

THE EFFECTS OF AN AVERSIVE AUDITORY STIMULUS ON BLOOD
PRESSURE, HEART RATE, AND EMOTIONAL REACTIVITY BASED
ON PERSONALITY (INTROVERSION/EXTRAVERSION)
TO PREDICT SELF-RATED HEALTH

THESIS

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ABSTRACT

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August 2012

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The purpose of the study was to determine the emotional and physiological reactivity of an aversive, 60-second, auditory stimulus compared to a 60-second control stimulus as a function of extraversion. Blood pressure, heart rate, and current emotional state were measure pre and post stimulus. The changes in the participants' scores on a self-rated emotional inventory provided a measure of emotional reactivity for this study. A measure of extraversion categorized participants accordingly and differences between these groups were analyzed. A measure of self-rated health was given and possible reasons for differences between groups are discussed. There were a total of 74 participants in this study. Based on a mean split of Eysenck Extraversion scores at 63.53,

32 (43.2%) participants fell into the extraversion group and 42 (56.8%) participants fell into the introversion group. The data were analyzed using mixed-measures ANOVAs. There were two significant findings: higher heart rates were recorded for the introversion group both pre and post stimulus, and the introversion group rated lower on the Self-Rated Health assessment.

CHAPTER I

INTRODUCTION

The purpose of this research was to determine the effects of an aversive sound on physiological variables such as blood pressure and heart rate as well as emotional reactivity. Pre and post measure were taken before and after the stimulus and compared to a control group. This experiment was a mixed-measures design. Participants were further categorized by personality (introversion/extraversion) to determine differences between groups. Also, an assessment of self-rated health was utilized to determine if there was a relationship between reactivity and self-rated health. This study is unique in that it compares extraverts to introverts in terms of both their emotional and physiological reactions to an aversive auditory stimulus.

Background

Environmental stimuli, such as sensory information, affect people both physically and emotionally. Research has examined the effects of many different forms of auditory stimuli such as music, speech, and tones. This research will focus on the effects of a loud, aversive sound. Auditory stimuli have been shown to elicit physiological responses such as changes in cortical levels, blood pressure, and heart rate (Stelmack, 1990; Holand, Girard, Laude, Meyer-Bisch, & Elghozi, 1999; Bradley & Lang, 2000). Emotional reactions are also common when the incoming stimulus is perceived as relevant, especially life-threatening (Donishi, Okamoto, Imbe, & Tamai, 2007). Reactions to environmental stimuli also differ between extraverts and introverts. Stemack, Achorn,

and Michaud (1977) found introverts to have greater physiological responses (measured by cortisol levels) to auditory stimuli than extraverts. Physiological arousal and emotional reactivity may be related to current health statuses. Self-rated health is one of the most common pieces of information in health related research and has been demonstrated to predict future morbidity and mortality, regardless of other physical, psychological, and social factors (Kaplan & Camacho, 1983).

Problem Statement

Many research studies have looked at the effects of aversive stimuli on physiological outcomes (Stelmack, 1990; Holand, Girard, Laude, Meyer-Bisch, & Elghozi, 1999; Bradley & Lang, 2000) as well as individual differences based on level of extraversion (Stelmack, Achorn, & Michaud, 1977; Stelmack, 1990). While studies have demonstrated the effects of aversive stimuli on emotional circuits such as the limbic system (Zald & Pardo, 2002), limited research has focused on the effect of a continuous (i.e. non-startle) aversive auditory stimulus on self-rated emotions, before and after the stimulus. Therefore, this study will combine the aforementioned variables into a unique design. Also, a measure of self-rated health will also be examined to determine if any relationship exists between these variables and the participants' self-rated health.

Purpose of the Study

The purpose of the study is to determine the effects of an aversive, 60-second, auditory stimulus compared to a 60-second control stimulus. Blood pressure, heart rate, and current emotional state will be measured pre and post stimulus. The changes in the participants' scores on a self-rated emotional assessment provide a measure of emotional reactivity for this study. A personality measure categorized participants as an

introvert or extravert and differences between these groups were analyzed. A measure of self-rated health was given and possible reasons for differences between groups are discussed.

Significance of the Study

In this study, there were few significant findings, though these findings may have implications for future research and are discussed later. Introverted participants had significantly higher heart rates than extraverted participants both pre and post stimulus for both experimental and control groups. Also, introverts rated significantly lower on the Self-Rated Health scale.

Overview of Methodology

The current study was conducted at Texas State University—San Marcos, using a convenience sample of undergraduate students. The study was a 2 x 2 x 2, quasi-experimental, mixed-design experiment. The two between-subject factors were personality, specifically level of extraversion; and stimulus condition (aversive or control). The within-subjects factor was time; each participant had their blood pressure and heart rate measured and rated their current emotional state before and after an auditory stimulus. Negative emotions (subscales fear, anger, anxiety, and a total of the three) were the focus of the Emotional Assessment Scale such that negative emotions were analyzed pre and post stimulus. A rating of self-rated health was also taken before the stimulus for all participants.

Research Questions and Hypotheses

Based on the past research reviewed, the following findings were expected. The experimental group (experiencing aversive auditory stimulus) was expected to show

increases in blood pressure, heart rate, and negative emotion from Time 1 (before aversive noise) to Time 2 (post measure, after aversive noise). The control group was not expected to show significant changes on blood pressure, heart rate, and negative emotion from Time 1 (before neutral noise) to Time 2 (after neutral noise). In addition, introverts in the experimental group were expected to rate higher than extraverts on the post measure (T2) on negative emotions, indicating a greater level of emotional reactivity to the aversive stimulus. Introverts were also expected to show greater increases in heart rate and blood pressure than extraverts. Extraverts in the experimental group were also expected to show increases on these measures due to the nature of the aversive stimulus, but to a lesser degree than the introverts.

Finally, it was predicted that introverts would have lower self-rated health, and that this finding will be accounted for by their increases in blood pressure, heart rate, and negative emotions.

