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THE EFFECTS OF BIOFEEDBACK TEMPERATURE TRAINING
ON ANXIETY IN HEALTHY ADULTS

A DISSERTATION
SUBMITTED TO THE GRADUATE FACULTY
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degree of
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BY
WILLIAM FRANKLIN CURTIS
Norman, Oklahoma
1976

THE EFFECTS OF BIOFEEDBACK TEMPERATURE TRAINING
ON ANXIETY IN HEALTHY ADULTS

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THE EFFECTS OF BIOFEEDBACK TEMPERATURE TRAINING ON ANXIETY IN HEALTHY ADULTS

CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

Biofeedback is a term coined in 1969 at the first meeting of a group called the "Biofeedback Research Society." The term refers to any technique which uses instrumentation to give an individual immediate and continuing signals on changes in a bodily function that he is not usually conscious of. These changes may occur in blood pressure, brain-wave activity, muscle tension or body temperature. Theoretically and, frequently, in actual practice, the information input enables the individual to learn to control many involuntary functions (Medical World News, 1973).

A few researchers have been using biofeedback techniques for more than 20 years. The concept, however, first received wide-spread attention from the scientific community in 1968 when psychologist Joe Kamiya of Langley Porter Neuropsychiatric Institute in San Francisco published an article in Psychology Today, entitled "Conscious Control of Brain Waves." Dr. Kamiya's fascination with biofeedback began in

1958 at the University of Chicago while he was involved in modern sleep research vis-a-vis electroencephalographic data. Dr. Kamiya became interested in the alpha rhythms that came and went in the waking EEGs and wondered if, through laboratory experiments, a subject could be taught awareness of an internal state.

In the late 1960's Dr. Neal Miller and his associates at Rockefeller University began a series of publications indicating they had trained rats to increase and decrease their heart rates, blood pressure, intestinal contractions, and other visceral functions by biofeedback techniques. Their techniques were so refined that they were able to teach rats to make one ear blush and not the other (Miller, 1969).

Dr. Miller wrote that his research had "deep implications for theories of learning, for individual differences in autonomic responses, for the cause and cure of abnormal psychosomatic symptoms, and possibly also for the understanding of normal homeostatis." He further added "...their success encourages investigators to try other unconventional types of training." (Medical World News, 1973)

Dr. Miller's research and writing have inspired numerous teams and individuals in the scientific community. This inspiration has also spread to the fields of counseling and to educational practitioners. The writing of this dissertation emanates from the influence of his work.

The writer has also been influenced by David G. Danskin who is Professor of Psychology and Education at Kansas State University and E. Dale Walters, Associate Research Psychologist at the Menninger Foundation, Topeka, Kansas. In an article entitled "Biofeedback and Voluntary Self-Regulation: Counseling and Education," authors Danskin and Walters challenge counselors and educators by referring to research "...demonstrating that voluntary control of psychological states (also) accompanies voluntary control of physiological functions." (Personnel and Guidance Journal, 1973)

The writer's choice of dissertation study was further influenced by Donna Kater and Jeanette Spires, elementary and secondary school counselors respectively, for the Junction City, Kansas school system. In an unpublished manuscript entitled "Biofeedback in the Elementary Schools: An Ounce of Prevention?" these counselors summarize a study conducted to determine whether elementary school children could learn the techniques for successfully performing a simple biofeedback task. Their study revolved around the biofeedback temperature trainer.

The study by Donna Kater and Jeanette Spires is unique in one important respect. Unlike numerous others to be cited in the review of the literature, their study was conducted primarily to determine if a specified population could master a specific biofeedback task. It did not

involve an attempt to aid individuals in conquering a major physical or psychological disorder.

Anxiety is generally considered a part of the dynamics and etiology of many organic and of most functional disorders. Therefore, it is assumed that with amelioration of these disorders through biofeedback, there is a concomitant reduction in anxiety. This study is concerned with identifying and exploring the extent to which healthy adults can reduce measurable amounts of anxiety through mastery of the biofeedback temperature trainer.

Statement of the Problem

The problem in this study was to investigate whether healthy adults can use biofeedback as an instrument for changing levels of anxiety. More specifically, the problem was to measure possible changes in anxiety after biofeedback training by comparing pre- and post-test scores on the A-Trait scale of the State-Trait Anxiety Inventory (Spielberger, 1970). Reduced levels of anxiety (or, increased levels) was inferred by negative and/or positive difference scores made by each of the subjects on the A-Trait scale.

Hypotheses to Be Tested in the Study

Current research indicates that success in biofeedback temperature training is correlated with the alleviation of physical and psychosomatic illnesses; it was hypothesized that individuals not suffering from these disorders could also profit significantly in lowering their levels of anxiety.

In the present study, the stated purpose was accomplished by testing the null propositions of the following hypotheses:

- Hypothesis I. There will be no statistically significant difference between the mean scores of the "high" anxious subjects on the pre-test as compared with the post-test.
- Hypothesis II. There will be no statistically significant difference between the mean scores of the "low" anxious subjects on the pre-test as compared with the post-test.
- Hypothesis III. "High" anxious difference scores will not be statistically different from the difference scores of "low" anxious subjects.

Empirical Question

The data also permitted the present researcher to answer the following question: Is there a relationship between relative successful use of the biofeedback temperature trainer and anxiety reduction?

CHAPTER II

REVIEW OF RELATED LITERATURE

Since the 1973 challenge by Danskin and Walters, other publications relating to temperature regulation have surfaced. Many of these publications emphasize the efficaciousness of temperature regulation for the alleviation of psychosomatic complaints and other pathologies. Green et al. (1972) cites a 1972 unpublished study by Paul Kurtz at the St. Cloud Hospital, St. Cloud, Minnesota. Kurtz's subjects consisted of four chemically dependent individuals and two alcoholics. After a four week training period on the temperature trainer (five days a week), all six subjects obtained high degrees of freedom from dependency on alcohol and drugs. In addition, they became more manageable while in the hospital and at the same time, retained their emotional independence.

Alice M. Green and Elmer E. Green (1975) give credence to the use of hand temperature training through an explanatory theory of migraine headache etiology. One aspect, they say, of the general syndrome of migraine headaches is vasoconstriction in the hands. It apparently results from intense sympathetic activation in response to stress.

Because there appears to be little parasympathetic innervation in the vascular system of the hands, voluntary vasodilation (learned through temperature feedback training) reflects a voluntary decrease of sympathetic overflow. They further explain:

Neural control centers for regulation of vascular behavior throughout the body are located in subcortical brain structures and it appears that the vascular system is rebalanced and the dysfunction in the head is corrected by the general sympathetic relaxation associated with self-induced warmth in hands.

Sargent et al. (1973) also reported work with migraine headache patients. Each of his patients learned the use of the temperature feedback trainer in an initial session. They were instructed to take the trainer home and practice twice daily. Use of the trainer was usually discontinued within a month. More than 80% of his headache patients obtained a significant degree of amelioration. Quantitatively, he says, relief ranged from "a little" to "almost complete."

