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The Effect of Binaural Auditory Beats on the Anxiety and Psychological Hardiness Levels of Graduate Students

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ABSTRACT

Three graduate students from a Midwestern urban university were selected from a pool of volunteers based on elevated levels of anxiety. The students were initially tested using the Self-Evaluation Questionnaire and Hardiness Scale. Students were provided with audio tapes using binaural beats. Each Self-Evaluation Questionnaire score was tracked for the purpose of determining the affect of the audio tapes on levels of anxiety and hardiness. All three students showed reduced levels of anxiety after using the tapes, with either a similar or higher level of Hardiness.

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Chapter One

Introduction

While the specifics vary, all people everywhere, throughout life, experience adversity. What sets people apart is their response to adversity not whether or not they experience it. Some respond positively, overcoming it, returning to at least the same level of functioning that preceded the adverse event or events. They are described in the literature by a variety of researchers as demonstrating psychological *resilience* (Masten & Garmezy, 1985) and *hardiness* (Kobasa & Maddi, 1979). There are even those who learn from their experience and attain a higher level of psychological functioning after experiencing adversity than they had prior to it. Such people can be described as *thriving* (Carver, 1998) .

Counselors are frequently called upon to work with people in the midst of stressful, anxiety-producing situations. As a result, they have a particular interest in identifying, understanding and using techniques that might increase and improve the resilience, hardiness and ability of their clients to thrive, despite these situations.

These three terms, psychological resilience, hardiness and thriving, are related but different. They are related in that each describes responses to adversity that do not impair an individual's psychological functioning over time. There is also an implied link here to Garmezy and Masten's references to what they describe as the importance of an individual's "competent behaviors" (1986,

p. 506) when dealing with adversity. They contend that competent social, sexual and work behaviors can significantly reduce the impact of severe life stressors. They also believe that people can be taught skills in a variety of ways that can decrease the negative impact of adversity and increase competency in dealing with it. The three terms are different in that each describes individual's "competent" responses from the perspectives of a number of researchers. Hardiness is one of these concepts that has at least one instrument within acceptable validity and reliability parameters for use in research.

According to Maddi and Khoshaba (1994) Kobasa and Maddi (1979) developed the term hardiness to describe the interrelationship of a combination of commitment, control and challenge abilities to help individuals turn stressful situations into positive rather than debilitating experiences. People high in commitment are self-reliant and become involved in situations rather than removing themselves from them. People strong in control take an active role in influencing the world around them. Those strong in challenge seek out experiences that help them to grow and learn.

As mentioned previously, psychological hardiness can be measured. The Hardiness Scale is one instrument designed to do so and is the one used in this study. Theoretically it should be possible to measure the effect of a counseling intervention, in this case *Hemi-Synch* audio tapes, on the overall hardiness levels of the subjects in this study. There will be data created in the form of scores for each of the three components of hardiness (commitment, control and challenge).

Each score in each of these three areas is added together to yield an overall score. Therefore, while the collection of this data on the three component areas of hardiness is unavoidable, it is the overall score that remains a primary focus of this study.

According to Garmezy (1994), psychological resilience is the accumulated sum of resources an individual has gained as a result of learning to deal with the challenges of adversity over a lifetime – not to deny difficulties, but to go on in spite of them. Individuals can survive adversity, thrive even. "The experience of adversity (serious stress or trauma, physical or psychological) can sometimes yield benefits to the person who experiences it" (Carver, 1998, p. 245). While it would seem that someone who thrives, by definition, has high degrees of resilience and hardiness, this concept is worthy of mention as well as future exploration, but is not a focus of this study.

Kagen (1983) describes stressful situations as events when an individual perceives a threat and responds with anxiety, fear, guilt or sadness. Therefore, an important skill that can help develop resilience is learning how to become more competent in dealing with these situations and emotions. So, if it were possible to help individuals reduce their anxiety and fear, it may increase the likelihood of their feeling more competent and resilient. It would be useful to discover therapeutic techniques that would facilitate this process. This study will focus on one technique that could reduce the level of anxiety as measured by the Self-Evaluation Questionnaire.

The therapeutic technique of focus here involves using an audio tape that uses binaural beats specifically designed to lower anxiety levels. The subjects selected for this study have relatively elevated levels of anxiety as measured by the Self-Evaluation Questionnaire and lower levels of hardiness as measured by the Hardiness Scale. The study is designed to determine if use of the audio tape does indeed reduce anxiety and increase overall psychological hardiness. If so, the tape might serve as a useful tool for helping the subjects to cope more effectively with anxiety. This in turn might result in improved confidence and an increased sense of competence for dealing effectively with anxiety. Obviously this would be a preferred outcome for the subjects as opposed to their becoming immobilized by their anxiety on the one hand or their avoiding or withdrawing from it on the other. Either of these responses to anxiety for the subjects of this study would likely result in failure to successfully complete the statistics course and therefore failure to complete the entire graduate course of study.

According to Atwater (1997) the Hemi-Synch audio tape makes use of a scientific phenomenon known as binaural beats. Binaural beats were discovered in 1839 by German experimenter H.W. Dove. Binaural beats do not actually exist but are perceived by the brain as the average combination of two sound waves with different frequencies. For example, if someone using a headset has a sound wave of 100 Hz fed into one ear and 110 Hz fed into the other, the brain perceives this as a sound wave of 105 Hz that rises and falls in amplitude of 10Hz. There was not a sound wave of 105 Hz but that is what the brain believes it hears. This

composite signal is called an auditory beat.

How the technology works is interesting, but not as important as what it claims to be able to do. According to Lane, Kasian, Owens and Marsh (1997) these beats elicit changes in a listener's state of consciousness, depending on the frequency of the beat. Different frequencies of this beat can be used to stimulate different parts of the brain for different results – to enhance memory and attention and to reduce anxiety. The tape in this study uses a combination of binaural beats, audio instructions, and "white noise" to attempt to induce in the listener a deep state of relaxation.

The purpose of the study is to determine the effect of a Hemi-Sync audio tape on the hardiness and anxiety scores of three volunteer graduate students in the high-anxiety environment of a graduate statistics course. The course can cause high anxiety levels for a number of reasons. It is required for graduation and requires more mathematical skills than other courses in the curriculum. It is generally taken toward the end of a student's program, after significant financial and time investments have been made. In addition to prohibiting graduation, failure could result in significant financial cost with little or no corresponding job or career benefit, such as increased salary or job opportunities. According to Kiselica, Baker, Thomas and Reedy (1994) high levels of anxiety can harm academic performance and cause a number of additional psychosocial problems. The mathematical nature and content of the course can also increase student anxiety. "Mathematics anxiety is the tendency to feel anxious or nervous

when attempting to solve mathematical problems, which can be generalized into anxious feelings about classes and tests in mathematics" (Lussier, 1996, p. 826).

The hypotheses in this project were that during treatment weeks (when the audio tape was used) anxiety scores would be the same or lower than those during non-treatment weeks, when anxiety levels would be higher. Overall, it was hypothesized that anxiety levels would continue to decrease from treatment week to treatment week. Therefore, scores would be lower in week four than in week two. It was also expected that decreased anxiety scores would result in significantly increased hardiness scores when baseline and final scores were compared.

Chapter Two

Review of Literature

A review of the research literature is presented that compares and contrasts the concepts of the psychological coping mechanisms of hardiness, resilience, and thriving. The focus is on individuals who demonstrate the ability to cope in constructive ways with anxiety and stress. In addition, binaural beats are explained, including their use in an audio tape format and as a therapeutic intervention for helping clients decrease their anxiety.

Hope Embedded in Adversity

While frequency and severity vary from person to person, adversity in life (serious stress or trauma, physical or psychological) is inevitable for all. Adversity results from societal challenges and difficulties resulting from poverty, disease and political oppression. Adversity results from difficulties in relationships within families and at work. Adversity results from traumatic life events such as acute and chronic illness, to name a few. Often it is the most vulnerable who are exposed to the most adversity. Yet, even the most vulnerable, often do not succumb to the risks and dangers of adversity.

McMillen (1999) cites a number of research studies by a number of authors regarding a wide range of people who have experienced severe adverse situations and report benefits despite them. For example, according to Thompson (1990), 45% of spouses of stroke survivors reported some benefit.

McMillen, Smith and Fisher (1997) reported that 55% of crash survivors and 95% of tornado survivors reported benefits three years afterward. As McMillen also emphasizes, it was not that people were not also harmed by these catastrophic events in their lives, because they undoubtedly were, but that benefits also occurred despite them.

These groups of people provide examples that can contribute to a broader understanding of how people can constructively deal with adversity. The field of psychology has developed the constructs of *resilience, hardiness and thriving* to understand and explain various aspects of this phenomenon. These constructs represent a "hope embedded in adversity" (Dyer & McGuiness, 1996, p. 276) both for those experiencing adversity as well as for the psychotherapists who work to assist them.

There is hope because people who have experienced traumatic life events also report experiencing benefits as a result of the experience. There is hope because children in difficult situations often avoid the expected adverse outcomes in adolescence and adulthood. "In a celebrated study on children, Werner and Smith reported in 1982...one of every three children evaluated to be at significant risk for adolescent problems developed into competent and confident young adults at age 18. Two of the three remaining two-thirds had turned into caring...adults by age 32" (Saleeby, 1996, p. 300). There is hope because while it would take a social revolution to eradicate environmental adversities for people, according to Epstein and Katz (1992) much of an

individual's stress is self-produced. This at least opens the possibility of helping individuals develop the interpersonal learning skills to deal with this stress, rather than merely succumbing to it. There is hope, because according to Carver (1998) and McMillen (1999) there are individuals who not only cope with adversity but who learn from it so as to function above and beyond their functioning level prior to experiencing it.

The Mind, Body, Behavior Connection

All three of these psychological concepts imply an important connection of the mind, body and behavior. Numerous studies have documented this connection. The Basic Behavioral Task Force of the National Advisory Mental health Council (1996) reports that hostile people are especially prone to develop heart disease and to behave in ways that jeopardize their health such as smoking, drinking and general risk-taking. Another study described by Sperry (1994) has demonstrated that lack of a close relationship with parents and an ambivalent attitude toward life and human relationship resulted in an increased likelihood of cancer later in life.