Objectives and Outcomes

The objective of this research was to determine the effects of a loud, aversive noise on both physiological and emotional measures for introverts and extraverts. Participants' self-rated health was also analyzed. Results of this study may add to the body of literature on emotional processing of loud noises as well as physiological reactivity. Finally, the current study contributes to the literature on physiological and emotional reactivity associated with variability in the personality trait extraversion.

Limitations

This study is not without a few limitations. First, the aversive auditory stimulus chosen for this experiment failed to produce increases in blood pressure, heart rate, or

negative emotional elevation. This indicates that while the frequency and volume level at which the stimulus was presented has been demonstrated to evoke physiological responses (Stelmack, Achorn, & Michaud, 1977), the stimulus failed to produce such effects in the current study. This is probably because the stimulus in prior studies used a brief, startle response rather than a 60-second tone. This meaning that, though it was possible that initial blood pressure and heart rate could have increased at the start of the aversive stimulus, it was not measured because physiological measures were only taken pre and post stimulus, and a constant reading was not obtained. This could have also been the cause for the absence of significant emotional response, though another study using a lasting (non-startle) aversive stimulus at similar frequency and volume produced increased cerebral blood flow in the amygdalae of participants (Zald & Pardo, 2002).

Also because of the relatively small sample size ($n=74$), results may be due to insufficient power to detect effects that may have been present. Another major limitation to the research was the fact that significantly more introverts were assigned to the experimental group based on published cutoff scores, potentially confounding the interpretability of the results.

Delimitations

The decision to use a convenience sample of undergraduate psychology majors from Texas State University—San Marcos limits the ability to generalize findings outside of a college population. Individuals who are not students within the given geographical area may bear different characteristics and, therefore, are not represented by this sample.

Assumptions

In this study, it was assumed that participants rated honestly on the Eysenck Extraversion Scale, the Emotional Assessment Scale, and the Self-Rated Health measures. It was also assumed that greater changes in blood pressure, heart rate, and self-rated emotional levels were an indication of reactivity to the aversive stimulus (by comparison with controls). It is assumed that the stimulus was aversive based on a prior experiments using similar frequencies and decibel levels (Stemack, Achorn, & Michaud, 1977; Zald & Pardo, 2002). It was also assumed that a mean split of Eysenck Extraversion Scale scores could be used to divide participants into introverts or extraverts in a meaningful way.

Definition of Key Terms

Physiological outcomes (systolic and diastolic blood pressure and heart rate) were determined by the Omron BP785 10 Series Upper Arm Monitor. High extraversion in this study was defined by a score of above a 63.53 on the Eysenck Extraversion Scale; low extraversion (or introversion) was defined by a score below a 63.53. Negative emotions on the Emotional Assessment Scale (EAS) were analyzed based on subscales of FEAR which included individual emotions Afraid, Scared, and Frightened, ANGER which included Angry, Mad, and Annoyed, and ANXIETY which included Anxious, Worried, and Nervous. A SUM of total negative emotions was defined by a sum of the negative EAS subscales. Emotional reactivity was the change score between the pre and post measure on the Emotional Assessment Scale.

Organization of the Thesis

This thesis is divided into five chapters. The first chapter is the introduction and includes the background of the study, the problem statement, the purpose and significance of the study, overview of methodology, research questions and hypotheses, objectives and outcomes, limitations, delimitations, assumptions, and definitions of key terms. The second chapter is the literature review and describes the foundation of the study based on prior research. The third chapter provides a detailed description of the methods used in this study. Samples, instruments, and techniques are also described in the third chapter. Results of the study are reported in the fourth chapter. The fifth and final chapter includes a discussion and implication of the results.

CHAPTER II

LITERATURE REVIEW

Incoming sensory information (e.g., noise) causes us to react to our environments. Our minds process sensory information through our senses and based on this information, physiological responses may occur. For example, seeing a life-threatening stimulus (such as a bear) would cause most of us to have an increased heart rate. Physiological responses can occur in less life-threatening situations too, such as the case of hearing a loud noise, and aversive noises cause physiological responses in humans (Stemack, Achorn, & Michaud, 1977; Stelmack, 1990; Holand, Girard, Laude, Meyer-Bisch, & Elghozi, 1999).

Reactions to aversive stimuli may be more evident in some populations. That is, individual differences may account for variations in reactions to auditory stimuli. Stelmack et al. (1977) found introverts to have greater physiological responses as measured by cortisol levels to auditory stimuli than extraverts. Aversive sensory information may also cause temporary emotional changes. Limited research exists on the direct link between aversive auditory stimuli and emotional changes in humans.

The greatest response variability to auditory stimuli that is seen between introverts and extraverts is for low frequency, large amplitude (loud) sounds. Research has demonstrated that greater physiological responses are evoked when auditory stimuli are between 75-90 dB. Lower intensities fail to yield significant differences (Hastrup,

1970). Low frequency sounds (500Hz or less) also evoke greatest physiological responses between extroverts and introverts (Stelmack et al., 1977).

Extraversion and Introversion

Extraversion and introversion are generally thought of as innate and stable personality characteristics with every person having certain levels of the trait. Carl Jung describes these traits in terms of orientation of value. Extraverts find value in the world around them and introverts find value within themselves. According to Hans Eysenck's theory of personality, extraverts and introverts differ on a biological basis. Introverts have lower baseline arousal thresholds of arousal in the reticular activating system of the brain, compared to extraverts (as cited by Stemack, 1990). Because of greater base-line arousal, introverts tend to avoid "extra" environmental sensation, such as loud sounds. Higher arousal in this area correlates with increased physiological response, such as hormonal activity. Introverts also have greater physiological responses to low frequency, high intensity noises (Stemack, Achorn, & Michaud, 1977). Introverts have greater responses to medium levels of noise compared to extraverts (Geen, 1984). In terms of laboratory performance, extroverts performed better on an arithmetic task during a loud noise (88dB) compared to a quiet condition which suggests extraverts may prefer an environment with greater auditory input. In the same study, introverts displayed reduced concentration which suggests introverts prefer a quieter environment and are more easily disrupted by increased auditory input (Belojevic, Slepcevic, & Jakovljevic, 2001).

