THE EFFECT OF ELECTROMYOGRAPH FEEDBACK ON THE I-E SCALE SCORES OF COLLEGE STUDENTS

By

PATRICIA RUTH GANT SOHLER

Bachelor of Music
University of Oklahoma
Norman, Oklahoma
1972

Bachelor of Arts
University of Oklahoma
Norman, Oklahoma
1975

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
MASTER OF SCIENCE
May, 1979

THE EFFECT OF ELECTROMYOGRAPH FEEDBACK ON THE I-E SCALE SCORES OF COLLEGE STUDENTS

Thesis Approved:

Kenneth D. Sandvold
Thesis Adviser

Vicki Green

Carl Meyer

Norman N. Durham
Dean of the Graduate College

ACKNOWLEDGMENTS

The author wishes to express her appreciation to her adviser, Dr. Ken Sandvold, for his guidance and assistance. Appreciation is also expressed to Dr. Vicki Green and Dr. Phil Murphy for their invaluable contributions as members of a committee rich with expertise.

Appreciation is extended to my husband, Ted, for his moral and financial support, as well as his grammatical counsel.

Special thanks is expressed to my mother and father, Mr. and Mrs. Robert C. Gant, for their everlasting encouragement.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

STATEMENT OF THE PROBLEM

In their quest for a cure for mental illness, interested individuals have approached this problem from many different angles. Pharmocology, psychotherapy, and psychosurgery have all been applied, with more or less success, to this age-old enigma. Biofeedback is a relatively new phenomenon that has been found to serve as a curative agent for many psychophysiological problems, including migraine headaches, high blood pressure, and many other illnesses. That the full scope of its applicability remains to be determined is reflected by the abundance of individuals dedicated to biofeedback research.

The purpose of this study was to determine if biofeedback can be used to benefit individuals suffering from mental illnesses other than those of a psychophysiological nature. To be more specific, the author hoped to find a method by which one can alter locus of control and level of depression through biofeedback training.

Internal-external locus of control, in the present study, was measured by Rotter's Internal-External (I-E) Scale. This scale has been found to differentiate psychiatric patients from normals. An additional measure of mental health was taken, using the Beck Depression Inventory. This scale was given to obtain a more direct estimate of the therapeutic value of biofeedback for the specific mental illness of depression. Biofeedback training took place through the use of an electromyograph.

CHAPTER II

REVIEW OF THE LITERATURE

Since its conception, locus of control has been deemed a very significant personality variable. Rotter (1966) defined locus of control in this way:

> When a reinforcement is perceived by the subject as following some action of his own but not being entirely contingent upon his action, then, in our culture, it is typically perceived as the result of luck, chance, fate, as under the control of powerful others, or as unpredictable because of the great complexity of the forces surrounding him. When the event is interpreted in this way by an individual, we have labeled this a belief in external control. If the person perceived that the event is contingent upon his own behavior or his relatively permanent characteristics, we have termed this belief in internal control (p. 1).

A large number of research studies have produced evidence linking locus of control to psychopathology. Shybut (1968) noted that psychiatric patients were more externally controlled than normals when tested with the Rotter Internal-External Locus of Control (I-E) Scale. He also found that long-term and severely disturbed patients were significantly more external than short-term, moderately disturbed patients. Supporting these findings is the earlier work of Cromwell, Rosenthal, Shakow, and Zahn (1961), in which schizophrenics were found to be significantly more external than normal subjects.

Palmer (1971) discovered that not only were psychiatric patients more external on Rotter's I-E scale than nonpsychiatric patients, but also that overall competence, as measured by an index derived from educa-

tion, marital status, and occupational level, differentiated the most external from the least external individuals within his sample of psychiatric patients. Lottman and DeWolfe (1972) found the Rotter I-E scale to further differentiate between process and reactive schizophrenics. Process schizophrenics are individuals who have exhibited a lack of competence throughout their lives. In contrast, a reactive schizophrenic has led a generally competent life until confronted with the crisis which precipitated the schizophrenic reaction. Process schizophrenics were found to be significantly more external than their reactive counterparts.

Individuals with mental disturbances less severe than schizophrenia have also been found to be more external than normals. There are several studies linking external locus of control and depression. Abramowitz (1969) reported a positive correlation between externality and reported incidents of depression among college students. Likewise, Calhoun (1974) obtained a positive correlation between externality (as measured by Rotter's I-E) and scores obtained on Zung's Self-Rating Depression Scale in a college student population. Warehime and Woodson (1971) also found externals to acknowledge the experiencing of negative affects, including depressive feelings, more often than internals. Goss and Morosko (1970) found that the I-E scale correlated significantly with the depressiveness subscale of the MMPI among three samples of alcoholic outpatients. Beck's (1967) description of the depressed patient provides a useful rationale for the relationship between externality and depression:

> The depressed patient is peculiarly sensitive to any impediments to his goal-directed activity. An obstacle is regarded as an impossible barrier. Difficulty in dealing with a problem is interpreted as total failure. His cognitive response to a problem or difficulty is likely to be an idea such

> as 'I'm licked,' 'I'll never be able to do this,' or 'I'm blocked no matter what I do. . . .' In achievement-oriented situations depressed patients are particularly prone to react with a sense of failure (256-257).

Harrow and Ferrante (1969) made a closer investigation of locus of control and psychopathology by examining the relationships among locus of control, types of disorders, and length of hospitalization. In general, the less competent patients with greater psychopathology and fewer social skills (which, in this case, tended to include the schizophrenics, younger patients, and, to a slight extent, males) were found to be the most external when administered the Rotter-I-E scale during their first week of hospitalization. The patients were administered the I-E scale a second time, after they had experienced at least six weeks in a hospital which relied heavily on milieu, group, and family treatment and whose staff attempted to foster rapid social-relearning, responsibility for behavior, control of symptoms, and a more independent life adjustment after discharge. The direction of change in locus of control from the first to the second administration varied greatly between schizophrenics and non-schizophrenics. Schizophrenics tended to become more external following six weeks of treatment, while the other patients (with the exception of the manic patients) became more internal. The sample included 29 schizophrenics, 25 depressives, 23 character disorders, 5 manics, and 6 patients described as "others". The shift from internal to external in the manics was explained as a recovery from a locus of control that was too internal (producing inappropriate grandiosity) to a more normal and healthier locus of control. The increasing externality of the schizophrenics was believed to be the result of greater pessimism concerning prognosis for these patients.

Two important questions arise from this demonstration of a relationship between locus of control and psychopathology: Can locus of control be altered; does altering locus of control in the direction more characteristic of the normal population result in improvement of metal health?