This mind, body and behavior connection also manifests itself when adversity occurs in a person's life. Garmezy and Masten ((1986) refer to Kagan [1983] who describes many individual's responses to adversity as a pattern involving the relationship between a stressor, the individual's perception of a stressor, and the changes that occur within the individual as a result. An identifiable stressor possesses several essential

components. One component is an event or events that serve as a stimulus. A second component is the individual's perception of the event or events as a potential threat. The third component is the physiological and psychological changes that occur in the individual in response to the perceived threat. Such changes may include but are not limited to anxiety, fear, guilt or sadness.

While this may be a frequently recurring pattern for the vast majority, it is at this stage that a significant split occurs between those who recover better and more quickly from adversity from those who do not. By definition, all three concepts have to do with recovery from adversity. Without sufficient degrees of coping-recovery mechanisms and skills resulting in resilience, hardiness and thriving, there is limited recovery or maybe no recovery at all. According to McMillen (1999) individuals have *self-righting tendencies.* These concepts seem to be reasonable ways of trying to understand how this self-righting works. When mentioned here as a group, they are referred to as *personal adversity coping mechanisms.*

Personality Factors

There are personality characteristics that tend to indicate an individual has sufficient resources to cope with and recover from adversity. Evans (1993) includes optimism and high self-esteem among them. Sperry (1994) suggests trust of other people and close satisfying relationships. Florian (1995) focuses on the tendency to perceive events in less threatening terms, a problem-focus and an ability to self-challenge with questions about life direction and life changes. Bowsher and Keep (1995) mention the ability to seek and find

information about resources needed for coping, including establishing social networks. Dyer and McGuiness (1996) add the belief that difficulties in life are to be expected and dealt with.

The presence or lack of certain of these characteristics also has important implications for an individual beyond a specific adverse situation, indeed for a person's whole life. According to Wolff and Sperry (1995) developing a pattern of thinking more optimistically about stressful events can provide an individual with (increased) protection against depression, illness, and premature death. Therefore, being able to deal competently with adversity can have significant short and long-term benefits for an individual. According to Garmezy and Masten (1986), learning to reduce anxiety is a competence that can be learned and developed. Such competence includes being able to reduce the anxiety to a level that it does not impair the individual by avoiding the adverse situation on the one hand nor becoming overwhelmed by it on the other.

Behavior Competencies

Just as there are characteristics that tend to make it easier to deal with adversity, there are also behaviors. Garmezy and Masten (1986) report that competent behaviors in social, sexual, and work areas of a person's life can reduce the negative impact of severe stressors. Conversely, incompetent behavior in these areas contributes to an individual's increased vulnerability to stressful life events. Adaptive skills developed in any area of life appear to

become part of an individual's psychological tool kit, available for use in other areas. Thus, a healthier person, defined as a person with more competencies, has more behavioral response options when stress occurs.

Both personality characteristics and competent behaviors are important ingredients in providing individuals with a greater range of options in response to adversity. However, the primary focus of this research project is more related to competent behaviors than personality characteristics. The reason is that, according to Garmezy and Masten (1986), the task of the therapist is to assess a client's competence in dealing with adversity and then assist the client in improving those skills. This is accomplished through skills training, reinforcing positive behaviors and facilitating shifts in thinking about the adversity.

The therapeutic framework within which these competent behaviors are taught is also important because it can make it easier to develop a perspective beyond the adversity itself. According to Compton (1992), the goal (of life as a partial result of psychotherapy) is to have a balanced perspective of one's life and experiences, sometimes referred to as equanimity. Adversity negatively impacts a person's state of equanimity and creates significant risks for both the short and long term. In contrast to the behaviorists, according to Sadigh (1991), the goal of psychotherapy is to make the unconscious conscious so an individual may understand and ultimately gain control (of attitudes and of behaviors). Either or both approaches can

help an individual develop additional useful competencies that are applicable to more than one area of life. Both schools of thought provide good news about helping individuals deal with adversity.

The approach in this research project is to explore the effect of a specific intervention on several individuals, to determine its potential benefits as an aide in modifying behavior, and as a new tool available to the participants. This exploration also takes place within the framework of three related and similar but different and contrasting concepts including psychological resilience, hardiness and thriving. As a category they are referred to as *personal adversity coping mechanisms.*

Psychological Resilience

According to Dyer and McGuiness (1996) resilience refers to the ability to bounce back from adversity. Wolff describes it in broader terms "as a process, capacity for, or outcome of successful adaptation despite challenging or threatening circumstances" (1995, p. 566). Saleeby (1996) says resilience means the skills, abilities, knowledge and insight that accumulate over time as people struggle to surmount adversity. The three very important parts of this concepts are the ability to bounce back, to adapt, and to accumulate resources over time for dealing with adversity. They all imply that people do learn. While an important concept, it only describes general behaviors in general terms, a serious limitation when designing a research project.

Psychological Hardiness

According to Mardi and Koshabba (1981, p. 94) "hardiness is both a belief system and the implementation of actions consistent with those beliefs." Hardiness has three components - commitment, control and challenge. Each is a distinct component dynamically interacting with the other two. In general terms, persons strong in commitment rely on themselves. Persons strong in control think that through personal effort they can influence the course of events around them. Persons strong in challenge believe that fulfillment is to be found in continual growth in wisdom through what is learned from experience.

In more detailed terms, according to Maddi and Khoshaba (1994) persons strong in commitment rely on themselves to find ways of turning whatever they are experiencing into something that seems interesting and important to them, getting involved rather than being alienated by circumstances. This being alienated by circumstances is described by Florian, Mikulnicer and Taubman (1995) as "distancing coping." When it occurs it causes additional stress of its own in addition to the stressful current situation. High levels of commitment keep the individual engaged with the situation even as there is pressure to disengage.

Persons strong in challenge believe that fulfillment is to be found in continual growth in wisdom through what is learned from experience, rather

than in easy comfort, security, and routine. The challenge component should be viewed as a particular case of the search for meaning in one's experiences and life.

A significant feature of hardiness is that each of its three component parts (commitment, control, and challenge) can be measured by the Hardiness Scale. The scores from each component can then be combined for an overall score. That is why the Hardiness Scale was one of the instruments used for this study. "Mastery of these components that help in managing stressful circumstances turns them into developmental rather than debilitating experiences" (Mardi & Koshabba, 1981, p. 94).

Psychological Thriving

According to Carver (1998), when adversity occurs there are four possible outcomes. The first possibility is that the person experiencing it sooner or later succumbs to the impact of the initial trauma, including the possibility of eventual death. The second possibility is that the person survives but is impaired. The third possibility is that the person survives and demonstrates resilience and hardiness by returning to the previous level of functioning. The final possibility is that the person surpasses the previous level of functioning or thrives. For example, a man survives having a heart attack then changes his diet and starts an exercise routine that helps him become much stronger and healthier than he was prior to the heart attack.

Thriving is an extreme form of growth because it occurs at the boundary and in delicate balance with an individual's ability to tolerate a presented threat and to respond to it with some degree of flexibility. However, there can be too much threat that precludes and completely prevents growth.

Summary

While the concepts of psychological resilience, hardiness and thriving provide a helpful overall introductory context, they are not all easily measured, an essential component of a research project. All three of these terms include many of the personality characteristics mentioned in the literature as key to bouncing back from adversity. The concept of resilience is very helpful for gaining a basic, foundational understanding of personal coping mechanisms. The concept of thriving is exciting and presents a number of possibilities for further study and application. Both concepts are difficult to measure and the latter is beyond the time frame and scope of this research study. Because hardiness is a more behaviorally-oriented concept and there is an instrument (the Hardiness Scale) available to measure it, hardiness was the personal coping mechanism of choice for this project.

Potential Costs and Benefits of Anxiety

Godbey and Courage (1994) define anxiety in terms of an individual's perception of many situations as threatening and dangerous. This definition seems more applicable to those with broader and deeper problems with anxiety, such as those with anxiety disorders. People with these problems

were not the subjects of this study. Pengilly and Dowd (2000) credit Sarason, Johnson and Siegal (1978) with pointing out the positive correlation between anxiety and stressful life events. This observation seems more helpful here because the subjects of this study are in the midst of a situation that offers a strong case for consideration as a stressful life event. The subjects were students in a required graduate statistics course with significant financial cost and with graduation and career benefits at some risk. The students had made significant commitments of time and money in order to be eligible to take this class. In addition, the class content dealt extensively with mathematics, itself a challenge to many, especially for those with little experience with statistical analysis and few experiences of self-efficacy with mathematics.

In addition to the broad definition of anxiety tied to perception and the correlation of anxiety and stressful life events, there is the issue of degree of anxiety, no matter the source. In fact, not all anxiety has negative effects. "Moderate levels of anxiety can enhance awareness, alertness and performance" (Kiselica, Baker, Thomas & Reedy 1994, p. 335). In the research literature Epstein and Katz (1992) discuss the psychological concept of *productive load.* Productive load refers to the total amount of socially and personally useful activities in which an individual is engaged. A total lack of load or what would appear to be a stressless state is not considered desirable, but boring. According to O'Leary (1998, p. 428) "too little stress is not challenging enough but moderate levels of stress... provide a challenge, that,

when overcome, strengthens competence." While the anticipated levels of anxiety anticipated here were moderate it was not the purpose of this study to measure the effect of the intervention on performance. The focus here was on how the intervention affected levels of anxiety (and hardiness) only.

While moderate levels of anxiety apparently can provide some benefits, high levels of anxiety are a problem and challenge. Kiselica et al (2000) cite a significant number of researchers in a number of studies over a ten year period who mention many deleterious effects of high anxiety throughout the life cycle. Some of these include a variety of anxiety disorders [American Psychiatric Association, 1987], depression, attention difficulties, somatic complaints [Strauss, 1990] , substance abuse [Segal, Hobfoll & Cromer, 1984] and career indecision [Hartman, Fuqua & Blum, 1985].

