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THE EFFECTS OF PREFERRED MUSIC, NONPREFERRED MUSIC, AND SILENCE ON ANXIETY, RELAXATION, AND MUSCLE TENSION

By

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ABSTRACT

THE EFFECTS OF PREFERRED MUSIC, NONPREFERRED MUSIC, AND SILENCE ON ANXIETY, RELAXATION, AND MUSCLE TENSION

By

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The purpose of this study was to determine the effects of preferred music, nonpreferred music, and silence on measures of state anxiety, relaxation, and muscle tension. Nine subjects were selected from a pool of 90 college students after passing criteria for trait anxiety and musical experience. Each of the nine subjects was tested individually for a total of three testing sessions, using one condition (preferred music, nonpreferred music, or silence) per session. Pretests-posttests of state anxiety and relaxation were administered during each condition, and muscle tension was measured using an electromyogram. Results were calculated with a repeated measures analysis of variance and Pearson product-moment correlations. A main effect was discovered between subjects in the measure of state anxiety, as well as a difference between conditions on the measure of relaxation. It was found also that state anxiety and relaxation were correlated significantly under silence. State anxiety and EMG muscle tension were related inversely under preferred music, while other EMG correlations were asociated with low correlation coefficients. Lastly, a trend appeared for preferred music to induce lesser anxiety and greater relaxation than nonpreferred music.

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THE PROBLEM

Introduction

In contemporary psychology, "anxiety" is used customarily to denote "a transitory emotional state or condition characterized by feelings of tension and apprehension and heightened autonomic nervous system activity" (Spielberger, 1971, p. 24). Stress, as defined by Webster's New Collegiate Dictionary (1977), is "a physical, chemical, or emotional factor that causes bodily or mental tension and may be a factor in disease causation." Anxiety and stress have been known to be major contributors to a variety of medical disorders. Hanser (1985) identified some of these disorders that are, in part, due to stress and anxiety: hypertension, gastrointestinal problems, skin disorders, headaches, coronary artery disease, female reproductive dysfunction, respiratory ailments, and other life-threatening diseases. In the field of psychopathology, high rates of depression and suicide have been linked to anxiety and stressful life events. In short, anxiety and stress are important etiological components of many physical and psychological problems.

Varied studies seem to indicate a positive correlation between increases in anxiety and muscle tension elevation (Goldstein, 1972). Similarly, decreased muscle tension, as well as decreases in other physiological measures such as heart rate, blood pressure, and respiration rate, generally indicates reduced anxiety and stress levels (Jacobson, 1938).

Diversified coping interventions to assist in the reduction of anxiety and stress levels, as well as in the decrease of muscle tension, incorporate such measures as diet, drug therapy, psychotherapy, biofeedback, massage therapy, relaxation techniques, and activity therapies such as art, dance, recreational, and occupational therapies. Music therapy, as one of the activity therapies, demonstrates the capability to facilitate the expression of, and changes in, emotion, thereby alleviating stress. Furthermore, music therapy relaxation techniques can aid in the reduction of muscle tension.

Need for the Study

There have been a number of studies involving research on a variety of physiological responses to music, such as studies on heart rate, respiration, blood pressure, galvanic skin response, and muscle tension. However, Dainow (1977) maintained that these studies were incomplete, possibly due to the many methodological issues involved. Important issues which he discussed included instructions to subjects, volume of the musical stimuli, subject attention, suppression of movement due to fear of disturbing electrodes, and differences between musicians and nonmusicians. Additionally, Dainow observed that the diversity of physiological variables and variety of musical stimuli create a multitude of measurement and interpretation problems. Increased sophistication of instrumentation has made measurement more reliable; however, interpretation problems remain due to inconsistencies in research methodology.

As examples of research with inconsistent results, Hodges (1980) summarized the music research related to heart rate: seven studies found that heart rate decreased in response to sedative music and increased to stimulative music; five indicated that heart rate increased in response to any music (stimulative or sedative); two studies stated that heart rate changed in response to stimulative or sedative music, but that the changes were not predictable; and seven found that music had no effect on heart rate.

Hodges concurred with Dainow that inaccurate measurements and confounding variables were factors which contributed to the inconsistent data. Another reason was that "the definitions of stimulative and sedative music may be too general and not allow for a clear enough distinction between two kinds of music" (Hodges, 1980, p. 396).

Gaston (1951) defined stimulative music as music which is primarily rhythmical, percussive, and contains detached notes. Sedative music, conversely, lacks rhythmic and percussive elements and is, instead, music which contains sustained melodic passages. As noted previously, many different studies have utilized music according to these two classifications. However, Hanser (1985) advised caution in selecting musical pieces to represent the entire class of either stimulative or sedative music. She stated that untested music may contain elements that might evoke differential responses in listeners. Taylor (1973) also suggested that sedative and stimulative music should not be classified solely on the basis of the characteristics of the music alone; the response of the listener should be taken into consideration as well.

The use of precategorized music, such as stimulative and sedative, lends to the "belief that intersubject responses to musical and other sensory stimuli are similar, predictable, and generalizable" (Davis & Thaut, 1989, p. 169). However, Lacey (1950) found that individuals exhibit highly idiosyncratic psychophysiological response patterns to stimuli, an idea supported by Lacey and Lacey (1970) as expressed in their concept of "response stereotype" or "response specificity." The idea that each individual responds uniquely to a given stimulus is also supported by Harrer and Harrer (1977) who identified three variables which may determine intrasubject response patterns to music:

> a). . .the lability or stability of the autonomic regulatory processes. This, in turn, is influenced by constitution (predisposition), age, sex, mode of life, physical fitness, general state of health, or such temporary factors as fatigue, drinking alcohol or coffee, and so on; b) emotional reactivity; and c) attitudes toward music, the importance of music in the subject's life. . . (p.202).

Studies on attitudes and preferences toward music appear to have been reviewed extensively by Kuhn (1981) and Wapnick (1976). Although numerous studies have researched music attitudes and preferences, few seem to have measured the effects of preferred music on psychological experiences and/or physiological responses. Hodges summarized the results of music research related to physiological responses, such as research on heart rate (as mentioned previously), blood pressure, respiration, galvanic skin responses, muscular and motor responses, and brain waves. These studies, however, utilized precategorized music and did not appear to take into consideration individual preferences. Similarly, some research studies (Logan & Roberts, 1984; Miller & Bornstein, 1977; Peretti & Swenson, 1974; Smith & Morris, 1977; Stoudenmire, 1975) measured the effects of music on anxiety or relaxation, but also employed precategorized music.

It appears there is a need to add to the limited amount of literature on the effects of preferred/nonpreferred music on psychological experiences, such as anxiety, and physiological responses, such as muscle tension. The results may shed further light on the significance of individual responses to musical stimuli, thereby increasing ways to address the problems of physical and psychological tension.

Purpose of the Study

The purpose of this study was to examine the effects of preferred music, nonpreferred music, and silence on measures of state anxiety, relaxation, and muscle tension. Music has been shown to have an effect on anxiety, relaxation, and muscle tension; however, review of the literature has not yet determined what kinds of music will produce what specific effects.

Nonpreferred music was chosen as an experimental condition to contrast preferred music. Dainow (1977) recommended to experimenters that "to promote even greater response, subjects should select as part of the stimulus material music that they are familiar with and either like or dislike" (p. 218). Davis and Thaut (1989) demonstrated that preferred music significantly decreased state anxiety in a group of college students, although the physiological data indicated that "the music aroused and excited rather than soothed autonomic and muscular activity" (p. 168). It is the attempt of this study to explore the relationship between preferred and nonpreferred music, to determine the significance of correlations between these conditions and silence, and to examine the relationships between psychological (subjective) and physiological (objective) measures of anxiety and relaxation.

Research Questions

Question 1: Will there be significant differences between preferred music, nonpreferred music, and silence on the measure of state anxiety?

Question 2: Will there be significant differences between preferred music, nonpreferred music, and silence on the measure of relaxation?

Question 3: Will there be significant differences between preferred music, nonpreferred music, and silence on the measure of muscle tension?

Question 4: Will there be significant relationships between measures of state anxiety, relaxation, and muscle tension under conditions of preferred music, nonpreferred music, and silence?

Assumptions

For the purpose of this study, the following assumptions were made:

1. The Spielberger State-Trait Anxiety Inventory is a valid and reliable measure of state and trait anxiety.
2. Subjects responded to the State-Trait Anxiety Inventory and the Subjective Relaxation Test honestly, in a manner most consistent with their affective state.
3. The Electromyogram Myosone 409 measures the sum of numerous action potentials, and accurately displays digital microvolt readings. It is as technically accurate as surface electromyogram recordings can be, in comparison to the more accurate intramuscular recordings (Buchtal, 1957).
4. Subjects responded accurately to the Musical Experience Questionnaire, honestly reporting the length of musical training they had received.

5. Subjects responded honestly to the Music Preference Test, indicating their preference, on a scale of one to seven, for each of the brief musical excerpts.

6. Of the subjects who were asked to bring their music to a testing session, those subjects truthfully chose, within limits of their resources, music which represented their preferred relaxing music.

7. Subjects reported truthfully that they were not under the influence of alcohol and/or drugs during the experimental sessions.

Limitations

1. Of the 90 subjects who were administered the music preference test, only nine subjects qualified for the remainder of the experiment after being screened for musical training and anxiety. This small number necessitated the need to label this thesis a "pilot study."

2. Motor responses to music stimuli were not examined, although they are related closely to muscle tension and electromyogram research studies.

3. Much literature abounds in music preference research which examines the influence of various factors on music preference. Although these variables were briefly commented upon, it was not the intent of this research paper to explore the following types of studies in depth: (a) the influence of musical characteristics on music preference; (b) the influence of personality types, sex, age, race, aptitude, and socioeconomic background on music preference; and (c) the influence of other factors such as familiarity and repetition on music preference.

Overview

Chapter II presents a review of related literature. The first two sections deal separately with anxiety and electromyography. The latter half reviews the music research: music and anxiety, music and musculature, music and psychophysiology, variables affecting psychophysiological responses to music, the measurement of music preference, and finally, music studies using preferred/nonpreferred music.

Chapter III discusses the methodology used to study the effects of music and silence on anxiety, relaxation, and muscle tension. The design, sample, instrumentation, and experimental procedures are presented, along with a description of the Music Preference Test.

Chapter IV presents the data in tables and graphs, as well as an interpretation of individual results. Chapter V includes a summary and conclusion of the study, an interpretive discussion, and recommendations for further research. The appendix contains the various forms utilized in this experiment, a list of selections used in the Music Preference Test, and tables of raw data.

CHAPTER II

REVIEW OF RELATED LITERATURE

Anxiety

According to Freud (1936, p. 85), anxiety was the "fundamental phenomenon and the central problem of neurosis." It was Freud who first recognized the condition of anxiety and the importance of its role in the etiology of psychoneurotic and psychosomatic disorders. Research on anxiety before 1950 was limited due to the "complexity of anxiety phenomena, the ambiguity and vagueness in theoretical conceptions of anxiety, the lack of appropriate measuring instruments, and ethical problems associated with inducing anxiety in laboratory settings" (Spielberger, Gorsuch, Lushene, Vagg, and Jacobs, 1983, p. 1). However, since 1950, advances have been made in two of these areas: anxiety has been clarified more clearly as a theoretical construct, and various scales have been devised to measure anxiety.

The concepts of state and trait anxiety, which were first introduced by Cattell and Scheier (1961), have helped to clarify anxiety as a theoretical construct. State anxiety may be defined as

> a transitory emotional state or condition of the human organism that varies in intensity and fluctuates over time. This condition is characterized by subjective, consciously perceived feelings of tension and apprehension, and activation of the autonomic nervous system . . . . Trait anxiety refers to relatively stable individual differences in anxiety proneness, that is, to differences in the disposition to perceive a wide range of stimulus situations as dangerous or threatening, and in the tendency to respond to such threats with A-State [state anxiety] reactions (Spielberger, 1972, p. 39).

Spielberger et al. (1983) state that persons who are high in trait anxiety interpret a broader range of situations as dangerous or threatening more often than persons with low trait anxiety. Although physically dangerous situations do not seem to be threatening differentially to high or low

trait anxiety subjects, a fear of failure seems to be characteristic of people with high trait anxiety. Sarason reports:

> the bulk of the available findings suggest that high anxious Ss are affected more detrimentally by motivating conditions or failure reports than are Ss lower in the anxiety score distribution. . . . It is interesting to note that high anxious Ss have been found to be more self-deprecatory, more self-preoccupied, and generally less content with themselves than Ss lower in the distribution of anxiety scores (1960, pp. 404-405).

A valid and reliable scale which measures state and trait anxiety is Spielberger's State-Trait Anxiety Inventory (STAI), first published in 1970 and revised in 1983. The inventory consists of two scales: Trait Anxiety and State Anxiety. The Trait Anxiety Scale contains 20 questions which asks subjects to indicate how they feel in general (i.e., tendencies toward anxiety). The State Anxiety Scale also contains 20 questions, but it asks subjects to describe how they feel at a particular moment in time. Spielberger correlated the two scales by administering them to college students during a testing session when they were exposed to varying amounts of stress. Results showed that the Trait Anxiety scores remained constant, while the State Anxiety scores increased during times of greater stress and decreased under more relaxed conditions, thus corresponding to the definitions of "relatively stable" trait and "transitory" state anxiety.

Cognitive and somatic anxiety are two other distinct concepts of anxiety. Davidson and Schwartz (1976) offer this example of cognitive anxiety: "a person who is physically tired and somatically relaxed to lie down, [but] unable to fall asleep because his 'mind is racing'" (p. 402). Conversely, somatic anxiety is characterized by bodily tension and autonomic stress without concomitant cognitive symptoms. For example, a neophyte meditator who may be able to induce a calm state of mind might still report muscular tension and somatic aches and pains throughout his/her body.

Davidson and Schwartz conjectured that anxiety may be mode specific, that is, experienced cognitively or somatically (physiologically), or a combination of both.

In measuring cognitive anxiety, the scale, questionnaire, and inventory, such as the State-Trait Anxiety Inventory, remain the most popular forms of measurement. Somatic anxiety may be measured in various ways using physiological indicators to measure such factors as heart rate, blood pressure, respiration rate, and muscle tension.

Through the 1930s and 1940s the search to associate specific physiological responses with psychological variables continued. It was not until the 1950s, however, that emotions could be diffentiated on the basis of physiological responses. Ax (1953), in his classic study, obtained several physiological measures from normal subjects under conditions designed to elicit fear and anger. He found significant differences in physiological reactions between fear and anger, differences which suggested that the response patterns of anger were similar to those produced by injections of norepinephrine and epinephrine combined and the response patterns of fear as being similar to injections of epinephrine. Martin (1961) summarized the results of four studies and concluded also that, despite some inconsistencies among the studies, anger was associated with a mixture of norepinephrine and epinephrine responses, and anxiety was associated with an epinephrine reaction.

The fundamental question of Ax, which emphasizes the classical use of physiological reactions by psychologists, asks: "Can . . . physiological reactions serve as an emotional . . . indicator during psychological observation?" (1953, p. 433). Do significant correlations exist between physiological and psychological measures of anxiety? Martin (1961) did not appear to believe so: "Research . . . gives little ground for optimism that these variables will correlate very highly, if at all" (p. 243). Schachter seemed to agree:

> . . . precisely the same physiological state --- an epinephrine-induced state of sympathetic arousal --- can be manifested as anger, euphoria, amusement, fear, or ... no mood or emotion at all. Such results are virtually incomprehensible if we persist in the assumption of identity between physiological stress, but they fall neatly into place if we specify the fashion in which cognitive and physiological factors interact (1967, p. 124).