Studies of nonpsychiatric populations have shown that behavioral techniques can be used to increase internality. Using first and third graders who had been evaluated by their teachers as being extremely external in their locus of control orientations, Reimanis (1974) found that teachers could cause an apparent increase in these students' internality (as measured by the Battle Scale) by using reinforcement principles to teach them behavior-effect contingencies. Reimanis (1974) also found that he could increase internality in college freshmen through counseling in which the subject was encouraged to talk about himself. His procedure was as follows: each time the subject gave an external response, he was interrupted and asked to answer these questions: Why had he said what he said? and What could he have done to prevent what happened? Thus, the attempt was made to get the subject to use an internal response in place of an external one. The subject was also encouraged to transfer internal control thoughts and verbalizations to future events. Following the above procedure, the experimental groups showed significant increase in Rotter I-E scores; there was no significant change in the scores of the control groups. Toward the end of the counseling sessions, a number of these students also began to behave more internally, by taking their own apartments, changing programs, and seeking out instructors to find out where they stood in a course and what they needed to do in order to get a good grade.

In a third study, Reimanis (1974) found that "high-risk" students

(as determined by examination of their high school GPA and SAT scores) could be trained to think more internally through achievement motivation training sessions patterned after Alschuler's work. Both high-risk and regular students were found to obtain significantly higher internal scores (using Rotter's I-E scale) following achievement motivation training, while there were no significant changes for the control groups. Seven months after the training, most male students in the experimental group continued to show a significant increment in I-E scores, while the increase in internality had disappeared in most of the female subjects. This sex difference was interpreted by Reimanis to be a function of the greater pressure placed on males to succeed in our society. Thus, it was felt that the males would feel more pressed to maintain the effect of the training that made achieving success more likely, than would the less-pressured females.

An increment in the direction of internality was also found to occur in male alcoholics following a six-week hospitalization, in which treatment consisted mainly of group therapy in which the staff stressed the importance of taking responsibility for making one's own life changes (O'Leary et al., 1975).

Eitzen (1974) found that he could alter the locus of control of male juvenile delinquents by using a token economy program. Before entering the token economy program, the delinquents were more external than a control group of junior high school boys. Nine months after the program began, the delinquents had achieved a significant increase in the direction of internality and were more internal than the control group. Lesyk (1968) achieved similar results using token economy with schizophrenic women. Following the token economy program, these schizophrenics

exhibited an increase in internality as well as an increase in positive, adaptive behavior. Furthermore, the subjects showing the greatest amount of behavioral improvement also exhibited the greatest increase in internality.

Many researchers have attempted to define the relationship between personality variables such as locus of control and the effects of biofeedback training. Fotopoulos (1970) found a significant difference between internals and externals in the ability to increase heart rate. Both with and without feedback, internals could increase their heart rates, while externals could only do so when given external reinforcement. Fotopoulos postulated that internals had not only learned to be responsible for their overt actions, but had also learned to control their physiological responses and perhaps even disease processes. Ray (1971), however, discovered that the relationship between locus of control and physiological self-control was much more complex than Fotopoulos predicted. He found that, with biofeedback training, internals were indeed more capable of increasing their heart rates than externals. However, externals were better able to decrease their heart rates than were internals. There was also a difference in the kind of heart-rate controlling strategies used by the two groups. Externals reported spending significantly more time "looking at objects in the room" than did internals. There was a significant negative correlation between the ability to increase one's heart rate and the previously mentioned reported strategy. There was also a significant positive correlation between this strategy and the ability to decrease heart rate. This supports the findings of Porges and Raskin (1969) that internal observations were associated with heart rate accelerations and external observations were

associated with heart rate decelerations.

Like Fotopoulos, Greer (1974) found support for the idea that internals were better able to control physiological responses. With EEG biofeedback, internal subjects demonstrated a significantly superior ability to increase percent-time alpha than the external subjects. The internal subjects were also significantly less anxious that the externals, according to their responses to a post-experimental questionnaire. Greer interpreted these differences as an indication that internals are "better able to adapt to the demands of complex situations." Dolecki (1975) also investigated the relationship between locus of control and the effects of EEG alpha feedback training but found no significant percent-time alpha differences between internals and externals. His measurement of changes on the State-Trait Anxiety Inventory between pre- and post-training situations for the treated (alpha feedback) and non-treated groups also produced no significant results.

In a similar vein, Armenia (1975) used skin conductance and non-specific electrodermal responses, as well as post-experimental responses to the Multiple Affect Adjective Check List, to measure the physiological responses of internals and externals to stress. These measures were made following the presentation of slides depicting people who had died violently. The results provided little support for the contention that internals are better able to control physiological responses aroused by stress than externals. The male internals did, however, report the least discomfort when presented with the noxious slides.

Grauke's (1973) following series of findings reveal an even more complicated relationship between locus of control and the effect of alpha rhythm feedback: (1) Those on either extreme of the I-E scale took

significantly longer to achieve criterion levels of alpha than did more moderate subjects. (2) Those subjects with the least anxiety and the greatest ego strength (according to pre-training administration of the Manifest Anxiety Scale (MAS) and the Sixteen Personality Factor Questionnaire (16PF)) had the highest percent of initial alpha rhythms. (3) Those subjects rated as external on the post-training administration of the Rotter I-E had more alpha percent on the last session and less learning variability. (4) The only significant difference between the expermental (biofeedback trained) group and the control group occurred in their responses to the MAS, which indicated that the experimental group evidenced less anxiety than the control group. This effect, however, was not confirmed by a significant difference on the secondary anxiety factor of the 16PF. In addition, there were no significant differences in post-training I-E scores between the control and experimental groups. Grauke concluded that the effects of learning to produce alpha rhythms did not cause a general change in anxiety, ego-strength, or locus of control. He also postulated that anxiety might be only a peripheral factor in alpha rhythm control. He suggested neuromuscular feedback as an alternative technique for future research, since anxiety might be more related to muscle relaxation than to alpha wave production.

Two other researchers explored the relationship between locus of control and EMG feedback. Vogt (1975) found no significant differences in the abilities of internals and externals to learn muscle control. Using subjects participating in an alcoholic treatment program, Parent (1975) found that external and internal alcoholics reacted differently to false negative feedback about muscle control success. Negative verbal feedback had a "deteriorative influence" on internals, and an "enhancing

effect" on external alcoholics. This "deteriorative influence" was detected through EMG readings which indicated a decrease in muscle control. However, he deemed his samples too small to be judged adequately by statistical analyses. Therefore, his results can be viewed only as suggestive.