Academic Performance and Mathematics Anxiety

Because the subjects are students in a statistics class it seems important to take a closer look at the relationship between more general definitions of anxiety and its more specific manifestations here, academic and mathematics anxiety. Brackney and Karabenick (1995) cite Tobias (1985) and Hembree (1988) when they suggest there is a relationship between worry and academic performance. Brackney et al (1995) also contend there are many other factors that impact academic performance, such as learning strategies, motivation, the belief one has the ability to successfully perform an academic task, intrinsic interest (in the subject matter), extrinsic sources (grades or approval), and the importance of reaching subsequent educational goals

(graduation). Therefore, managing anxiety is an important factor in successful academic performance but it is only one factor.

In addition to a more general form of anxiety that may exist regarding academic performance, mathematics itself can contribute to student anxiety. "Mathematics anxiety is the tendency to feel anxious or nervous when attempting to solve mathematical problems, which can be generalized to anxious feelings about classes and tests and mathematics" (Lussier, 1996, p. 827). According to Lussier (1996), level of anxiety is related to levels of experience and self-confidence. Those with more experience and self-confidence tend to have lower anxiety. Those with less experience and self-confidence tend to have higher anxiety. According to Casey, Nuttall and Pezaris (1997) environmental and biological factors are responsible for variations in math achievement. Some of these factors are that boys perceive themselves to be more competent than girls even though girls achieved higher grades. Gender stereotyped expectations are formed early and are lasting. Casey et al (1997) also cite Wigfield and Eccles (1992) who claim it is not actual success or failure but rather perceived success and failure that influences internalized beliefs about potential for success at math. The subjects in this research project were chosen based on their elevated anxiety levels. This concept of perception would seem to have some application to the high anxiety levels of the subjects of this study despite the fact that there was no knowledge of their personal history and level of academic success or

failure with mathematics. In addition, this class provided significantly greater need for mathematical skills than any other in the curriculum. Therefore, it seems reasonable to expect accordingly a higher level of mathematics anxiety than in other courses.

Anxiety and Hardiness

As mentioned earlier, adversity may cause anxiety, fear, guilt or sadness. Any of these was possible for the subjects of this study. However, anxiety was chosen as the key issue in this study for a variety of reasons. High anxiety has significant potential for adversely effecting academic performance. This particular course has relatively high costs and potential benefits for the students. There is significant likelihood for mathematics anxiety in a number of the students who may or may not have had much if any previous experience with statistical analysis. With an eye toward both the potential costs and benefits for the subjects and the likelihood of increased levels of anxiety for some taking the course it would seem potentially important to review the literature in search of links between anxiety and anxiety management. The research literature indicates there is a positive connection between personal adversity coping mechanisms (resilience, hardiness and thriving), with an emphasis here on hardiness, and the competent management of adversity and anxiety. Dyer and McGuiness (1996), Wolff (1995) and Saleeby (1996) define and discuss resilience. Mardi and Khoshabba (1981) and Maddi and Khoshabba (1994) deal with hardiness

and Carver (1998) discusses thriving.

Anxiety is related to adversity and stress, which are mentioned interchangeably in the literature. It could be very important, if not essential, for the students in this class situation and research study to have access to one or more relatively simple and inexpensive techniques that would be helpful in reducing their levels of anxiety. The technique or intervention used toward the goal of reducing the general, circumstantial, academic and mathematics anxiety of the students in this study involves *binaural beats* and *binaural beat technology* used in the form of an audio tape.

Binaural Beats

Binaural beats were discovered in 1839 by a German experimenter, H.W. Dove. According to Atwater (1988) the human ability to "hear" binaural beats appears to be the result of evolutionary adaptation. Lane, Kasian, Owens and March (1998, p. 249) describe binaural beats as two auditory signals of similar frequency that when mixed together result in a composite signal with a frequency midway between the upper and lower frequencies and an amplitude modulation that occurs with a frequency equal to the difference between the two original frequencies. For example, mixing tones of 100 Hz and 110 Hz yields a signal with a perceived frequency of 105 Hz. The amplitude-modulated composite signal is called a binaural beat. Binaural beats are perceived by the brain to exist, but in reality, do not.

Anecdotal evidence does suggest that presentation of low-frequency

binaural auditory beats can elicit a variety of changes in the listener's state of consciousness that might have a broad range of applications. For example, the presentation of binaural auditory beats in the delta and theta frequency ranges is said to be associated with enhanced creativity and improved sleep. Preliminary studies suggest that binaural beats in the EEG beta frequency range can enhance attention and memory task performance, and that those in the alpha frequency range may increase alpha EEG production and subjective relaxation. Binaural beats in the alpha frequency range and their production of relaxation (or decrease in anxiety) are a focus of this study. According to Atwater (1997) when an individual passively listens to binaural beats this may not automatically engender an altered state consciousness. The listener must be willing and have the ability to listen and relax and focus attention. Because the perception of binaural beats is said to be heightened by masking noise, referred to as white or pink noise, is often added to the carrier signal by the tape's manufacturer . Such is the case here. A narrator's voice providing an explanation of how the tape works and instructions on how to use it effectively are also included.

Binaural Beat Technology as a Therapeutic Intervention

According to Haggerty (1993) binaural beat technology that decreases arousal may have applications in the treatment of insomnia or stress. Tapes using binaural beats promote mind-body unity, to a point much closer to homeostasis, the ideal state of mental and physical equilibrium. While people

may seldom have the "wrong emotional reaction" (Haggerty, 1993, p. 4), their appropriate emotional reaction may be too much – they may overreact. Instead of viewing something as a problem, they may see it as a disaster, a catastrophe. Learning not to react with catastrophizing or awfulizing is a prerequisite to becoming more resistant to stress. A mental imagery scenario can be created to depict the most successful defense or coping mechanism. Repeatedly running this mental "tape" (facilitated by a binaural beat audiotape) convinces the brain that the person is coping rather than succumbing.

The producer of binaural beat technology audio tapes claims they can reduce levels of anxiety for those who use them. The purpose of this project is to determine the effect of the audio tapes on the hardiness scores and anxiety levels of three graduate students in a stressful statistics course situation during the alternating treatment and non-treatment weeks of the four week study.

Conclusion

While all people experience adversity, all do not respond to it similarly. There are four possibilities – succumbing to the trauma, surviving but remaining impaired, surviving and returning to the same functioning level prior to the adversity, surviving and developing a higher level of functioning. What determines the outcome in part is due to the severity of the trauma. There can be traumas so severe an individual cannot survive them. However, there are certain personality characteristics that contribute to an individual's

ability to be resilient and to possess hardiness. Some of these characteristics include optimism, high self-esteem, trust of other people and close satisfying relationships, as well as a belief that difficulties in life are to be expected and dealt with.

It is just as important for the individual and even more important from the perspective of the therapist that in addition to personal characteristics, there are behaviors that contribute to an individual's competence in dealing with adversity. Personality characteristics are difficult to change, but dealing with behavior and assisting clients with changing behavior are a strength of the therapeutic process when it is done well.

Behavioral competencies might be enhanced through the use of skills training, systematic reinforcement of positive behaviors, facilitating shifts in attributional processes and assisting in role modeling. Therefore, when trying to survive adversity it is admittedly desirable to have certain personality characteristics. However, it is also desirable to possess and have the openness and capacity for developing new competencies. It is not only who someone is that makes it possible to survive adversity. It is possible for therapists to teach and for clients to learn some new ways of dealing with the nearly inevitable anxiety, fear, guilt and sadness. The mind, body and behavior are connected in this process.

Therapists have instruments available to them for helping individuals self-assess their emotional states. In this research study the focus is on three

graduate students in a statistics class who have elevated anxiety levels likely related to academic achievement and mathematics anxiety. The intervention is an audio tape that uses binaural beats to decrease stress and anxiety levels. Its use and non-use will be tracked as will its effect on the anxiety and hardiness levels of the three subjects. The goal is to measure the affect of an audio tape that incorporates binaural beats on the anxiety levels (mind and body) of the three subjects and the relationship of anxiety levels to their hardiness levels (mind).

Chapter Three

Research Methodology

Single-Case Research Design

A single-case research design was used because it presents a number of advantages for therapists in clinical settings over other designs. According to Lundervold and Belwood (2000) some of these advantages include the fact that this design is useful in clinical settings where the focus is on therapeutic impact, not contribution to a research base. The affects of specific therapies are measurable and can be used to make therapeutic treatment adjustments. Single-case research methods are user-friendly because they do not require strong quantitative skills, although statistical analysis still occurs. This design can help bridge the gap between the social science aspect of the field of counseling and the everyday techniques of the practitioner. It simultaneously satisfies the scientific mandate for data that demonstrates the effectiveness of techniques and treatments while helping the practitioner (potentially with the client, as part of a therapeutic team) learn in a systematic way what is helping the client. Conversely, it may help both learn what is not helping or not helping much, resulting in revision or termination of that intervention.

According to Lundervold and Belwood (2000), it is especially useful in clinical settings. Although not used in a clinical setting in this case, this design does tend to increase the likelihood it will be used by practitioners. This is also a good design to use when experimenting with (relatively) new methodologies such as binaural beat technology. It is a more user friendly statistical model that also makes

statistical analysis possible. According to Heppner and Kivlighan (1998) it makes it possible to test therapeutic techniques by creating data useful in evaluating therapeutic outcomes. This in turn makes it possible to customize treatment to take the fullest possible advantage of what is working best. According to Gay and Airasian (1996) such designs can be applied when the sample size is one or when a number of individuals is considered as one group (as is true in this case). It is typically used to study the behavioral change an individual exhibits as a result of some intervention, or treatment. Because it is more user friendly it may encourage practitioners to become more data-based and focused on research. It is consistent with professional standards for accountability. The overriding objective is to identify interventions that work and to promote their use as well as identify interventions that do not work or work less well and modify them.