Schacter suggested that, given a state of physiological arousal, a person will label feelings associated with that arousal by way of the social interpretations one gives to the situations in which these feelings are experienced.

Crabbs and Hopper (1980) did not find significant relationships between physiological (electromyogram and finger temperature) and self-report (STAI) measures of anxiety. However, there was a significant positive relationship of each measure with itself during the three testing phases of their study. Crabbs and Hopper hypothesized that their findings supported the research of Davidson and Schwartz, which suggested that anxiety may be experienced cognitively and/or somatically. Subjects seemed to be aware of one type of measurement exclusive of the other, although other subjects appeared to be aware of both dimensions.

In the study by Reinking and Kohl (1975), subjects seemed to be aware of both cognitive and somatic dimensions, at least during the last part of the experiment. Four groups were compared with each other to observe the effects of different kinds of relaxation training: (a) classic Jacobson-Wolpe instructions, (b) EMG feedback, (c) EMG feedback plus Jacobson-Wolpe instructions, and (d) EMG feedback plus a monetary reward. Each group, in addition to a control group, had their EMG levels recorded and were asked to report their levels of subjective tension on a scale of 1 to 10. Results showed that all groups, except for the control, indicated increased physiological relaxation over a total of 15 sessions. The correlations between EMG and self-report measures improved from r = .38 in the first three experimental sessions to .57 during the last 3 sessions.

Shipman et al. (1964) tested for anxiety and muscle tension with psychiatric patients under three varying conditions: (a) "Affect Arousal. The purpose . . . was to evoke as much intense affect as possible through a stress interview" (p. 333); (b) Self Control. The patient was asked to describe how he controlled his feelings and was encouraged to maintain an attitude of strong self control; and (c) Neutral Interview. In an attempt to decrease apprehension, the patient was given advance knowledge of what was to occur on that day and was asked to avoid any personally disturbing topics. One difference this study made was that the patients did not rate their own emotional state, but were, instead, rated by two independent observers. Results indicated that muscle tension was found to be similar in all three conditions, and that the link between state anxiety and muscle tension elevation did not correlate. On the contrary, the most anxious patient was shown to have the least rise above EMG baseline. The authors noted that, although group averages showed no significant differences, individuals behaved in varying ways (e.g., some tensed with anxiety; others went "limp"), emphasizing the importance of personality differences.

Leboeuf (1977) incorporated personality differences into his study by comparing the effects of EMG feedback training on anxiety in introverts and extroverts; introversion-extroversion was defined by the Eysenck Personality Inventory. The introverted/extroverted subjects were chosen for anxiety only if their anxiety scores fell at least one half of one standard deviation above the trait anxiety mean of Spielberger's State-Trait Anxiety Inventory, as published in the test manual. Additionally, only subjects who demonstrated some degree of muscle tension, as defined by the author, were accepted. Although both introverts and extroverts showed significant decreases in muscle tension, only introverts displayed significant decreases in state anxiety. Interestingly, 6 out of 16 extroverts reported an increase in anxiety. For future research, Leboeuf suggested identifying other techniques for the anxious extrovert that would be capable of inhibiting anxiety.

Stoudenmire (1972) also compared introverts and extroverts by testing for the effects of muscle relaxation training on anxiety. All subjects were screened for introversion/ extroversion and trait anxiety using the same scales and standards as Leboeuf. Results indicated that no significant decrease was found in trait anxiety; however, introverts demonstrated a significant decrease in state anxiety measures, a finding similar to Leboeuf's study.

Lastly, Goldstein (1964) compared normal women and chronically anxious women during periods of rest and a white-noise stimulus. Significant differences were found in muscle tension between the two groups, with the anxious group responding with greater muscle activity.

Varying results have been obtained in studies of anxiety. One explanation for this is based on Lacey's (1950) concept that individuals evince highly idiosyncratic response patterns, and that "for a given individual some physiological measures may be much more sensitive indicators of change in anxiety level than others" (Martin, 1961, p. 244). Another reason may be due to the difficulties involved in defining anxiety itself. Goldstein (1972) noted that researchers have usually depended upon the diagnoses of experts or upon some psychological test of anxiety. Goldstein cited Malmstrom's (1968) work in which two different adjective check lists -- the Zuckerman Affect/Adjective Check List (AACL) and the Nowlis Mood Adjective Check List (MCL) --- were used together. It was found that frontalis muscle tension correlated positively with the AACL but negatively with the MCL. Goldstein surmised that, similar to other tests of anxiety, the AACL and MCL have broached only limited aspects of the psychophysiological state of anxiety.

<u>Electromyography</u>

The term "muscle tension" has been used quite freely, especially in the older psychophysiological literature (Hassett, 1978). It has ranged from Jacobson's (1938) measurements of kneejerks to the recording of muscles used in different tasks, such as in the task of striking typewriter-like keys under changing conditions (Morgan, 1916). Other measures of muscle tension are more direct, including the assessment of posture of a limb, and the rigidity of a certain muscle (Goldstein, 1972). Care, therefore, must be taken when comparing studies.

The electromyogram (EMG) provides a direct measure of electrical activity associated with muscular contraction. The EMG actually measures the sum of numerous action potentials, but does not directly measure muscular contraction, which is a mechanical event that occurs immediately after the electrical firing of a group of muscle fibers (Goldstein, 1972).

What, then, is the physiological basis of an action potential? Goldstein (1972) and Hassett (1978) provide concise explanations of muscles and muscle action potentials. A muscle is a mass of tissue which consists of millions of individual muscle fibers bound by a sheet of connective tissue. Muscle fibers function as a group known as a motor unit. The number of fibers in each motor unit depends upon the type of muscle. For example, muscles of the eye may have only 10 fibers in a motor unit, while muscles concerned with larger motor movements, such as the postural muscles, may have 3000 muscle fibers in each motor unit. Each motor unit is innervated by a single nerve fiber (neuron), the cell body of which is located in the spinal cord for the muscles of the body and in the brain stem for the muscles of the head.

During the resting state each muscle fiber possesses a negative intracellular potential which forms the basis of the electrical occurrence of the action potential. By way of the potassium-sodium pump theory, a cell's selectively permeable membrane allows potassium and chloride ions to diffuse more freely than sodium ions through the membrane. Therefore, there exists a greater concentration of sodium ions outside the cell, and more potassium ions inside the cell. When potassium ions diffuse out of the cell, a positive charge is created outside the cell and an accompanying negative intracellular charge, thus causing the cell to polarize.

A depolarization, or reversal, of the resting membrane potential occurs when the cell becomes active and increases its permeability to sodium, resulting in a temporarily greater concentration of sodium inside the cell and a correspondingly lesser amount of potassium. This depolarization is known as the muscle action potential. The resting level returns in a millisecond when the membrane potential becomes internally positive, allowing increased permeability to potassium and decreased permeability to sodium.

Excitation of the cell not only results in a depolarization of the membrane potential but also causes a wave of contraction to spread over the fiber with continual velocity. Muscular contraction is a function of the number of motor units activated and their frequency of firing. In summary, because muscular contraction is proportional to the electrical activity of the motor units firing, the EMG provides an index of muscular contraction or tension. Quantification of tension is expressed in microvolts; for example, the lower the microvolt level, the more relaxed the muscle.

EMG activity is usually detected by electrodes attached to the skin. Intramuscular electrodes are used also, but primarily when there is concern with the activity of individual muscle units. Surface electrodes are utilized commonly when interest centers on groups of muscles (Goldstein, 1972). Hassett (1978) notes that a particular problem with the use of electrodes is electrode polarization, when "electrodes begin to act as miniature batteries generating a potential of their own" (p. 27). However, commonly used silver-silver chloride electrodes (electrodes made of silver and coated with silver chloride) resist polarization.

Selection of muscle sites is an important variable in the consideration of recording EMG activity. The frontalis and forearm muscles have been used commonly in many research studies as indicators of general muscle tension. However, are they predictors of overall body tension, or do they specifically measure tension in their respective muscles? Goldstein, in reviewing the literature, found muscle tension to be centered about the limb musculature. This tension, though, changed under varying conditions. For example, Voas (1952) found that the trapezius and masseter muscles were most prominent during stress and frustration, and that the best indicators of tension during mental work were the arm muscles. Voas reported that only the frontalis muscle, however, maintained a high level of reliability throughout a test period of approximately nine days. Fair (1983) discovered that the forehead and neck regions are good indicators of generalized muscle tension, and are "associated with anxiety, back pain, and tension headaches" (p. 173). Fair suggested that a common sense approach in the selection of muscle sites was to ask the subject to report which area of the body most frequently became tense. However, this approach would make it difficult to standardize treatment which is necessary in experimental research. Finally, Alexander and Smith (1979) seemed skeptical that EMG measurement from a single site could indicate overall tension:

> . . . the relationship between skeletal muscle tension in general, let alone at a single site, and relaxation in the psychophysiological [sic] sense has yet to be explicated. It will not do to simply make the assumption that muscle biofeedback experiments, in which all that is recorded is EMG from a single site, are studying relaxation in any

> form other than in the limited sense of the physiological relaxation of a circumscribed muscle group (p. 115).

There are other variables that need to be controlled in EMG experiments. Age has been the variable most fully investigated, although Goldstein reported inconsistencies in the literature in correlating age with muscle tension. Education, IQ, and sex appear to be unrelated to changes in muscle tension. Goldstein stated that a few studies which reported variations between the sexes found differences in strength to be the causative factor.

Temperature has been found to affect muscle tension. Goldstein reported that muscular activity was effective in raising intramuscular temperature, and that "atmospheric temperature was found to be positively correlated with general muscle tension factors obtained during rest" (p. 337). By maintaining a constant room temperature level and restricting the activity of subjects, she suggested that it is possible to control for some of the effects of temperature.

The above variables, i.e., age, sex, education, temperature, and IQ can be classified as "artifacts." According to Kallman and Feuerstein (1986),

> "artifacts" are defined here as any change in a psychophysiological response system that is not attributable to a psychobiologically relevant stimulus. This includes not only the traditionally defined sources of artifacts such as movement or electrical interference but the more subtle environmental variables that can produce a false-positive interpretation of the psychophysiological record . . . . These artifacts can be divided into two major categories: artifacts of instrumentation and recording, and artifacts of interpretation (p. 340).

The subject and the measurement environment are two sources of instrumentation artifacts. The primary subject artifact is movement, such as between the subject and electrode/electrode paste. Even eye blinks may cause changes in the recording of frontalis muscle tension.

Transient electrical fields in the test room are the main environmental sources of instrumentation artifact. Sources such as wall outlets, fluorescent light fixtures, and electromechanical equipment can cause interference, but these may be eliminated by grounding the subject or by electrically shielding the test room, as even small electrical signals can interfere with the recording.

Artifacts of interpretation include variables already mentioned (sex, age, education, IQ, and temperature), as well as other variables such as noise, light, odors, tactile stimulation, and medical conditions, all of which could lead to false-positive readings. Finally, habituation to a novel stimulus is an additional factor to consider. Kallman and Feuerstein define habituation as "a decrease in a physiological response with repeated stimulus presentations" (p. 340). Assessment over several sessions was recommended as a way to ensure that a response was due not only to the novelty of the stimulus.

Music and Anxiety

There have been numerous research studies focusing on the effects of music on anxiety. Although studies indicate that music does affect anxiety, the data are inconsistent as to what kinds of music will produce what specific effects. It is believed generally that sedative music decreases anxiety, while stimulative music increases anxiety. Questions still remain unanswered, however, regarding the effects on anxiety of: (a) precategorized music such as stimulative-sedative, happy-sad, calm-exciting; and (b) specific characteristics of music such as tempo, intensity, pitch, and rhythm. Biller, Olson, and Breen (1974) utilized happy and sad music to examine the effects of both listening and participation in music on state and trait anxiety. The two songs used were "Sunshine Superman" and "Catch the Wind" by Donavan, rated independently to be classified as happy and sad, respectively. College students listened either passively or actively (played tambourine) or heard no music.

No differences were reported in trait anxiety, which supported the definition of trait as measuring relatively stable emotional differences (Spielberger et al., 1983); however, subjects who were exposed to the sad song showed significantly lower state anxiety. On the other hand, participation in playing the tambourine did not seem to have a noticeable effect on state anxiety.

State and trait anxiety were measured also in a study by Stoudenmire (1975) who compared sedative music and muscle relaxation training. One hundred-eight female college students were defined as "anxious" as their anxiety scores fell at least one-half of one standard deviation above the STAI trait anxiety mean. Pretreatment and posttreatment scores of the STAI were compared, indicating that both conditions were effective in lowering state anxiety levels, but not trait anxiety levels.

In a somewhat different vein, music classified as stimulative and soothing was used to investigate the effects of background music upon client-counselor interaction. Though Prueter and Mezzano (1973) found no significant differences, there seemed to be a trend for soothing music to promote more client-counselor and affective interaction than did stimulating music or a lack of music. The authors cautioned that their research should be viewed as a pilot study, however, due to the small number (6 counselors and 18 clients).

The study by Rohner and Miller (1980) also demonstrated a trend for sedative music to decrease state anxiety more effectively than stimulating music. One hundred fifty-six subjects were selected, and defined as "high-anxiety" with their scores falling above the mean of the normative group on the administration of the Eight State Questionnaire. The subjects were assigned randomly to one of four musical conditions: (a) familiar-stimulating, (b) familiar-sedative, (c) unfamiliar-stimulating, or (d) unfamiliar-sedative.

A no-music condition made up the control group. No significant differences were found, and the musical conditions did not reduce anxiety any more than the condition of silence, although sedative music tended to lower anxiety more effectively than stimulating music, as stated above. Familiarity with the music had little effect upon the subjects.

Logan and Roberts (1984) utilized two different kinds of music which have been claimed to induce a state of relaxation: (a) new age music by Steven Halpern entitled "Comfort Zone," and (b) "superlearning" music, a learning capacity enhancing music developed by Superlearning Corporation. The authors compared the effects of these musical types and silence on subjective tension level. On eight separate occasions throughout a relaxation training session, twenty-five college students were required to record their present tension level on a predetermined scale developed by the authors. Logan and Roberts claimed that the procedure of testing on eight separate occasions would help to record more accurately a subject's momentary tension level and would minimize problems related to tension level changes over long periods. No statistically significant differences were found in tension levels produced by the two kinds of music, but the no music group had the lowest overall tension level.

Smith and Morris (1976) tested 66 college students under conditions of stimulative music, sedative music, or no music during a psychology examination. The examination consisted of five sections, and one of the five following types of music was played during each section of the test: classical, jazz and blues, country/bluegrass, easy listening, and rock. Subjects rated their worry, ability to concentrate, emotionality (physiological-affective arousal), expectancy of performance, and like-dislike of the music. It was found that stimulative music significantly increased worry and emotionality as compared with sedative music. Preferred music did not seem to have an effect on a subject's emotional state.