Several researchers (Sargent, 1973; Gladman and Estrada, 1974; Taub, 1974; and Schwarts, 1973) have reported on the control of Raynaud's disease with the aid of biofeedback temperature training (a vascular problem in the hands and/or feet which can result in gangrene). The basic rationale for its occurrence and its amelioration seems to be the same as for migraine headaches. (A. Green and E. Green, 1975)

Green et al. (1973b) summarized explanatory theories of how biofeedback works by explaining that the exact neural

mechanisms involved in biofeedback "voluntary controls" training programs have not been delineated. However, Green and his colleagues at the Menninger Foundation tended to corroborate J. V. Brady's (1958) work concerning the limbic system and its significance as the "emotional" or "visceral" brain. Brady's research findings were built on the ground-work laid by J. W. Papez (1937). So from Papez to Brady, and eventually from Green (1973b), the chain of events in biofeedback training can be conceptualized in the following way: perception of somatic behavior through biofeedback → cognitive response → emotional (limbic) response → hypothalamic response → autonomic response → somatic response → biofeedback and perception.

Green (1973a) adds a less complicated description of biofeedback training:

It seems likely that the main factor related to "success" in biofeedback training is effective involvement of the patient, through immediate knowledge of results, in gaining control of his own physiological functions. Immediate knowledge of results simplifies the task of coupling intention with autonomic passivity, or "generating" passive volition. The seeming contradiction, in these words, passive and volition, is more apparent than real. If volition is linked to tranquil detachment, the autonomic system seems to respond to "visualization" of change.

The immediate presentation of the physiological change in response to volition adds a "game" element to attempts at self-regulation. Interest in games is ubiquitous in humans and when the "game field" is one's own body (instead of a pinball machine, for instance) there is an added element of fascination.

As reported earlier, Kater and Spires (1975) report a pilot study using a temperature trainer with elementary students. They found that 89% of 167 children from grades

one to six could raise the temperature of their hands within five minutes on the first attempt. Additional use of the machine in actual classroom work, they feel, helps to demonstrate the inter-relationship of body, mind, and emotions in that there was an improvement in class work and behavior which correlated with increases in hand temperature.

Definition of Terms

The following terms have been developed in connection with the study:

Adult: An individual 21 years of age or older.

Anxiety: Anxiety is generally defined at two levels: The first is a physiological level which involves physiological changes such as increases in rate of heart beat, blood pressure, and secretions of epinephrine. Anxiety can also be defined psychologically, i.e., as a diffuse feeling of apprehension and uneasiness from an unidentifiable source. Similar to the definition of IQ, anxiety can be defined operationally. In the present dissertation, anxiety is being defined operationally, i.e., it is what the Spielberger State-Trait Anxiety Inventory measures.

Healthy: The absence of symptoms requiring medical or psychiatric treatment.

Sympathetically dominant: Refers to the function of the sympathetic division of the autonomic nervous system. The sympathetic division is primarily active during periods of stress or emergency and is, therefore, said to dominate

under such conditions. It operates in opposition to the parasympathetic division which predominates during quiet and restful periods.

Limitations of the Study

As the present study was an exploratory investigation concerning the use of biofeedback temperature training and its relationship to anxiety reduction, generalizations concerning the effectiveness of biofeedback training on anxiety reduction must be made cautiously.

Since the sample used in the present study consisted of volunteers, the researcher cannot assume that the same results would be obtained with non-volunteer subjects. Further, the variable of motivation was not controlled and therefore the researcher is without information concerning the effects this variable may have had on the results of the study.

Since the relationship of reduced levels of anxiety to academic performance and/or job performance was not examined, no conclusions may be drawn concerning academic or job performance from the present dissertation. This study has only demonstrated that normal adult males can reduce their levels of anxiety as measured by a paper and pencil anxiety inventory. However, the writer believes that the study is of heuristic value because it raises questions which point to the need for further research.

Purpose and Significance of the Study

A review of the literature suggests that a study investigating the relationship between ability to increase hand temperature and anxiety reduction has potential for practical application. Specifically, the significance of this study is that it makes information available concerning the effects of biofeedback training on anxiety reduction for healthy adults.

Educational practitioners are constantly confronted with the symptoms of a stress-oriented society. The symptoms--competition, tension, helplessness, and eventually anxiety--are responsible for numerous feelings which make it difficult for adults to profit from organized educational programs. This study involving the ability of healthy adults to reduce anxiety with help from biofeedback temperature training shows potential for helping adults engage in self-exploration. It may also aid individuals in their search for self-awareness. Finally, the study may prove to be a major resource for the seemingly universal goal of individual control or self-control.

CHAPTER III

METHOD

The following section is designed to serve as a summary for the methods, operations, and statistical procedures which were employed in the study.

Subjects

The subjects consisted of 25 male students and male faculty members at Oscar Rose Junior College, ranging in age from 21 to 49 years. Originally, 30 subjects volunteered to participate. Because of attrition, however, complete data were obtained for only 25 subjects. The total sample means and standard deviations of age and years of formal education were 31.64 ± 8.57 and 15.92 ± 3.20 , respectively.

The study was limited exclusively to the use of males because of the numerous physiological changes (GSR, EEG, etc.) caused by the monthly menstrual cycle in females. Also, recent research (Broverman, 1968) tends to indicate that females are more sympathetically dominant (as opposed to parasympathetically) than males. The subjects were also screened at the time of recruitment concerning their health

and for a reported history of alcohol and/or drug abuse. Only those subjects who declared themselves as free of drug addiction, free of excessive alcohol use, and as being asymptomatic of any chronic medical or psychiatric disability requiring professional treatment were included in the study.

Subjects were divided into two groups on the basis of the pre-test scores on the Spielberger State-Trait Anxiety Inventory. The median pre-test score for the entire group was 31.69. Those subjects who scored above the median were designated "High Anxious" and placed in the High Anxious Group (HAG). Subjects who scored below the median were labeled "Low Anxious" and assigned to the Low Anxious Group (LAG). In the HAG, the means and standard deviations for age and education were 31.17 ± 9.76 and 16.33 ± 3.31 ; and 32.08 ± 7.69 and 15.54 ± 3.18 in the LAG (see Appendix G). The groups did not differ significantly in age or education.

Instruments

Charles D. Spielberger's State-Trait Anxiety Inventory was administered. The State-Trait Anxiety Inventory was specifically developed as a research instrument for investigating anxiety phenomena in "normal" (i.e., non-psychiatrically disturbed) adults. The scale is divided into two separate sections (see Appendix A and B). The first section is designated as both "A-State" and X-1. It consists of 20 statements which requires an examinee to indicate how he feels at a particular moment in time. This

particular scale is used in measuring situational anxieties such as may be encountered in a stressful experimental procedure, in a test environment, and in other novel situations. As such, "A-State" or X-1 was of little concern to the purposes of this research. The second division of the scale is called "A-Trait" or X-2. It is primarily concerned with measuring relatively stable individual proneness to anxiety. Like "A-State", "A-Trait" is composed of 20 questions. The questions on "A-Trait", however, require an examinee to reflect upon how he generally thinks, feels, and responds over generalized periods of his life.