Physiological Changes Associated with Sensory Information

Auditory stimuli have been shown to cause physiological changes in humans. Sensory stressors such as aversive noises can arouse our sympathetic nervous system and

cause higher blood pressure, cortical hormonal levels, and heart rate (Holand, Girard, Laude, Meyer-Bisch, & Elghozi, 1999). In a study by Bradley and Lang (2000), unpleasant sounds were shown to increase electromyographic activity and heart rate deceleration compared with neutral and pleasant sounds. Physiological differences between introverts and extroverts are due to differing baseline levels in areas of the brain related to arousal. According to Eysenck (1967), larger activation of the cortico-reticular loop may account for greater sensory sensitivity in introverts. Supporting this idea, Stemack et al. (1977) found introverts to have a greater physiological response, as measured by cortical levels, to an aversive auditory stimulus, compared with extroverts.

Emotional Reactivity and Individual Differences

Emotional reactions are a natural and common human phenomenon. A study by Kimura, Donishi, Okamoto, Imbe, and Tamai (2007) suggests auditory input within the ventral areas of the brain affect emotional centers and memory formation. Emotional reactivity is a result of both environmental stimuli and pre-stimulus, baseline affect (Nelson, Shankman, Olino, & Klein, 2011). That is, an individual may have an emotional reaction to something in his or her environment, but this reaction may be moderated by the individual characteristics of that person. Research has shown that emotional responses accompany aversive environmental stimuli, including aversive auditory stimuli.

Emotional responses to aversive sensory stimuli are attributed to activation of the amygdala within the brain. A study by Zald and Pardo (2002) demonstrated that this is also the case for auditory information. Researchers found aversive sounds played at moderate frequencies (4000-6000 Hz) and high intensities (85-90 dB) increased cerebral

blood flow in the amygdalae of participants who previously endorsed being sensitive to aversive sounds. Though a self-rating of emotional distress was not obtained in this experiment, changes in negative emotions would be expected due to activation of the amygdala.

Studies have shown that some people, such as depressed, anxious, and schizophrenic individuals, have abnormal emotional reactions to environmental stimuli. For example, according to Peeters, Nicolson, Berkhoff, Delepaul, and deVries (2003), depressed individuals reported fewer positive and negative emotional reactivity to negative events compared with healthy controls. Also, individuals with anxiety disorders show greater physiological responses to emotionally charged stimuli than controls (Hamann & Canli, 2004). Extraverts may be generally more prone to positive emotion than introverts. Specifically, extraversion seems to contribute to positive emotion, neuroticism toward negative emotion, through appraisal of a specific event (Wang, Shi, & Li, 2009). Also, extraversion has been shown to be correlated with subjective well-being (Pavot, Diener, & Fujita, 1990)

Differences in Self-Rated Health

Physiological arousal and emotional reactivity are related to a person's physical health. Previous research shows that greater extraversion is related to health behaviors, health outcome expectancies, and likelihoods for positive health outcomes. Opposite findings were found for people high in neuroticism (Williams, O'Brien, & Colder, 2004). Self-rated health was significantly correlated with personality traits and coping strategies. Particularly, extraversion was positively correlated with self-rated health; neuroticism was negatively correlated with self-rated health (Jiang, Dai, & Cai, 2007).

Self-rated health was chosen as it is a convenient and valuable construct to assess. Self-rated health is one of the most common pieces of information in health related research and has been demonstrated to predict future morbidity and mortality, regardless of other physical, psychological, and social factors (Kaplan & Camacho, 1983).

CHAPTER III

METHODS

The following chapter describes the research methodology and procedures that were used in the study. It consists of the following sections: research perspective, research design, research questions and hypotheses, participants, research variables, research instruments, data collection procedures, data and statistical analyses, setting and environment, bias and error, reliability and validity, and a summary.

Research Perspective

This research was guided by an interest in individuals' different responses to their environments. Specifically, more information is desired on how an aversive sound affects people's physiological and emotional states, and if there are individual differences based on personality type. Results of this study may add to the body of literature on how and why differences exist among these variables.

Research Design

This study was conducted at Texas State University—San Marcos, using convenience sampling of undergraduate students. This experiment was a 2 x 2 x 2 quasi-experimental between-subjects design. The independent variables in this study were the personality of the participants (level of extraversion) and the auditory stimuli (aversive vs. neutral). The dependent variables were blood pressure, heart rate, emotional reactivity, and self-rated health. Blood pressure, heart rate, and emotional reactivity were

measured pre and post auditory stimulus. Level of extraversion was determined after participation.

Research Questions and Hypotheses

The current study aimed to examine associations among sensory stressors, personality, blood pressure, emotional response, and subjective health measures. Specifically, it examined at the emotional experience of participants in response to an aversive auditory stimulus compared to a neutral, non-aversive auditory stimulus. Outcome variables including systolic and diastolic blood pressure, heart rate, and Emotional Assessment Scale (EAS) scores were analyzed for both independent variables: stimulus condition and personality type. Therefore, the primary research questions are a) what are the effects of an aversive auditory stimulus on blood pressure, heart rate, emotional reactivity and b) how are these results related to personality and self-rated health.

Based on the past research reviewed, the following findings were expected. The experimental group (experiencing aversive auditory stimulus) was expected to show increases in blood pressure, heart rate, and negative emotion from Time 1 (before aversive noise) to Time 2 (post measure, after aversive noise). The control group was not expected to show significant changes on blood pressure, heart rate, and negative emotion from Time 1 (before neutral noise) to Time 2 (after neutral noise). In addition, introverts in the experimental group were expected to rate higher than extraverts on the post measure (T2) on negative emotions, indicating a greater level of emotional reactivity to the aversive stimulus. Introverts were also expected to show greater increases in heart rate and blood pressure than extraverts. Extraverts in the experimental group were also

expected to show increases on these measures due to the nature of the aversive stimulus, but to a lesser degree than the introverts.