In a later study, Smith and Morris (1977) differentiated between music majors and psychology majors when testing for the effects of stimulative and sedative music on anxiety, concentration, and performance. Subjects were assigned randomly to five music groups (similar to their 1976 study) while performing a test. Concentration, worry, and emotionality were again rated by the subjects, in addition to their like or dislike of the music. Results were varied. Worry increased more under stimulative music conditions than sedative music, but neither condition differed significantly from no music. As expected, concentration was higher with no music, and higher for sedative than for stimulative music. Differences, which reached borderline significance, were found between psychology majors and music majors. Music majors found stimulative music more distracting, while psychology majors found both stimulative and sedative music distracting. Only easy listening music produced better concentration than no music for psychology majors. Though all subjects liked sedative music better than stimulative, music majors liked all types of music better than psychology majors. Smith and Morris concluded that

> the effects of music are to be understood in terms of cognitive processes such as worry, expectancy, and concentration, rather than primarily on the basis of the arousal or reduction of physiological-affective responses to musical stimuli. Any person variable which affects these cognitive processes. . . should affect one's anxiety and performance under music conditions (p. 1052).

Smith and Morris recommended the use of specific kinds of music in connection with musical preferences, as their correlations of the like/dislike variable indicated. Additionally, differences between psychology majors and music majors were recommended as deserving further research attention.

Peretti and Swenson (1974) also compared music majors and nonmusic majors, and males and females to determine the effects of preselected music on anxiety, as measured by the galvanic skin response (GSR). Fifty male music majors and 50 female music majors, and an equal number of nonmusic majors of each sex were administered a pencil-maze task while GSR was being recorded. Music was later introduced into the experimental situation under similar conditions. Results indicated that music majors (both sexes) demonstrated a greater decrease in anxiety levels than nonmusic majors. Furthermore, female music and nonmusic majors showed greater changes as compared with males of both groups, and female music majors had a greater decrease in anxiety when compared with female nonmusic majors. The authors hypothesized that the greater decrease in anxiety of female music majors may have resulted from tendencies to be more influenced by the music, or from more unstable or flexible anxiety states.

Fisher and Greenberg (1972) also explored the effects of gender by employing college females to listen to either exciting, calm, or no music, and then to indicate their mood and rate the music. Several personality scales, including a measure of femininity (as measured by the 1964 Gough California Inventory), were taken during the music listening. The exciting music produced significantly higher anxiety and aggression scores, and calm music produced the least anxiety. Interestingly, it was found that femininity was related inversely to the amount of change observed, but no relationship was found between other personality measures and the effects of music on mood change.

Music and Musculature

Sears (1952, 1958, 1960) was instrumental in stimulating interest in the relationship between music and postural change/muscle tension. His 1952 study measured the effects of stimulative music and sedative music on posture. While the music played, 12 subjects were photographed through a one-way mirror, providing evidence of the postural angle, or erectness, of a subject, and also indicating muscular tension. Sear's findings reported that musical stimuli can influence posture significantly.

In another study, Sears (1958, 1960) utilized the electromyograph and measured the effects of stimulative and sedative music on degree of muscle tension, comparing musicians and nonmusicians, males and females. Subjects' tension levels were recorded from their forearm flexor and extensor muscles. Stimulative music was played if a subject's degree of tension was low, and sedative music was played when a subject's tension was high. Results indicated that sedative music was effective in reducing tension nearly 100% of the time, although stimulative music was less effective in increasing tension. Sears' findings that changes were produced more effectively in females correlate with similar findings of Peretti and Swenson (1974).

Preferred music was used as feedback which was contingent on maintaining low frontalis muscle tension levels in a 1974 study by Epstein, Hersen, and Hemphill. This contingent preferred music feedback was the treatment for a 39-year-old male who was plagued by chronic tension headaches. Frequency and intensity of the headaches, as well as medication needs, were evaluated by this male on an inpatient and, later, outpatient basis. Decreased headaches and lowered medication levels were observed during the feedback phase, but the headaches and medication levels increased after feedback was terminated. The authors surmised that "feedback was not a sufficient condition to produce long-lasting clinical effects" (p. 63) and that more controlled studies were needed to determine the necessary elements that would lead to longer-lasting effects.

Harrer and Harrer (1977) have observed that music listening may lead to changes in autonomic responses, even when sounds are not consciously perceived, as with incidental music for films, and functional music in places like shopping malls, elevators, and factories. Harrer and Harrer graphically demonstrated an increase in the number and amplitude of muscle action potentials as a subject listened to music. They noted also that qualitative differences exist between various muscles. For example, greater frontalis muscle activity was found during an arithmetical task, while muscle action potentials of the legs increased sharply during dance music. Another interesting finding reported fluctuations of muscle activity as a subject listened to Bach's Brandenburg Concerto No. 1. It is intriguing that the changes occurred at the same passages and were reproducible by repeat performances. Lastly, Harrer and Harrer showed that lullabies decreased and marches increased muscular hand strength as measured by an ergometer.

Prager-Decker (1978) compared the influence of four relaxation techniques (music listening skills, progressive muscle relaxation -- PMR, EMG biofeedback, and EMG facilitated PMR) on EMG muscle tension levels. Eighty-one college-aged males were categorized separately as either internally-controlled or externally-controlled individuals. Seven relaxation training sessions were administered, followed by exposure to six repetitions of an industrial accident film. Biofeedback was shown to reduce EMG levels significantly more than music or PMR training. An interesting finding was that externally controlled subjects reduced their EMG levels more and faster than did the internally controlled subjects. In Leboeuf's (1977) study, both introverts and extroverts significantly decreased their muscle tension with the use of EMG biofeedback training. Only introverts, however, displayed a significant reduction in state anxiety. These examples seem to typify the disparity between physiological and psychological measures of anxiety.

Scartelli (1982, 1984) has pursued research actively on the effects of EMG feedback and sedative music on relaxation.

In his 1982 study, he compared EMG biofeedback training with biofeedback training plus a sedative instrumental music background in six spastic cerebral palsied adults (three in each group). The dependent variable was the amount of tension in the finger extensor muscles. Results strongly favored the music condition which showed a 65% mean decrease of muscle tension, in contrast to a 32.5% mean decrease in the other group. Scartelli cautioned, however, that definite conclusions cannot be drawn because of the small sample size.

Scartelli added a third condition to his 1984 experiment: a sedative music only condition. Thirty music majors were assigned randomly to one of the three conditions, with the degree of frontalis muscle tension acting as the dependent variable. Precautions were taken prior to the experiment as each subject underwent a brief interview to determine whether any physical discomfort (e.g., headache) was being experienced that might contribute to an unusually high tension reading. In addition, an EMG measurement was taken prior to the experiment to, again, safeguard against abnormally low or high muscle tension levels. Results indicated that the EMG biofeedback group did not obtain a significant mean decrease in EMG levels, which the other groups obtained. Although no significant differences were demonstrated among the three conditions, the biofeedback/ sedative music condition seemed to be the most effective in reducing frontalis muscle tension.

In a third study, Scartelli and Borling (1986) approached the use of EMG biofeedback training with sedative music in a different vein. The biofeedback training and music were presented sequentially instead of simultaneously, as Scartelli's previous two studies had done. Three conditions were examined for their effects on frontalis muscle tension: EMG biofeedback with simultaneous presentation of sedative music; sedative music followed by EMG biofeedback training; and EMG biofeedback followed by the sedative music. Although significant differences were not obtained, the sequenced application of biofeedback training and sedative music was found to have a more dramatic reduction in microvolt levels. Also, sequenced presentations appeared relatively more productive than simultaneous applications of the music and biofeedback training. During the simultaneous condition, confusion was reported by subjects (in the present study and in Scartelli's 1984 study) of having to decide to which stimulus to attend primarily -- the music or the auditory biofeedback.

Pollack (1988) explored the effects of stimulative and sedative classical music on the muscle tension, or tone, of spastic cerebral palsied children. Eight children were treated individually to eight 5-minute music listening periods, including one no-music condition. Muscle tone was measured not with an electromyogram, but by viewing videotapes of pretests-posttests of resting posture and performance of an arm motion task in each session. An overall decrease in muscle tone was shown, although individual differences revealed varying effects. Stimulative and sedative music seemed equally effective in decreasing muscle tone. Pollack concluded that music preference was influential in inducing a variety of responses to the music, as observed through affect, verbal expressions, and behavior during the listening periods.

A final study which utilized music in determining relaxation/tension was done by Kibler and Rider (1983). Seventy-six subjects were divided into three groups which received one of these conditions: (a) sedative music (M); (b) progressive muscle relaxation (PMR); or (c) music plus progressive muscle relaxation (M + PMR). Sedative music consisted of two works by Debussy -- *Prelude to the Afternoon of a Faun* and *Clouds*. Finger temperature, or vasoconstriction, was used as a stress indicator. All conditions were found to decrease finger temperature significantly; however, no condition was more significant than the other, although the M + PMR group's mean increase was greater than the mean increases of the other two groups. This finding supports the related research literature which demonstrates that the use of music in conjunction with other relaxation techniques enhances relaxation more than either music or other technique used alone.

Music and Psychophysiology

In Chapter I, it was noted by Hodges (1980) and Dainow (1977) that the incredible diversity of physiological variables, inaccurate measurements, and lack of methodological control contributed to inconsistent data regarding the effects of music on psychological and physiological measures of anxiety and relaxation. Standley (1986) appeared to review the literature extensively and found 81 studies exploring the effects of music or sound in medical and dental treatment. Though the trend was usually that sedative music decreased physiological responses and stimulative music heightened responses, Standley emphasized that statistically significant changes were not always demonstrated and that varying individual responses occurred. Dainow contended that since a greater number of research studies opposed the relationship between subjective and objective data than supported it, "it must be concluded that little if any correlation exists between the subjective and objective responses to music" (p. 217).

Barger (1979) found that sedative music (Bach's Air on a G String) produced significant differences in a self-report measure of arousal between conditions of music and silence, and between conditions of music and music plus verbal suggestions of relaxation. None of the conditions, however, were more effective than silence in reducing heart rate.

Discrepancies were found also between subjective and objective measures of tension in Jellison's (1975) study. "Calming" music (Bach's Air on a G String) and "exciting" music (Dvorak's Symphony No. 9, 4th movement) were compared with each other and with conditions of white noise and silence. No significant differences were found in physiological measures, but both types of music produced significant decreases in state anxiety, while white noise showed significant increases in state anxiety.

The contention that subjective and objective responses are in agreement was supported by Miller and Bornstein (1977) who found that subjective and objective measures of anxiety correlated positively with each other. Eighty subjects were assigned randomly to one of these 30-minute relaxation procedures: (a) progressive relaxation, (b) muscle and mental relaxation, (c) mental relaxation, (d) self-relaxation (no instructions on how to relax), plus classical music paired with each of the foregoing conditions. Relaxation was assessed with self-report anxiety scales and EMG recordings. Significant changes under all conditions were found in the direction of relaxation on both the EMG measurement and the anxiety scales. Music was not shown to add to the overall effectivness of treatment, but the authors suggested that the inclusion of more relaxation sessions may have made a difference.

Rider, Floyd, and Kirkpatrick (1985) seemed to take their study a step further by measuring not just the "typical" physiological parameters such as heart rate, blood pressure, or muscle tension, but the adrenal corticosteroids, or "stress hormones." The authors stated that several of these steroids are released from the adrenal cortex during stress. The effects of music (music that was used in Kibler and Rider's 1983 study), progressive muscle relaxation, and guided imagery in a taped induction were tested on 12 female nurses. During an initial briefing period, nurses were administered a series of psychological tests. A tendency was demonstrated for high trait anxiety nurses to be affected more positively by the tape. Other results included a significant decline in circadian amplitude and a significant increase in degree of corticosteroid rhythm entrainment. The

mean corticosteroid level also decreased during the listening periods, although nonsignificantly. The authors implied that a technique exists to change body chemistry positively by utilizing music, and recommended further exploration of the role of music in facilitating relaxation.

Variables Affecting Psychophysiological Responses to Music

> When a particular piece of music causes the heart rates of subjects to increase, what does this mean? It means only that the heart rates increased. It is not known whether the heart rates increased because the subjects enjoyed the music, were excited by it, were made anxious by it. . ., or because of any other unknown reason (Hodges, 1980, p. 396).

Hodges' keen observation illustrates the difficulties inherent in research studies, studies which sometimes appear overwhelmed by the immensity of variables and individual differences. Lacey's (1950) concept of "individual stereotypy" exemplifies the need to consider individual differences and preferences, especially in design and interpretation phases of an experiment. Harrer and Harrer (1977) stressed that

> the system of maximal response. . . depends mainly on (a) the character of the subject's individual autonomic response. In some persons psychological stimuli such as stress give rise to respiratory changes predominantly, whereas in others marked circulatory. . . alterations are elicited by the same type of stimuli; (b) the type of music which is being played (p. 204).

The "type of music" could include music categorized as stimulative-sedative, happy-sad, exciting-calm, or other, more typical classifications such as jazz, rock, or classical. Characteristics of the music, such as volume, tempo, rhythm, and pitch also deserve attention.

Hassett (1978) concisely summarized the need for control of variables in psychophysiological experiments: "The total pattern of physiological response to a given situation is a function both of the situation and of the individual" (p. 154). Careful consideration shown for individual characteristics and other variables would ensure more controlled research studies.

DeJong, Van Mourik, and Schellekens (1973) researched the effects of tempo on various physiological parameters (heart rate, respiration rate, skin conductance, and galvanic skin response). Forty-five subjects were divided into three groups: (A1) amateur musicians; (A2) nonmusicians; (A3) students from the Amsterdam Conservatory of Music. The musical stimuli consisted of three pieces of different tempi (fast, medium, slow) within each style period (Baroque, Romantic, Modern). Subjects were asked to rate the music from "very beautiful" to "very ugly" on a scale of one to seven. Varied results indicated that: (a) heart rate was faster for group A3 than for A1; (b) heart and respiration rates (HR & RR) were faster for fast music, but RR was faster for slow than for medium music; (c) HR was faster during beautiful music for groups A1 and A3; (d) RR was faster during beautiful music, and skin conductance (SC) and galvanic skin response (GSR) were higher during beautiful music; (e) group A2 showed significant HR decelerations, accompanied by increases in RR and SC; (f) group A3 had a significant HR acceleration during the beautiful music; and (g) group A1 showed a HR deceleration during the "ugly" music. In summary, different tempi were found to produce highly significant differences for HR, RR, SC, and GSR.

Dainow (1977) reviewed the literature on the effects of volume and discovered that the intensity and sometimes duration of reactions corresponded strongly with the loudness of the music. Wilson and Aiken (1977) tested 52 nonmusic majors for the effects of intensity level of rock music upon physiological (GSR, heart rate, & respiration rate) and psychological (an adjective check list) responses. Decreased GSR and heart rate, and increased respiration rate

indicated a response associated with arousal and attention to the music. However, intensity level only slightly affected physiological responses, possibly because the two decibel levels (79 & 95 decibels) were not sufficiently differentiated. Conclusions were limited to those whose preference was hard rock music.

Abeles (1980) cited the work of a few authors who reported that repetitions of musical selections increased preference. Bartlett (1973) found that greater awareness of musical structure induced positive affective response from repeated listenings of Schubert's Fifth Symphony in subjects whose most preferred music was not classical. Upon comparing the first and later sessions these subjects demonstrated a decline in preference for the initially most-liked music.

Familiarity of music, a subject closely akin to music preference, is another variable which has been explored in research studies. In the experiment by Fontaine and Schwalm (1979), 35 subjects were instructed to perform a vigilance task under conditions of familiar rock, familiar easy-listening, unfamiliar rock, unfamiliar easy-listening, and no music. Though type of music had no effect, familiar music produced significantly higher levels of arousal (as measured by heart rate) than unfamiliar music. Concurrently, subjects who listened to the unfamiliar music showed significantly higher arousal levels than subjects who listened to no music. In contrast, Jacobson (1956) and Rohner and Miller (1980) found that the familiarity or unfamiliarity of music had negligible effects upon anxiety.