Studies relating to test-retest reliability of the "A-Trait" scale tend to yield reasonably high correlations. The most comprehensive of these studies is by the test author. Spielberger (1970) published the following test-retest correlations for adult males:

<u>Time Lapse</u>	<u>N</u>	<u>T/Rr</u>
1 hour	88	.84
20 days	38	.86
104 days	25	.73

In addition to the favorable data covering the reliability of the instrument, the State-Trait Anxiety Inventory was chosen to aid in conducting the present research because of its easy administration and quick scoring procedure. Data obtained during the first testing period of this study were labeled "pre-test" scores.

Description of Apparatus

The biofeedback temperature trainer used in this study was the T2-P (see Appendix C). It is manufactured and sold exclusively by SYSTEC ELECTRONICS, INC. of Lawrence, Kansas. The instrument is powered by two 216 Everready or two 2V6 Burgus dry cell batteries (9 volts each). The trainer is contained in a 5" x 7½" plastic case. Its width is 2½ inches. The trainer is equipped with a "meter feedback indicator" which displays temperature changes and the direction of the change, i.e., positive or negative; a "zero adjust dial" (used to zero or calibrate the meter); a function switch (for turning the trainer on or for turning it off); and a thermistor probe to which individuals attach the middle finger of the dominant hand with plastic adhesive tape.

Task

The task involved fifteen days of actual temperature training. During this period, each subject was requested to spend fifteen minutes per day (at the same time each day) hooked up to the trainer. Because week-ends were excluded, the total time for this section of the study actually lasted 19 days. The room temperature was monitored daily (and periodically during the day). A constant temperature of 73 F degrees was observed during the entire study. Individual temperature training sessions were scheduled to correspond with the time each subject entered the (research)

building. That is, subjects were scheduled for temperature training based upon a class or work schedule which required their presence in the building at least fifteen minutes prior to their time on the temperature trainer to offset the variability of the outside temperature. The trainer was located in the researcher's office which assisted in establishing environmental consistency. The subjects were provided with a master chart on which they maintained daily records of their progress (see Appendix F).

After each subject completed all of the fifteen training sessions, they were asked to return after two days for the post-test. Post-test scores were ascertained by readministering the "A-Trait" scale of the State-Trait Anxiety Inventory.

Procedure

During the first contact with subjects, rapport was established. After rapport was established, demographic data were obtained and the Spielberger State-Trait Anxiety Inventory was administered.

During the second contact, subjects were instructed for 20 minutes on the temperature trainer. This involved explaining the maneuvers necessary for hand calibration (i.e., for starting the trainer each day). The session also allowed subjects to experiment with different techniques for actual temperature training of which there are three basic suggestions which can be combined or used separately. One

technique is to sit quietly and observe the trainer's needle movements. A second technique is to use imagery such as imagining that one is on a hot beach or in a sauna bath or to imagine that one has his hand in warm water. Another technique is to read printed relaxation and warmth exercises provided by the manufacturer of the trainer (see Appendices D and E).

Regardless of a subject's selected technique for temperature training, his major charge for each session was to keep the trainer's indicator (i.e., needle) increasing toward numbers on the right of zero point (see Appendix G). Numbers to the right of zero point are positive Fahrenheit degrees. As long as a subject could keep the indicator to the right of zero point, he was increasing his hand temperature. Conversely, indications to the left of zero point meant a decrease in hand temperature.

Increases and decreases in hand temperature were measured by observing positive (and/or negative) readings on the largest (picture) dial of the trainer (see Appendix C). Temperature changes greater than $\pm 2.5^{\circ}\text{F}$ were calculated by hand calibrating the indicator back to zero point and adding (or subtracting) additional indicator movements.

In addition to becoming familiar with the trainer, the initial training session provided an opportunity for responding to questions which may have arisen as a result of subjects having had actual exposure to the trainer and to biofeedback in general. Following the two initial contacts,

each subject engaged in 15 independent temperature training sessions.

Statistical Analysis

Subjects were divided into two groups (designated as "high anxious" and "low anxious") on the basis of their pre-test scores on the Spielberger State-Trait Anxiety Inventory. As Spielberger (1970) did not designate "high" or "low" anxious cutoffs, the present researcher arbitrarily made the designations based upon the median score.

Hypothesis I, that is, the comparison of pre-test with post-test mean scores of the "high" anxious group was examined by use of the t test for correlated samples. Hypothesis II, that is, the comparison of pre-test mean scores with the post-test mean scores of "low" anxious subjects was analyzed by means of the t -test for correlated samples.

Hypothesis III, that is, the difference scores of the high anxious group as compared with the difference scores of the low anxious group was analyzed by means of the t test for independent samples.

In addition, the median temperature change score was determined. Those subjects who scored below the median (6.87 degrees) were considered "unsuccessful" in temperature training. Likewise, those subjects who scored above the median were labeled "successful" during temperature training.

Collapsing across the anxiety variable, those subjects who were labeled successful (Group S) were compared

with subjects who were unsuccessful (Group U) by means of the t test for independent samples.

Further, the anxiety variable was examined between the successful group and the unsuccessful group. An examination of the relationship between the biofeedback technique and reduced levels of anxiety, if any, within the two groups was examined by means of the t test for independent samples. Finally, the test-retest consistency of the Spielberger State-Trait Anxiety Inventory was examined by means of the Pearson r.

CHAPTER IV

RESULTS

The findings of the present study are presented in the following order:

1. Overall test results of the total sample on the Spielberger State-Trait Anxiety Inventory, temperature change, age and education.
2. Results related to pre- and post-test scores on the Spielberger State-Trait Anxiety Inventory and temperature change for the two experimental groups.
3. Results relating to the testing of Hypothesis I and II.
4. Results relating to the testing of Hypothesis III.
5. Results concerned with the question addressed to the relationship between success and lack of success on the temperature trainer.
6. Results related to the correlation between the pre- and post-test anxiety scores.

Overall Test Results

The mean for the entire sample of the present study (N = 25) on the Spielberger State-Trait Anxiety Inventory

for the pre-test condition was 33.04 with a standard deviation of 6.90 and a mean of 29.40 with a standard deviation of 6.36 for the post-test condition. The mean difference of 3.64 between the two times of testing was significant ($t = 2.76$, $p < .02$, two-tailed) indicating that the subjects had lowered their level of anxiety by the second time of testing. The mean temperature change for the 15 training sessions for the total sample was 6.88 degrees with a standard deviation of 2.34 and was in the positive direction; that is, the group overall demonstrated an increase in temperature over the 15 training sessions.

Spielberger Trait Levels of Anxiety and Temperature Change

The means and standard deviations for the high and low anxious subjects on the Spielberger State-Trait Anxiety Inventory and mean temperature change may be found in Table I.