Pines and Julian (1972) presented one possible explanation of those findings which indicated externals could outperform internals in biofeedback training tasks. These researchers perceived internals and externals as equally concerned about control, but responding differently to to task and social demands. Pines and Julian described the learning to control alpha rhythms through biofeedback as a task that requires the production of something that has to be allowed to come of its own accord. They postulated that this passive-volition approach should be harder for internals than externals due to their respective locus of control orientations.

In spite of the contradictory and often discouraging findings, it is possible to see glimmers of hope in those few studies that found biofeedback to be of some benefit in producing changes such as increased self-control, as well as to enhance self-esteem and self-confidence. Subjects participating in a biofeedback training program offered by Danskin and Walters (1975) received training in both EMG feedback and finger skin temperature feedback. Their subjective reports included such statements as: "I have learned . . . that I have a potential for self-control, both physical and emotional" and "In general, (I have) more confidence in the ability to control internal states of mind." Johnson and Meyer (1974) found that three 40 minute training sessions using EEG alpha rhythm feedback did not increase internality for those who were

able to master the control of their alpha. However, it is notable that for those subjects that were unable to learn control, there was a significant increase in externality. Johnson and Meyer also found that subjects who had an internal locus of control prior to the alpha training were better able to use feedback to increase their alpha activity than were external subjects. One possible interpretation of these data is that those who did learn control were already so internal that the training could produce little change in their locus of control, while those who were externals were not given enough training to allow them success in alpha control.

In spite of the documented utility of locus of control as a mental health indicator, an additional measure of mental health, in the form of the Beck Depression Inventory (DI) was included in this research study. (Refer to Appendix A for a copy of this inventory.) The Beck Depression Inventory (1961) is a useful tool for assessing objectively the existence and depth of depression. When compared with subjective clinical assessment of depression, the DI has the advantage of quick administration and no dependence on the skill or clinical bias of the rater. It is usually completed by the subject within ten minutes and can be scored in one or two minutes.

The DI has the additional advantage of having been well researched in terms of validity and reliability. Beck (1961) used a large sample of American psychiatric patients to test the validity and reliability of the DI. Four experienced psychiatrists functioned as diagnosticians for the study. These psychiatrists judged each patient as either depressed or non-depressed. Each patient deemed depressed was also rated according to the depth of depression. These clinical judgements had a high

positive correlation with the DI scores, indicating a high degree of validity for the DI. Studies of the internal consistency and stability of the instrument also indicated a high degree of reliability. The DI has been found to discriminate effectively among patients with varying degrees of depression. It is able to detect changes in the depth of depression after an interval of time. With the interval separating test administrations ranging from two to five weeks, change in DI scores reflected the change in the depth of depression noted by the evaluating psychiatrists.

Metcalfe and Goldman (1965) repeated Beck's method of validating the DI. Using a sample of English psychiatric patients, these researchers compared DI scores to the clinical assessments made by each patient's psychiatrist. The results of this study agreed with those of the original validation. Furthermore, an analysis of their data revealed that age, intelligence and sex had no significant effect on DI scores.

The current study was an attempt to replicate in part the research by Johnson and Meyer (1974). Because there was a change in locus of control following biofeedback training, albeit in the undesired direction, in those subjects who failed to increase their alpha production, the existence of some link between success in physiological self-control and locus of control seemed possible. In light of Grauke's postulation that anxiety may be more related to neuromuscular control than to alpha rhythm control, EMG feedback was incorporated into the training procedure. The present study also used the number and duration of training periods found by Coursey (1975) to produce success in learning physiological control. Coursey's experimental group received eight 21-minute biofeedback training sessions, with at least one day separating each session. This

methodology was adopted in an effort to avoid the undesirable effects from failure to achieve control found by Johnson and Meyer (1974); that is, an increase in externality. And finally, since the main purpose of this study was to attempt to make external subjects more internal, subjects who were found to be extremely internal based on a pre-training administration of Rotter's I-E were omitted from the study.

Hypotheses to be tested were the following: (1) EMG biofeedback would produce an increase in internality exhibited by a lowered score on Rotter's I-E scale, (2) Biofeedback would produce a decrease in depression exhibited by a lowered score on Beck's DI, (3) Those subjects in the experimental group who achieved the most success in learning physiological control would have the greatest increases in internality (exhibited by the greatest decreases in I-E scores) and the greatest decreases in depression (exhibited by the greatest decreases in DI scores). Success in learning control of muscle tension was assessed in terms of the mean difference between pre-biofeedback training EMG levels and all subsequent EMG levels recorded during the eight biofeedback sessions, with eight EMG readings per session. Those subjects with the greatest mean differences were deemed the most successful, (4) I-E and DI scores would be positively correlated for both experimental and control groups and in both pre- and post-training administrations of these scales.

CHAPTER III

METHOD

Subjects

Thirty-seven students, ranging in age from 18 to 35, volunteered to be participants in this experiment. This group consisted of 24 females and 13 males solicited from six different undergraduate classes offered during a summer session at Oklahoma State University. The opportunity to experience biofeedback training after the completion of the experiment was used as an incentive to the potential subjects. One of the classes' professors also offered bonus points to be added to the students test scores for research participation.

The Rotter I-E scale (Appendix B) was administered to the 37 volunteers in groups of from one to eight individuals. Copies of the scale and answer sheets were distributed, and a modification of Rotter's (1966) standard instructions was read. (Refer to Appendix C for a copy of these instructions.)

Subjects were chosen according to their scores on the I-E scale. Those 24 volunteers (18 females and 6 males) who obtained the highest scores of externality were asked to return for further research participation. These subjects were not informed that they were chosen because of their I-E scores. Of these 24 who were asked to return, two subjects asked to be released from their obligations as subjects before the train-

ing sessions began. Three other subjects were omitted because their comprehension of the English language was deemed insufficient to understand the DI and I-E scale items. These were international students to whom English was apparently a second language. One other subject left the university before the study was completed. Thus, only 18 of the 24 subjects originally selected completed the experiment.

Instruments

As was previously stated, the Rotter Internal-External (I-E) scale (Rotter, 1966) was used to identify external students in the first phase of the experiment. This is a 29-item forced choice scale with six buffer items intended to obfuscate the purpose of the test. The 23 critical items attempt to measure to what degree the subject perceives events in his life as a consequence of his own actions, or as a phenomenon beyond his own personal control. The score is the total number of external choices. Thus, possible scores range from 0 (internal) to 23 (external).