Finally, it was predicted that introverts would have lower self-rated health, and that this finding will be accounted for by their increases in blood pressure, heart rate, and negative emotions.

Participants

Participants for this study were sampled via convenience sampling from undergraduate students at Texas State University-San Marcos. Most students were psychology majors. Students from three undergraduate psychology courses were recruited. The professors of these three courses offered extra-credit to the students who signed up and participated in this study. There were a total of 74 participants in this study. There were 45 females (60.8%) and 29 males (39.2%). A majority of the participants were Caucasian (58.1%), 29.7% were Hispanic, 9.5% were African American, and 2.7% of the participants endorsed another ethnicity. Of the participants, 23% were freshmen, 29.7% were sophomores, 29.7% were juniors, and 17.6% were seniors. Based on a mean split of Eysenck Extraversion scores at 63.53, 32 (43.2%) participants fell into the extraversion group and 42 (56.8%) participants fell into the introversion group.

Only students with an uncorrected hearing deficit were asked not to participate in the study because the study included the use of auditory stimuli. Only one student was turned away from participation due to a hearing deficit. Participants were randomly assigned to stimulus groups by pulling paper slips from a cup. There was an equal

number of experimental and control slips in the cup. After a slip was pulled, it was not replaced.

Research Variables

There were several variables utilized in the study. The independent variables were the stimulus (aversive or neutral) and levels of participant extraversion. The dependent variables were blood pressure, heart rate, self-rated health, and emotional reactivity. Stimulus levels were dichotomous. Because extraversion was dichotomized, it was used also used as a dichotomous variable although it originally consisted of ordinal data. The extraversion measure consisted of 20 items which were endorsed on a 1-5 Likert scale. Possible scores ranged from 20-100 with higher scores indicating higher levels of extraversion. A mean split of Eysenck Extraversion Scale scores was used to dichotomize participants into a high or low extraversion group. Physiological measures (i.e. heart rate and blood pressure) were taken 3-4 times during the experiment. Each measure consisted of the systolic and diastolic reading along with heart rate. The second of the pre-stimulus physiological measures was compared with the post-stimulus measure as it provided the best estimation of pre-stimulus measures. The self-rated health measure consisted of three items endorsed on a 1-7 ordinal Likert scale and possible scores ranged from 3-21 with higher scores indicating higher self-rated health. The emotional reactivity scale consisted of 24 emotion words which were endorsed on a 1-5 Likert scale. Negative emotions were analyzed specifically including subscales FEAR, ANXIETY, ANGER, as well as a SUM of these three subscales.

Research Instruments and Procedures

Students came to a lab in the psychology department basement at Texas State University-San Marcos. They were greeted and signed in, indicating which professor they wanted their extra-credit to go to. Participants completed consent and demographic forms (see Appendix A). They signed two copies, one for the researcher and one for their personal records. They were then randomly assigned to either the experimental group or the control group. Participants assigned to the experimental group had their blood pressure and heart rate taken with upper-arm monitor (see Appendix E). At least two blood pressure measurements were taken before the stimulus was given. An additional measurement was taken if a +5 or -5 change was noticed in systolic or diastolic blood pressure from the first measure to the second measure. They then filled out the Eysenck Extraversion Scale (see Appendix B), Self-Rated Health Survey (see Appendix C), and Emotional Assessment Scale (see Appendix D). The aversive stimulus was a 440Hz tone played at 85 dB. The control stimulus was a low frequency, “brown noise” played at 55 dB. Both audio clips were stored on the researcher’s personal laptop computer in mp3 format and played through headphones (Sennheiser HD 202). Both noises were metered with a digital sound decibel meter to ensure each participant heard their respective tone (aversive or control) at the appropriate sound level before it was played. Participants were informed that they would be played a noise through a pair of headphones. They were told that the noise may or may not be unpleasant and they could take their headphones off at any time if they wished and that they would still receive extra credit. Participants then put on their head phones and the 60-second stimulus was played. All participants in both groups listened to the entire stimulus. When the stimulus was over, the participants filled

out another copy of the Emotional Assessment Scale and had their blood pressure and heart rate taken once again. The control condition differed only in that participants received a 60-second neutral stimulus. Participants were then free to leave.

Data and Statistical Analyses

A series of statistical procedures were used to analyze data from this 2 x 2 x 2 mixed-design. For the analyses, between-subject factors were high and low extraversion and the experimental and control procedures. A mean split ($M=63.53$) was used to establish the two groups on extraversion scores. Within-subjects factors were the pre and post auditory stimulus measures. General linear models, specifically mixed-measures ANOVAs, were utilized to examine group differences before and after the stimulus for the following dependent variables: blood pressure, heart rate, and emotional reactivity. That is, the difference between the experimental and control group was analyzed for each of the dependent variables, then the differences between the extraversion and introversion groups were analyzed. A t-test determined characteristics of the self-rated health measure across extraversion, introversion, control, and experimental group.

Setting and Environment

A lab in the psychology department basement (Room 16) at Texas State University-San Marcos was the setting of this experiment. All participants in the study were run in the same lab by the same researcher. The room was a quiet setting with minimal hallway traffic and conversation. Participants were run between 9:00 – 3:00 on Thursdays and Fridays over a 3 month period.

Bias and Error

Due to the self-report measures in this study, there was some potential for error. Self-Rated Health, Emotional Assessment Scales scores, and Eysenck Extraversion Scale scores were all subjective ratings and therefore it is possible that some participants may have not answered truthfully on some items.