However, despite its multitude of advantages, according to Lundervold and Belwood single-subject research design "continues to be the 'best-kept secret in counseling'" (2000, p. 92). This continues to be true despite the fact that this research design has been developed for use in practice settings, evaluating counseling intervention outcomes.

There are advantages but also concerns about this design, concerning both external and internal validity. A major criticism of this research design is that results cannot be generalized to the population of interest. For single-subject design the key to being able to generalize the results is being able to replicate the results with a number of subjects, preferably diverse subjects (in gender, age, location, etc.). The more diverse the replications are, the more generalizable the results are.

An additional concern is that it is not possible to be sure if the results from treatment are the same as they would have been if the treatment phase had been the first phase instead of the baseline phase. It is especially important that measurement of the target behavior be done in exactly the same way every time, or as nearly the same as is humanly possible. Three data points are usually considered the minimum number of measurements needed to establish baseline stability.

The data is presented in the form of one or more data tables and graphs or figures. While analysis of the data by the researcher is crucial, in most therapeutic relationships whether or not there has been sufficient clinical significance can only be partially based on statistical significance. It must also be substantially based on ongoing dialogue between the client and therapist. Ultimately, they must decide together what interventions to continue, revise and discontinue. This research design method and resulting data serve as a potentially useful tool both can use as together they seek the desired, targeted behaviors and behavioral changes. As helpful as this research design may be it is not a substitute for the mutual learning process involving client and therapist but is an enhancement of it.

In summary, this design is empirical, yet relatively easy to use over time. It increases the likelihood of more responsive therapeutic treatment and opportunity for beneficial therapeutic outcomes. Last, but not least, it can be very useful for satisfying the documentation requirements for third-party payment of the therapist.

Four-Phase Single-Subject Design

The ABAB Design is a type of single-subject design that uses a four-phase experiment, frequently referred to as a reversal design. The ABAB Design

examines the effect of treatment (or independent variable) by either presenting (in this case presenting binaural beat technology) or withdrawing the variable during different phases in an attempt to provide unambiguous evidence of the causal effect of the independent variable. The ABAB design starts with a period baseline data gathering (A1) and then treatment phase (B1). In this design, there is a return to a baseline period (A2) where the intervention is withdrawn and then a second treatment phase (B2) occurs.

The assumption underlying the reversal is that if the independent variable caused the change in the dependent variable in the B1 phase, then a removal of the independent variable ought to return the subject to a level similar to the baseline phase. Moreover, if the reversal does result in a return to the baseline, then readministering the independent variable at B2 will serve as a replication and further strengthen the inferred causal relationship. If the behavior at A2 does not revert back to the baseline levels, a causal relationship cannot be inferred between the independent and dependent variable, as other (unknown) variables may be accounting for the change. In other words, this design greatly enhances the conclusions by demonstrating the effects of the treatment twice. It provides very convincing evidence of treatment effectiveness.

In this study, Week 1 was an A-Phase or non-treatment week as was Week 3. Week 2 was a B-Phase or treatment week as was Week 4. During non-listening weeks (Weeks 1 and 3) the class instructor was to keep the tapes to guarantee they would not be used. During treatment or listening weeks (Weeks 2 and 4) the instructor was asked to distribute the tapes to each subject. After the fourth week, each subject was to complete a Hardiness Scale and mail it to the researcher. The researcher would collect

the audio tapes, tape players, headphones and Listening/Non-Listening Record form at Week 5, at completion of the project.

Subjects and Data Collection

All of the graduate counseling students in a class of approximately 30 at a liberal arts, co-ed Midwestern university were invited to participate in the study. The class was predominately female and white but also included two African-American females and two white males. They were told the time span and the procedural requirements needed to participate in the study. Subjects would be chosen on the basis of scores on the Self-Evaluation Questionnaire and Hardiness Scale. Twelve student volunteers in the class completed and submitted a Hardiness Scale and Self-Evaluation or State-Trait Anxiety Inventory. Seven students were identified as potential participants based on their responses to questions three and four of the Self-Evaluation Questionnaire (State Side, Y-1). Those selected indicated answers for Item 3 ("I am tense") and Item 4 ("I feel strained") with a 4 Score ("Very Much So") or a 3 score ("Moderately So") or a 2 score ("Somewhat"). Four students with such scores were targeted as preferred subjects. Subject One had scores of 3 for both Item 3 and Item 4. Subject Two had scores of 2 for both Item 3 and Item 4. Subject Three had a score of 4 for Item 3 and a score of 3 for Item 4. Student or Subject Four had a score of 2 for Item 3 and 3 for Item 4. The four subjects were contacted and asked to participate. While all four agreed to do so, the fourth expressed some concern about the time commitment and agreed to be an alternate. Subject One was a 37 year-old white male. Subject Two was a 42 year-old white female. Subject Three was a 28 year-old white female. It was not necessary to use the fourth subject.

Instrumentation: Self-Evaluation Questionnaire

According to the State-Trait Anxiety Inventory Manual (1983), the Self-Evaluation Questionnaire or State-Trait Anxiety Inventory has been used extensively in research and clinical practice. It comprises separate self-report scales for measuring state and trait anxiety. The S-Anxiety Scale (STAI Form Y-1) consists of twenty statements that evaluate how respondents feel "right now, at this moment." This scale was the focus of this study. The T-Anxiety Scale (STAI Form Y-2) consists of twenty statements that assess how people generally feel.

The essential qualities evaluated by the STAI-S Anxiety scale are feelings of apprehension, tension, nervousness and worry. In addition to assessing how people feel 'right now', the STAI-S Anxiety Scale may also be used to evaluate how they felt at a particular time in the recent past and how they anticipate they will feel either in a specific situation that is likely to be encountered in the future or in a variety of hypothetical situations. Scores on the S-Anxiety scale increase in response to physical danger and psychological stress and decrease as a result of relaxation training. This characteristic is especially important in this study because the therapeutic intervention has to do with relaxation training.

The S-Anxiety scale has been found to be a sensitive indicator of changes in transitory anxiety experienced by clients and patients in counseling, psychotherapy, and behavior- modification programs. The scale has also been used to assess the level of S-Anxiety induced by stressful experimental procedures and by unavoidable real-life stressors such as imminent surgery, dental treatment, job interviews, or important school tests.

In responding to the STAI S-Anxiety scale, examinees blacken the number on

the standard test form to the right of each item-statement that best describes the intensity of their feelings: (1) not at all; (2) somewhat; (3) moderately so; (4) very much so. In responding to the T-Anxiety Scale, examinees are instructed to indicate how they generally feel by rating the frequency of their feelings of anxiety on the following four-point scale: (1) almost never; (2) sometimes; (3) often; (4) almost always.

The STAI was designed to be self-administering and may be given either individually or to groups. The inventory has no time limits. Repeated administrations of personality tests either lead to greater reliability in differentiating among subjects or have no significant influence on test scores. College students generally require about five minutes or less to complete the S-Anxiety scale.

Complete instructions for the S-Anxiety are printed on the test form. The scoring weights for the anxiety-present items are reversed, i.e. responses marked 1, 2, 3, or 4 are scored 4, 3, 2, 1, respectively. The anxiety-absent items for which the scoring weights are reversed on the S-Anxiety scales are: S-Anxiety: 1, 2, 5, 8, 11, 15, 16, 19, 20.

To obtain a score for the S-Anxiety scale, the weighted scores for the twenty items that make up each scale are added together, taking into account the fact that the scores are reversed for the above items. Scores for the S-Anxiety scale can vary from a minimum of 20 to a maximum of 80.

Spielberger (1983) cites Buros [1978] who claims the STAI has been used more extensively in psychological research than any other anxiety measure. Stability, as measured by test-retest coefficients, is relatively high for the STAI T-Anxiety scale and low for the S-Anxiety scale, as would be expected for a measure assessing

changes in anxiety resulting from situational stress. The internal consistency for both S-Anxiety and T-Anxiety scales are quite high as measured by alpha coefficients. The internal consistency for Form Y is slightly higher than for Form X. The overall media alpha coefficients for the S-Anxiety and T-Anxiety scales for Form Y in the normative samples are .92 and .90 respectively, as compared to median alphas of .87 for S-Anxiety and .89 for T-Anxiety in the normative samples for Form X.

Correlations between the S-Anxiety and T-Anxiety scales are typically higher under conditions that pose some threat to self-esteem, or under circumstances in which personal adequacy is evaluated; and correlations are lower in situations characterized by physical danger. A major advantage of the T-Anxiety scale is that it consists of only twenty items and thus requires only half as much time to administer as other scales. Form Y also measures trait anxiety with high internal consistency and without items with depressive content or weak psychometric properties. The internal consistency of the S-Anxiety scale was highest in the two most stressful experimental conditions and lowest in the relaxed condition.

The STAI has been used increasingly in investigations of stress-related psychiatric and medical disorders and as an outcome measure in research on biofeedback and various forms of treatment. The inventory has been used in numerous studies of psychological stress. Use of the STAI to evaluate process and outcome in counseling, psychotherapy, relaxation training, biofeedback, and behavioral and cognitive treatment studies has dramatically increased over the past decade.

Instrumentation: Hardiness Scale

According to Bartone, Ursano, Wright, and Ingraham (1989) the Hardiness Scale is a 45-item instrument designed to measure dispositional resilience, the

hardiness of one's personality. Each item has four options for answers: Never (0), Seldom (1), Sometimes (2), Often (3), Very often (4). Hardiness is considered to relate to how one approaches and interprets experiences. Three components of hardiness serve as subscales of the Hardiness Scale: commitment which refers to imputed meaning and purpose to self, others, and work; control, a sense of autonomy and influence on one's future; and challenge, a zest and excitement for life which is perceived as opportunities for growth. Hardiness has been shown to relate to how people relate to how people process and cope with stressful events. In stressful situations, hardiness has been shown to be associated with high levels of well-being.

Normative data are being developed by Paul Bartone. Published norms are not available, though the Hardiness Scale was studied originally with 164 military disaster assistance officers, 93% of whom were male, 85% white, with a median age of 34.