A second instrument, the Beck Depression Inventory (Appendix A), was administered only to those subjects participating in the second or training phase of the experiment. The DI is based on Beck's clinical observations and records of the characteristic attitudes and symptoms of depressed patients. He selected a group of attitudes and symptoms which appeared to be specific for depressed patients and which were consistent with the descriptions of depression contained in the psychiatric literature. From these selections he developed a list of descriptive statements related to characteristic aspects of depression (e.g., pessimism, sense of failure, social withdrawal, etc.). For each characteristic symptom there is a "category" of statements in the first person.

These range from mild or neutral statements to one indicating a severe form of the symptom. Each statement is assigned a score of 0, 1, 2, or 3 to indicate the symptom's severity. In some categories, two statements receive the same score.

Variables

The independent variable was the administration of biofeedback training. Half of the subjects (the experimental group) received training, while the other half (the control group) received identical treatment (EMG electrode attachment and monitoring) without training. In the control group, the aural feedback was replaced by recordings of classical music.

The dependent measures were:

1. Scores on the Rotter I-E scale (I-E)
2. Scores on the Beck Depression Inventory (DI)
3. Amount of pre- to post-training decrease in scores on the Rotter I-E (I-Ed)
4. Amount or pre- to post-training decrease in scores on the Beck Depression Inventory (DId)
5. Mean differences between pre-biofeedback training EMG levels and all subsequent EMG levels measured during the biofeedback training sessions (EMGMd)

Apparatus

Electromyographic (EMG) measures were recorded from an Autogen 1700 Feedback Myograph using standard frontalis placements two inches on either side of center forehead and one inch above each eyebrow. Midway

between the other electrodes, a ground electrode was placed upon the forehead. Those subjects in the experimental group received auditory feedback of continuous muscular tension through headphones connected to the autogen unit. The feedback was in the form of clicks which were logarithmically proportional to the level of EMG activity being monitored.

Pre-training DI Administration

The DI was administered to each subject individually. The subject was informed that any information given while answering the scale would be held in strict confidentiality by the experimenter. Each subject was then read the standard instructions for administration of the Beck Depression Inventory (Beck, 1967) (Appendix D).

Biofeedback Training Procedure

An equal number of subjects (two males and seven females) were randomly assigned to an experimental and a control group. Those in the experimental group participated in eight one-half hour sessions of biofeedback training. During each session, subjects were seated in a comfortable chair and asked to relax with legs and arms uncrossed. EMG electrodes were attached at the standard frontalis placements. The subject was asked to sit quietly while the baseline was recorded. Levels of muscle tension in microvolts were recorded from the frontalis muscle. The earphones were then placed on the subject's head at which time the tape recorded instructions were begun. These instructions were an adaptation of those used by McSwain (1978). (Refer to Appendix E for a copy of these instructions.) After the instructions were given, the input to

to the earphones was switched to the Autogen 1700 Feedback Myograph. Each subject received 21 minutes of continuous biofeedback.

The control group also attended eight one-half hour sessions. These subjects were seated in a comfortable chair and asked to relax with legs and arms uncrossed, and EMG electrodes were attached at the standard frontalis placements. The subject was asked to sit quietly while the baseline was recorded. Levels of muscle tension in microvolts were recorded from the frontalis muscles. The earphones were then placed on the subject's head at which time the tape recorded instructions were begun. (Refer to Appendix F for a copy of these instructions.) After the instructions were played, the input to the earphones was switched to recordings of Brahm's Symphonies Numbers 1, 3, and 4 and the Brahm's Violin Concerto. A different part of these recordings was heard by the subject at each session.

For both experimental and control groups, the experimenter monitored one physiological measure for the subjects in the sessions. She used the Autogen 5100 Digital Integrator during the first two minutes of each trial to reflect the average integral amplitude of the EMG level in microvolts. The 5100 integrator combines the frontalis EMG signals and, thus, reflects the average level of muscle tension over a two-minute period. The sessions were scheduled over a four-week period, with at least one day intervening between each session.

Immediately following each subject's last session, the Rotter I-E scale was again administered. Those instructions used in the pre-training administration were again read, and the subject recorded his/her responses on an answer sheet. The subject was then readministered Beck's DI, following a reminder of the confidentiality of his/her an-

swers and a reading of the standard instructions. Subjects were then asked to read and answer three additional questions pertaining to their experiences as subjects. (Refer to Appendix G for a copy of these questions.) Each subject was then scheduled for a debriefing session.

CHAPTER IV

RESULTS

Descriptive Statistics

The means, standard deviations and ranges for six key variables are presented in Table I. These include the pretraining I-E scores for both (1) the group of 34 original volunteers (four subjects considered too deficient in English comprehension are omitted) and (2) the final group of 18 subjects completing the experiment. The range of the final group of subjects extends only 1.33 points below the average mark (10.33) for the initial group. Thus, the extremely internal subjects have been excluded. The upper range of the final group declined from the original group's 18 to 17; the highest scorer in the original group decided not to complete the experiment.

Two other key variables, (3) EMGMd (mean differences between pretraining EMG levels and all subsequent EMG levels measured during the sessions) for experimental subjects and (4) EMGMd for control subjects, reflected the amount of tension reduction during the sessions. Two of the experimental subjects produced negative EMGMd's; that is, they were unable to utilize the biofeedback training to lower their EMG levels, and actually appeared to be more tense throughout most of the training sessions than during the initial EMG baseline readings. The large standard deviation for the experimental group EMGMd indicates that the

TABLE I

RANGES, MEANS AND STANDARD DEVIATIONS
FOR SIX KEY VARIABLES

Variable	N	Range	Mean	S.D.
Pre-training I-E for original group (excluding 4 English deficient subjects)	33	2 - 18	10.33	4.05
Pre-training I-E for final group of subjects	18	9 - 17	12.39	2.23
EMGMd for experimental subjects	9	-57.86 - 157.90	63.74	76.80
EMGMd for control subjects	9	-91.13 - 142.56	34.99	96.12
EMG baselines for experimental subjects	9	159 - 364	259.44	64.66
EMG baselines for control subjects	9	111 - 476	272.00	122.99

N = number of subjects in the sample

S.D. = standard deviation

I-E = scores on the Rotter Internal-External Scale

EMGMd = the mean difference between pre-biofeedback training and pre-classical music session EMG levels and all subsequent EMG levels measured during the biofeedback and classical music sessions (in microvolts per second)

EMG baselines = electromyograph measures of tension taken prior to the onset of feedback or classical music (in microvolts per second)

potential of subjects to learn physiological control varied greatly. Some of this variability is no doubt a reflection of the wide range and large standard deviation of the initial EMG baselines. These last two variables listed on Table I, (5) EMG baselines for experimental subjects and (6) EMG baselines for control subjects, had a high positive correlation ($r = .92$) with EMGMd for all subjects.