Reliability and Validity

The Eysenck Extraversion Scale used in this experiment is the Extraversion or “E” scale from the Eysenck Personality Inventory (Eysenck & Eysenck, 1965). Vingoe (1966) found that subjects self-ratings of introversion/extraversion correlated at .63 (significant at .01 level) with the Eysenck extraversion scale. To further show construct validity, Kramer (1969) found that 242 participants unfamiliar with the Eysenck Extraversion Scale rated similarly on how extraverted they appeared to others and how extraverted they really were. These ratings correlated significantly (.46, .48 respectively) with their Eysenck Extraversion scores. In another study, the extraversion scale of the Eysenck Personality Inventory was found to be one of the most reliable subscales with a reliability median of .82, considered an adequate number by the researchers (Caruso, Witkiewitz, Belcourt-Dittloff, & Gottlieb, 2001).

Emotional reactivity and current emotional states were measured by the Emotional Assessment Scale (EAS) developed by Carlson, Collins, Stewart, and Porzelius (1989). In this study, negative emotions were analyzed specifically to determine if the aversive stimulus cause increases in negative emotions. Negative emotions on EAS were analyzed based on subscales of FEAR which included individual emotions Afraid, Scared, and Frightened, ANGER which included Angry, Mad, and

Annoyed, and ANXIETY which included Anxious, Worried, and Nervous. A SUM of total negative emotions was defined by a sum of the negative EAS subscales. According to the developers of this scale, it is a useful tool for measuring temporary levels of emotions and met established guidelines for validity and reliability. The EAS showed convergent validity with measures of similar emotional states from other scales of emotions including the Beck Inventory and the Profile of Mood States. The EAS consists of 24 descriptor words. Inter-item reliability coefficients of the 24 descriptor words ranged from .70 to .91. Split-half reliability was computed at $r = .94$. The original EAS from Carlson et al. (1989) used a visual analog scale with ratio data where there was a possible zero value score. For convenience purposes, this study used a 5-point Likert scale and interval data.

The Self-Rated Health 5 (Eriksson, Unden, & Elofsson, 2001) is a three-item, subjective assessment designed to measure a person's perceptions of their own current physical health. Responses are measured on a 7-point Likert scale with higher scores indicating higher levels of self-rated health. The SRH-5 has internal consistence of $\alpha = .70$ for Caucasian men and women.

The blood pressure monitor used was the Omron BP785 10 Series Upper Arm Monitor. White and Anwar's (2001) findings showed no differences in accuracy of the Omron compared to aneroid sphygmomanometer method (1.56 ± 4.42 mmHg and 3.49 ± 4.61 mmHg for systolic and diastolic blood pressure respectively). Based on previous research, all of the instruments used in this study have demonstrated acceptable reliability and validity (Vingoe 1966; Carlson, Collins, Stewart, and Porzelius, 1989; Eriksson, Unden, & Elofsson, 2001).

Summary

This chapter focused on the methodology, procedures, and materials that were used in the current study. The current study is a 2 x 2 x 2 mixed design. Participants were 74 undergraduate students from Texas State University-San Marcos recruited via convenience sampling who were offered extra-credit in one of their psychology courses. Participant outcomes were analyzed based on condition (experimental and control) and participant personality (extraversion or introversion). Participants either received a 60-second aversive auditory stimulus or a neutral one. Blood pressure, heart rate, and current emotional state were compared pre and post stimulus. A measure of self-rated health was also included. The data were analyzed using mixed-measures ANOVAs.

CHAPTER IV

RESULTS

Methodology Summary

The current study was conducted at Texas State University-San Marcos, using a convenience sample of undergraduate students. The study was a 2 x 2 x 2, quasi-experimental, mixed-design experiment. The two between-subject factors were personality (extraversion/introversion) and stimulus condition (aversive or control). The within-subjects factor was time; each participant had their blood pressure and heart rate taken and filled out an assessment of current emotional state before and after an auditory stimulus. A rating of self-rated health was also taken before the stimulus for all participants. The research questions were a) what the effects are of an aversive auditory stimulus on blood pressure, heart rate, and emotional reactivity and b) how do these results relate to personality and self-rated health.

Participants

The participants for this study were 74 undergraduates from Texas State University-San Marcos. The participants were given extra-credit in one of their psychology courses. The researcher contacted three psychology professors and asked permission to recruit their students for a graduate research study. The researcher created sign-up sheets for the students to sign up for a particular time slot. The sign-up sheet included a brief description of the study. One professor gave the researcher access to her TRACS website so that the students could sign up online. The students who signed up

and attended the experiment were given extra-credit and used as participants for the study.

There were 45 females (60.8%) and 29 males (39.2%). A majority of the participants were Caucasian (58.1%), 29.7% were Hispanic, 9.5% were African American, and 2.7% of the participants endorsed another ethnicity. Of the participants, 23% were freshmen, 29.7% were sophomores, 29.7% were juniors, and 17.6% were seniors. Based on a mean split of Eysenck Extraversion scores at 63.53, 32 (43.2%) participants fell into the high extraversion group and 42 (56.8%) participants fell into the low extraversion group. Participants were randomly assigned to either an experimental or control group by pulling a “C” or “E” slip out of a cup, with no replacement. Only one student was turned away from the experiment due to an uncorrected hearing deficit. He was still given extra-credit for his class. The rest of the participants completed the entire study and all of their data was used for analyses.

Results

Results based on stimulus condition

Analysis 1

Descriptive statistics for systolic blood pressure by condition and time of measure can be found in Table 1. Results of a mixed measures ANOVA revealed that there was no difference in systolic blood pressure based on the condition [$F(1,72)=.009, p=.927$].

Likewise there was no difference between the times of measure [$F(1,72)=1.327, p=.253$].

Table 1. Descriptive Statistics for Systolic BP by Condition and Time

<u>Condition</u>	Time of Measure	
	Pre M (SD)	Post M (SD)
Experimental	109.06 (11.815)	107.33 (20.369)
Control	109.42 (12.424)	106.32 (23.045)

* *No differences were statistically significant.*

Analysis 2

Descriptive statistics for diastolic blood pressure by condition and time of measure can be found in Table 2. Results of a mixed measures ANOVA revealed no difference in diastolic blood pressure based on the condition [$F(1,72)=.787, p=.378$]. Likewise there was no difference between the times of measure [$F(1,72)=.996, p=.332$, partial eta-squared=.014].