The Hardiness Scale is scored by first reverse-scoring items 3-7, 9-12, 14, 16, 18, 20, 23, 24, 26, 29, 31, 32, 34, 35, 37, 40, 41, and 43-45. Each subscale is then scored by summing the subscale items. Higher scores indicate more hardiness.

The internal consistency (alpha) coefficients were .62, .66 and .82 for the challenge, control, and commitment subscales, respectively. As a total summated scale, the Hardiness Scale had an alpha of .85. The 45-item Hardiness Scale was developed from a pool of 76 items. Scale scores correlated .93 with total scores on the 76-item version. Hardiness scores were predictive of mental and physical health. Scores are sensitive to measuring change due to the level of stressful events.

Procedures

Each subject was provided with a packet. The packets included an instruction

sheet, a form for tracking dates when the audio tape was used, 12 Self-Evaluation Questionnaires (three for each of the four weeks of the study), five envelopes (one for each of the four weeks plus one for the final Hardiness Scale, addressed to the researcher), one Hardiness Scale, one tape player with headphones, one brochure (Hemi-Sync Tape Taking Techniques explaining binaural beats and Hemi-Sync), and one Hemi-Synch audio tape.

Each subject was instructed to choose three consistent days per week and consistent times during each of these days to complete a Self-Evaluation Questionnaire. During these same three days and times of the day during the two treatment weeks the subjects were instructed to listen to the Hemi-Sync audio tape, then complete a Self-Evaluation Questionnaire. All three subjects were to complete three Self-Evaluation Questionnaires each week and mail them to the researcher. In an attempt to simplify the complex instructions as much as possible, the subjects were asked to complete both parts of the Self-Evaluation Questionnaire even though the intention was to use only the T-Anxiety Scale scores.

Chapter Four

Results

Description of Data Analysis

According to Lundervold and Belwood (2000) there is no general consensus as to the appropriate statistical approach for the analysis of data obtained from a single case. Nonstatisticians are left with the difficult decision of how to analyze data from a single case or small number of cases. In addition, even if there is a statistically significant result (changes that have a substantial and meaningful effect on the functioning of the individual) this does not necessarily have clinical significance. Therefore, while statistical reliability is a necessary condition for determining clinically significant change, clinical change does not necessarily result.

However, Lundervold and Belwood (2000) do provide some ideas about presenting data. The traditional method of evaluating outcomes using single-case designs has been visual inspection of graphed data to determine a pattern in the data. Some of the terms to be considered here are slope, trend, stability, level and overlap. Slope is the magnitude or steepness of the trend. A trend in the data indicates a pattern upward, downward or staying the same (stability). Level is the magnitude of change observed.

Overlap is the extent to which data patterns across phases overlaps with each other. This makes it possible to analyze data within and across each of the four phases of the study (ABAB) for one or more individuals as the case may be.

In this analysis was important to pay attention to whether or not the independent variable (therapeutic intervention) in this case, the audio tape, results in a change in the dependent variable (the target behaviors) in this case, a decrease in the

anxiety level and increase in the hardiness level. When the treatment was withdrawn, was there then a return to the baseline? Because there were two non-treatment (A-phases) and two treatment phases (B-Phases) this provided an opportunity for additional confirming or disputing data. If the behavior did not revert back to the baseline levels, a causal relationship cannot be inferred between the independent and dependent variable, as other (known) variables might be responsible for the change. A large change in the level between baseline and intervention phases would be an important indicator of a change in the target and would be consistent with the hypothesis that the intervention was responsible for the change.

Data Analysis

Table 1 presents Pre-Test and Post-Test Hardiness Scores for all three subjects. While all three scores for commitment, control and challenge are available only the overall scores were compared to one another. Table 2 presents 13 Self-Evaluation Questionnaire Scores for Subjects 1, 2 and 3. This includes one Pre-Treatment Score plus 12 scores, 3 for each of the four weeks of the research study, plus a mean score for each subject for each week of the study. Weeks One and Three were both non-treatment or A-Phase weeks. Weeks Two and Four were both treatment or B-Phase weeks.

Mean scores for Subjects 1 and 2 decreased from phase to phase throughout the study. This was also the case for Subject 3 except for the second baseline phase (a non-treatment week) when the mean score increased. The mean score decreased again in the next phase (the second treatment week) to the level in the first treatment phase.

Figures 1, 2 and 3 display all 13 scores for Subjects 1, 2 and 3 from Table 2. A visual inspection of Figure 1 (Subject 1) indicates that, while anxiety levels did not

decrease in every session, a slight general downward trend in anxiety levels occurs

Table 1. Summary of Hardiness Scale Scores

Subject	Pre-Test		Post-Test		% Change
1	Commitment	56	Commitment	60	+7.14%
	Control	47	Control	48	+2.13%
	Challenge	39	Challenge	43	+10.26%
	Overall	142	Overall	151	+6.34%
2	Commitment	59	Commitment	60	+1.69%
	Control	52	Control	55	+5.77%
	Challenge	48	Challenge	50	+2.08%
	Overall	159	Overall	165	+3.77%
3	Commitment	50	Commitment	52	+4.00%
	Control	50	Control	47	-6.00%
	Challenge	42	Challenge	39	-7.14%
	Overall	142	Overall	138	-2.82%

throughout the phases of the study. In week 1 (Non-Treatment 1 or A-Phase 1) two of three Self-Evaluation scores decreased from the Pre-Test or Initial Score. In week 2 (Treatment 1 or Phase-B) two of three scores were either less than or equal to scores in week 1. In week 3 (Treatment 2 or Phase-A2) two of three scores were less than week 2. In week 4 (Treatment 2 or Phase-B2) two of three scores were less than week 3 (scores in week 4 were up to 30% less than the Pre-Test or Initial Score).

A visual inspection of Figure 2 (Subject 2) also indicates a slight general downward trend in anxiety levels throughout the phases of the study, but one that is more irregular than in Figure 1. In week 1 (Non-Treatment 1 or A-Phase 1) two of