Keston and Pinto (1955) and Abeles (1980) concluded that gender is not likely to be a factor in the influence of music preference. However, Sears (1960) and Peretti and Swenson (1974) found that females demonstrated greater changes than males in muscle tension and anxiety, respectively.

Abeles also reviewed the literature on the effects of musical training and found that training influences music

preference, specifically by the length of time spent in musical participation. Scartelli and Borling's (1986) study seemed to be one of the few which specified training restrictions for subjects: "2 years or less [of] formal music study and no formal music activity participation . . . in the previous 3 years" (p. 159). The limitations were applied in an attempt to utilize subjects who would process the music in a nonanalytical manner. Bradley (1971) measured the effects of analytical training versus repetition on the music preferences of seventh graders, and also showed that training significantly influenced music preference. Landreth (1974) concluded in her study that training, or "increased knowledge and understanding of a musical score" (p. 12), affected heart rate response to music. Nonmusicians were divided into groups for the experiment, and physiological recordings were taken while subjects listened to Beethoven's Symphony No. 5. Significant differences were found between the group who listened each week to an audiotutorial tape of Beethoven's Symphony No. 5 and the control group who participated in a general music class, demonstrating that training may be an important variable in the influence of physiological responses to music.

As an adjunct to research on the effects of musical training, differences between musicians and nonmusicians have been the focus of a number of studies. Dainow (1977) defined the term "musicians" as "those with greater knowledge of experience, whether playing music or listening to music" (p. 217). Lack of a standard definition has probably contributed to the discrepant findings which Hodges (1980) noted: 14 studies indicated significant differences between musicians and nonmusicians, while 8 studies showed no differences. In studies already reviewed, DeJong et al. (1973), Peretti and Swenson (1974), Sears (1960), and Smith and Morris (1977) found differences between musicians and nonmusicians.

Abeles (1980) concluded that there seems to be "insufficient evidence to clearly identify interactions" (p.133) between all of the above variables and psychological/ physiological responses to music. Though the effects of these factors appear unknown and warrants further research, necessary precautions should still be exercised in order to control for possible confounding variables.

Measurement of Music Preference

The measurement of attitudes in music research has been concerned with constructs such as preference, attitude, opinion, and taste. In attempting to systematize the terminology, Kuhn (1981) defined each precisely:

> Attitudes are positive or negative feelings associated with psychological objects; attitudes are expressed verbally as opinions, and behaviorally as preferences. Because attitudes. . . are predispositions. . . , they are not directly observable or measurable. . . .
>
> Taste has been shown to be a product of prior training, and it represents a learned disposition to approach or avoid certain generic musical styles. . . .
>
> An opinion is a verbal expression of attitude made in the absence of a stimulus object and without contextual or situational referents being given. . . .
>
> Preference is the act of choosing, esteeming, or giving advantage to one thing over another. . . (pp. 4-6).

Although Kuhn states that an opinion "is a verbal expression of attitude," "preference" will be defined here as the verbal, written, and behavioral expression of attitude, for the purposes of this research paper.

How are music attitudes measured? Kuhn provides a comprehensive review of various kinds of measurement techniques used in music, and cites studies which incorporate each technique. The most common type of measurement used in music preference research is the self-report mode (LeBlanc, 1984). In this mode, verbal or written responses are required of subjects to honestly report their feelings toward a stimulus. Self-report measures include open-ended questions, paired comparisons, multiple choice scales, ranked preferences, rating scales, pictographic scales, summated ratings, and semantic differentials (Kuhn, 1981). Construction of these scales as valid forms of measurement appears to be a formidable task:

> It is difficult to design and interpret measures of attitude and interest . . . . Reliability and validity are exceedingly difficult to determine, and equivalent forms are virtually impossible to construct. . . . There are no right or wrong answers. The subject can often sense what the test writer is seeking and can modify his responses accordingly if he wishes. The examiner must depend upon the examinee to be truthful. Curiously, however, the item, "I have never been in trouble with the law," on the California Psychological Inventory is marked "true" by 20 per cent of the prison inmates tested (Lehman, 1968, pp. 78-79).

Regardless of the difficulties inherent in self-report modes, these measures have been used extensively in a number of music preference studies. Kuhn commented that "if a researcher is using a dependent measure of opinion or preference for groups of subjects, then a self-report rating measure is the most efficient and, in all likelihood, is quite adequate" (p. 14).

The measurement of observed behavior on music preference includes observational measures, single stimulus listening time, reward value, multiple stimulus listening time, and manipulative response measures, as categorized by Kuhn (1981). According to LeBlanc (1984), two popular recording instruments in the measure of behavioral responses include the Operant Music Listening Recorder (OMLR) used by R. Douglas Greer and associates and the Music Selection Recorder (MSR) used by Terry L. Kuhn and associates. With these instruments, simultaneously available musical stimuli are offered on different channels, and music preference is considered analagous to the time spent listening to the stimuli.

The Music Selection Recorder was utilized in a study by Kuhn, Sims, and Shehan (1982). Fifty-five college students rated three music selections on a like-dislike scale; these three selections were then made available on different channels of the MSR. Results indicated a low correlation between degree of liking and listening time. Although some subjects reported a high degree of preference for a particular piece, the reasons they gave for not listening to that selection included: "boredom, intrigue with new style, imagery generated by music, liking for all three selections with no preference, dislike for all the selections with no preference, [and] curiousity about the nonpreferred selections. . ." (p. 187).

This study points to the discrepancy between attitude and behavior. Attitudes are of value to the extent in which they predict observable behavior. However, Flowers (1981) noted that the majority of studies have not found a direct nor obvious connection between the two indices. Berlyne (1974) emphasized the need for further research in this area:

> It can hardly be reiterated too often that we need extensive study of ways in which nonverbal behavior can be predicted from verbal judgements of the same or other subjects. Until such studies have been completed, totally unwarranted assumptions on this point are bound to be rife. Specialists in other areas besides psychological aesthetics, notably the social psychology of attitudes and market research, have assumed far too freely that what people do is in line with what they say (p. 328).

Kuhn remarked that more highly controlled experiments, advanced measuring techniques, and increased complexity of statistical analyses "should make it possible to demonstrate a cause-and-effect explanation of music attitude acquisition in the future" (p. 15). In the meantime, LeBlanc (1984) recommended the use of more than one kind of data, e.g., written and behavioral, so that each may serve as cross-validation checks for the other.

Music Studies With Preferred/Nonpreferred Music

It appears that the majority of studies which researched the effects of music on psychological experiences and/or physiological responses have utilized some form of precategorized music, while relatively few have used the subject's preferred music or incorporated a like-dislike variable into their research design. Some of these studies which used preferred music or a like-dislike variable have already been reviewed (Bartlett, 1973; Epstein, Hersen, & Hemphill, 1974; Smith & Morris, 1976; Smith & Morris, 1977; Wilson & Aiken, 1977). Additional studies will be reviewed here in the remaining section of this chapter.

In detailing the use of music therapy with burn patients, Christenberry (1979) suggested that familiar or preferred music may be useful in reorienting a burn patient after the initial trauma. A familiar song may help to decrease confusion and disorientation and increase order in the patient's life through familiarity and repetition. The nonthreatening quality of the music could also aid in restoring a sense of security, thus furthering reorientation. Secondly, a burn patient may have difficulty accepting disfigurement and/or loss of function of a body part, and may manifest symptoms of low self-esteem. The use of music which a patient prefers and enjoys could be structured into a session to ensure successful, pleasurable experiences as a means of increasing self-esteem.

Predetermined musical selections were used in a study by Ries (1969) in which subjects (extroverts and introverts) were asked to rate the music on a five-point like-dislike scale and on a five-point scale ranging from Very Much Effect to No Effect. Galvanic skin response and respiratory reactions were recorded as physiological data for each subject. Although no correlation was found between GSR and the like-dislike scale, a correlation was discovered between GSR and the effect the music had on subjects, specifically extroverts. Also, the more a subject liked the music, the deeper her/his breathing became, indicating a significant correlation between music preference and breathing amplitude.

Rider (1985) compared five taped music conditions plus two control conditions to determine their effects on the EMG and pain levels of 23 spinal cord injury patients. Five of the music conditions were preceded by nine minutes of muscle relaxation instructions followed by a one-minute instruction to use the music as a guide towards pain relief. Two of the five music types were Steve Reich's "minimalistic" music; two pieces were "impressionistic": Debussy's Prelude to the Afternoon of a Faun and Pat Metheny's "If I Could." The fifth condition, "entrainment" music, consisted of synthesized and acoustic guitar music "which exhibited a definite mood shift from unpleasant to pleasant. . ." (p. 186). Each of the musical selections were scaled on a self-report music preference questionnaire. A no music control contained 20 minutes of muscle relaxation/pain relief imagery, and a no relaxation/no imagery control consisted of 20 minutes of a subject's most preferred music.

Results showed that all conditions, except the music of Reich and Debussy, were found to have significantly lower EMG levels, but the entrainment condition was the most effective in lowering both EMG and pain levels. All conditions were more effective than preferred music in lowering pain. However, the comparison between preferred music and the other taped conditions might be more valid if preferred music were paired with the relaxation/imagery induction. Also of interest was the finding that the two least preferred music types, the minimalistic music and the entrainment music, were the most effective in lowering pain levels.

Curtis (1986) also examined the influence of music on pain relief in terminally ill cancer patients during the last six months of their lives. Three conditions were compared: (a) no intervention, (b) background hospital sounds, and (c) a 15-minute tape of calm, preferred, instrumental music. Statistically significant differences were not found, although an analysis of individual responses suggested that the music may have been more effective than the nonmusic conditions.

The study by Hanser, Larson, and O'Connell (1983) demonstrated that preferred music reduced pain during labor in all seven expectant mothers who participated in the experiment. An individualized music program was developed by the music therapist:

> Selections were based on the mother's preferences and on observations of the tempo or pace of her breathing. Musical excerpts of gradually faster tempi were recorded to correspond with the mother's breathing rates. . . . During the course of labor, the music therapist observed the mother's breathing tempo and played the corresponding recorded music on a portable cassette player (pp. 52-53).

Despite the study's impressive results in reducing pain in 100% of the mothers, the authors cautioned that the experiment represented only an initial attempt in examining the role of music in the birth process with its small sample and lack of objective subject samplings.

Stratton and Zalanowski (1984) compared the effects of five types of music (soothing classical, stimulating classical, romantic, atonal, and Muzak arrangements), silence, and the degree of liking upon self-reported relaxation. Thirty-six college students were asked to rate their liking for the music on a scale of 1-10. It was found that the degree of liking was the factor most closely related to relaxation. Subjects with the greatest degree of liking were found significantly to be more relaxed than subjects who liked the music the least, and subjects who disliked the music were significantly less relaxed than the subjects who received no music. However, subjects who liked the music the most did not report greater relaxation than the subjects with no music. The authors stressed that the subjects were not given an opportunity to choose the music they heard, and recommended further research in this area.

In measuring the influence of preferred music on anxiety, relaxation, and physiological responses, Davis and Thaut (1989) allowed the subjects to provide the music to which they most preferred to relax. Eighteen college-aged nonmusicians were individually tested three times as they listened to their most preferred relaxing music. The State Anxiety Inventory (Spielberger et al., 1983) and a seven-point Likert relaxation scale were administered before and after each testing session, while physiological indicators measured heart rate, vascular constriction, muscle tension, and finger skin temperature. Results indicated that relaxation increased while anxiety, as measured subjectively, decreased. Physiological data did not indicate decreased anxiety, however. It was shown that autonomic and muscular activity were aroused and excited rather than soothed by preferred music. This seeming inconsistency between psychological and physiological measures may be explained by Berlyne's (1971) theory of hedonic value and arousal: "First, . . . when arousal approaches the upper extreme, a decrease to a lower arousal level is pleasurable and rewarding. Second, a limited rise in arousal, which is not enough to drive arousal up into the unpleasant range, can apparently be pleasurable" (p. 82). Davis and Thaut suggested that the increased relaxation and decreased anxiety were facilitated by increases in physiological arousal which accompanied the enjoyment of the music.

Summary

Anxiety has been measured in both cognitive (psychological) and somatic (physiological) terms. The most popular forms of measuring cognitive anxiety are scales, questionnaires, and inventories, such as the State-Trait Anxiety Inventory. The concepts of state and trait anxiety, defined as "transitory" and "relatively stable" anxiety, respectively, have been incorporated into many research studies which measure cognitive anxiety. Somatic anxiety can be measured using various physiological indicators to measure such factors as heart rate, galvanic skin response, respiration rate, and muscle tension. A widely used instrument which measures the degree of muscle tension, or more precisely, the sum of numerous action potentials, is the electromyograph (EMG). An issue of debate in the use of the EMG is whether it measures overall body tension or just the muscle site to which the electrode is attached. Also, a number of variables, such as age, gender, temperature, and other instrumentation and interpretation artifacts, need to be controlled in EMG experiments.

There appears to exist a lack of correlation between psychological and physiological measures of anxiety. One reason may be due to the difficulties in defining anxiety itself. Another explanation may be based on the concept that individuals respond in highly idiosyncratic patterns, and that changes in anxiety levels could be indicated more sensitively with differing physiological measures, depending on the individual.

Research on the effects of music on psychophysiological measures of anxiety or tension have usually employed precategorized music, such as stimulative-sedative, happy-sad, or calm-exciting. On the whole, sedative music seemed to decrease state anxiety and muscle tension while stimulative music appeared to heighten such responses. The results of such studies, however, were not always significantly different and varying individual responses occurred. Many variables, which need to be considered and controlled, could affect the outcome of these studies; these variables include, but are not limited to, tempo, volume, repetition, familiarity, gender, and training.

Music preference is measured commonly using the verbal or written self-report mode such as multiple choice scales, ranked preferences, or rating scales. Behavioral measures frequently utilize the Operant Music Listening Recorder or the Music Selection Recorder, both of which consider music preference as analagous to the time spent listening to musical stimuli. The discrepancy between the self-report mode and behavioral measures is often seen, however, pointing to the need to further examine the relationship between attitude and actual behavior.

Studies which explore the relationship between preferred music and anxiety or tension have shown, overall, that preferred music may decrease anxiety. However, the decrease in anxiety is usually demonstrated through psychological measures. The lack of correlation between subjective (psychological) and objective (physiological) measures is again apparent in the music research literature, emphasizing the value of accurate measurements and the need for methodological control.

CHAPTER III
METHODOLOGY

Design

This study adopted a repeated measures design using pretests-posttests of the dependent variables, state anxiety and relaxation. The independent variables consisted of preferred music, nonpreferred music, and silence, each of which was used in one of three 15-minute listening sessions. A third dependent variable, degree of muscle tension, was recorded during each of the 15-minute conditions.

Sample

The sample population for the initial portion of this study consisted of 90 undergraduates, ages 18-22, selected from introductory psychology classes from a large, four-year midwestern university through informed consent procedures. Nine of the 90 subjects (five females, four males) participated in the latter portion of the experiment after passing these selection criteria: (a) must have scored approximately one-half of the standard deviation above the trait anxiety mean of the State-Trait Anxiety Inventory (STAI) as published in the test manual: 42.89 for males, 45.47 for females (Spielberger et al., 1983); (b) must have had two years or less of formal musical training or music activity participation, e.g., band or choir.