Table 2. Descriptive Statistics for Diastolic BP by Condition and Time

<u>Condition</u>	Time of Measure	
	Pre M (SD)	Post M (SD)
Experimental	72.72 (7.44)	72.72 (8.210)
Control	75.24 (9.615)	73.74 (10.797)

* *No differences were statistically significant.*

Analysis 3

Descriptive statistics for heart rate by condition and time of measure can be found in Table 3. Results of a mixed measures ANOVA revealed that was no difference in heart rate based on the condition [$F(1,72)=.941, p=.335$]. Likewise there was no difference between the times of measure [$F(1,72)=.338, p=.563$].

Table 3. Descriptive Statistics for Heart Rate by Condition and Time

<u>Condition</u>	Time of Measure	
	Pre M (SD)	Post M (SD)
Experimental	75.06 (12.282)	75.36 (13.747)
Control	72.13 (13.362)	72.71(11.657)

* *No differences were statistically significant.*

Analysis 4

Descriptive statistics for EAS subscale FEAR emotions (afraid + scared +frightened) by condition and time of measure can be found in Table 4. Results of a

mixed measures ANOVA revealed that there was no significant difference in fear emotions based on the condition [$F(1,72)=.001, p=.967$]. Likewise there was no difference from pre to post measure [$F(1,72)=.492, p=.485$].

Table 4. Descriptive Statistics for EAS Subscale FEAR by Condition and Time

Condition	Time of Measure	
	Pre M (SD)	Post M (SD)
Experimental	3.67 (1.493)	3.28 (1.111)
Control	3.68 (1.082)	3.14 (.536)

* *No differences were statistically significant.*

Analysis 5

Descriptive statistics for EAS subscale ANGER emotions (angry + mad + annoyed) by condition and time of measure can be found in Table 5. Results of a mixed measures ANOVA revealed that there was no significant difference in anger emotions based on the condition [$F(1,72)=.168, p=.683$]. Likewise there was no difference from pre to post measure [$F(1,72)=.985, p=.324$].

Table 5. Descriptive Statistics for EAS Subscale ANGER by Condition and Time

Condition	Time of Measure	
	Pre M (SD)	Post M (SD)
Experimental	3.83 (1.802)	3.83 (1.630)
Control	3.65 (1.457)	3.49 (1.346)

* *No differences were statistically significant.*

Analysis 6

Descriptive statistics for EAS subscale ANXIETY emotions (anxious + worried + nervous) by condition and time of measure can be found in Table 6. Results of a mixed measures ANOVA revealed that there was no significant difference in anxiety emotions

based on the condition [$F(1,72)=.002, p=.964$]. Likewise there was no difference from pre to post measure [$F(1,72)=1.509, p=.223$].

Table 6. Descriptive Statistics for EAS Subscale ANXIETY by Condition and Time

Condition	Time of Measure	
	Pre M (SD)	Post M (SD)
Experimental	6.11 (2.339)	4.39 (2.074)
Control	6.14 (2.162)	5.00 (2.173)

* *No differences were statistically significant.*

Analysis 7

Descriptive statistics for EAS total negative emotions or SUM (FEAR + ANGER + ANXIETY) by condition and time of measure can be found in Table 7 . Results of a mixed measures ANOVA revealed that there was no significant difference in negative emotions based on the condition [$F(1,72)=.015, p=.904$]. Likewise there was no difference from pre to post measure [$F(1,72)=.019, p=.89$].

Table 7. Descriptive Statistics for EAS SUM by Condition and Time

Condition	Time of Measure	
	Pre M (SD)	Post M (SD)
Experimental	13.58 (5.050)	11.50 (4.205)
Control	13.46 (3.602)	11.62 (3.192)

* *No differences were statistically significant.*

Results based on personality

Analysis 8

Descriptive statistics for systolic blood pressure by personality and time of measure can be found in Table 8. Results of a mixed measures ANOVA revealed that there was no difference in systolic blood pressure based on personality [$F(1,72)=.197,$

$p=.658$]. Likewise there was no difference between the times of measure [$F(1,72)=1.118$, $p=.294$].

Table 8. Descriptive Statistics for Systolic BP by Personality and Time

Personality	Time of Measure	
	Pre M (SD)	Post M (SD)
Introverts	109.47 (12.043)	107.75 (25.170)
Extraverts	109.07 (12.198)	106.10 (18.807)

* *No differences were statistically significant.*

Analysis 9

Descriptive statistics for diastolic blood pressure by personality and time of measure can be found in Table 9. There was no difference in diastolic blood pressure based on personality [$F(1,72)=.041$, $p=.841$]. Likewise there was no difference between the times of measure [$F(1,72)=1.214$, $p=.274$].

Table 9. Descriptive Statistics for Diastolic BP by Personality and Time

Personality	Time of Measure	
	Pre M (SD)	Post M (SD)
Introverts	73.25 (9.391)	72.69 (10.597)
Extraverts	74.60 (8.127)	73.24 (8.825)

* *No differences were statistically significant.*

Analysis 10

Descriptive statistics for heart rate by personality and time of measure can be found in Table 10. Results of a mixed measures ANOVA revealed that there *was* a significant difference in heart rate based on personality [$F(1,72)= 4.057$, $p=.048$] so that introverts had higher heart rates than extraverts across trials. There was no difference between the times of measure [$F(1,72)=.191$, $p=.663$].