The difference of 10.50 between the High-Anxious Group (HAG) and the Low-Anxious Group (LAG) during the pre-test condition was significant ($t = 5.71$, $p < .001$, two-tailed). The difference of 6.28 between HAG and LAG at post-test was also significant ($t = 2.74$, $p < .02$, two-tailed). Therefore, the two groups differed significantly in levels of anxiety at both times of testing. (See Figure I.)

As reported earlier, the two experimental groups did not differ on age or education.

It was also of interest to examine the difference, if any, between the HAG and LAG on temperature change across

TABLE I

MEAN AND STANDARD DEVIATIONS FOR HIGH ANXIOUS AND LOW
 ANXIOUS GROUPS ON THE SPIELBERGER STATE-TRAIT
 ANXIETY INVENTORY AND TEMPERATURE CHANGE

Group	Pre-Test		Post-Test		Difference Scores		Temperature Change	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
High Anxious	38.50	6.05	32.67	6.99	5.83	8.45	6.45	5.81
Low Anxious	28.00	2.08	26.38	3.93	1.62	3.52	7.27	5.29

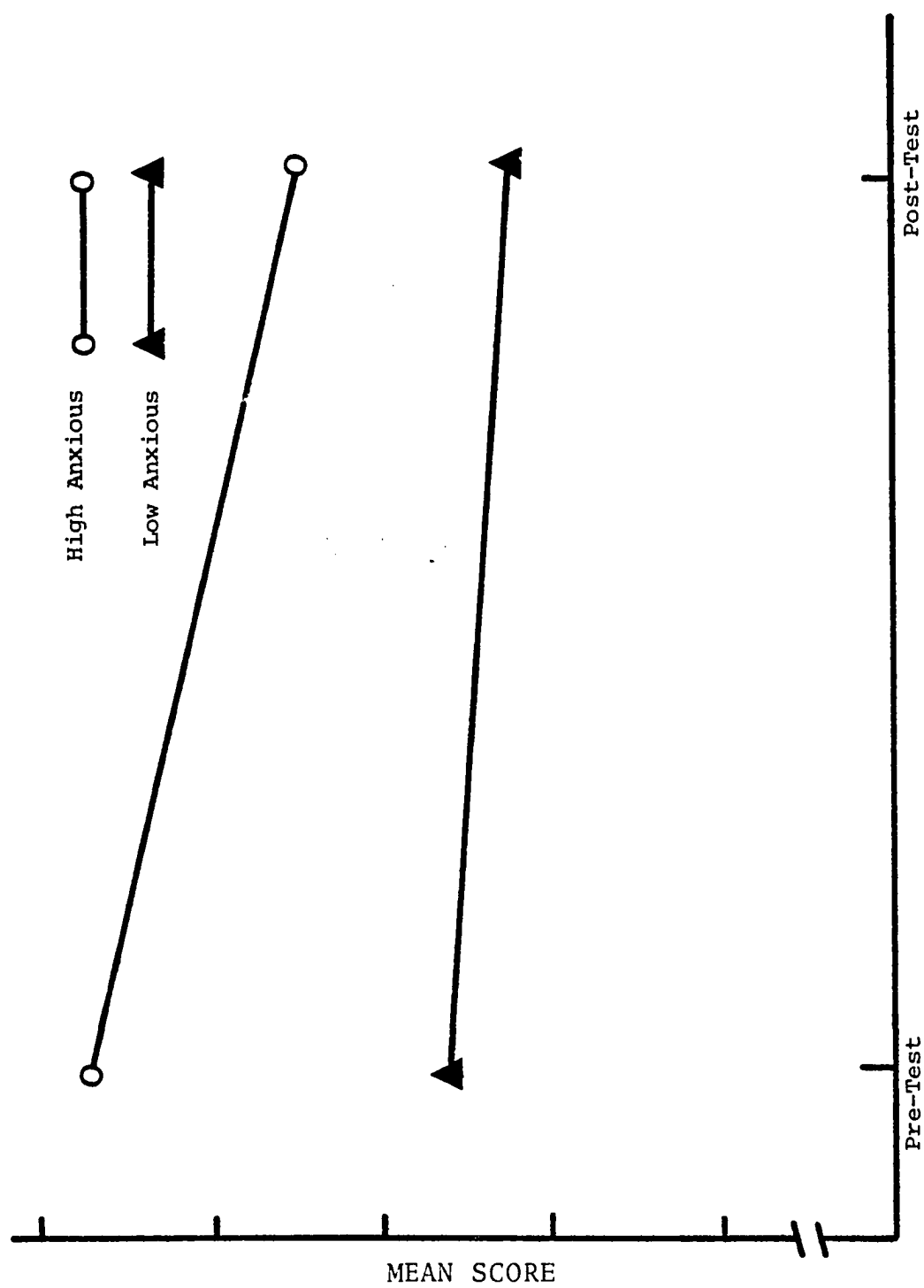


Figure I. Mean scores on the Spielberger State-Trait Anxiety Inventory.

the 15 sessions. It was found that the mean temperature change of the HAG ($\bar{x} = 6.45$) did not differ significantly from the mean temperature change of 7.27 of the LAG ($t = 0.87$, ns, two-tailed). The trend in the data suggests, however, that there was a greater mean temperature change across the 15 sessions in the LAG than there was in the HAG.

Hypotheses I and II

Hypothesis I stated that there would be no statistically significant difference between the means of the high anxious subjects on the pre-test as compared with the post-test scores. The mean difference of 5.83 for the HAG between the pre- and post-test conditions was statistically significant ($t = 2.39$, $p < .05$, two-tailed). Therefore, we can reject the null hypothesis. As can be seen by referring to Table I and Figure I, the results indicate that the HAG had significantly reduced their levels of anxiety by the second time of testing.

Hypothesis II stated there would be no statistically significant difference between the means of the low anxious subjects on the pre-test as compared with the post-test scores. The mean difference of 1.62 for the LAG between the pre- and post-test conditions was not statistically significant ($t = 1.65$, ns, two-tailed). As may be seen by comparing the means presented in Table I and Figure I, the LAG only slightly reduced their levels of anxiety by the time of the second testing. Therefore, as stated by the null

hypothesis, the researcher found no significant difference between the pre- and post-test conditions for the LAG.

Hypothesis III

Hypothesis III stated that the difference scores of the high anxious subjects would not be statistically significantly different from the difference scores of the low anxious subjects. The mean difference scores (i.e., pre-test minus post-test, see Table I) of the HAG ($\bar{M}_d = 5.83$) differed from the mean difference scores of the LAG ($\bar{M}_d = 1.62$) by 4.22. This difference was not statistically significant ($t = 1.60$, ns, two-tailed). As the null hypothesis stated, there was no statistically significant difference between the difference scores of the HAG and LAG. However, it should be noted that the results indicate that the HAG tended to reduce their levels of anxiety by the second time of testing to a greater extent than did the LAG.