Setting

The group setting for the administration of the Trait Anxiety Scale of the STAI, the Musical Experience Questionnaire, and the Music Preference Test was held in a large classroom at the University's School of Music, where subjects were seated at individual desks to record their answers on paper. The setting for the individual testing periods was held in a single room of the Music Therapy Clinic/Psychology of Music laboratory, where subjects were seated in a recliner chair facing a curtain with their backs to the experimeter. Care was taken to ensure that fluorescent lights were not utilized during the operation of the EMG.

Instrumentation

The music preference test was taped and played on a Sony Stereo Cassette Deck TC-FX6. Also utilized for the test were a Hafler Pre-Amplifier, an Adcom Power Amplifier Model GFA-555, and Altec Speakers. Taped music during the individual sessions was played on a Kenwood Stereo Cassette Deck KX-620, amplified through a Sony STR-AV330, and heard through Celestion Speakers. A General Radio Company Sound-Level Meter, Type 1551-C was used to control the decibel level of the music. Muscle tension data were collected with an Electromyogram Myosone 409 by Bio-Logic Devices, Inc., using Signa electrode gel on silver-silver chloride surface electrodes. State and trait anxiety were assessed with the Spielberger State-Trait Anxiety Inventory, while relaxation was measured with the Subjective Relaxation Test (Appendix A) using a 7-point Likert scale (1 = extremely relaxed; 7 = extremely stressed).

Music preference was assessed by a music preference test that was developed by Bartlett (1973) and revised for this current research (see Appendix B). The test consisted of 56 taped musical excerpts, each of which was approximately 30 seconds long; about eight seconds of silence separated each excerpt. Subjects were asked to rate each excerpt on a scale of 1 to 7 (1 = strongly like; 7 = strongly dislike). There were eight musical categories; each category contained seven examples of each which were presented in random order with the exception that no single type of music was offered twice in a row. The eight categories were: country western, jazz, folk, classical, atonal, hard rock, light rock, and new age. Atonal music was chosen as a category separate from classical music as a result of the 1984 study by Stratton and Zalanowski, which was reviewed in chapter II. Comparing the effects of five types of music, the authors found that atonal music lead to significantly less relaxation. Inclusion of atonal music into the Music Preference Test was based on the expectation that it might be chosen as a least preferred type of music.

Taped instructions for the music preference test were quoted verbatim from Bartlett's test:

> The purpose of this test is to determine what kinds or types of music you like and the degree to which you like them. You will hear a series of short musical excerpts. After the completion of each excerpt, you are asked to rate how much you like that particular excerpt to the best of your ability by circling the appropriate number on the rating scale provided. Each scale consists of a number which corresponds with a degree of dislike or like. For example, if, after listening to a musical excerpt you decide you like "mildly" that selection, then you should mark the appropriate rating scale in the following manner. There will be a brief pause after each excerpt to mark your rating. Do not attempt to change a previously marked rating. First, one musical example will be given to help your understanding of the test. Are there any questions?

At the completion of the test, further instructions were given:

> That completes our test. Now, you will find on the next page a list of musical types: classical, atonal, country western, light rock, hard rock, jazz, folk, and new age. Please place the number one next to the musical type that you like best, the number two next to the musical type you like next best, the number three beside the type you like third best, and so forth for all eight musical types. Thank you.

Prior to the experiment, the music preference selections were rated by three judges (three doctoral music degree candidates) to determine the test's face validity in terms of the categorizations of music. A majority decision by the judges' panel confirmed the choice of selections as categories.

For the individual sessions, preferred music was provided by the subjects, and specifically, was that music which was determined to be their most preferred as shown by the music preference test (see Table 1). The types of preferred music and the number of subjects who chose each type as their most preferred include: (a) hard rock--4; (b) light rock--3; (c) new age--1; and (d) jazz--1. Nonpreferred music was provided by the experimenter. The categories of music which were specified as nonpreferred and the number of subjects who selected each category as their least preferred music include: country western--3, atonal--5, and hard rock--1.

Procedure

Subjects met together in a large classroom where forms were handed out initially: the consent form, the Musical Experience Questionnaire, the Trait Anxiety Scale of the STAI, and the answer sheet to the Music Preference Test (Appendix A). After ensuring that the consent form was read and understood, the subjects were asked to complete the Musical Experience Questionnaire and the Trait Anxiety Scale. After completion of the scale and the questionnaire, the Music Preference Test was administered, with the volume adjusted to a comfortable level. Anonymity of each response was accomplished by a predetermined number which was assigned to each subject.

Table 1

Subjects' Preferred and Nonpreferred Music

Preferred Music	
A-Ha: Hunting High and Low	Journey: Greatest Hits
Berlin: "No More Words"	Pat Metheny: Still Life
Duran Duran: "The Chauffeur"	Orchestral Manoeuvres In The Dark: The Pacific Age
Frankie Goes To Hollywood: "Relax"	Pink Floyd: The Wall
Amy Grant: The Collection	Shadowfax
Janet Jackson: "Control," "Nasty," "What Have You Done For Me Lately?"	Styx: "Mr. Roboto"

Nonpreferred Music

Country Western

Willie Nelson: "I'd Trade All Of My Tomorrows," "Fraulein"

Emmy Lou Harris: "Heartbreak Hill"

Lester Flatt and Earl Scruggs: "Folsom Prison Blues," "Long Road To Houston"

Patsy Cline: "Your Cheatin' Heart"

Atonal

Bernd Alois Zimmerman: Perspectives

Arnold Schoenberg: Trio (String), Opus 45 (1946)

Hard Rock

Metallica: "Hit The Lights," "The Four Horsemen," "Phantom Lord"

Each of the nine subjects who participated in the latter portion of the experiment was tested individually for a total of three testing periods, at a minimum of three days apart. The presentation order of preferred music, nonpreferred music, and silence were counterbalanced for all the subjects.

At the beginning of each individual session, standard questions were asked of each participant:

> These questions are purely for research purposes and your answers will remain strictly confidential. Are you presently experiencing any pain in your body, e.g., headache, stomachache? Are you taking any muscle-relaxing drugs or other kinds of medication? Are you under the influence of any narcotic substance? Have you consumed alcohol within the past 24 hours? If so, how much?

The Subjective Relaxation Test and the State Anxiety Scale were then administered. After completion of these scales, an explanation of the EMG was given during a subject's first individual session:

> This machine is run on batteries. There is no chance of getting shocked. These are the electrodes which will be attached to your shoulders and the back of your neck. You will feel no pain from them and you will soon forget they are on. All you may feel is the sticky electrode gel which is used to provide a better recording for the electrodes. The gel is water-soluble, and there should be no trace of it afterward, on you or your clothing. Do you have any questions?

Two surface electrodes were attached onto the subject's upper left and right trapezius muscles, with a ground electrode attached at the base of the neck. Further instructions were then given:

> Make yourself as comfortable as possible. The chair reclines into two more positions; use whichever one feels most comfortable. Do not go to sleep. I will record readings for the next five minutes. Please try not to move. If you have to move, e.g., cough or sneeze, do not be too concerned about it; I will just begin recording that segment over again.

The EMG was set to display digital readings at 30-second analysis time intervals, using a wide band pass filter and a slow meter averaging time constant. Baseline readings were taken for the next five minutes, with the lights dimmed slightly.

At the completion of the five-minute period, the subject was allowed to move. If preferred music was used, the volume of the music was adjusted to a level comfortable to the subject during this time. If nonpreferred music was the experimental condition, the decibel levels of both the hard rock and country western music were preset at approximately 60-70 decibels (dB). Because the atonal music varied more in volume, its decibel levels ranged from 50 dB to 80 dB. Whether music or silence was the condition presented, the subject was told to make herself/himself as comfortable as possible. Instructions to remain awake and stationary for the next 15 minutes were repeated. EMG readings continued to be monitored.

At the end of the 15-minute period, the music was turned off and the subject was again allowed to move if he/she chose. The State Anxiety Scale and the Subjective Relaxation Test were readministered, and the electrodes were removed after completion of the tests. The subject was instructed to refrain from discussing the experiment with classmates or friends until after the end of the University's term, in order to control for possible biasing of other subjects. All of the above individual testing procedures, with the exception of the explanation of the EMG, were repeated two more times for each subject.

Pilot Testing

The individual experimental procedures were practiced with five normal subjects of varied ages to provide an opportunity for the researcher to use the EMG and to gain consistency and continuity in the procedures. Dimmer lighting resulted from suggestions made by two subjects; the lights were dimmed to possibly enhance relaxation.

Chapter IV
RESULTS

Difference scores for the dependent variables, state anxiety and relaxation, were obtained by subtracting the posttest scores from the pretest scores for each condition. EMG difference scores represent the differences between the average number of microvolts for each condition and their respective average-microvolt baselines. These results are presented in Tables 2-4, while the raw data scores for each subject are reported in Appendix C. Positive scores indicate an increase in relaxation levels and a decrease in anxiety and muscle tension levels. Conversely, less positive or more negative scores indicate decreased relaxation and increased anxiety and muscle tension.

Table 2

State Anxiety Difference Scores Under Conditions of Preferred Music, Nonpreferred Music, and Silence

Subject	Preferred Music	Nonpreferred Music	Silence
1	8	10	11
2	-1	1	5
3	5	3	-1
4	6	6	13
5	1	-2	3
6	11	6	4
7	4	5	7
8	8	-4	1
9	6	-3	10
M	5.3	2.4	5.8

As seen from the mean values for each condition, preferred music and silence seemed to induce less anxiety and greater relaxation than nonpreferred music, but nonpreferred music indicated less muscle tension than the other conditions. Also, silence appeared to produce the greatest degree of muscle tension. However, the EMG results may be skewed due to the scores of Subject 3 under nonpreferred music, and Subject 2 under silence.

An analysis of the effects of each measure upon conditions and subjects was performed using a repeated measures analysis of variance (Table 5). None of the $\underline{F}$ values were significant at the .05 level, although two $\underline{F}$ values were significant at the .10 level. Table 5 shows that there is a main effect between state anxiety and subjects at the 10% level, with a table value of 2.09 at 8 and 16 degrees of freedom, indicating a statistical difference between subjects on the measure of anxiety. The other significant effect at the .10 level is between relaxation and music preference, with a table value of 2.67 at 2 and 16 degrees of freedom. This seemed to indicate that the conditions of preferred music, nonpreferred music, and silence influenced relaxation, but only at the 10% level.

Table 3

Relaxation Difference Scores Under Conditions of Preferred Music, Nonpreferred Music, and Silence

Subject	Preferred Music	Nonpreferred Music	Silence
1	1	2	4
2	1	0	1
3	2	1	0
4	2	0	3
5	0.5	0	0.5
6	2	2	2
7	2	0	2
8	2.5	-0.5	0
9	1	1	1
M	1.5	0.5	1

The two table values for state anxiety-conditions and EMG-conditions were associated with a *p* of only .25. In other words, the conditions of music and silence appeared to have little effect on state anxiety and muscle tension. The table value for the effect between EMG and subjects was associated with a *p* of .25, while the probability for the effect between relaxation and subjects was only .50, indicating few differences between subjects on measures of muscle tension and relaxation.

Table 4

EMG Difference Scores Under Conditions of Preferred Music, Nonpreferred Music, and Silence

Subject	Preferred Music	Nonpreferred Music	Silence
1	0.06	0.91	0.05
2	-0.27	-0.37	-3.80
3	0.96	10.43	-0.19
4	-0.33	-0.29	0.36
5	0.96	0.58	-0.10
6	-2.26	-0.49	0.20
7	0.29	0.02	0.19
8	0.58	3.45	0.25
9	-0.18	0.22	0.45
M	-0.02	1.61	-0.29

Another analysis of variance was computed to determine if division of the EMG scores into five-minute segments would indicate a difference that was not shown when scores were averaged for the full 15 minutes. This analysis was performed to observe if time had an effect on the degree of muscle tension. The data, as reported in Table 6, were not found to be significant at the .05 level. Values for the first five-minute EMG period were associated with a p of .25. Values for the middle five-minute period were associated with a p of .50 for the EMG-conditions effect, and a p of .25 for the EMG-subjects effect. Finally, p values of .25 and .50 were associated with the EMG-conditions effect and the EMG-subjects effect, respectively, for the last five-minute period. Therefore, time, as measured in three five-minute segments, does not appear to have a significant effect on muscle tension.

Table 5

Analysis of Variance Summary Table

Source	*dF*	*SS*	*MS*	*F*	*p*
I. State Anxiety					
Conditions: C	2	61.55	30.78	2.26	>.05
Subjects: S	8	251.33	31.42	2.31	>.05*
Interaction: CS	16	217.79	13.61		
II. Relaxation					
C	2	5.05	2.53	2.70	>.05*
S	8	10.67	1.33	1.42	>.05
CS	16	14.95	0.93		
III.EMG					
C	2	18.93	9.46	2.23	>.05
S	8	52.82	6.60	1.55	>.05
CS	16	68.11	4.25		

* significant at the .10 level

Table 6

Analysis of Variance for EMG: First, Middle, and Last Five-Minute Segments

	Source	*dF*	*SS*	*MS*	*F*	*p*
I. First 5 Mins.						
Conditions:	C	2	37.25	18.62	2.06	>.05
Subjects:	S	8	120.06	15.00	1.66	>.05
Interaction:	CS	16	144.50	9.03		
II. Middle 5 Mins.						
	C	2	11.07	5.53	1.49	>.05
	S	8	43.73	5.46	1.47	>.05
	CS	16	59.43	3.71		
III. Last 5 Mins.						
	C	2	15.81	7.90	1.98	>.05
	S	8	38.80	4.85	1.21	>.05
	CS	16	63.76	3.98		

Pearson product-moment correlations were calculated between conditions and measures (see Table 7). Only one correlation was found to be significant at the .01 level: state anxiety under silence with relaxation under silence. The probability for all other correlations was greater than .05. Interestingly, the correlations between state anxiety and relaxation under the remaining conditions of preferred and nonpreferred music also appear to be related substantially (r = .540 and .580, respectively). This would seem to indicate that as relaxation increased, anxiety decreased, and vice versa, strengthening the relationship between the self-report modes.

Table 7

Pearson Product-Moment Correlations

	Preferred Music			Nonpreferred Music			Silence		
	SA	REL	EMG	SA	REL	EMG	SA	REL	EMG
Preferred Music									
SA	---	.540	-.510	.333	---	---	.118	---	---
REL	---	---	-.159	---	-.159	---	---	-.100	---
EMG	---	---	---	---	---	.378	---	---	.024
Nonpreferred Music									
SA				---	.580	-.115	.440	---	---
REL				---	---	.035	---	.467	---
EMG				---	---	---	---	---	.027
Silence									
SA							---	.811*	.164
REL							---	---	.174
EMG							---	---	---

* $p < .01$

SA = state anxiety

REL = relaxation

EMG = electromyogram

Moderate correlations were found between relaxation/ nonpreferred music and relaxation/silence (r = .467), and between state anxiety/nonpreferred music and state anxiety/ silence (r = .440). These correlations may suggest that the measure of relaxation was similar under conditions of both nonpreferred music and silence, and that the same could be implied of state anxiety. However, the significance of these relationships may appear misleading. A correlation coefficient implies a relationship between two variables of commonality. The amount of relationship is expressed in percentage as computed by squaring the coefficient. For example, a coefficient of .440, as seen above, indicates that a relationship exists between two variables equal to 19%. Therefore, if 19% represents the amount of relationship that can be accounted for, 81% remains unaccounted for. Consequently, a .440 relationship, although seemingly moderate, is far from direct.