Table 10. Descriptive Statistics for Heart Rate by Personality and Time

Personality	Time of Measure	
	Pre M (SD)	Post M (SD)
Introverts	75.84 (14.939)	77.22 (13.576)
Extraverts	71.81 (10.854)	71.55 (11.555)

* Differences between groups were significant, $p < .05$

Analysis 11

Descriptive statistics for EAS subscale FEAR emotions (afraid + scared + frightened) by personality and time of measure can be found in Table 11. Results of a mixed measures ANOVA revealed that there was no significant difference in fear emotions based on personality [$F(1,72) = .024, p = .898$]. Likewise there was no difference from pre to post measure [$F(1,72) = .003, p = .953$].

Table 11. Descriptive Statistics for EAS Subscale FEAR by Personality and Time

Personality	Time of Measure	
	Pre M (SD)	Post M (SD)
Introverts	3.70 (1.403)	3.21 (1.052)
Extraverts	3.65 (1.210)	3.20 (.687)

* No differences were statistically significant.

Analysis 12

Descriptive statistics for EAS subscale ANGER emotions (angry + mad + annoyed) by personality and time of measure can be found in Table 12. Results of a mixed measures ANOVA revealed that there was no significant difference in anger emotions based on personality [$F(1,72) = .510, p = .477$]. Likewise there was no difference from pre to post measure [$F(1,72) = .336, p = .564$].

Table 12. Descriptive Statistics for EAS Subscale ANGER by Personality and Time

<u>Personality</u>	Time of Measure	
	Pre M (SD)	Post M (SD)
Introverts	3.58 (1.347)	3.55 (1.175)
Extraverts	3.85 (1.833)	3.75 (1.721)

* No differences were statistically significant.

Analysis 13

Descriptive statistics for EAS subscale ANXIETY emotions (anxious + worried + nervous) by personality and time of measure can be found in Table 13. Results of a mixed measures ANOVA revealed that there was no significant difference in anxiety emotions based on personality [$F(1,72)=.041, p=.841$]. Likewise there was no difference from pre to post measure [$F(1,72)=.765, p=.385$].

Table 13. Descriptive Statistics for EAS Subscale ANXIETY by Personality and Time

<u>Personality</u>	Time of Measure	
	Pre M (SD)	Post M (SD)
Introverts	6.18 (2.200)	4.94 (2.331)
Extraverts	6.08 (2.291)	4.50 (1.961)

* No differences were statistically significant.

Analysis 14

Descriptive statistics for EAS total negative emotions or SUM (FEAR + ANGER + ANXIETY) by personality and time of measure can be found in Table 14. Results of a mixed measures ANOVA revealed that there was no significant difference in negative emotions based on personality [$F(1,72)=.014, p=.907$]. Likewise there was no difference from pre to post measure [$F(1,72)=.080, p=.779$].

Table 14. Descriptive Statistics for EAS SUM by Personality and Time

Personality	Time of Measure	
	Pre M (SD)	Post M (SD)
Introverts	13.45 (4.032)	11.70 (3.820)
Extraverts	13.58 (4.640)	11.45(3.664)

* No differences were statistically significant.

Analysis 15

A t-test revealed that the low extraversion group ($M=16.81$, $SD=2.597$) rated significantly lower on a measure of self-rated health (SRH) than the high extraversion group ($M=18.03$, $SD=2.102$) [$t(72) = -2.17$, $p < .05$].

Summary

This chapter provided the results of this study. The research questions were a) what the effects are of an aversive auditory stimulus on blood pressure, heart rate, and emotional reactivity and b) how do these results relate to personality and self-rated health. Based on the results, there were two significant findings: introverts had higher heart rates across trials compared to extraverts and introverts rated lower on their Self-Rated Health scores. The remaining analyses were insignificant. The final chapter will discuss possible findings for this study's results including the relatively few significant findings, as well as implications for future research, implications for practice, and the limitations of the study.

CHAPTER V

INTERPRETATION AND RECOMMENDATIONS

In this final chapter, conclusions, study limitations, and implications for future research are discussed. The purpose of this research was to determine the effects of an aversive auditory stimulus on blood pressure, heart rate, and emotional reactivity compared to a neutral auditory stimulus. Participants were further analyzed based on a mean split of extraversion scores. A measure of self-rated health was also given to determine if these scores were related to participant personality.

Summary of Results

Only a few of the hypotheses were supported. First, participants who fell into introversion group indeed rated lower on their self-rated health scores. Introverts also had significantly higher heart rates than extraverts, regardless of stimulus condition. Secondly, participants in the control group (receiving the neutral stimulus) indeed did not show significant changes in blood pressure (systolic or diastolic) or heart rate. Participants in the experimental group did not rate higher on negative emotions from pre to post stimulus and there was not differences based on personality. There were also no significant changes pre to post stimulus on blood pressure (systolic and diastolic) and heart rate. Basically, the aversive stimulus failed to produce any significant effects.

Discussion of Results

The aversive auditory stimulus failed to produce any of the expected results. That is, it did not increase blood pressure, heart rate, or negative Emotional Assessment Scale (EAS) scores. In fact, trends between the control and experimental groups were very similar. One possible explanation for these results could be due to the length of the stimulus. Because it lasted an entire 60-seconds, any transient effects (e.g., temporary increases in subjective emotion, heart rate) if present were not recorded because only one post stimulus measure for these variables was taken, at the end of the 60-seconds. That is, blood pressure could have spiked at the beginning of the stimulus, but diminished by the time the post measure was taken. Taking a constant measure of blood pressure would have revealed any spikes throughout the stimulus; unfortunately, a constant measure was not possible with the monitor used. Another study using startle-stimuli of the same sound produced increased cortisol (Stelmack, Achorn, & Michaud, 1977). A cortisol sample may have revealed an increase of stress hormones in the presence of this study's stimulus.