The control group also had a positive mean and a large standard deviation for EMGMd (the mean differences between EMG levels measured prior to the inception of the classical music sessions and all subsequent EMG levels recorded during the sessions). The positive mean EMGMd indicates that even the control subjects became more relaxed. In fact, there was no significant difference between the mean EMGMd's for each group. Aside from the obvious explanation of habituation to a novel situation, there may have been other factors which contributed to the tension reduction in the control subjects. One factor might be the soothing nature of Brahms' music, which is considered by many to be a relaxing listening experience. The subjective reports of several control subjects gave credence to the notion that the control group's positive mean EMGMd was more than just a reflection of habituation. In response to the three additional post-training questions concerning their experience as subjects, one control group subject reported she felt more relaxed after the sessions. Another reported she tried to find more time to relax in the evenings and a third stated that she found herself looking forward to the session because of the chance it gave her to relax. A fourth subject reported that she felt sleepy following the sessions, and that now, even outside the lab, classical music made her sleepy. Periodically during the sessions, it was necessary to

gently nudge awake subjects in both groups who were prone to fall asleep.

Six of the experimental subjects indicated that training did affect them outside the laboratory. One student used the techniques she had learned during training to help her get to sleep; another found it easier to concentrate. Two other subjects tried to relax outside the sessions using their newly acquired methods of relaxation but were unsure as to their success. Another student reported that she felt better immediately following the sessions, and a sixth stated that the experience had simply increased her interest in biofeedback. The general feeling in both groups toward the experiment was positive.

Hypotheses

The first hypothesis tested was: EMG biofeedback would produce an increase in internality exhibited by a lowered score on the Rotter I-E scale. The effect of biofeedback training was assessed by using a t-test. Experimental and control groups were compared in terms of amount of decrease in scores occurring between pre- and post-training administrations of the I-E. The results of the t-test were in the predicted direction but did not reach the .05 level of significance. (Refer to Table II for a summary of the means and standard deviations.) Thus, the findings failed to support the prediction that EMG feedback would increase internality.

The second hypothesis tested was: EMG biofeedback would produce a decrease in depression exhibited by a lowered score on the Beck Depression Inventory (DI). Again, the effect of biofeedback was assessed using a t-test to compare experimental and control groups. This analysis was computed in terms of the amount of decrease in scores occurring between

TABLE II

COMPARISON OF PRE- AND POST-TRAINING
I-E SCORES USING A T-TEST

	I-E				I-Ed	
	Pre-training		Post-training			
Group	Mean	S.D.	Mean	S.D.	Mean	S.D.
Experimental	12.11	2.37	10.00	3.00	2.11	4.68
Control	12.67	2.18	11.89	1.90	0.78	3.81
N=18					T = 0.67	

N = number of subjects in the sample

S.D. = standard deviation

I-E = scores on the Rotter Internal-External Scale

I-Ed = amount of pre- to post-training decrease in scores on the Rotter I-E

pre- and post-training administrations of the DI. And again, the results were in the predicted direction, but non-significant. (Refer to Table III for a summary of the means and standard deviations.) Thus, the prediction that EMG feedback would reduce depression also failed to be supported.

The third hypothesis was: Those subjects in the experimental group who achieved the most success in learning physiological control would have the greatest increases in internality (exhibited by the greatest decreases in I-E scores) and the greatest decreases in depression (exhibited by the greatest decreases in DI scores). Success in learning control was assessed in terms of the mean difference between pre-biofeedback training EMG levels and all 63 subsequent EMG levels measured during the training procedure. Those subjects with the greatest mean differences (EMGMd) were considered the most successful. The Pearson Product Moment Correlation was used to assess the relationship between each subject's reduction in tension level (EMGMd) and his/her I-E decrease (I-Ed). The correlation was found to be in the predicted direction (positive) but was non-significant ($r = .39$). Thus, a prediction that the most successful learners of tension control would exhibit the greatest decreases in externality failed to be supported. Another Pearson Product Moment Correlation was computed to assess the relationship between EMGMd and DI score decrease (DId). This correlation was nearly zero ($r = -.10$) and did not support the hypothesis, which predicted a positive correlation between these two variables. This finding indicated a lack of support for the prediction that successful learning of physiological control would correlate positively with a decrease in depression.

The fourth hypothesis stated: I-E and DI scores would be positively

TABLE III

COMPARISON OF PRE- AND POST-TRAINING
DI SCORES USING A T-TEST

	DI				DId	
	Pre-training		Post-training			
Group	Mean	S.D.	Mean	S.D.	Mean	S.D.
Experimental	12	8.65	8.11	6.96	3.89	4.91
Control	9.33	3.81	6.44	3.09	2.89	2.94

N = 18 t = .53

N = number of subjects in the sample

S.D. = standard deviation

DI = scores on the Beck Depression Inventory

DId = amount of pre- to post-training decrease in scores on the DI

correlated for each subject across groups and across pre- and post-training administrations. A result very close to zero ($r = .027$) was found using the Pearson Product Moment Correlation. Thus, this hypothesis was also not supported by the data obtained in this study. Contrary to other studies which indicated a significant correlation between locus of control and depression, the indication of the findings of the current study is that, at least for college populations, there is no significant relationship between the Rotter I-E and the Beck DI.

Additional Analyses

Pearson Product Moment Correlations were used to assess the relationships between the initial EMG baselines and the pre-training I-E and DI scores. A positive correlation ($r = .39$), significant at the .10 level, was found to exist between the baselines and the pre-training I-E scores of the total group of subjects. The correlation between the baselines and the DI scores was nonsignificant ($r = -0.14$). An additional Pearson Product Moment Correlation for the pre-training I-E and the pre-training DI scores exhibited a slightly negative but non-significant correlation ($r = -.158$) between these two variables.

Another Pearson Product Moment Correlation revealed a high positive correlation ($r = .92$, significant at the .001 level) between initial EMG baselines and EMGMd. This high correlation indicated that an analysis of covariance might disclose a significant difference between group EMGMd means. By removing the effect of EMG baselines, the variance could possibly be reduced to the extent that the difference between groups would become significant. In a post hoc analysis of covariance using EMG baseline as a covariate, however, the difference between groups remained non-

significant (F = .069). Furthermore, the assumption that the regression coefficient is constant within each of the treatment populations could not be met, casting doubt as to the validity of this analysis.