Figure 2. Subject 2 Self-Evaluation Questionnaire Scores

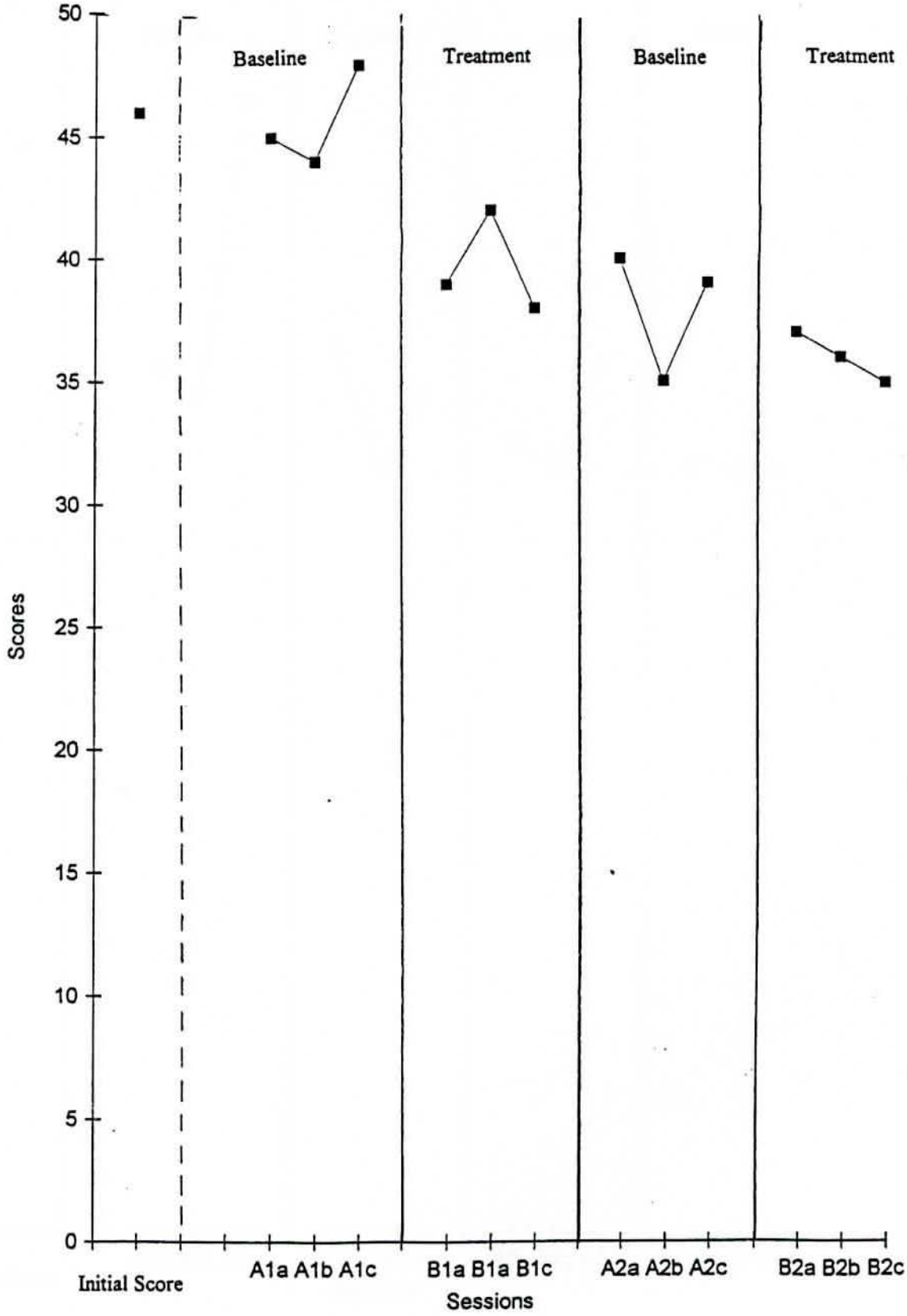


Figure 1. Subject 1

Self-Evaluation Questionnaire Scores

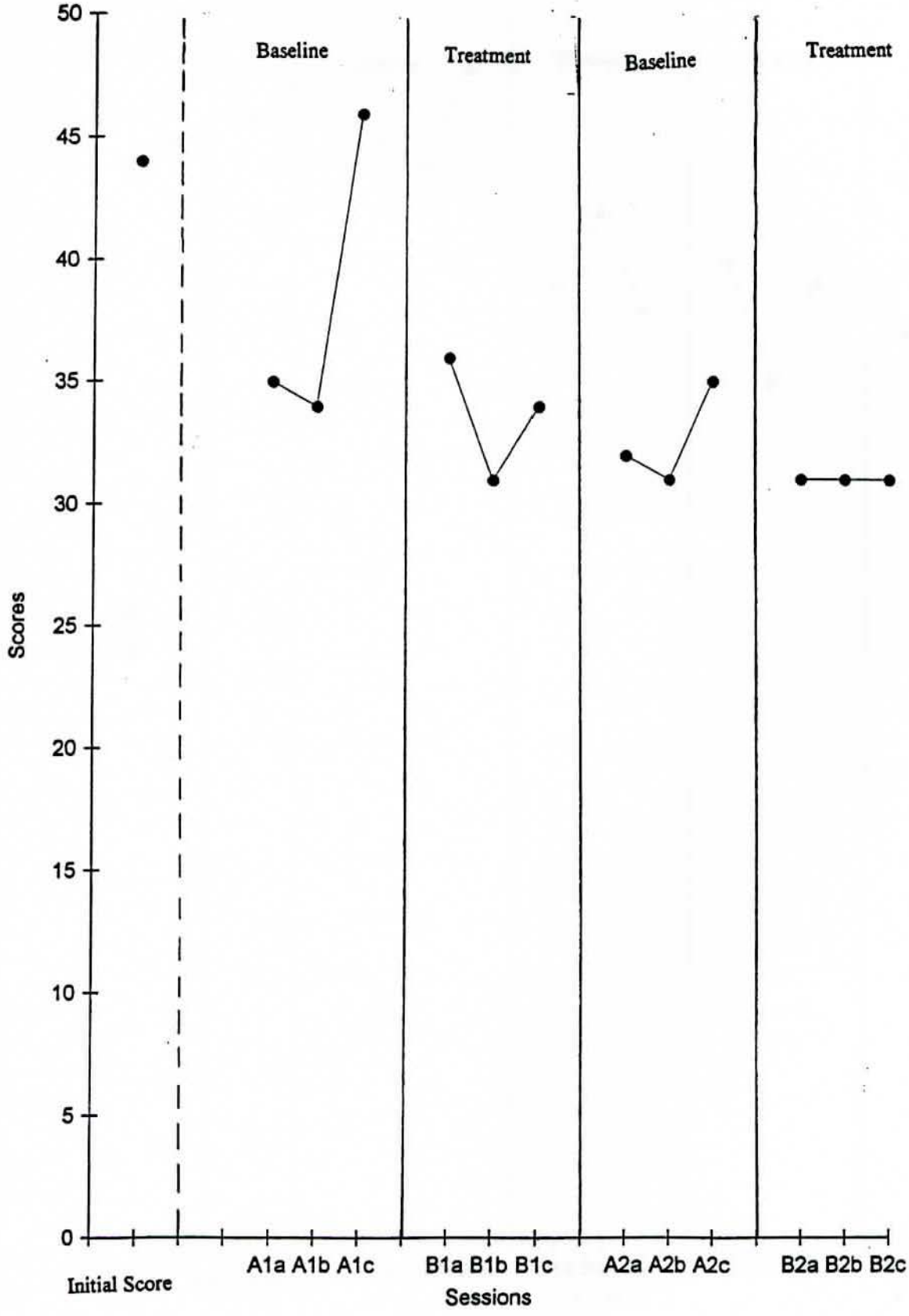
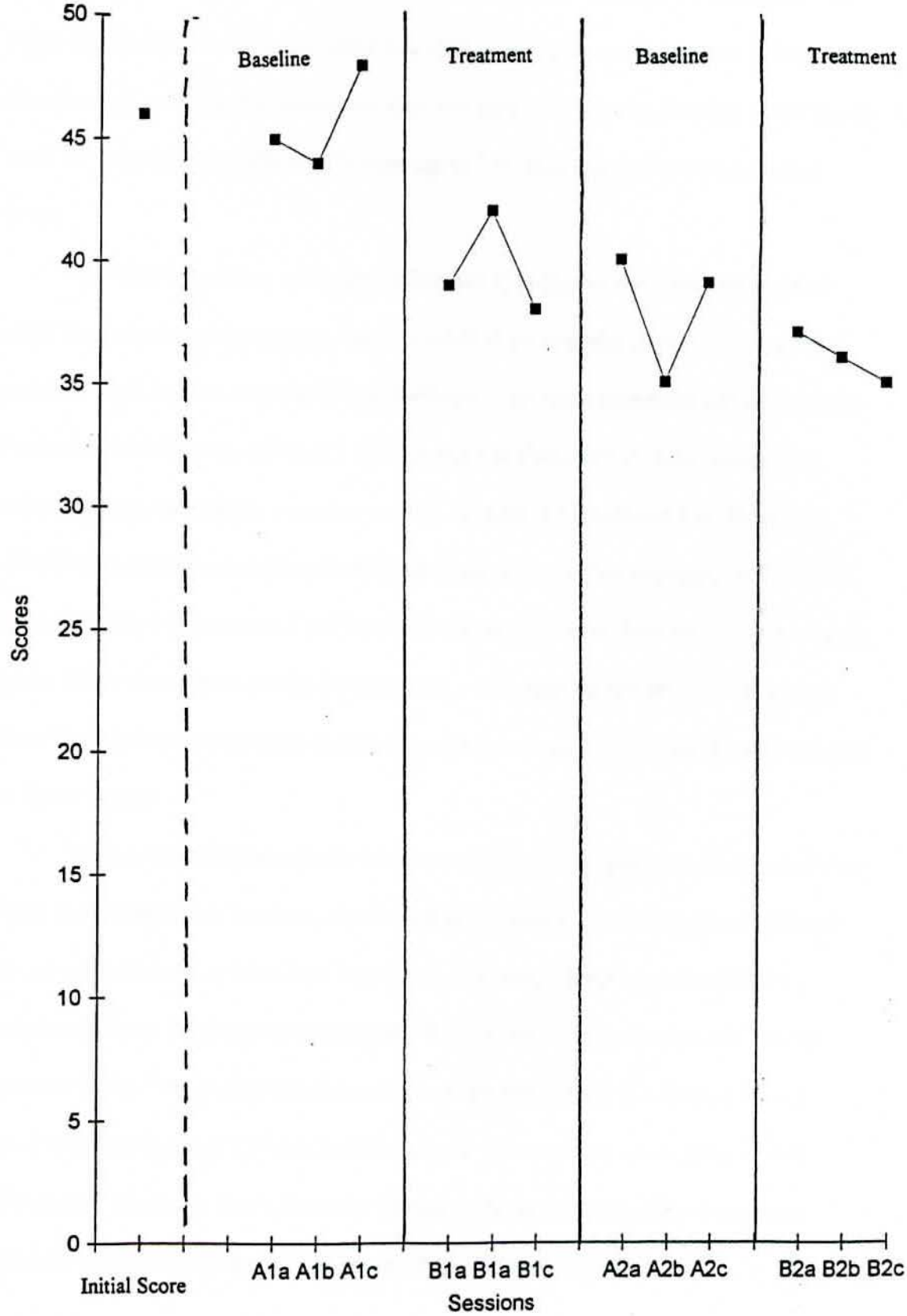


Figure 2. Subject 2 Self-Evaluation Scores



three scores decreased from the Pre-Test or Initial Score. In week 2 (Treatment 1 or Phase-B) all three scores were either less than or equal to scores in week 1. In week 3 (Treatment 2 or Phase-A2) one score was less than all the scores in week 2. Scores in week 4 (Treatment 2 or Phase-B2) were up to 24% less than the Pretest or Initial Score.

A visual inspection of Figure 3 (Subject 3) indicates that while there were some sharp decreases in anxiety, they occurred in an irregular pattern with no clear trend. In week 1 (Non-Treatment 1 or A-Phase 1) all three scores decreased from the Pre-test or Initial Score. In week 2 (Treatment 1 or Phase-B) all three scores were either less than or equal to scores in week 1. In week 3 (Treatment 2 or Phase-A2) there was an increase in anxiety level from session one to two and again from two to three. In week 4 (Treatment 2 or Phase-B2) the anxiety level decreased then increased again. While the overall pattern was irregular, there was a clear decrease in anxiety from the Initial or Pretest level (scores in week 4 were up to 36% less than the Pre-test or Initial Score).

The overall Hardiness Scale scores are depicted in Figure 4 in the form of a bar chart. Each subject has two bars, one for a Pre-Treatment or Pre-Test Score and one for a Post-Treatment or Post-Test Score. The Hardiness Scale score for Subject 1 increased from a Pre-Treatment Score of 142 to a Post-Treatment Score of 151, an increase of 6%. The overall Hardiness Scale score for Subject 2 increased from a Pre-Treatment Score of 159 to a Post-Treatment Score of 165, an increase of 4%. The overall Hardiness Scale Score for Subject 3 decreased from a Pre-Treatment Score of 142 to Post-Treatment Score of 138, a decrease of 3%.