Comparisons Between Successful and Unsuccessful Groups on the Temperature Trainer

As a post hoc analysis the subjects were re-grouped according to the relative success or lack of success on the use of the temperature trainer. Those subjects scoring above the median on temperature change (6.87 degrees) were considered successful and therefore were placed in the Successful Group (SG). Subjects who scored below the median were labeled unsuccessful and were placed in the Unsuccessful

Group (UG). As may be seen in Table II (see Appendix G), the mean change for the SG was 8.86 degrees. The mean temperature change for the UG was 4.87 degrees. This difference of 3.86 degrees was statistically significant ($t = 7.48$, $p < .001$, two-tailed).

Although not statistically significant ($t = 1.32$, ns, two-tailed) the SG tended to score lower on the Spielberger State-Trait Anxiety Inventory ($\bar{x} = 31.31$) than did the UG ($\bar{x} = 34.92$) during the pre-test condition. Both groups reduced their levels of anxiety by the second time of testing (see Table II). However, since the SG reduced their test scores by a mean of 3.62 and the UG by 3.67, the mean difference of 0.05 was not statistically significant ($t = 0.02$, ns, two-tailed).

It was also of interest to examine the difference, if any, between the SG and UG on age and education. The groups did not differ on age ($\bar{x} = 0.85$, $t = 0.24$, ns, two-tailed). However, a mean difference of 2.88 years of education was found between the two groups, with the UG being more highly educated than the SG (see Table II). This difference in education between the two groups was significant ($t = 2.46$, $p < .05$, two-tailed).

Correlation Between the Pre- and Post-Test Anxiety Scores

The test-retest reliability of the Spielberger State-Trait Anxiety Inventory was examined by a Pearson r . An $r = 0.49$ ($p < .02$, two-tailed) was obtained when the subject's

TABLE II

MEANS AND STANDARD DEVIATIONS FOR SUCCESSFUL (SG) AND
 UNSUCCESSFUL (UG) GROUPS ON TEMPERATURE CHANGE
 AND THE SPIELBERGER STATE-TRAIT ANXIETY
 INVENTORY

Group	Temperature Change		Pre-Test		Post-Test	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
SG	8.86	1.30	31.31	6.07	27.69	5.45
UG	4.87	1.28	34.92	7.50	31.25	6.97

pre-test score was correlated with his post-test score following training on the T2-P Temperature Trainer. Thus the test-retest consistency was found to be relatively good for the sample of subjects tested in the present study.

CHAPTER V

DISCUSSION

Results of the present investigation indicate that exposure to biofeedback temperature training may have contributed to the reduction of levels of anxiety in the subjects of the present study. Overall, the group mean of 33.04 at the time of pre-test condition compared well with Spielberger's corresponding normative group (37.68). Although the total sample was initially relatively low in levels of anxiety as compared with the normative group, the overall sample significantly reduced their levels of anxiety as measured on the Spielberger State-Trait Anxiety Inventory by the second time of testing. These results are consistent with the findings of Kater and Spires (1974) who report beneficial behavior gains in children after exposure to biofeedback temperature training. Therefore, it may be inferred from the overall results of this study that normal adult males can profit from biofeedback temperature training in reducing their levels of anxiety.

The total sample was divided into two experimental groups. Those subjects who scored above the median were assigned to the High Anxious Group (HAG). The subjects

who scored below the median were assigned to the Low Anxious Group (LAG). These two experimental groups differed significantly in levels of anxiety at both times of testing. In examining the mean temperature change across the fifteen sessions, the trend in the data suggests that the LAG tended to have a higher mean temperature change than did the HAG. However, the mean difference between the two groups of .82 degrees was not statistically significant. Therefore, it may be concluded that the two groups were relatively similar in learning the biofeedback temperature technique.

Hypothesis I

Hypothesis I addressed itself to the finding related to the "High Anxious Group." It had been stated (i.e., Hypothesis I) that there would be no statistically significant difference between the means of the High Anxious Group on the pre-test as compared with the post-test scores on the Spielberger State-Trait Anxiety Inventory. Since the results indicate that the HAG had significantly reduced their levels of anxiety by the second time of testing, the null hypothesis was rejected. These findings suggest that the subjects in the HAG particularly benefitted from the experimental procedure.

Hypothesis II

It had been anticipated that there would be no statistically significant difference between the mean of the "Low Anxious Group" on the pre-test as compared with the

mean of the post-test. It was found that the "Low Anxious Group" reduced their mean level of anxiety by 1.62. This finding was not statistically significant and the researcher failed to reject the null hypothesis. It may be speculated, however, that while no statistically significant differences were found between the two sets of anxiety scores for the "Low Anxious Group," the subjects experienced a ceiling effect. That is, since the group scored low initially in levels of anxiety ($\bar{x} = 28.00$), the probability is high that there was little room to statistically demonstrate anxiety reduction with the anxiety scale employed in the present study.

Hypothesis III

The results of the testing of Hypothesis III show that there was no statistically significant difference between the mean difference scores of the "High Anxious Group" and the mean difference scores of the "Low Anxious Group." Although the mean difference between the two groups of 4.22 was not statistically significant, the difference was in the direction of demonstrating that the "High Anxious Group" tended to reduce their levels of anxiety to a greater extent than did the "Low Anxious Group." As reported earlier in the discussion, the HAG did statistically reduce their level of anxiety by the second time of testing while the LAG did not. It is suggested, therefore, that this statistical manipulation of the data, i.e., the use of difference scores, may have masked the differences between the groups. It is

suggested that a large sample might clarify the testing of Hypothesis III.

Empirical Question

The subjects were re-grouped according to their relative success or lack of success on the temperature trainer. Those subjects scoring above the median were considered "successful" on temperature training. Those subjects who scored below the median were considered "unsuccessful." Upon examination of the anxiety variable, the data shows that the "Successful Group" (SG) tended to score lower on the Spielberger State-Trait Anxiety Inventory at the initial time of testing than did the "Unsuccessful Group" (UG) ($\bar{M}_d = 2.61$). This difference between the groups, however, was not statistically significant.

In spite of the difference between the groups on mean temperature change, both groups reduced their levels of anxiety by the second time of testing. However, the mean difference of change between the groups was so small ($\bar{M}_d = 0.05$) that the groups were almost identical in mean anxiety change.

Since age and education may have been variables related to success or lack of success on the experimental task, they were examined between the two groups. There was no age difference between the two groups. However, the two groups did differ significantly on years of education with the UG being the more highly educated group.

The relative lack of success of the UG in increasing their hand temperature may be related to the fact that since education was higher in the UG, there was a greater proportion of faculty members in the group. It follows that the UG may have been less motivated than was the group composed primarily of students who possibly were motivated by the need to please their professor.

Test-Retest Reliability

Finally, it was of interest to examine the test-retest reliability of the Spielberger State-Trait Anxiety Inventory. When the subject's pre-test anxiety scores were correlated with his post-test score following training on the T2-P Temperature Trainer, it was found that the test-retest consistency was relatively good for the total sample of subjects in the present study.

Implications of the Effects of Biofeedback Temperature Training Upon Anxiety

Generally, the results of the present dissertation demonstrate that normal healthy adults can benefit from biofeedback temperature training. It also seems likely that high anxious individuals are likely to profit significantly more than low anxious ones. The possibilities for practical application of biofeedback temperature training are almost limitless. The ability to reduce non-pathological levels of anxiety is only one of the many possibilities. Probably the most dramatic implication for this dissertation is the idea that if one can learn to control an involuntary

function such as body temperature, one is more likely to anticipate mastery over reactions which are voluntary.