One last correlation of interest exists between state anxiety and EMG under the condition of preferred music. A negative correlation was found (r = -.510), indicating an inverse relationship. In other words, muscle tension levels did not decrease as state anxiety decreased, as expected, but instead, moved in the reverse direction. However, this occurrence happened only under the condition of preferred music. This implies that, though preferred music may lower state anxiety, preferred music could also, conversely, increase muscle tension.

The next sets of graphs present the data for each subject. The odd-numbered figures (e.g., 1, 3, 5, 7) compare difference scores for each measure under conditions of preferred music, nonpreferred music, and silence. Constants were added onto the actual difference scores (+4 for EMG; +5 for state anxiety and relaxation), first, for purposes of analysis, and second, to make the graphs more easily readable. Although the graphs vary in scale, they are presented to indicate directional differences in tension/relaxation. The even-numbered figures (e.g., 2, 4, 6, 8) display the average number of microvolts for each 30-second interval during baseline and condition. Discussion of quantitative results accompany each set of graphs.

Figure 1 indicates that silence induced the greatest degree of relaxation and the least amount of anxiety in Subject 1, and that preferred music had the opposite effect. The EMG, however, showed that preferred music and silence were nearly equal in difference scores, while nonpreferred music demonstrated the greatest difference in muscle tension. A look at Figure 2 reveals that nonpreferred music contains the highest baseline, in terms of number of microvolts. The subject mentioned that a slight cramp was felt in his right side due to running prior to the experiment. This may account for the greater degree of muscle tension during the nonpreferred music baseline, and subsequent large difference score when the EMG levels returned to levels similar to that of the other conditions.

There seems to be a discrepancy in Subject 2's anxiety and muscle tension scores, as seen in Figure 3. Silence seemed to induce the least anxiety, but also the greatest muscle tension; conversely, the condition of preferred music contained the greatest anxiety and the least muscle tension. Figure 4 may aid, partly, in explaining this disparity. Immediately noticeable in this figure are the extremely wide leaps in tension during silence. Subject 2 had difficulty remaining awake during the silent condition; a few reminders to keep her head upright were required, beginning at the sixth 30-second interval of the 15-minute period. Although the EMG machine was reset whenever the experimenter noticed gross head movement or sleep, it was hard to control for slighter movement (i.e., nod of the head). During the preferred music condition, a few reminders to remain awake were again needed, e.g., the leap in tension at interval six of the 15-minute period. Ideally, these data should have been disregarded due to movement artifacts.

Subject 3's anxiety and relaxation scores seem to be in agreement, with preferred music showing greater relaxation/lesser anxiety and silence indicating the opposite (see Figure 5). The EMG scores, though, graphically show that nonpreferred music brought about the greatest degree of muscle tension reduction. A closer look at Figure 6 discloses one reason for the large difference in EMG scores: a high degree of tension in the baseline of the nonpreferred

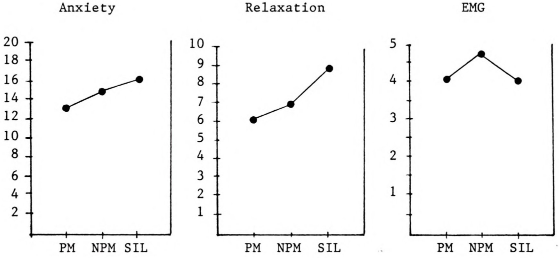

Figure 1. Difference Scores Across Measures Under Conditions of Preferred Music, Nonpreferred Music, and Silence: Subject 1.

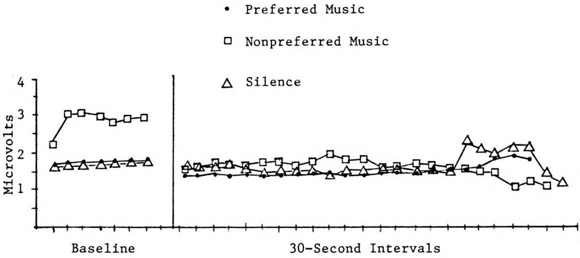

Figure 2. Average EMG Microvolts Under Experimental Conditions: Subject 1.

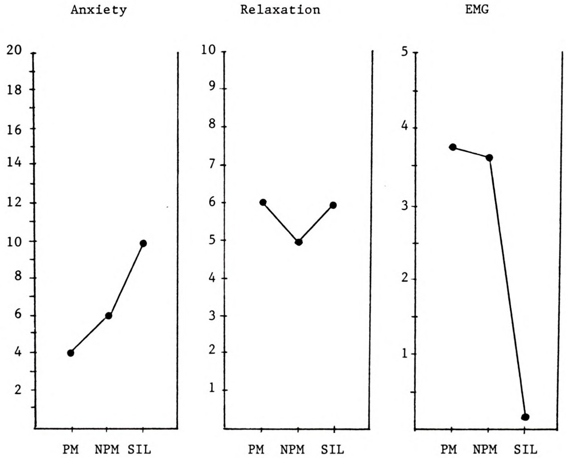

Figure 3. Difference Scores Across Measures Under Conditions of Preferred Music, Nonpreferred Music, and Silence: Subject 2.

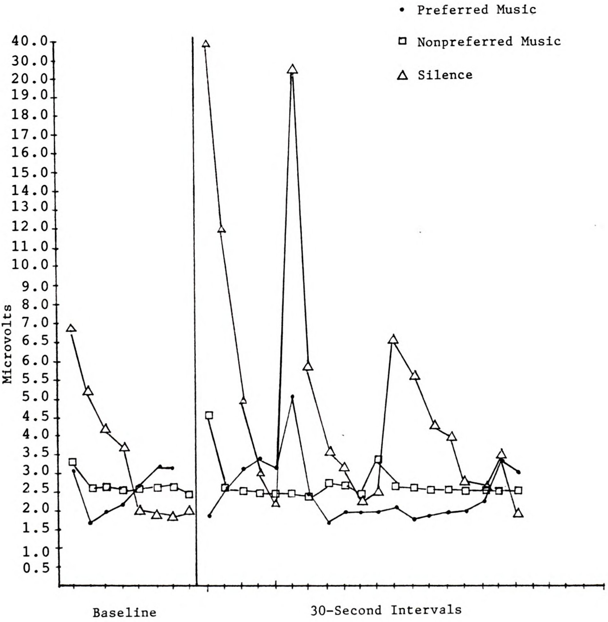

Figure 4. Average EMG Microvolts Under Experimental Conditions: Subject 2.

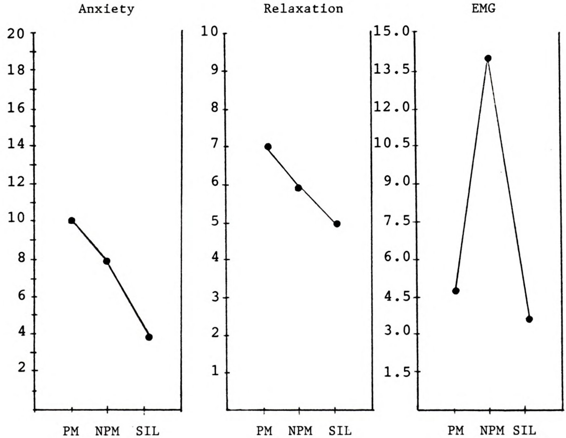

Figure 5. Difference Scores Across Measures Under Conditions of Preferred Music, Nonpreferred Music, and Silence: Subject 3.

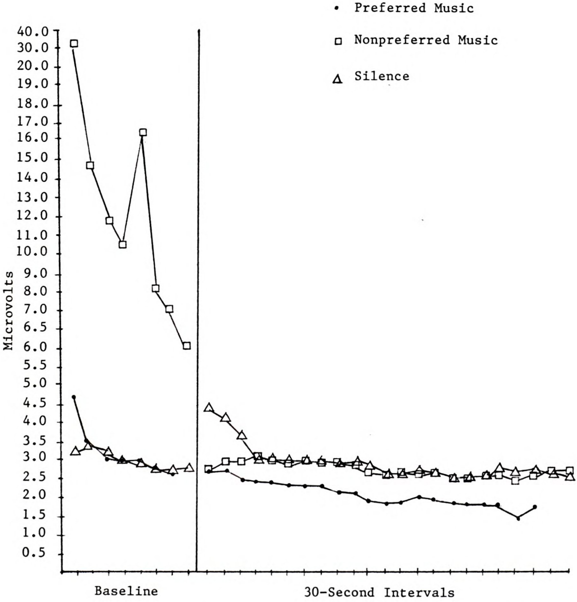

Figure 6. Average EMG Microvolts Under Experimental Conditions: Subject 3.

music condition. During the actual listening period, however, the tension decreased to levels similar to the condition of silence. In general, Figure 6 shows that preferred music induced the lowest tension levels, similar to the anxiety and relaxation findings shown in Figure 5.

Psychological and physiological data appear to agree with each other in the condition of silence for Subject 4 (Figure 7). During this condition, greater relaxation and lesser anxiety and muscle tension was observed. The conditions of preferred and nonpreferred music also seem to be correlated under anxiety and EMG measures, both indicating similar tension levels. Figure 8, however, shows that preferred music has a slightly higher tension level than nonpreferred music.

Figure 9 indicates that the condition of silence brought about the greatest change in anxiety for Subject 5, but showed little change in EMG tension. Also, anxiety levels differed between preferred and nonpreferred music: preferred music seemed to induce less anxiety. Preferred music also brought about a greater change in muscle tension, although nonpreferred music seemed to have a similar EMG difference score. Relaxation scores did not vary greatly between conditions.

Figure 10 demonstrates a partial reason for the small difference in tension during silence: the baseline was already low. A decrease in muscle tension, therefore, would not have shown much difference. Also, preferred and nonpreferred music both show decreases in tension. The higher baseline of preferred music, though, allows for a slightly greater difference between baseline and condition.

Figure 11 demonstrates quite opposite changes for Subject 6 in measures of anxiety and EMG tension. Preferred music induced the least anxiety but the greatest amount of muscle tension; silence, on the contrary, showed the greatest anxiety and the least muscle tension. The differences in nonpreferred music scores were more similar to the silence

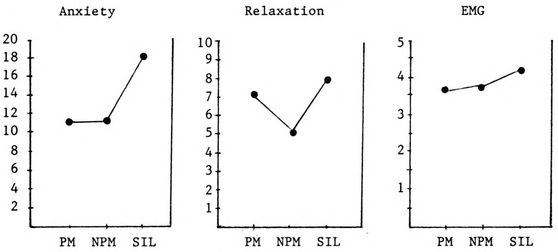

Figure 7. Difference Scores Across Measures Under Conditions of Preferred Music, Nonpreferred Music, and Silence: Subject 4.

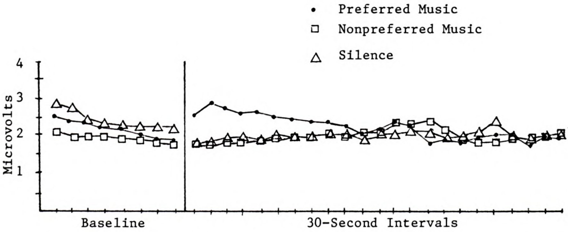

Figure 8. Average EMG Microvolts Under Experimental Conditions: Subject 4.

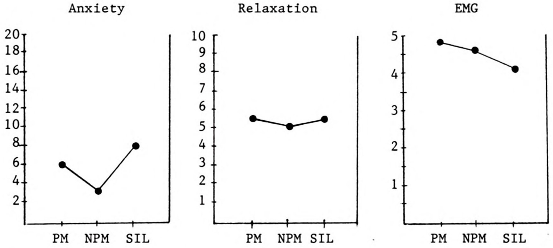

Figure 9. Difference Scores Across Measures Under Conditions of Preferred Music, Nonpreferred Music, and Silence: Subject 5.

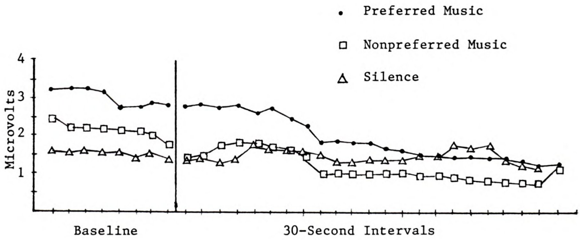

Figure 10. Average EMG Microvolts Under Experimental Conditions: Subject 5.

scores than to the scores for preferred music. There were no differences in relaxation.

Figure 12 shows a dramatic increase in tension level at the onset of the preferred music listening period, which tapered off to lower levels during the latter half. Nonpreferred music also demonstrates an increase in tension from baseline to the music listening period. These scores, however, remain high and do not taper off as do the preferred music scores, except at the last six 30-second intervals. Subject 6 reported difficulty in remaining awake during the last 3-4 minutes of the nonpreferred music listening period, which seems to account for the lower microvolt levels. The condition of silence indicates lower tension levels than the other conditions, both during baseline and during the 15-minute period. The subject stated that Motrin was taken for a headache approximately five hours prior to the experiment in which silence was the experimental condition. Perhaps the medication was a factor in reduced muscle tension levels.

Subject 7's EMG levels did not seem to vary greatly, although changes in anxiety and relaxation can be observed in Figure 13. Silence appeared to effect the greatest change in anxiety reduction, and preferred music the least change. Both silence and preferred music seemed to induce equal relaxation changes, while nonpreferred music brought about the least relaxation. A look at Figure 14 reveals relatively similar EMG levels, with nonpreferred music indicating slightly lower tension than preferred music or silence. The subject reported a need to cough during the last half of the nonpreferred music baseline; suppression of the cough may have resulted in greater muscular tension.

Figure 15 indicates that preferred music induced greater relaxation and lesser anxiety for Subject 8, and nonpreferred music induced the opposite: greater anxiety and lesser relaxation. Nonpreferred music, however, showed the greatest positive change in muscle tension. Figure 16 demonstrates a high baseline for nonpreferred music, permitting a greater

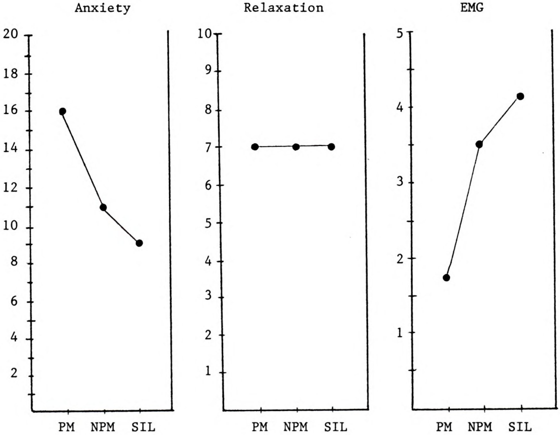

Figure 11. Difference Scores Across Measures Under Conditions of Preferred Music, Nonpreferred Music, and Silence: Subject 6.