Figure 3. Subject 3 Self-Evaluation Scores

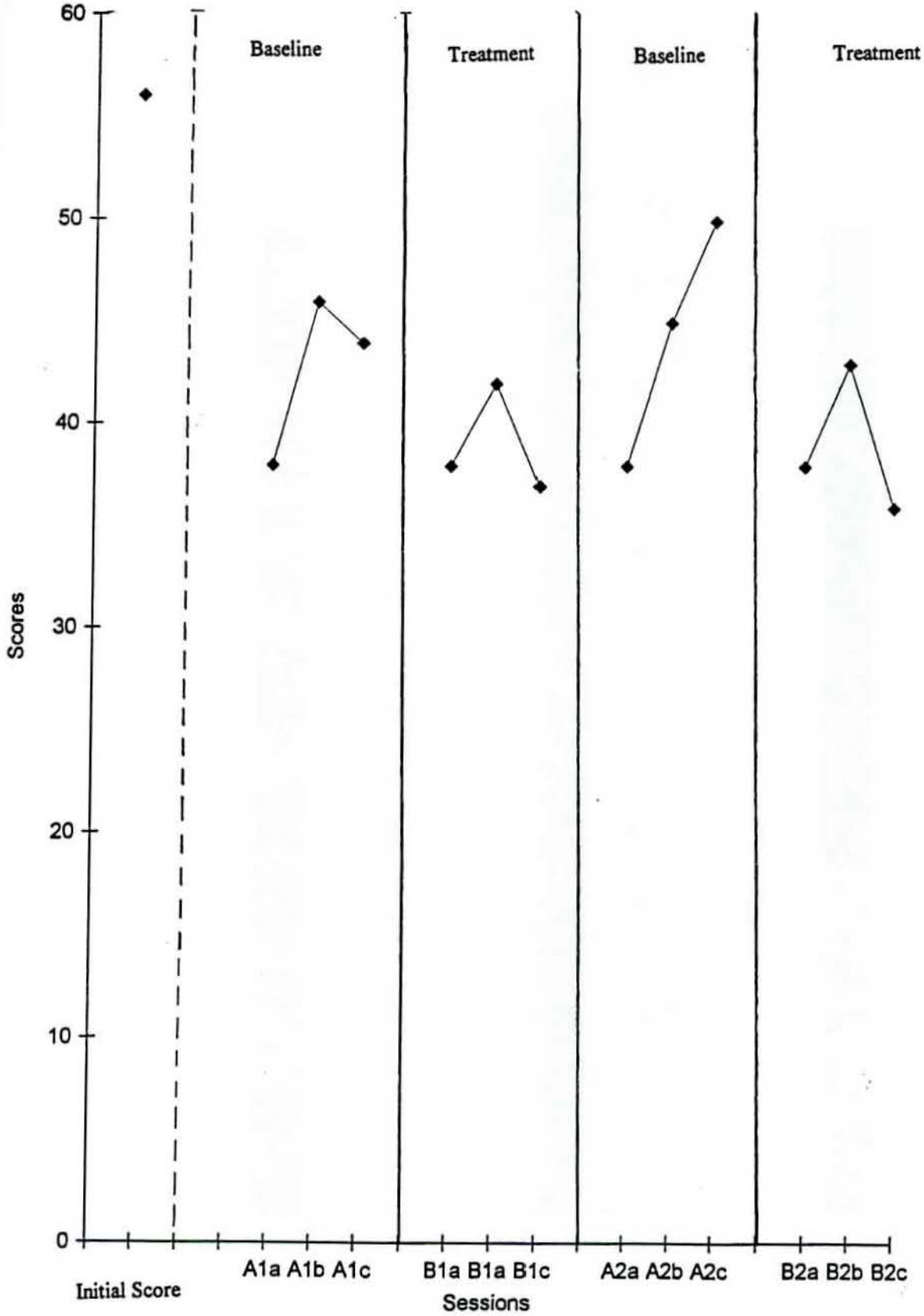
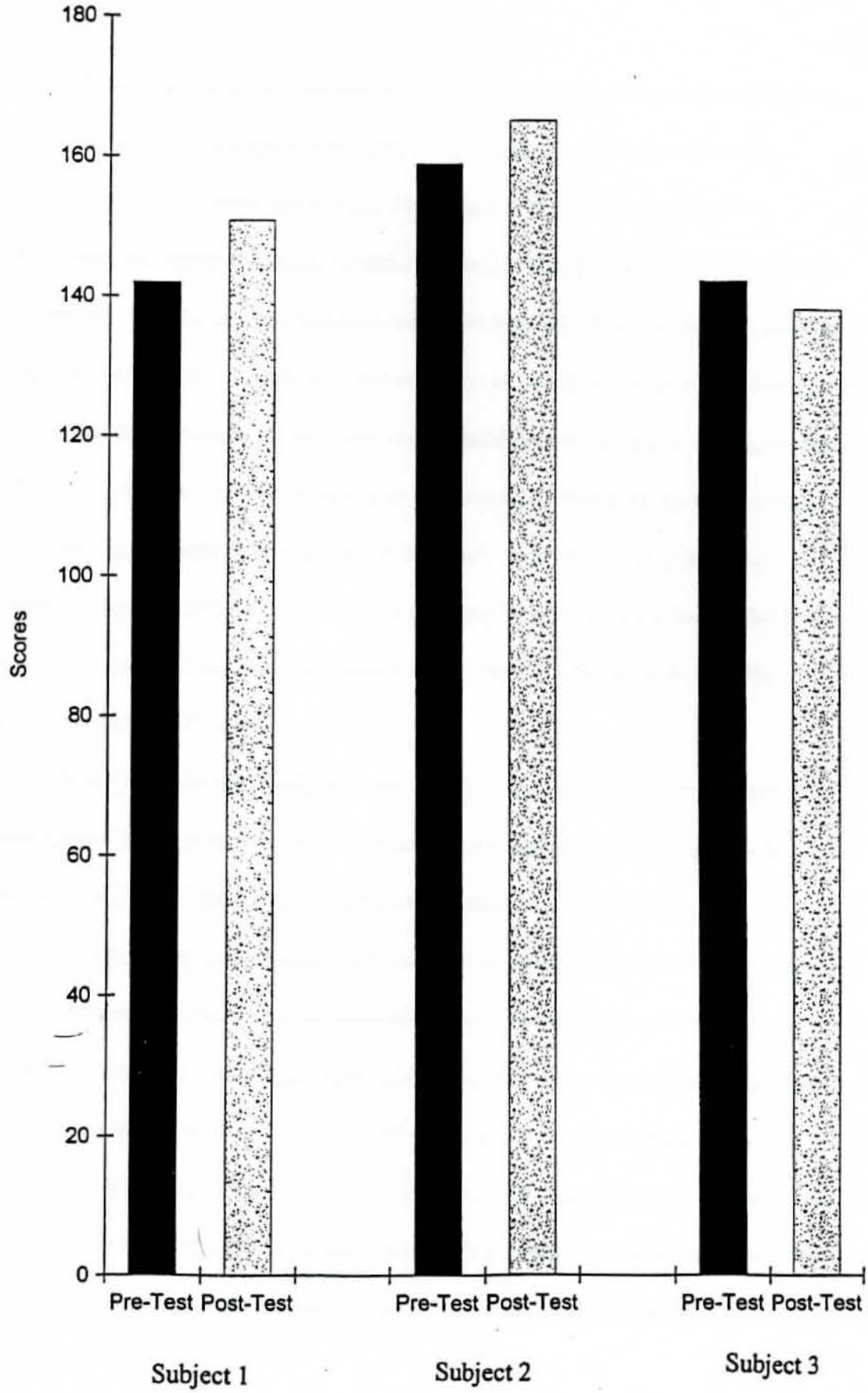


Figure 4. Overall Hardiness Scores



Chapter Five

Discussion

It was helpful to have access to graduate students and their instructor who were so willing to participate in this study. The student subjects were mostly cooperative in their timely completion and return of the Self-Evaluation Questionnaires, Hardiness Scale, Listening/Non-Listening Record, audio tapes and tape players. Providing self-addressed envelopes was essential for making compliance as easy as possible for the subjects and as timely as possible for the researcher. Having completed questionnaires in hand was very helpful and reassuring to the researcher in determining that the subjects appeared to be listening to the audio tapes on at least a somewhat regular schedule. The male in the study (Subject 1) completed the Listening/Non-Listening Record more completely than Subject 3 who did not fill in any part of the form and more accurately than Subject 2 who did not correctly document listening times.

It might prove interesting to know how the level of competence reflected in participation in the study was related to performance in the course. Garmezy & Masten (1986) point out the importance of competent behaviors in dealing with adversity. According to Compton (1992) these competent behaviors play an important role in maintaining a balanced perspective of one's life or equanimity during adversity. Therefore it might also have been helpful to have some assessment of the participant's self-perception of the overall balance of activities in their lives.

Use of the Hemi-Sync audio tape seems to have contributed to reduced overall anxiety levels in all three study subjects although the pattern of decrease varied. The pattern was more regular for Subject 1, less regular for Subject 2 (and even less

regular for Subject 3. Hardiness scores increased somewhat for Subjects 1 and 2 and decreased somewhat for Subject 3. Subjects 1 and 2 (the two older subjects at age 37 and 42 respectively) had reduced anxiety and slightly increased hardiness levels. Subject 3 (the youngest at age 28) had the largest overall decrease in anxiety and was the only person with a decrease in overall hardiness. All three cases in this study would seem to demonstrate an unexpectedly weaker relationship between anxiety and hardiness than anticipated.

Limitations

This research study had several limitations. There were many potential causes of anxiety for the subjects in this study in addition to the more obvious ones such as academic achievement and mathematics anxiety. There was no attempt to discover any other reasons for anxiety at any point in the study. The subjects represented a fairly narrow level of diversity in terms of education (all are graduate students) age (range from 28 to 42), race (all were White) and location (all were in the same class). By necessity, the project was very time limited and focused only on two outcomes, anxiety and hardiness levels.

While the study was statistically feasible, there was missing information that would have been helpful if the subjects of the study and the researcher worked together in a clinical setting. Unlike in a clinical setting there was no accompanying ongoing dialogue between researcher and subject. Therefore there was no discussion of revision in use of the intervention by itself or in combination with other anxiety-reducing activities. Possibly, this audio tape would be effective when used in combination with one or more other activities. It could have been interesting to explore the affect of more frequent use of the tape including its use

during sleep. There was no data about previous academic performance nor performance in this class as at least one measure of the possible impact of the intervention. While a form was provided to the subjects for tracking their Self-Evaluation Scores, the researcher had no control over the consistent use and non-use of the audio tape during treatment and non-treatment weeks. The researcher was completely dependent on the subjects in the study to use the tapes according to a set schedule and the instructor to distribute and collect the tapes as needed. According to the Listening/Non-Listening Record, Subject One used the tapes in mid-morning and mid-afternoon. Subject Two was inconsistent in completing the form and Subject Three did not use the form at all.