As Mulholland (1973) succinctly states:

The emotional state of the student has perhaps as much effect as attention on the learning process. Unpleasant emotions such as anxiety...can impede learning, as can too much or too little emotional arousal. By using biofeedback techniques we could train a person to maintain the physiological states associated with moderately pleasant feelings while he learned.

Significance of the Study to Adult Education

The writer previously explained that this study was exploratory and all implications are necessarily limited due to the parameters of the design. A review of the literature relating to temperature training in the present dissertation is limited because the temperature trainer as a biofeedback technique is relatively new. However, there is some information relating to the practicality of temperature training in educational environments which cannot be dramatized statistically. Danskin and Walters (1975), for example, devote the major part of their article to summarizing subjective responses from students who participated in a feedback training program at Kansas State University. Generally, the results indicate that the students learned to deal with anxiety-producing situations which were interfering with their educational pursuits. One participant reported:

The program made me aware of anxiety reactions I would get in class, before tests, and whenever my class load got extremely heavy. These tense feelings would reduce my efficiency and make the situation that caused anxiety in the first place worse. Through biofeedback I have realized that I control these situations, internalize these fears, and I no longer need to. Biofeedback has

put me in touch with the beginnings of these feelings and has shown me how reacting positively and self-actualizing to my environment rather than letting external forces control my behavior or feelings. Specifically, it has helped me study more efficiently, concentrate for longer periods of time, and meet my commitments to class work.

Another student responded by reporting:

Now I react to crisis situations faster than I used to. Decision making has always been difficult for me until now. Immediately the most rational alternatives are displayed in my mind and I single out the one I feel is best.

Another group of students made comments relating to their general state of mind and to their levels of increased self-confidence and self-esteem. One participant intoned:

As I look back on my life, I see I have always been an up-tight, nervous person and have never understood the tension I carried in my body and its result. Several times in my life, usually during a period of emotional distress, the problem would gain an upper hand. I had visited professionals and was usually given drugs as a means of controlling this. At 20 years of age I was taking tranquilizers regularly. In the biofeedback program I discovered many things about myself. One, that I could control my tensions and by doing so, I could better handle problems as well as become a more capable, balanced human being. This also restored my self-confidence. I am now actively involved in my own business and hoping soon to return to college and finish my degree. I feel capable of reaching goals I've set for myself and capable of handling problems we meet in daily life, and maintaining a sense of inner joy and peace.

Mulholland (1973) elaborates on potential educational benefits in the general field of biofeedback (temperature training, EMG or electromyographic muscle training, EEG or electroencephalographic training with alpha rhythm and EOG or electrooculargraphic training of eye movements). Mulholland advises, for example, that educators can use biofeedback as a method for eliminating unpleasant emotions such

as anxiety, fear, or anger which can impede learning. He also implies that biofeedback can be used to help individuals maintain physiological states associated with moderately pleasant feelings which facilitate learning, remembering and retrieval.

Other educational applications of biofeedback in general can be seen through the research of Hardyck and Petrinovich (1969) who studied subvocal activity during reading among students at the University of California, Berkeley. Using EMG techniques for measuring muscle tension at the larynx, these researchers worked with a sample of 50 college students. The experimental subjects learned to eliminate subvocal activity within the first hour of treatment. The control group, which was not exposed to biofeedback, showed no change during the first part of the experimental procedure. As part of the study, the control group received EMG training and also learned to inhibit subvocal activity. Only two of the 50 subjects failed to respond to the biofeedback technique after treatment. The results of this study and a similar one (conducted with high school students) helped Hardyck and Petrinovich conclude that treatment to eliminate subvocal speech by using a biofeedback technique might help high school and college age populations improve their reading skills, i.e., help them learn to read faster without reducing comprehension.

Wickramasekera (1972) is another researcher whose efforts demonstrate the application of biofeedback technology

to the field of education. He reported an example of EMG feedback assisted relaxation training (used adjunctively with systematic desensitization) for the treatment of test anxiety. Results from Wickramasekera's anecdotal case report on one subject indicate that the experiment was a total success in that the subject was able to pass an examination that she had several times avoided taking because of high anxiety levels. The results of this study suggest that students preparing for general or comprehensive examinations might benefit from a combination of biofeedback technology and systematic desensitization.

Although not all of the articles mentioned in this section are uniquely concerned with temperature training, they have a great deal in common. They demonstrate that with a small degree of creativity and ingenuity, biofeedback procedures can become plausible solutions to educational problems which have experienced minimal success with conventional treatment procedures.

Further Research

The results of the present study have generated the following suggestions for further research.

First, any additional research concerning biofeedback temperature training and its relationship to anxiety reduction should encompass a larger N than encountered in this study. A larger N would be particularly helpful in dismissing or confirming the existence of a ceiling effect as is suspected to exist in the testing of Hypothesis II.

A second suggestion is to replicate this study using a student population only. It would be of interest to examine grade point averages before and after temperature training to see what correlation, if any, there is between levels of anxiety and grades.

A third suggestion is concerned with the age of the present experimental group. The present study consisted of a rather fortuitous age composition. Although the "Successful Group" in the present study had a slightly younger mean age than did the "Unsuccessful Group," the differences are not statistically significant. A study comparing groups with significantly different age compositions might be of considerable value in answering questions relating to the efficaciousness of temperature training for a variety of adult age ranges.

Another suggestion for further research is related to "life positions" of experimental group members. In the present study, the "Unsuccessful Group" was statistically significantly more educated than was the "Successful Group." Two plausible speculations could be posed. First, perhaps the more formal education one has attained, the less likely he is to value (i.e., take seriously) exercises which are void of rigorous scientific testing. Second, and possibly more probable, is the possibility that in this study the "Unsuccessful Group" was composed of more faculty members with a greater variety of responsibilities and pressures unrelated to the experiment. The preponderance of pressures

and multiple responsibilities may have greatly affected the ability of many subjects in the "Unsuccessful Group" to devote their full energy and attention to temperature training. A study revolving around "life positions" (i.e., levels of formal education and responsibility-related stress) would be helpful in providing specific types of information regarding the effects of biofeedback temperature and degrees of "normal" stress upon which it is most likely to be effective.

A final suggestion for further research is to conduct a similar study using female subjects. In addition to a study relating to a sample concerned with differences in "life positions" of females, another study could concern itself with whether the experimental group was pre- or post-menopausal.