CHAPTER V

DISCUSSION

Hypothesis one predicted that EMG feedback would produce an increase in internality exhibited by a lowered score on Rotter's I-E scale. The results were in the expected direction but were non-significant. Based on the results, one could conclude that biofeedback has no effect on locus of control. There could, however, be several other interpretations of the results. One possible interpretation is rooted in the conception of locus of control presented by Pines and Julian (1972). (Refer to Chapter II for a synopsis of their theory.) According to these researchers, the passive-volition approach they attribute to the external individual should facilitate the learning of tension control through EMG feedback training. In fact, a non-significant Spearman correlation of $r = .423$ exists between the pre-training I-E scores and the success in tension reduction rankings of the experimental subjects. In other words, external subjects had a greater reduction of tension during feedback training than did internal subjects.

Following this line of thought, it seems reasonable that success in learning to reduce tension through EMG feedback training would reinforce an external locus of control rather than the internal locus of control previously postulated in hypothesis one. The results of a Pearson Product Moment Correlation utilized for hypothesis three tends to refute this interpretation, however. The results indicated a positive, although

non-significant, correlation (r = .30) between success at learning physiological control and decreased externality. Thus, those who benefited most from EMG feedback training tended to adopt a more internal locus of control. Apparently the fact that initially more external subjects benefited most from training may simply be a reflection of two other correlations: one that exists between initial EMG baselines and tension reduction (r = .92, significant at the .001 level), and another that exists between pre-training I-E scores and initial baselines (r = .39, significant at the .10 level). That is, external subjects tended to be more tense at the beginning of the experiment, and, thus, had more room for improvement in terms of tension reduction. A higher initial tension level gives the external subject a greater chance of showing success as calculated in this study (average difference between tension level at the beginning of the experiment and all other tension levels recorded during the experiment).

A second interpretation of the results is that the effect of EMG feedback was obscured by an unexpected effect produced in the control group. It is notable that there was no significant difference in EMGMD's for experimental and control groups. The control group became more relaxed during the sessions, according to the EMG recordings of their tension levels. Some of the control subjects reported feelings of relaxation during and after their sessions. Even an analysis of covariance, designed to remove the effect of baselines, did not produce a significant result. It is possible that the control group was receiving some kind of effect from their treatment which caused a marginal increase in internality, thus decreasing the differences between the two groups. The control group did become slightly more internal between pre- and post-training

I-E administrations. However, even if the mean I-E for the controls had not increased, the difference between the two groups would not have been significant. Nevertheless, a method of dealing with the control group which does not include listening to classical music or other relaxing events might be of benefit in future research.

A third and more logical interpretation is that the procedure used to teach tension reduction was not sufficiently effective to produce a change in locus of control large enough to be detected with the sample size of this study. The large variation in ability to learn control seems to have contributed to the non-significance of the effect. In addition to a larger sample size, shaping procedures could be used to increase the success in tension reduction achieved by the subjects. Other procedures often used in conjunction with biofeedback training in clinical settings, such as autogenic training, could also be utilized to increase subjects' success.

The second hypothesis, that EMG feedback would produce a decrease in depression as measured by the Beck Depression Inventory, also failed to be supported by this study's results. There was not a significant difference between the two groups in terms of pre- to post-training depression score changes. Both groups showed some decrease in depression, however. The experimental group had a slightly greater mean decrease than the control group, although the difference did not reach the desired level of significance.

One explanation of the lack of significant results is that the population sampled did not manifest enough depression before training to show a treatment effect. The mean pre-training depression score (10.67) is almost one standard deviation below the mean score of those subjects

judged to have mild depression in Beck's original validation study for the DI (Beck et al., 1961). Those subjects exhibiting severe depression in Beck's study obtained scores which had a mean two standard deviations above the sample mean in the current study. It is quite possible that, were the current experiment repeated with a mildly to severely depressed sample, EMG feedback training could produce a significant decrease in DI scores.

The third hypothesis predicted that those experimental subjects who achieved the greatest success in tension reduction would also exhibit the greatest increases in internality and the greatest decreases in depression. The correlation between tension reduction (EMGMd) and increased internality (I-Ed) was non-significant ($r = .39$). Again, the correlation was in the predicted direction but not large enough to be considered significant, given the size of the sample. A larger sample and a procedure with the previously mentioned additions of shaping and autogenic training could produce a significant effect.

The correlation between tension reduction and depression decrease was nearly zero and in a direction opposite to that predicted ($r = -.10$). As was mentioned previously, this may be due to the lack of measurable depression in the population sampled. With a psychiatric population, the initial depression of most of the subjects would be expected to be much greater, presenting the possibility for a more radical decrease in DI scores.

In spite of the findings of many studies which indicated a positive correlation between externality and depression, the correlation between the I-E scores and DI scores of the subjects in this study was nearly zero ($r = .027$). Again, the restriction of the range of scores, this

time in I-E scores as well as DI scores, is certainly a factor in the inability of this study to produce results which would support this last hypothesis. The most internal subjects were systematically eliminated in the initial phase of the experiment; thus, the bottom half of the I-E range was not included in this correlation. The range of DI scores was likewise restricted by the lack of clinically depressed subjects.

In short, the results of this study suggest the need for further research in this area. The lack of a significant difference between the experimental and control groups in terms of tension reduction (EMGMd, the mean difference between initial tension level and tension levels recorded during the rest of the experiment) suggests that a fair test of the hypotheses has not yet been made. With the suggested changes in procedure (an increase in sample size, the addition of shaping and autogenic training, and the exclusion of classical music and other relaxing procedures for the control group), a change in locus of control towards internality may be detectable. The question of whether or not a change in locus of control through EMG feedback training can produce a decrease in depression also remains unanswered. The use of a different depression inventory with the college student population or the same inventory with a different population (e.g. psychiatric patients) might lead to a significant correlation between I-E and depression. The findings of other researchers which have linked externality and depression lend credence to such a notion.

BIBLIOGRAPHY

Abramowitz, S. I. Locus of control and self-reported depression among college students. Psychological Reports, 1968, 25, 149-150.

Armenia, J. An investigation of the effects of locus of control on stress behavior. Dissertation Abstracts International, 1975, 36 (3-B), 1424.

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., and Erbaugh, J. An inventory for measuring depression. Archieves of General Psychiatry, 1961, 4, 53-63.

Beck, A. T. Depression: Clinical, Experimental and Theoretical Aspects. New York: Harper and Row, 1967.