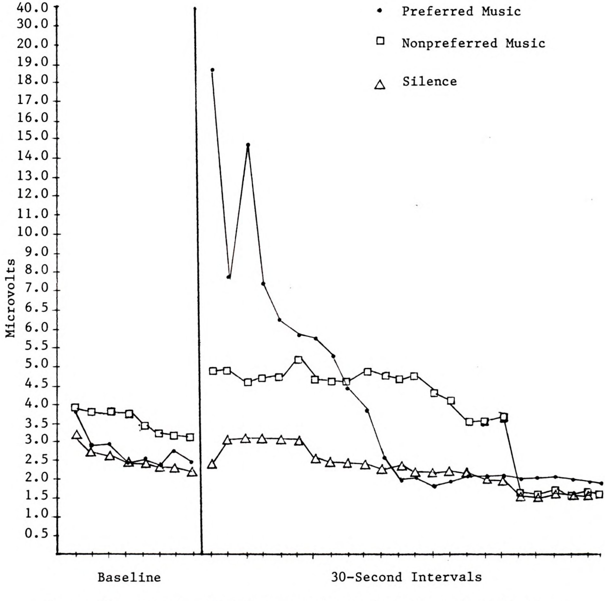

Figure 12. Average EMG Microvolts Under Experimental Conditions: Subject 6.

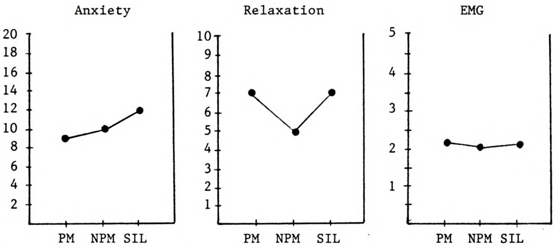

Figure 13. Difference Scores Across Measures Under Conditions of Preferred Music, Nonpreferred Music, and Silence: Subject 7.

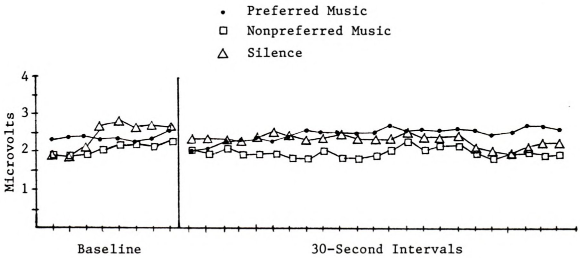

Figure 14. Average EMG Microvolts Under Experimental Conditions: Subject 7.

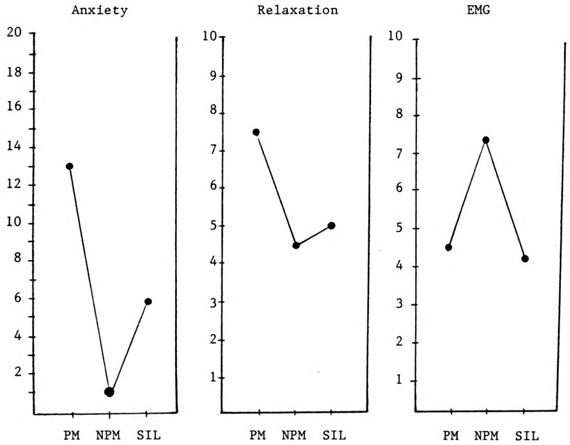

Figure 15. Difference Scores Across Measures Under Conditions of Preferred Music, Nonpreferred Music, and Silence: Subject 8.

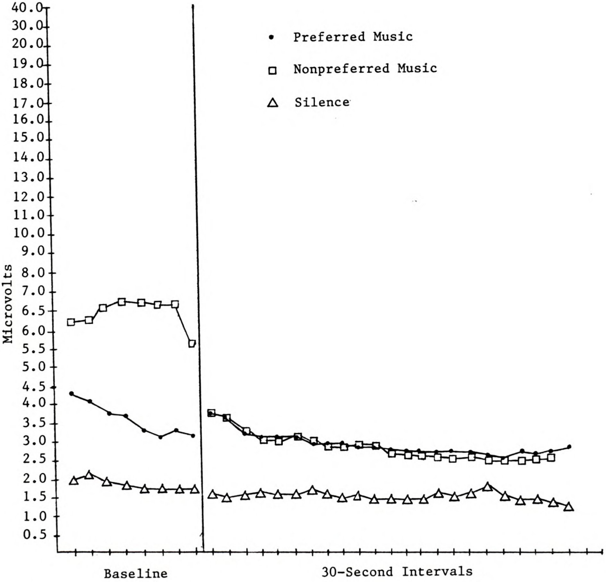

Figure 16. Average EMG Microvolts Under Experimental Conditions: Subject 8.

decrease in tension and a larger increase in the difference score. The condition of silence did not seem to have much effect on muscle tension, anxiety, or relaxation. One last note for Subject 8: a rise in muscle tension during the last four intervals of preferred music is indicated in Figure 16. The subject reported throat irritation which occurred during this time period; the irritation may have been responsible for the slight increase in tension.

Silence induced the least anxiety and nonpreferred music demonstrated the greatest amount of anxiety for Subject 9, as shown in Figure 17. Silence also showed the greatest decrease in muscle tension, while preferred music demonstrated the greatest increase in tension. Silence, in this case, seems to be correlated positively with both anxiety and EMG data. There were no differences in relaxation. Figure 18 lends support to the EMG data in Figure 17. Silence shows the greatest reduction in tension, and the overall rise from baseline during the preferred music condition indicates an increase in tension.

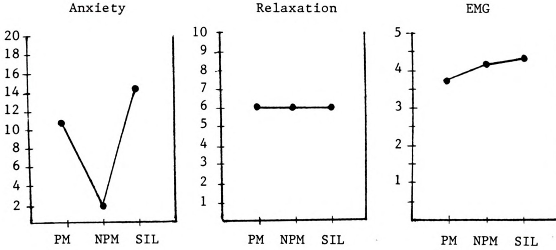

Figure 17. Difference Scores Across Measures Under Conditions of Preferred Music, Nonpreferred Music, and Silence: Subject 9.

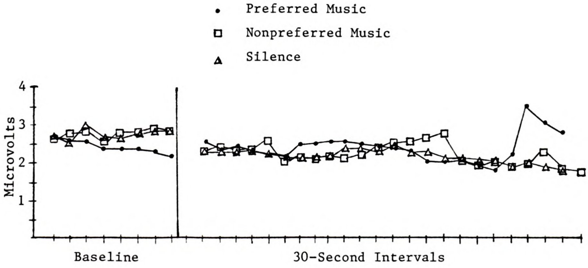

Figure 18. Average EMG Microvolts Under Experimental Conditions: Subject 9.

CHAPTER V
CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

Summary

The purpose of this study was to determine the effects of preferred music, nonpreferred music, and silence on measures of state anxiety, relaxation, and muscle tension. Nine subjects were selected from a pool of 90 college students after passing criteria for trait anxiety and musical experience. Each of the nine subjects was tested individually for a total of three testing periods. One condition (preferred music, nonpreferred music, or silence) per session was used, with the presentation order counterbalanced for all the subjects. Pretests-posttests of state anxiety and relaxation were administered during each condition, and muscle tension was measured using an electromyogram. Results were obtained using a repeated measures analysis of variance to analyze the effects of each measure upon conditions and subjects. Pearson product-moment correlations were calculated to determine relationships between conditions and measures. Quantitative results were reported in tables and graphs and explained in the accompanying text. The tables presented results from the analysis of variance and Pearson correlations, and also reported difference scores for each measure under conditions of preferred music, nonpreferred music, and silence. The graphs presented difference scores for each subject, as well as individual EMG data under all conditions.

Conclusions

The following conclusions are paired with the research questions asked in chapter I:

Question 1: Will there be significant differences between preferred music, nonpreferred music, and silence on the measure of state anxiety?

The analysis of variance showed that the main effect between conditions and state anxiety was not significant at the .05 level.

Question 2: Will there be significant differences between preferred music, nonpreferred music, and silence on the measure of relaxation?

The analysis of variance revealed that the main effect between conditions and relaxation was not significant at the .05 level. However, a significant effect between conditions and relaxation was found at the .10 level.

Question 3: Will there be significant differences between preferred music, nonpreferred music, and silence on the measure of muscle tension?

The analysis of variance showed that the main effect between conditions and muscle tension was not significant at the .05 level.

Question 4: Will there be significant relationships between measures of state anxiety, relaxation, and muscle tension under conditions of preferred music, nonpreferred music, and silence?

One significant correlation was found at the .01 level: state anxiety/silence and relaxation/silence. The probability for all other correlations was greater than .05. The relationship between state anxiety and relaxation under conditions of preferred and nonpreferred music also appeared to be correlated substantially (r = .540 and .580, respectively), indicating that relaxation increased as anxiety decreased, and vice versa.

A negative correlation (r = -.510) was established between state anxiety and muscle tension under the condition of preferred music, pointing to an inverse relationship in which state anxiety decreased as muscle tension increased. This relationship was not found under conditions of nonpreferred music or silence.

There seemed to be little relationship between measures of relaxation and muscle tension. Correlations were low under all conditions: preferred music (r = -.159); nonpreferred music (r = .035); and silence (r = .174). This appears to imply that as psychological relaxation decreased, a corresponding decrease in physiological relaxation as measured by the EMG was not found.

On the measure of state anxiety, Pearson correlations revealed that there was little correlation between preferred music and silence (r = .118) and between preferred and nonpreferred music (r = .333). A moderate correlation appeared to exist between nonpreferred music and silence (r = .440). On the measure of relaxation, only a small inverse correlation appeared between preferred and nonpreferred music (r = -.159) and between preferred music and silence (r = -.100). A moderate positive correlation was calculated between nonpreferred music and silence (r = .467) on the measure of relaxation. Finally, low correlations were discovered between preferred and nonpreferred music (r = .378), preferred music and silence (r = .024), and nonpreferred music and silence (r = .027) on the measure of muscle tension.

In summary, no significant F values were found at the .05 level. Two main effects, however, were found to be significant at the .10 level: state anxiety across subjects and relaxation across conditions. Pearson correlation computations found that state anxiety and relaxation were correlated significantly under the condition of silence. State anxiety and relaxation were correlated also, although nonsignificantly, under preferred and nonpreferred music. In addition, a moderate relationship was established in state anxiety under conditions of nonpreferred music and silence, and in relaxation under the same conditions. State anxiety and EMG muscle tension were related inversely under preferred music, while other correlations of EMG were associated with low correlation coefficients. Lastly, a trend appeared for preferred music to induce lesser anxiety and greater relaxation than nonpreferred music.

Discussion

The initially tested 90 subjects produced 16 subjects who passed both of these criteria: a) must have scored approximately one-half of the standard deviation above the trait anxiety mean of the STAI, and b) must have had two years or less of formal musical training or music activity participation. Of these 16 subjects, only nine participated in the experiment. The small number of subjects necessitates the need to limit the results of the study to this specific sample only. The high standards set for selecting subjects may appear too stringent, and might have prevented greater subject participation. On the other hand, a second possibility for the small subject number could be due to the population from which the subjects were chosen (introductory college psychology classes). These college students might have had, for example, more musical training than individuals without college education.

A variety of music, including rock, new age, jazz, and Christian, were selected by the subjects as being their most preferred relaxing music (Table 1). Although the majority of related research studies seem to have utilized precategorized music such as stimulative or sedative, attempts at placing these subjects' preferred music into similar categories may be difficult due to a variety of stylistic features such as tempo, volume, and rhythm. Approximately 77% of the chosen music contained lyrics. It was not the purpose of this study, however, to explore the specific effects of vocal music versus the effects of instrumental music.

The decision of choosing categories for inclusion in the Music Preference Test was difficult. A number of categories which now exist in the musical repertoire have developed since the time of Bartlett's (1973) study. For instance, in the general category of "rock," further divisions can be found: pop, progressive rock, funk, heavy metal, disco, and new wave. New age music was mistaken occasionally for new wave; this is an example of confusion among categories, and a need for clearer categorical definitions. One type of music which consistently required definition (at the end of each Music Preference Test) was atonal music. To briefly demonstrate characteristics of atonal music, e.g., tone clusters, wide leaps, and lack of a tonal center, a piano was utilized, in addition to verbal explanations. Other categories of music which were not included in the Music Preference Test, besides the ones mentioned above, are reggae, fusion, bluegrass, polkas, waltzes, marches, movie music, Broadway tunes, and rhythm and blues. Clearly, a music preference test that was designed to utilize as many of these categories as possible would lengthen the time required for completion of the test. Thus, the categories selected for this study were chosen to represent a variety of musical styles. For example, "light rock" could mean pop, ballads, and easy listening rock; "hard rock" would include heavy metal, progressive rock, new wave, and funk.

A common problem in a study which uses a repeated measures design to measure physiological responses is that of establishing a subjects's baseline. Would an increase or decrease from that baseline necessarily indicate a response due to the experimental stimulus, e.g., a decrease in muscle tension due to preferred music? Or could a decrease in EMG tension from an unusually high baseline be a natural result of progression over time? For example, Subject 3's baseline for nonpreferred music was quite high, beginning at 32 microvolts and staying in a range of 10-16 microvolts for about 3 minutes (see Figure 6). During the listening portion, the levels remained approximately in the 2.5-3.5 microvolt range, similar to levels under other conditions. Was the large difference score (14.43) due to the nonpreferred music, or to time progression? In such a case, should the nonpreferred music session have been repeated until the subject's baseline was within the "normal" range (similar to baselines from other conditions)? These questions point to a few of the difficulties inherent in physiological research.

The low correlations associated between muscle tension and state anxiety or relaxation concur with Dainow's (1977) observation that little correlation exists between the psychological and physiological responses to music. One reason that may account for this disparity is attention to the music. Hanser (1985) noted that a reaction comparable to stress may be produced by attending to the music. Davis and Thaut (1989) remarked also that physiological responses could be indicative of either pleasant or unpleasant experiences. Additionally, Fontaine and Schwalm (1979) demonstrated that familiar music produced higher levels of arousal than unfamiliar music. These factors may offer an explanation for the inverse relationship found between state anxiety and muscle tension under the condition of preferred music, which is demonstrated in Figures 11 and 12. The trend for muscle tension to increase while state anxiety decreases is similar to the findings of Davis and Thaut. The explanation for this inconsistency between psychological and physiological data may be explained by Berlyne's (1971) theory of hedonic value and arousal which states that decreases from high arousal levels as well as increases from low levels of arousal can be perceived as pleasant. It appears that a reduction in anxiety and an increase in physiological arousal accompanied a pleasurable listening experience which was induced by preferred music.

Preferred music appeared to induce lesser anxiety and greater relaxation than nonpreferred music. The implications of this for music therapy suggest that a client's musical preferences are important considerations in the determination of appropriate music therapy activities designed to alleviate stress or facilitate changes in emotion. In the process of developing individualized strategies, a music therapist attempts to establish a directional stimulus-response relationship (Thaut, 1990). In other words, music is utilized to facilitate desired responses. Selection of appropriate music, then, must be determined not only by musical characteristics, but by an individual's unique background, which includes factors such as preference, familiarity, cultural context, and past experiences (Davis & Thaut, 1989). Significant psychophysiological changes may then occur if attention is paid to these important variables.

Recommendations

A number of improvements can be made in this study.

1. Criteria for selection of subjects could be less restrictive to allow for greater participation. For example, the requirements for musical experience would be expanded to that of Scartelli and Borling's (1986) study: "2 years or less [of] formal music study and no formal music activity participation. . . in the previous 3 years" (p. 159). This would allow for individuals who played in junior high school band, for example, to participate as long as the requirements for formal music study were met. In a similar manner, selecting subjects from a different population (e.g., subjects with only a high school education) might permit increased subject participation.