REFERENCES

- Barber, T. X., et al. (eds.), Biofeedback and Self-Control 1970, An Aldine Annual. Chicago: Aldine-Atherton, Inc., 1971.
- Biofeedback in Action. Medical World News, March 5, 1973.
- Broverman, D.; Haiber, E.; Kobayashi, Y.; and Vogel, W., "Roles of Activation and Inhibition in Sex Differences in Cognitive Abilities." Psychological Review, 1968, 75, 23-50.
- Danskin, D. G.; and Walters, E. D., "Biofeedback and Voluntary Self-Regulation: Counseling and Education." Personnel and Guidance Journal, 1973, 51, 633-638.
- . "Biofeedback Training as Counseling." Reprinted by the American Personnel and Guidance Association, 1975, 116-122.
- Green, A. and Green, E., "Biofeedback: Research and Therapy." Research Department, The Menninger Foundation, Topeka, Kansas, 1975.
- Green, E.; Green, A.; and Walters, E., "Biofeedback Training In Anxiety Tension Reduction." Research Department, The Menninger Foundation, Topeka, Kansas, 1973a.
- Green, E.; Green, A.; Walters, E.; and Sargent, J., "Autogenic Feedback Training." The Menninger Foundation, Topeka, Kansas, 1973b.
- Hardyck, C. D.; Petrinovich, L. F., "Treatment of Subvocal Speech During Reading." Journal of Reading, 1969, 1, 1-11.
- Haugen, G. B.; Dixon, H. H.; and Dickel, H. A., A Theory for Anxiety Tension Reactions. New York: Macmillan Co., 1963.
- Hill, G. E., "Standards for Test Users." Measurement and Evaluation in Guidance, 1969, 2, 140-149.

- Kamiya, J., "Conscious Control of Brain Waves." Psychology Today, 1968, 1, 56-60.
- Karlins, M. and Andrews, L. M., Biofeedback: Turning on the Powers of Your Mind. New York: J. P. Lippincott, 1972.
- Kater, D.; Spires, J., "Biofeedback in the Elementary Schools: An Ounce of Prevention?" Unpublished manuscript. Presented at American Personnel and Guidance Association Convention, New Orleans, 1974.
- Luthe, W. (ed.), Autogenic Therapy, Volume I. New York: Grune and Stratton, 1969.
- Mears, A., Relief Without Drugs. Garden City, N.Y.: Doubleday and Co., 1967.
- Miller, N., "Learning of Visceral and Glandular Responses." Science, 1969, 163, 434-445.
- Mulholland, T., "It's Time to Try Harder in the Classroom." Psychology Today, 1973, 7, 103-104.
- Papez, J. W., "A Proposed Mechanism of Emotion." Archives of Neurology and Psychiatry, 1937, 28, 725-743.
- Sargent, J.; Green, E.; Walters, E., "The Use of Autogenic Feedback Training in a Pilot Study of Migraine and Tension Headaches." Headache, 1972, 12, 120-124.
- Sargent, J.; Walters, E. D.; Green, E., "Psychosomatic Self-regulation of Migraine Headaches." Seminars in Psychiatry, 1973, 5, 415-428.
- Schultz, J. H. and Luthe, W., Autogenic Training: A Psychophysiological Approach in Psychotherapy. New York: Grune and Stratton, 1959.
- Shapiro, D., et al. (eds.), Biofeedback and Self-Control, 1972. Aldine Publishing Co., 1973.
- Spector, S., "Monoamine Oxidase in Control of Brain Serotonin and Norepinephrine Content." Annals of the New York Academy of Sciences, 1963, 107, 856-864.
- Spielberger, C. (ed.), Anxiety and Behavior. New York: Academic Press, 1966.
- Spielberger, C.; Gorsuch, R.; and Lushene, R., STAI Manual. Palo Alto: Consulting Psychologist Press, Inc., 1970.

- Stoyva, J. M., et al. (eds.), Biofeedback and Self-Control, 1971. Chicago: Aldine-Atherton, Inc., 1972.
- Tart, C. T. (ed.), Altered States of Consciousness. New York: John Wiley & Sons, Inc., 1969.
- Taylor, D. A.; Wheeler, L.; and Attman, I., "Stress Reactions in Socially Isolated Groups." Journal of Personality and Social Psychology, 1968, 9, 369-376.
- Taylor, J. A., "A Personality Scale of Manifest Anxiety," Journal of Abnormal and Social Psychology, 1953, 48, 285-290.
- Walters, E. Dale, "Technique for Temperature Feedback Training." Unpublished manuscript, Research Department, The Menninger Foundation, Topeka, Kansas, 1973.
- Wickramasekera, I., "Instructions and EMG Feedback In Systematic Desensitization: A Case Report." Behavior Therapy, 1972, 3, 460-465.
- Zuckerman, M., "The Development of an Affective Adjective Checklist for the Measurement of Anxiety." Journal of Consulting Psychology, 1960, 24, 457-462.

APPENDIX A

X-1

SELF-EVALUATION QUESTIONNAIRE

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

STAI FORM X-1

NAME _____ DATE _____

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

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

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APPENDIX B

X-2

46
SELF-EVALUATION QUESTIONNAIRE
STAI FORM X-2

NAME _____ DATE _____

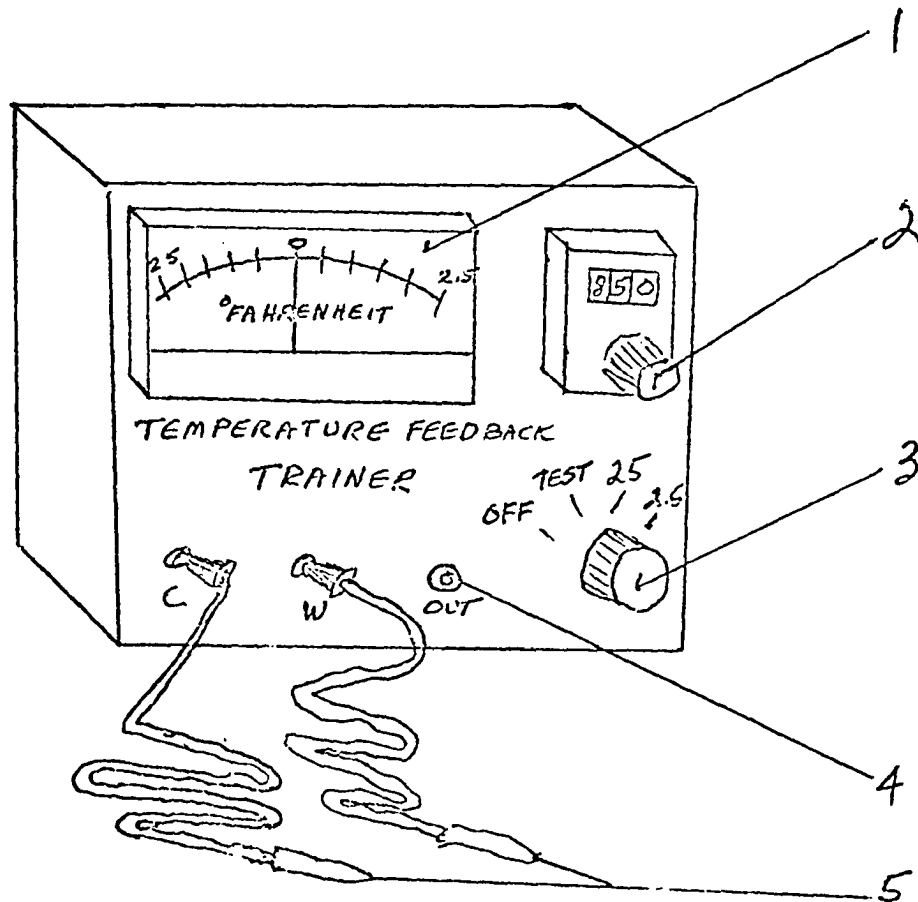
DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one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