Calhoun, L. G., Cheney, T., and Dawes, A. S. Locus of control, self-reported depression, and perceived causes of depression. Journal of Consulting and Clinical Psychology, 1974, 42, 736.

Coursey, R. D. Electromyograph feedback as a relaxation technique. Journal of Consulting and Clinical Psychology, 1975, 43, 825-834.

Cromwell, R., Rosenthal, D., Shakow, D., and Zahn, T. Reaction time, locus of control, choice behavior, and descriptions of parental behavior in schizophrenic and normal subjects. Journal of Personality, 1961, 29, 363-380.

Danskin, D. G., and Walters, E. D. Biofeedback training as counseling. Counseling and Values, 1975, 19, 116-121.

Dolecki, L. S. The effects of alpha feedback training on anxiety in internally and externally controlled female students. Dissertation Abstracts International, 1975, 36 (9-B), 4724-4725.

Eitzen, D. S. Impact of behavior modification techniques on locus of control of delinquent boys. Psychological Reports, 1974, 35, 1317-1318.

Fotopoulos, S. Internal versus external control: increase of heart rate by thinking under feedback and no feedback conditions. Dissertation Abstracts International, 1970, 31B, 3703-3704.

Goss, A., and Morosko, T. E. Relation between a dimension of internal-external control and MMPI with an alcoholic population. Journal of Consulting and Clinical Psychology, 1970, 34, 189-192.

Grauke, C. E. The relationship between conditioned alpha rhythm and psychological variables. Dissertation Abstracts International, 1973, 34B, 4662-4663.

Greer, W. F. The relationship of locus of control and baseline abundance to the autoregulation of the human alpha rhythm. Dissertation Abstracts International, 1975, 36 (2-B), 941-942.

Harrow, M., and Ferrante, A. Locus of control in psychiatric patients. Journal of Consulting and Clinical Psychology, 1969, 33, 582-589.

Johnson, R. K., and Meyer, R. G. The locus of control construct in EEG alpha rhythm feedback. Journal of Consulting and Clinical Psychology, 1974, 42, 913.

Lesyk, J. J. Effects of intensive operant conditioning on belief in personal control in schizophrenic women. Dissertation Abstracts International, 1969, 29 (12-B), 4849.

Lottman, T., and DeWolfe, A. Internal versus external control in reactive and process schizophrenia. Journal of Consulting and Clinical Psychology, 1972, 39, 344.

McSwain, N. Double blind investigation of cognitive factors in muscular biofeedback. Unpublished doctoral dissertation, Oklahoma State University, 1978.

Metcalfe, M., and Goldman, E. Validation of an inventory for measuring depression. British Journal of Psychiatry, 1965, 111, 240-242.

O'Leary, M. R., Donovan, D. M., Cysewski, B., and Chaney, E. F. Perceived locus of control, experienced control, and depression: a trait description of the learned helplessness model of depression. Journal of Clinical Psychology, 1977, 33, 164-168.

Palmer, R. D. Parental perception and perceived locus of control in psychopathology. Journal of Personality, 1971, 39, 420-431.

Parent, N. R. Investigation of locus of control utilizing biofeedback techniques and two types of feedback. Dissertation Abstracts International, 1975, 36 (3-B), 1450-1451.

Pines, H. A., and Julian, J. W. Effects of task and social demands of locus of control differences in information processing. Journal of Personality, 1972, 40, 407-416.

Porges, S., and Raskin, D. Respiration and heart rate components of attentive observation to external and internal stimuli. Journal of Experimental Psychology, 1969, 81, 497-503.

Ray, W. J. The relationship of locus of control, self-report measures, and feedback to the voluntary control of heart rate. Biofeedback and Self-Control, 1974, 203-211.

Reimanis, G. Effects of locus of reinforcement control modification procedures in early graders and college students. Journal of Educational Research, 1974, 68, 124-127.

Rotter, J. B. Generalized expectancies for internal versus external control of reinforcement. Psychological Monographs, 1966, 80 (Whole No. 609), 1-28.

Shybut, J. Time perspective, internal versus external control and severity of psychological disturbance. Journal of Clinical Psychology, 1968, 24, 312-315.

Vogt, A. T. Electromyograph responses and performance success estimates as a function of internal - external control. Perceptual and Motor Skills, 1975, 41, 977-978.

Warehime, R. G., and Woodson, S. Locus of control and immediate affect states. Journal of Clinical Psychology, 1971, 27, 443-444.

APPENDIXES

APPENDIX A

BECK DEPRESSION INVENTORY

QUESTIONNAIRE

A.
- 0 I do not feel sad
- 1 I feel blue or sad
- 2a I am blue or sad all the time and I can't snap out of it
- 2b I am so sad or unhappy that it is quite painful
- 3 I am so sad or unhappy that I can't stand it

B.
- 0 I am not particularly pessimistic or discouraged about the future
- 1 I feel discouraged about the future
- 2a I feel I have nothing to look forward to
- 2b I feel that I won't ever get over my troubles
- 3 I feel that the future is hopeless and that things cannot improve

C.
- 0 I do not feel like a failure
- 1 I feel I have failed more than the average person
- 2a I feel I have accomplished very little that is worthwhile or that means anything
- 2b As I look back on my life all I can see is a lot of failures
- 3 I feel I am a complete failure as a person (parent, husband, wife)

D.
- 0 I am not particularly dissatisfied
- 1a I feel bored most of the time
- 1b I don't enjoy things the way I used to
- 2 I don't get satisfaction out of anything any more
- 3 I am dissatisfied with everything

E.
- 0 I don't feel particularly guilty
- 1 I feel bad or unworthy a good part of the time
- 2a I feel quite guilty
- 2b I feel bad or unworthy practically all the time now
- 3 I feel as though I am very bad or worthless

F.
- 0 I don't feel I am being punished
- 1 I have a feeling that something bad may happen to me
- 2 I feel I am being punished or will be punished
- 3a I feel I deserve to be punished
- 3b I want to be punished

G.

0 I don't feel disappointed in myself
1a I am disappointed in myself
1b I don't like myself
2 I am disgusted with myself
3 I hate myself

H.

0 I don't feel I am any worse than anybody else
2a I am critical of myself for my weaknesses or mistakes
2b I blame myself for my faults
3 I blame myself for everything bad that happens

I.

0 I don't have any thoughts of harming myself
1 I have thoughts of harming myself but I would not carry them out
2a I feel I would be better off dead
2b I feel my family would be better off if I were dead
3a I have definite plans about committing suicide
3b I would kill myself if I could

J.

