0	+3.5
K.F.	INTP	+1.0	-2.7	+15.7	+9.7	+1.5	+2.8
P.J.	INTP	+1.3	+.1	+4.3	-.4	+4.0	+7.1
C.E.	ISFJ	+3.0	+3.8	+3.5	+10.3	+4.3	-.3
L.W.	ISFJ	-.2	+1.4	+.1	+1.6	-5.3	-2.0
V.R.	ENFJ	-.6	-.5	-.3	-.1	+3.1	+1.1
S.P.	INFP	+5.6	-.3	-.1	+1.2	+1.7	+.1
P.C.	ESTJ	+8.0	+9.5	+18.0	+15.4	-1.1	+8.1
S.S.	ISTJ	-1.4	-2.5	-1.4	-.1	+1.4	-1.0
	Means =	+1.4		+4.4		+1.3	
Group B				(Autogenic)		(Jacobsonian)	
S.Y.	ENTJ	+.1	+3.2	+.3	+2.4	+13.5	+2.5
K.G.	INFP	-.7	-.3	-1.7	-1.4	+6.9	+3.4
K.N.	ESFJ	+1.8	+3.5	+.1	+.3	+2.0	+2.1
D.E.	ENFJ	+3.3	-5.7	-4.5	-.6	+13.0	+1.5
B.K.	INFJ	+.7	+7.3	+3.7	-.7	+7.6	+1.1
B.C.	INTP	+10.6	+1.8	+.9	-1.5	-2.5	+1.3
C.H.	INFJ	+12.2	+2.4	+12.1	+13.5	+9.0	+.7
C.F.	ENTP	-.7	+8.4	+2.3	-.1	+8.5	+6.2
A.M.	INFP	+7.9	+8.7	+4.8	-1.6	+5.5	+1.3
	Means =	+3.4		+1.6		+4.6	
Low Imagery							
Group A				(Jacobsonian)		(Autogenic)	
T.S.	ENFP	+1.0	+2.2	+9.5	+8.7	+11.1	+8.0
V.H.	ISFJ	+2.7	+7.6	+3.6	+.1	+1.1	-.7
D.D.	ENFP	-1.6	-2.3	-1.9	+2.5	-1.2	+2.8
A.D.	ENFJ	+8.7	-.2	+3.6	+3.6	+.2	+2.8
P.W.	INFJ	-1.2	+7.1	+6.7	+.9	+1.2	+.2
M.L.	ENFJ	+.6	+.2	+3.3	+6.4	+1.9	+5.0
A.H.	ESFJ	+6.1	+2.3	+9.0	+9.4	+6.0	+4.6
P.L.	ENFP	-1.1	-1.0	+1.0	+8.4	-2.2	-1.9
E.A.	INFP	+.1	-1.3	+.1	+1.2	-.8	-1.3
	Means =	+1.6		+4.3		+2.1	
Group B				(Autogenic)		(Jacobsonian)	
S.A.	ISTJ	+1.5	+3.3	+1.6	+9.2	+3.7	+1.4
T.G.	INFJ	+3.8	-2.0	+5.3	+1.1	+1.2	-.3
J.W.	ESFJ	+1.5	+2.4	+1.5	+.1	+2.6	+1.3
L.A.	ESFJ	-.7	+.1	-.9	+.8	+2.2	-.3
K.O.	ESFJ	-.4	-1.9	+.9	0	-.7	+.6
J.M.	INFP	-.4	-1.0	+1.0	+2.5	+13.9	+4.9
S.B.	ENFP	-.7	+4.4	+8.1	+5.0	+1.4	+8.9
S.D.	ESFP	+5.2	+5.2	+10.7	-.9	+10.3	+2.2
N.B.	ENFJ	+1.0	+6.0	+2.5	+4.0	+.4	-.3
	Means =	+1.5		+2.9		+3.0	

Appendix N

Between Sessions Variance Data

Appendix N

Between Session Variance Data

	Baseline	Treatment 1	Treatment 2
High Imagery			
Group A		(Jacobsonian)	(Autogenic)
Mean	19.8°	23.2°	26.6°
Median	21°	22°	29°
Range	$5\text{-}34^{\circ}$	$9\text{-}38^{\circ}$	$14\text{-}49^{\circ}$
Group B		(Autogenic)	(Jacobsonian)
Mean	33.0°	30.4°	33.7°
Median	35°	26°	31°
Range	$7\text{-}57^{\circ}$	$17\text{-}53^{\circ}$	$22\text{-}58^{\circ}$
Low Imagery			
Group A		(Jacobsonian)	(Autogenic)
Mean	35.3°	31.6°	27.1°
Median	34°	32°	25°
Range	$9\text{-}78^{\circ}$	$11\text{-}44^{\circ}$	$14\text{-}46^{\circ}$
Group B		(Autogenic)	(Jacobsonian)
Mean	24.5°	32.8°	30.9°
Median	23°	29°	26°
Range	$7\text{-}49^{\circ}$	$6\text{-}54^{\circ}$	$10\text{-}66^{\circ}$

VITA

Dean G. Allen

Candidate for the Degree of

Doctor of Philosophy

Dissertation: Autonomic Self Control for Clinical Relaxation as a Function of Imagery

Major Field: Psychology

Date of Birth: February 25, 1944

Education: Bachelor of Arts in Sociology, 1967, Idaho State University; Master of Arts in School Psychology, 1972, Idaho State University.

Teaching Experience: Behavior Modification for Classroom Personnel, 1973-74, Idaho State University; Diagnostic Evaluation of Learning Disabilities, Teaching Assistant, 1975, Utah State University; The Emotionally Disturbed Child, 1977, University of Idaho; Normal Social Functioning, 1977, Boise State University; Systematic Training for Effective Parenting, 1977-78, Boise State University; The Development of Consciousness, 1978, Boise State University; The Psychology of Consciousness: Understanding & Programming the Mind & Body for Self Health, 1978-80, Boise State University.

Professional Experience: 1967-70, Epidemiologist with U.S. Public Health Service Venereal Disease Control Program, Baltimore, Maryland; 1970-72, Psychologist Trainee with the Idaho Child Development Centers, Pocatello, Idaho; 1972-74 Director of Clinical Services & Psychologist with the Child Services Division of the Human Development Center, Pocatello, Idaho; 1975-76 Special Consultant to the Idaho State Director of Special Education, Boise, Idaho; 1977-78, Faculty Member with Boise State University Social Work Department, Boise, Idaho; 1978-80 Counseling Internship with Boise State University Counseling and Testing Center, Boise, Idaho.