2. Anxiety was measured in an atmosphere that was more conducive to relaxation than to anxiety. Since Kallman and Feuerstein (1986) noted that physiological responses seem to be related to specific situations, it is recommended that future research designs incorporate some type of anxiety-invoking situation to make the environment and measurements more "psychobiologically relevant."

3. Intensity has been shown to affect responses to music (Dainow, 1977). Although the subjects were allowed to control the volume of their preferred music, perhaps a future study could increase the volume of nonpreferred music past the decibel levels set for this study (70-80 dB). This suggestion is based on a subject's comment that distraction from the nonpreferred music would have been more difficult had the music been any louder.

4. An analysis of variance was performed on five-minute increments of EMG levels to determine if time had an effect on muscle tension. A different approach, similar to one used by Landreth (1974), would be to divide the musical stimulus not into time periods, but into musical segments which are characterized by tempo and volume, for example. Landreth discovered that varying musical settings induced significant heart rate changes, but that these changes would not have been noticeable had the summation of heart rates been taken during the entire musical selection. This procedure may be useful in identifying specific musical elements which may influence psychophysiological responses.

5. Specific elements of nonpreferred music may also need to be identified. A few subjects who disliked country western reported, at the end of the nonpreferred music listening session, that their tolerance for Willie Nelson's music was higher than for the music of someone like Patsy Cline or Emmy Lou Harris. The subject whose nonpreferred music was hard rock stated that she especially disliked the sound of loud electric guitars. Therefore, this study could

be improved by eliciting responses from individuals, prior to the music listening sessions, regarding specific qualities of the music they dislike.

6. Reinking and Kohl (1975) found that the low correlation between psychological and physiological measures of anxiety may increase with practice of self-measured relaxation, using EMG biofeedback as the tool. The authors hypothesized that "the increasing correlations may show subjects' improving ability to perceive and discriminate the internal cues reflecting autonomic activity" (p. 599). Hanser (1985) recommended that music therapy researchers further investigate the area of biofeedback, and suggested that "future investigations . . . explore the potential to monitor continuously the listener's physiological reactions to different musical selections" (p. 200). These musical selections might include subjects' preferred music and/or nonpreferred music.

7. A variety of responses occurred between subjects, as demonstrated graphically in Figures 1-18, while only one correlation was found to be significant at the .05 level. These differential responses and lack of significant relationships seem to indicate a need to pursue psychophysiological research using a within subject approach, i.e., examining individual response patterns to a variety of musical stimuli using a repeated measures design (Davis & Thaut, 1989). This procedure would deviate from the more traditional research approach which categorizes music (e.g., stimulative or sedative) according to supposedly consistent response patterns, and instead, focus on idiosyncrasies of individuals under specific conditions (e.g., preferred music).

APPENDICES

APPENDIX A

FORMS

CONSENT FORM

You indicate your voluntary agreement to participate by completing and returning this questionnaire.

The purpose of this study is to examine the effects of various kinds of music on relaxation and muscle tension. You will be asked to: 1) complete a short music questionnaire, 2) complete a self-evaluation questionnaire, and 3) listen to various musical excerpts as you record your degree of liking for them on a piece of paper. For the second half of the experiment, if you willingly choose to participate, you will be seen individually for three sessions which will be approximately a half hour each. For each session, you will be asked to complete a self-evaluation questionnaire and also to indicate your current level of relaxation. You will be seated in a recliner chair with surface electrodes attached to your upper shoulder areas as you either listen to music or sit in silence. The electrodes will be attached to an instrument that measures muscle tension. There should be no discomfort involved.

All results will be treated with strict confidence and you will remain anonymous in any report of research findings. Results may be made available to you on request and within these restriction results.

Your participation is voluntary. You may choose not to participate at all, may refuse to participate in certain procedures or answer certain questions, or may discontinue the experiment at any time.

This is a statement to the effect that the experiment has been explained to you, and that you understand it, including any inherent risks and/or discomforts.

You may contact me (Bonnie Chan) at 393-8984 if you have any questions or concerns that may be raised by participating in the study.

MUSICAL EXPERIENCE QUESTIONNAIRE

NAME:____ NO._______
(last) (first)

Instruments you play or have played:		Private Study?		
___________________	Yrs._____	yes	no	Yrs.___
___________________	Yrs._____	yes	no	Yrs.___
___________________	Yrs._____	yes	no	Yrs.___
___________________	Yrs._____	yes	no	Yrs.___
___________________	Yrs._____	yes	no	Yrs.___

Musical organizations you have performed in at junior and senior high schools:

Band____ yrs._____ Glee Club____ yrs._____

Orch.____yrs._____ Other___________________________________ Yrs.___

Choir____yrs._____

Record/tape/CD collection: small ____ moderate ____ extensive ____

Types of records/tapes/CD's collected: ______________________________________
(Folk, New Age, Jazz, etc.)

____

____

____

____

Other music courses taken in high school or college:

____ Describe:

____ Describe:

____ Describe:

Trait Anxiety Scale

Sample Questions

(taken from the State-Trait Anxiety Inventory by Spielberger, Gorsuch, Lushene, Vagg, and Jacobs, 1983)

	Almost Never	Sometimes	Often	Almost Always
1. I feel nervous and restless.	1	2	3	4
2. I feel like a failure.	1	2	3	4
3. I am happy.	1	2	3	4
4. I lack self-confidence.	1	2	3	4
5. I am content.	1	2	3	4

State Anxiety Scale

Sample Questions

	Not At All	Somewhat	Moderately So	Very Much So
1. I feel calm.	1	2	3	4
2. I feel upset.	1	2	3	4
3. I feel indecisive.	1	2	3	4
4. I feel content.	1	2	3	4
5. I feel confused.	1	2	3	4

Music Preference Test Answer Sheet

Number ____

	Strongly Like 1	Like 2	Mildly Like 3	Neither Like Nor Dislike 4	Mildly Dislike 5	Dislike 6	Strongly Dislike 7
xample #1	1	2	3	4	5	6	7
o. 1	1	2	3	4	5	6	7
2	1	2	3	4	5	6	7
3	1	2	3	4	5	6	7
4	1	2	3	4	5	6	7
5	1	2	3	4	5	6	7
6	1	2	3	4	5	6	7
7	1	2	3	4	5	6	7
8	1	2	3	4	5	6	7
9	1	2	3	4	5	6	7
10	1	2	3	4	5	6	7
11	1	2	3	4	5	6	7
12	1	2	3	4	5	6	7
13	1	2	3	4	5	6	7
14	1	2	3	4	5	6	7
15	1	2	3	4	5	6	7
16	1	2	3	4	5	6	7
17	1	2	3	4	5	6	7
18	1	2	3	4	5	6	7
19	1	2	3	4	5	6	7
20	1	2	3	4	5	6	7
21	1	2	3	4	5	6	7
22	1	2	3	4	5	6	7
23	1	2	3	4	5	6	7
24	1	2	3	4	5	6	7
25	1	2	3	4	5	6	7
26	1	2	3	4	5	6	7
27	1	2	3	4	5	6	7
28	1	2	3	4	5	6	7
29	1	2	3	4	5	6	7
30	1	2	3	4	5	6	7

	Strongly Like 1	Like 2	Mildly Like 3	Neither Like Nor Dislike 4	Mildly Dislike 5	Dislike 6	Strongly Dislike 7
o. 31	1	2	3	4	5	6	7
32	1	2	3	4	5	6	7
33	1	2	3	4	5	6	7
34	1	2	3	4	5	6	7
35	1	2	3	4	5	6	7
36	1	2	3	4	5	6	7
37	1	2	3	4	5	6	7
38	1	2	3	4	5	6	7
39	1	2	3	4	5	6	7
40	1	2	3	4	5	6	7
41	1	2	3	4	5	6	7
42	1	2	3	4	5	6	7
43	1	2	3	4	5	6	7
44	1	2	3	4	5	6	7
45	1	2	3	4	5	6	7
46	1	2	3	4	5	6	7
47	1	2	3	4	5	6	7
48	1	2	3	4	5	6	7
49	1	2	3	4	5	6	7
50	1	2	3	4	5	6	7
51	1	2	3	4	5	6	7
52	1	2	3	4	5	6	7
53	1	2	3	4	5	6	7
54	1	2	3	4	5	6	7
55	1	2	3	4	5	6	7
56	1	2	3	4	5	6	7

MUSICAL CATEGORIES

Classical

Atonal

Country Western

Light Rock

Hard Rock

New Age

Jazz

Folk

Subjective Relaxation Test

How do you feel at this moment?

(Please circle a number.)

Extremely Relaxed	Very Relaxed	Mildly Relaxed	Indifferent	Mildly Stressed	Very Stressed	Extremely Stressed
1	2	3	4	5	6	7

EMG LAB REPORT

Number _____

EMG Session # _____

Date _______________

Condition _________

Meter Readings
(Microvolts)

1.	17.
2.	18.
3.	19.
4.	20.
5.	21.
6.	22.
7.	23.
8.	24.
9.	25.
10.	26.
11.	27.
12.	28.
13.	29.
14.	30.
15.	31.
16.	32.

Comments: ______________________________________

APPENDIX B

MUSIC PREFERENCE TEST ITEMS

MUSIC PREFERENCE TEST ITEMS

KEY:

CW = Country Western	A = Atonal
J = Jazz	HR = Hard Rock
F = Folk	LR = Light Rock
C = Classical	NA = New Age

	CATEGORY	ARTIST/COMPOSER	SELECTION
1.	CW	Tanya Tucker	"Rainy Girl"
2.	J	David Sanborn	"Darn That Dream"
3.	F	Joan Baez	"There But For Fortune"
4.	C	Franz Schubert	Symphony No. 6
5.	A	Karlheinz Stockhausen	
6.	HR	ZZ Top	
7.	LR	Wham	"Heartbeat"
8.	CW	Oak Ridge Boys	"Ol' Kentucky Song"
9.	NA	Andreas Vollenweider	
10.	F	Judy Collins	"So Early, Early in the Spring"
11.	C	Antonio Vivaldi	Four Seasons
12.	LR	Billy Ocean	"Without You"
13.	A	Arnold Schoenberg	Five Pieces For Orchestra
14.	J	McCoy Tyner	"Lazy Bird"
15.	LR	Glenn Medeiros	"Nothing's Gonna Change My Love For You"
16.	NA	George Winston	"Thanksgiving"
17.	CW	Randy Travis	"Forever Amen"
18.	C	Nicolai Rimsky-Korsakov	Capriccio Espagnol
19.	J	Louis Armstrong	
20.	F	John Denver	"Garden Song"
21.	A	Iannis Xenakis	Metastasis
22.	LR	Miami Sound Machine	"Give It Up"
23.	NA	Vangelis	
24.	HR	Van Halen	"Why Can't This Be Love?"
25.	CW	Willie Nelson	"Good Hearted Woman"

26.	F	Gordon Lightfoot	"Ordinary Man"
27.	CW	Dolly Parton, Linda Ronstadt, Emmy Lou Harris	"Pain of Loving You"
28.	C	Amadeus Mozart	(Piano Quintet)
29.	J	Duke Ellington	
30.	NA	Kitaro	"Silk Road"
31.	J	Akiyoshi/Lew Tabakin	
32.	C	Peter Tchaikowsky	<u>Romeo and Juliet</u>
33.	HR	David Bowie	
34.	J	Keith Jarrett	"Too Young To Go Steady"
35.	F	Pete Seeger	"Freight Train"
36.	A	Pierre Boulez	
37.	NA	Suzanne Cianni	"Velocity of Love"
38.	LR	Barbra Streisand	"Comin' In And Out Of Your Life"
39.	C	Ludwig von Beethoven	<u>Symphony No. 6</u>
40.	HR	U2	
41.	CW	Charlie Daniels Band	
42.	A	Lukas Foss	
43.	J	Pat Metheny	
44.	C	Howard Hanson	<u>Symphony No. 2</u>
45.	HR	Def Leppard	"Rock! Rock!"
46.	F	Peter, Paul, & Mary	"Early Mornin' Rain"
47.	NA	David Lanz & Paul Speer	"Rainforest"
48.	LR	Billy Joel	"Uptown Girl"
49.	A	Anton von Webern	<u>Cantata No. 1</u>
50.	LR	Journey	
51.	LR	Whitney Houston	"All At Once"
52.	CW	Emmy Lou Harris	
53.	NA	Ray Lynch	"Deep Breakfast"
54.	F	Kingston Trio	"Where Have All The Flowers Gone?"
55.	A	Elliott Carter	<u>Double Concerto for Harpsichord & Piano with Two Chamber Orchestras</u>
56.	HR	Cheap Trick	"The House is Rockin'"

APPENDIX C

RAW DATA

Table C.1

State Anxiety Pretest-Posttest Raw Scores

Subject	Preferred Music	Nonpreferred Music	Silence
1	29-21	38-28	40-29
2	41-42	48-47	39-34
3	42-37	42-39	43-44
4	28-22	49-43	60-47
5	22-21	23-25	27-24
6	35-24	42-36	40-36
7	24-20	34-29	28-21
8	35-27	28-32	21-20
9	28-22	24-27	32-22

Table C.2

Relaxation Pretest-Posttest Raw Scores

Subject	Preferred Music	Nonpreferred Music	Silence
1	2-1	5-3	6-2
2	4-3	5-5	3-2
3	4-2	4-3	5-5
4	4-2	4-4	6-3
5	2.5-2	3-3	2.5-2
6	3-1	5-3	4-2
7	3-1	3-3	3-1
8	5-2.5	3-3.5	2-2
9	2-1	4-3	3-2

Table C.3

Average EMG Microvolt Scores for Baseline and Condition

Subject	Preferred Music Base-Condition	Nonpreferred Music Base-Condition	Silence Base-Condition
1	1.90-1.84	2.90-1.99	1.87-1.82
2	2.66-2.93	2.67-3.04	3.52-7.32
3	3.16-2.20	13.43-3.00	3.03-3.22
4	2.19-2.52	1.90-2.19	2.42-2.06
5	3.07-2.11	2.10-1.52	1.55-1.65
6	2.81-5.07	3.54-4.03	2.55-2.35
7	2.42-2.71	2.06-2.04	2.49-2.30
8	3.57-2.99	6.37-2.92	1.91-1.67
9	2.42-2.60	2.71-2.49	2.72-2.27

Table C.4

Average EMG Microvolt Scores: First, Middle, and Last Five-Minute Segments

Subject	Preferred Music	Nonpreferred Music	Silence
1			
First	1.60	1.95	1.64
Middle	1.74	2.17	1.66
Last	2.12	1.84	2.16
2			
First	3.52	3.03	14.86
Middle	2.47	3.02	4.35
Last	2.83	3.07	3.27
3			
First	2.42	3.13	3.67
Middle	2.15	2.99	3.02
Last	2.03	2.89	3.03

Subject	Preferred Music	Nonpreferred Music	Silence
4			
First	2.69	1.92	1.98
Middle	2.45	2.29	2.07
Last	2.45	2.31	2.15
5			
First	2.74	1.79	1.60
Middle	2.03	1.44	1.51
Last	1.63	1.36	1.83
6			
First	10.06	4.91	2.88
Middle	3.29	4.71	2.34
Last	2.50	2.47	1.53
7			
First	2.41	1.98	2.46
Middle	2.81	2.04	2.42
Last	2.88	2.09	2.05
8			
First	3.24	3.30	1.62
Middle	2.79	2.89	1.63
Last	2.98	2.61	1.77
9			
First	2.47	2.43	2.24
Middle	2.57	2.69	2.44
Last	2.73	2.33	2.13

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