0 I don't cry any more than usual
1 I cry more now than I used to
2 I cry all the time now. I can't stop it
3 I used to be able to cry but now I can't cry at all even though I want to

K.

0 I am no more irritated now than I ever am
1 I get annoyed or irritated more easily than I used to
2 I feel irritated all the time
3 I don't get irritated at all at the things that used to irritate me

L.

0 I have not lost interest in other people
1 I am less interested in other people now than I used to be
2 I have lost most of my interest in other people and have little feeling for them
3 I have lost all my interest in other people and don't care about them at all

M.

0 I make decisions about as well as ever
1 I try to put off making decisions
2 I have great difficulty in making decisions
3 I can't make any decisions at all any more

N.

0 I don't feel I look any worse than I used to
1 I am worried that I am looking old or unattractive
2 I feel that there are permanent changes in my appearance and they make me look unattractive
3 I feel that I am ugly or repulsive looking

O.

0 I can work about as well as before
1a It takes extra effort to get started at doing something
1b I don't work as well as I used to
2 I have to push myself very hard to do anything
3 I can't do any work at all

P.

0 I can't sleep as well as usual
1 I wake up more tired in the morning than I used to
2 I wake up 1-2 hours earlier than usual and find it hard to get back to sleep
3 I wake up early every day and can't get more than 5 hours sleep

Q.

0 I don't get any more tired than usual
1 I get tired more easily than I used to
2 I get tired from doing anything
3 I get too tired to do anything

R.

0 My appetite is no worse than usual
1 My appetite is not as good as it used to be
2 My appetite is much worse now
3 I have no appetite at all any more

S.

0 I haven't lost much weight, if any, lately
1 I have lost more than 5 pounds
2 I have lost more than 10 pounds
3 I have lost more than 15 pounds

T.

0 I am no more concerned about my health than usual
1 I am concerned about aches and pains or upset stomach or constipation
2 I am so concerned with how I feel or what I feel that it's hard to think of much else
3 I am completely absorbed in what I feel

U.

0 I have not noticed any recent change in my interest in sex
1 I am less interested in sex than I used to be
2 I am much less interested in sex now
3 I have lost interest in sex completely.

APPENDIX B

ROTTER'S I-E SCALE

SOCIAL - REACTION SCALE

I more strongly believe that:

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

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

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

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

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

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

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

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

9. a. I have often found that what is going to happen will happen.
   b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

APPENDIX C

I-E INSTRUCTIONS

This is a questionnaire to find out the way in which certain important events in our society affect different people. Each item consists of a pair of alternatives lettered a or b. Please select the one statement of each pair (and only one) which you more strongly believe to be the case as far as you're concerned. Be sure to select the one you actually believe to be more true rather than the one you think you should choose or the one you would like to be true. This is a measure of personal belief; obviously there are no right or wrong answers.

Your answers to the items on this inventory are to be recorded on a separate answer sheet. Print your name on the answer sheet. Please answer these items carefully but do not spend too much time on any one item. Be sure to find an answer for every choice. Find the number on the answer sheet and fill in either a or b, whichever you choose as the statement more true.

In some instances you may discover that you believe both statements or neither one. In such cases, be sure to select the one you more strongly believe to be the case as far as you're concerned.

APPENDIX D

DI INSTRUCTIONS

This is a questionnaire. On the questionnaire are groups of statements. I will read a group of statements. Then I want you to pick out the one statement in that group which best describes the way you feel today, that is, right now!

APPENDIX E

EXPERIMENTAL GROUP INSTRUCTIONS

This is an experiment on the effects of biofeedback upon an individual's physiological pattern of responses. Through the earphones, you will hear a series of clicks. As you decrease the number of clicks, you will be gaining control over your particular physiological pattern. Let yourself begin to feel quite relaxed. We have found that the following procedures generally produce the most relaxation. Close your eyes. Try not to blink, swallow or move your face but let it feel heavy and sagging. Breathe deeply and rhymically. Try to settle into a daydreamy type of state. Let relaxing images come into your mind. These machines are quite sensitive and often record, not only your physiological pattern, but also movements. To control for movements, we have placed electronic filters on the machines which screen out movements. However, occasionally the bodily movements will override the filters. At this time, you will hear an increase in the clicks. Therefore, try to remain as still as possible during the session. The session will last approximately twenty-one minutes. Any questions?

APPENDIX F

CONTROL GROUP INSTRUCTIONS

This is an experiment on an individual's physiological pattern of responses. The electrodes attached to your forehead provide information which allow us to measure your physiological responses. These machines are quite sensitive and often record, not only your physiological pattern, but also movements. To control for these movements, we have placed electronic filters on the machines which screen out movements. However, occasionally the bodily movements will override the filters. Therefore, try to remain as still as possible during the session. Music will be played through the earphones to screen out any noise that may occur during the twenty-one minute session. Any questions?

APPENDIX G

THREE ADDITIONAL QUESTIONS

Briefly, (in not more than three sentences) what have been your experiences and feelings as a subject in this experiment?

Has this experiment had any effect on you outside the lab sessions?

If so, what was the effect?

VITA[2]

Patricia Ruth Gant Sohler

Candidate for the Degree of

Master of Science

Thesis: THE EFFECT OF ELECTROMYOGRAPH FEEDBACK ON THE I-E SCALE SCORES OF COLLEGE STUDENTS

Major Field: Psychology

Biographical:

Personal Data: Born in Wichita Falls, Texas, May 1, 1950, the daughter of Robert C. and Geraldine D. Gant; married Theodore Sohler, January 2, 1975.

Education: Graduated from Duncan High School, Duncan, Oklahoma, in May, 1968; received Bachelor of Music degree from the University of Oklahoma, Norman, Oklahoma, in 1972; received Bachelor of Arts degree in psychology from the University of Oklahoma, Norman, Oklahoma, in July, 1975.

Professional Experience: Teaching Assistant, Department of Psychology, Oklahoma State University, 1975 - 1978; Research Assistant, Department of Psychology, Oklahoma State University, 1976; Psychological Associate, Psychological Services Center, Stillwater, Oklahoma, 1975 - 1976; Psychological Associate, Bi-State Mental Health Clinic, Stillwater, Oklahoma, 1976 - 1977; Psychology Trainee, Wichita Veterans Administration, Wichita, Kansas, 1977; Psychological Associate, Childrens Medical Center, Tulsa, Oklahoma, 1977 - 1978; Psychology Trainee, Oklahoma City Veterans Administration, Oklahoma City, Oklahoma, 1978 - 1979.