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
21. I feel pleasant	①	②	③	④
22. I tire quickly	①	②	③	④
23. I feel like crying	①	②	③	④
24. I wish I could be as happy as others seem to be	①	②	③	④
25. I am losing out on things because I can't make up my mind soon enough	①	②	③	④
26. I feel rested	①	②	③	④
27. I am "calm, cool, and collected"	①	②	③	④
28. I feel that difficulties are piling up so that I cannot overcome them	①	②	③	④
29. I worry too much over something that really doesn't matter	①	②	③	④
30. I am happy	①	②	③	④
31. I am inclined to take things hard	①	②	③	④
32. I lack self-confidence	①	②	③	④
33. I feel secure	①	②	③	④
34. I try to avoid facing a crisis or difficulty	①	②	③	④
35. I feel blue	①	②	③	④
36. I am content	①	②	③	④
37. Some unimportant thought runs through my mind and bothers me	①	②	③	④
38. I take disappointments so keenly that I can't put them out of my mind	①	②	③	④
39. I am a steady person	①	②	③	④
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	①	②	③	④

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APPENDIX C
TRAINER



1. Meter-feedback indicator, displays temperature changes and direction of change.
2. Zero adjust - used to zero the meter and read out absolute and differential temperature.
3. Function switch.
4. Output jack for recorder drive.
5. Thermistor probes.

APPENDIX D
RELAXATION

RELAXATION

I feel quite quiet... I am beginning to feel quite relaxed... my feet feel heavy (When your attention is focused on the body or body parts, they will feel heavy when relaxed. With attention focused inward but on body parts, the tendency is to feel light when relaxed) and relaxes...my ankles, my knees, and my hips feel heavy, relaxed, and comfortable... my solar plexus, and the whole central portion of my body, feel relaxed and quiet...my hands, my arms, and my shoulders, feel heavy, relaxed, and comfortable...my neck, my jaws, and my forehead feel relaxed. They feel comfortable and smooth...my whole body feels quiet, heavy, comfortable and relaxed.

APPENDIX E

WARMTH

WARMTH

I am quite relaxed...my arms and hands are heavy and warm...
I feel quite quiet...my whole body is relaxed and my hands
are warm, relaxed and warm...my hands are warm, warmth is
flowing into my hands, they are warm...warm...I can feel the
warmth flowing down my arms into my hands...my hands are
warm...relaxed and warm.

APPENDIX F
PROGRESS CHART

MASTER PROGRESS CHART
(For First Five Subjects)

WEEK 1	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5
Monday	to	to	to	to	to
Tuesday	to	to	to	to	to
Wednesday	to	to	to	to	to
Thursday	to	to	to	to	to
Friday	to	to	to	to	to

WEEK 2	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5
Monday	to	to	to	to	to
Tuesday	to	to	to	to	to
Wednesday	to	to	to	to	to
Thursday	to	to	to	to	to
Friday	to	to	to	to	to

WEEK 3	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5
Monday	to	to	to	to	to
Tuesday	to	to	to	to	to
Wednesday	to	to	to	to	to
Thursday	to	to	to	to	to
Friday	to	to	to	to	to

APPENDIX G

DEMOGRAPHIC DATA AND TEST RESULTS FOR HIGH ANXIOUS GROUP

Subject	Age	Education	Pre-Test Score	Post-Test Score	Difference Score	Temperature Score
1	21	13	52	44	8	5.9
2	25	14	46	31	15	5.4
3	26	15	43	23	20	9.4
4	39	14	41	31	10	8.0
5	22	13	39	25	13	7.7
6	22	14	38	33	5	5.9
7	31	19	37	40	-3	3.7
8	35	20	35	36	-1	4.4
9	49	20	34	26	6	11.4
10	42	20	33	25	3.5	3.5
11	21	13	33	43	-10	7.5
12	41	21	32	33	-1	4.6
MEAN	31.17	16.33	38.50	32.67	5.83	6.45
S.D.	9.76	3.31	6.05	6.99	8.45	2.41

DEMOGRAPHIC DATA AND TEST RESULTS FOR LOW ANXIOUS GROUP

Subject	Age	Education	Pre-Test Score	Post-Test Score	Difference Score	Temperature Score
13	31	18	31	30	1	5.6
14	28	18	30	34	-4	6.7
15	30	18	30	24	6	5.6
16	21	13	30	33	-3	9.5
17	39	13	29	20	9	5.0
18	34	14	29	26	3	8.3
19	22	13	29	27	2	9.2
20	47	14	27	23	4	7.7
21	37	13	27	24	3	9.1
22	33	13	26	27	-1	7.0
23	42	21	26	25	1	2.1
24	25	13	25	25	0	10.7
25	30	21	25	25	0	8.0
MEAN	32.08	15.54	28.00	26.38	1.62	7.27
S.D.	7.70	3.18	2.08	3.93	3.52	2.30

DEMOGRAPHIC DATA AND TEST RESULTS FOR SUCCESSFUL GROUP

Subject	Age	Education	Pre-Test Score	Post-Test Score	Difference Score	Temperature Score
22	33	13	26	27	1	7.0
11	21	13	33	43	-10	7.5
5	22	13	38	25	13	7.7
20	47	14	27	23	4	7.7
25	30	21	25	25	0	8.0
4	39	14	41	31	10	8.0
18	34	14	29	26	3	8.3
21	37	13	27	24	3	9.1
19	22	13	29	27	2	9.2
3	26	15	43	23	20	9.4
16	21	13	30	33	-3	9.5
24	25	13	25	25	0	10.7
9	49	20	34	28	6	11.4
MEAN	31.23	15.54	31.31	27.69	3.61	8.86
S.D.	9.64	2.73	6.07	5.45	7.54	1.30

DEMOGRAPHIC DATA AND TEST RESULTS FOR UNSUCCESSFUL GROUP

Subject	Age	Education	Pre-Test Score	Post-Test Score	Difference Score	Temperature Score
23	42	21	26	25	1	2.1
10	42	20	33	25	8	3.5
7	31	19	37	40	-3	3.7
8	35	20	35	36	-1	4.4
12	41	21	32	33	-1	4.6
17	39	13	29	20	9	5.0
2	25	14	46	31	15	5.4
13	31	18	31	30	1	5.6
15	28	18	30	24	6	5.6
1	21	13	52	44	8	5.9
6	22	14	38	33	5	5.9
14	28	18	30	34	-4	6.7
MEAN	32.08	17.42	34.92	31.25	3.66	4.87
S.D.	7.64	3.09	7.50	6.97	7.50	1.28