While there were some more definite trends in the anxiety levels of all three subjects, there was no way of knowing if the changes in Hardiness Scores were related to anxiety level or something else. Indeed, there were relatively small changes in the Hardiness Scores, either positive or negative. This makes it appear statistically that the intervention may have had somewhat limited benefit. Again, there was no clinical opportunity to confirm this with the subjects.

The data for subjects 1 and 2 showed decreases in anxiety and increases in hardiness. The data for subject 3 showed a smaller decrease in anxiety and a decrease in hardiness. This seems to indicate that there is a positive relationship between anxiety and hardiness. That is, if anxiety decreases hardiness increases. If anxiety increases, hardiness decreases. There are two examples of the former and one of the latter. It might also be concluded that the audio tape might not be as helpful in either reducing anxiety or increasing hardiness for some as it is for others, but that it does have the potential for doing so. Its use and benefit may be worth the effort for

those with relatively high anxiety due to the modest cost in terms of equipment and time needed to use the audio tape on a regular basis. This benefit could be considered in combination with and comparison to the costs and benefits of other practices and activities that have the potential to reduce anxiety such as regular physical exercise, tutoring and meditation, to name a few. While anxiety is not the only factor involved in academic performance it would seem to be of greater importance in this situation because the subjects have already succeeded academically in a number of classes in order to get this far. Thus they have proved other factors are not a problem or that they have overcome them. Therefore, anxiety due to the factors described herein would likely seem involved. Reduction of anxiety in ways that contribute to the likelihood of academic achievement in this situation would seem key. Therefore, listening to these tapes might be helpful for those students primarily dealing with anxiety and not ability, especially as one of the activities of an anxiety-reducing regimen and strategy.

Recommendations for Further Research

First of all, if this study were replicated, it is recommended that a form be used for each session or at least each week to indicate when the person listened to the tapes during listening weeks. This would at least provide additional opportunity to urge consistent use of the tape during the study instead of waiting until the end and then finding incomplete, inconsistent or non-existent data. By then it obviously is too late to make any adjustments. While there seemed to be little effect on the hardiness levels of participants it would be interesting to know their effect on student performance in the class based on final grades. Another avenue of exploration would be to use the audio tape with students who had previously failed the course. Their anxiety levels might tend to be higher and the audio tape might also end to have a greater impact on

these higher levels of anxiety.

It might be interesting to compare the use of the Hemi-Sync tape to other documented interventions used to reduce anxiety, such as massage therapy, physical exercise, listening to music, preparatory information, social support and a spiritual perspective. It might also prove interesting and helpful to study the effect of combining Hemi-Sync tapes with one or more of these other interventions to determine what combination might be most useful for reducing anxiety. Another study might compare the use of the audio tape during sleep to non-sleep periods.

Conclusion

Some strong statements are made in the research literature, especially by Lundervold and Belwood (2000), about the need to bridge the gap between research (design) and clinical practice. This single-case research design provides a relatively user-friendly way for clinicians to apply acceptable research techniques to clinical practice. Use of this design makes it possible to quantify the results of one or more interventions, making it useful for the therapeutic team as well as third parties should that be necessary for reimbursement or other purposes. It is also valuable because it can be applied quickly to generate statistically valid data in the clinical setting where there is often limited time to produce measurable results for the client as well as for third-party funders.

It would be helpful for therapists to introduce the constructs of resilience, hardiness and thriving to clients as strategic approaches useful for bringing a meaningful context to those experiencing adversity. It is possible to learn ways and to implement practices that reduce anxiety and improve coping ability. One practice worth considering is the use of Hemi-Sync audio tapes. There appears to be little risk

of harm with a likely benefit of a decrease in one's overall anxiety. This can be beneficial to both short-term and long-term health when individuals are at increased risk due to adverse or stressful circumstances, such as completing a statistics course or writing a thesis in order to meet requirements for graduation.

Appendix A

SELF-EVALUATION QUESTIONNAIRE

Developed by Charles D. Spielberger
in collaboration with
R. L. Gorsuch, R. Lushene, P. R. Vagg, and G. A. Jacobs

STAI Form Y-1

Name _____ Date _____ S ___

Age _____ Sex: M ___ F ___ T ___

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

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
1. I feel calm	①	②	③	④
2. I feel secure	①	②	③	④
3. I am tense	①	②	③	④
4. I feel strained	①	②	③	④
5. I feel at ease	①	②	③	④
6. I feel upset	①	②	③	④
7. I am presently worrying over possible misfortunes	①	②	③	④
8. I feel satisfied	①	②	③	④
9. I feel frightened	①	②	③	④
10. I feel comfortable	①	②	③	④
11. I feel self-confident	①	②	③	④
12. I feel nervous	①	②	③	④
13. I am jittery	①	②	③	④
14. I feel indecisive	①	②	③	④
15. I am relaxed	①	②	③	④
16. I feel content	①	②	③	④
17. I am worried	①	②	③	④
18. I feel confused	①	②	③	④
19. I feel steady	①	②	③	④
20. I feel pleasant	①	②	③	④

Consulting Psychologists Press, Inc.
3803 E. Bayshore Road · Palo Alto, CA 94303

SELF-EVALUATION QUESTIONNAIRE

STAI Form Y-2

Name _____ Date _____

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

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
21. I feel pleasant	①	②	③	④
22. I feel nervous and restless	①	②	③	④
23. I feel satisfied with myself	①	②	③	④
24. I wish I could be as happy as others seem to be	①	②	③	④
25. I feel like a failure	①	②	③	④
26. I feel rested	①	②	③	④
27. I am "calm, cool, and collected"	①	②	③	④
28. I feel that difficulties are piling up so that I cannot overcome them	①	②	③	④
29. I worry too much over something that really doesn't matter	①	②	③	④
30. I am happy	①	②	③	④
31. I have disturbing thoughts	①	②	③	④
32. I lack self-confidence	①	②	③	④
33. I feel secure	①	②	③	④
34. I make decisions easily	①	②	③	④
35. I feel inadequate	①	②	③	④
36. I am content	①	②	③	④
37. Some unimportant thought runs through my mind and bothers me	①	②	③	④
38. I take disappointments so keenly that I can't put them out of my mind	①	②	③	④
39. I am a steady person	①	②	③	④
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	①	②	③	④

Date:
Initials:

Below are statements about life that people often feel differently about. Circle a number to show how you feel about each one. Read the items carefully, and indicate how much you think each one is true in general. There are no right or wrong answers; just give your own honest opinion.

		Not at all true 0	A little true 1	Quite true 2	Completely true 3
1	Most of my life gets spent doing things that are worthwhile.	0	1	2	3
2	Planning ahead can help avoid future problems.	0	1	2	3
3	Trying hard doesn't pay, since things still don't turn out right.	0	1	2	3
4	No matter how hard I try, my efforts usually accomplish nothing.	0	1	2	3
5	I don't like to make changes in my everyday schedule.	0	1	2	3
6	The "tried and true" ways are always best.	0	1	2	3
7	Working hard doesn't matter, since only the bosses profit by it.	0	1	2	3
8	By working hard you can always achieve your goals.	0	1	2	3
9	Most working people are simply manipulated by their bosses.	0	1	2	3
0	Most of what happens in life is just meant to be.	0	1	2	3
1	It's usually impossible for me to change things at work.	0	1	2	3
2	New laws should never hurt a person's paycheck.	0	1	2	3
3	When I make plans, I'm certain I can make them work.	0	1	2	3
4	It's very hard for me to change a friend's mind about something.	0	1	2	3
5	It's exciting to learn something about myself.	0	1	2	3
6	People who nevef change their minds usually have good judgement.	0	1	2	3
7	I really look forward to my work.	0	1	2	3
8	Politicians run our lives.	0	1	2	3
9	If I'm working on a difficult task, I know when to seek help.	0	1	2	3
0	I won't answer a question until I'm really sure I	0	1	2	3

understand it.

21 I like a lot of variety in my work.	0	1	2	3
22 Most of the time people listen carefully to what I say.	0	1	2	3
23 Daydeams are more exciting than reality for me.	0	1	2	3
24 Thinking of yourself as a free person just leads to frustration.	0	1	2	3
25 Trying your best at work really pays of in the end.	0	1	2	3
26 My mistakes are usually difficult to correct.	0	1	2	3
27 It bothers me when my daily routine gets interrupted.	0	1	2	3
28 It's best to handle most problems by not just thinking of them.	0	1	2	3
29 Most good athletes and leaders are born, not made.	0	1	2	3
30 I often wake up eager to take up my life wherever it left off.	0	1	2	3
31 Lots of times, I don't really know my own mind.	0	1	2	3
32 I respect rules because they guide me.	0	1	2	3
33 I like it when things are uncertain or unpredictable.	0	1	2	3
34 I can't do much to prevent it if someone wants to harm me.	0	1	2	3
35 People who do their best should get full support from society.	0	1	2	3
36 Changes in routine are interesting to me.	0	1	2	3
37 People who believe in individuality are are only kidding themselves.	0	1	2	3
38 I have no use for theories that ar not closely tied to facts.	0	1	2	3
39 Most days, life is really interesting and exciting for me.	0	1	2	3
40 I want to be sure someone will take care of me when I'm old.	0	1	2	3
41 It's hard to imagine anyone getting excited about working.	0	1	2	3
42 What happens to me tomorrow depends on what I do today	0	1	2	3
43 If someone gets angry at me, it's usually no fault of mine.	0	1	2	3
44 It's hard to believe people who say their work helps society	0	1	2	3
45 Ordinary work is just too boring to be worth doing.	0	1	2	3

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