Because blood pressure and heart rate have relatively fast rebound rates, possible spikes may not have been recorded in the present study. In a study by Radstaak, Geurts, Brosschot, Cillessen, and Kompier (2011), in response to a mental stressor, heart rates recovered (returned to normal) within 30 seconds of the stressor. With this in mind, it is possible that heart rates in the current study could have significantly increased at the start of the stimulus but returned to normal by the time the post-stimulus measure was taken. However, in the same study by Radstaak et al. (2011) blood pressures recoveries to the same stressor were also measured and averaged around 4 minutes. This does not provide

evidence that, if a blood pressure spike occurred in the current study, it would have had time to recover so that elevations would go unnoticed. However, in a study by Veer et al. (2011), cortisol levels, blood pressure, and heart rate recovery were examined in participants who underwent a laboratory mental stressor compared with a control group. Cortisol levels remained significantly higher than controls ($p < .05$) throughout the stressor and after 90 minutes whereas blood pressure was not significantly different from controls even after 60 minutes ($p > .1$). This study provides evidence that cortisol assays are a more sensitive measure of physiological reactivity and remain at higher levels over time than blood pressure. These results would explain why cortisol levels were affected by the noise in the Stemack, Achorn, and Michaud (1977) study.

One interesting finding was that introverts had significantly higher heart rates (pre and post stimulus) than extraverts. While characteristics not attributed to the stimulus were not of initial interest in the study's hypothesis, this result is still of interest. This outcome is not surprising based on prior research. According to Eysenck (1967), introverts have greater potential for arousal and show greater variations in heart rate. In a study by Gange, Geen, and Harkins (1979), introverts displayed higher heart rates across three trials: during a vigilance task, observing a task, and just sitting quietly.

The hypothesis that introverts would rate significantly lower on a self-rated health survey was supported. Previous research has supporting this finding that extraverts tend to rate higher than introverts and individuals high in neuroticism on self-rated health measures (Williams, O'Brien, & Colder, 2004; Jiang, Dai, & Cai, 2007).

Summary Statement

This study demonstrated that introverts had higher heart rates than extraverts regardless of stimulus condition, pre and post stimulus. Introverts also rated significantly poorer on a measure of self-rated health. These findings have been supported by prior research. Negative Emotional Assessment Scores did not increase from pre to post stimulus in the experimental group and there were no differences based on personality.

Implications for Future Research

As prior research has shown, aversive environmental stimuli can have negative effects on emotional and physiological well-being. Loud sounds are inevitable in our everyday lives and may affect us beyond annoyance. Although the current study did not support this claim, other studies have shown that loud sounds can raise cortisol levels, blood pressure, heart rate, and affect emotional processes (Stelmack, Achorn, & Michaud, 1977; Holand, Girard, Laude, Meyer-Bisch, & Elghozi, 1999; Bradley & Lang, 2000; Zald & Pardo, 2002). All these effects can negatively affect an individual's physical and psychological well-being, especially people who are more sensitive to such sensory input, such as introverts (Stelmack, 1967).

Future research may aim to monitor moment-to-moment changes in variables affected by aversive auditory input, such as blood pressure and current emotional state. Recording changes in how individuals react over time to noise may be helpful in understanding the step-by-step processes involved in an individual's processing of aversive noises. Future research may attempt to understand the dynamic nature of sensory processing and its effects on an individual's physical and emotional status.

Implications for Practice

The finding that introverts had significantly higher heart rates than extraverts is of clinical interest. In general, elevated resting heart rate is a cardiovascular risk, as more strain is put on the heart to pump blood (Böhm et al., 2010). Therefore introverts may be at higher risk for aversive health outcomes. Also of interest was the finding that introverts rated significantly poorer on their self-rated health survey. This is not surprising considering that studies have shown level of extraversion is positively correlated with higher self-rated health (Jiang, Dai, & Cai, 2007). Self-rated health has been demonstrated to predict future morbidity and mortality, regardless of other physical, psychological, and social factors (Kaplan & Camacho, 1983) and therefore would be beneficial to patients if assessed by health care providers.

Limitations

This study is not without a few limitations. First, the aversive auditory stimulus chosen for this experiment failed to produce increases in blood pressure, heart rate, or emotional reactivity. Negative emotions did not increase for the experimental group and there were no differences based on personality. This indicates that although the frequency and volume level the stimulus chosen has been demonstrated to evoke physiological responses (Stelmack, Achorn, & Michaud, 1977), the stimulus failed to produce such effects. This is probably because the stimulus in prior studies used a brief, startle response rather than a 60-second tone. This meaning, though it was possible that initial blood pressure and heart rate could have increased at the start of the aversive stimulus, it was not measured because physiological measures were only taken pre and post stimulus,

and a constant reading was not obtained. This could have also been the case for the emotional response, though another study using a lasting (non-startle) aversive stimulus at similar frequency and volume produced increased cerebral blood flow in the amygdalae of participants (Zald & Pardo, 2002).

Neither introverts nor extraverts receiving the aversive stimulus rated higher in negative emotions post stimulus. In fact, though not significant, ratings of negative emotion were lower post stimulus for both experimental and control groups. This suggests that the participants may have been responding on the emotional assessment more to the experiment itself than how they felt in the present moment. For example, participants may have rated higher in negative emotions pre stimulus as a result of the impending experiment and because they had just had their blood pressure taken. With this in mind, it is less surprising that both groups would have rated having fewer negative emotions post stimulus due to relief that the noise (and basically the experiment itself) was over. For example, participants in the experimental group may have rated having fewer negative emotions at the end of the experiment not because the noise wasn't aversive, but because they were relieved that it was over.

Also because of the relatively small sample size ($n=74$), there were few significant findings. Another major limitation to the research was the fact that significantly more introverts were assigned to the experimental group by chance alone which confounds the interpretability of the results. The decision to use a convenience sample of undergraduate psychology majors from Texas State University—San Marcos limits the ability to generalize findings outside of this area. Individuals who are not

students in this area may bear different characteristics and, therefore, are not represented by this sample.

Summary and Conclusions

Many research studies have looked at the effects of aversive stimuli on physiological outcomes (Stelmack, 1990; Holand, Girard, Laude, Meyer-Bisch, & Elghozi, 1999; Bradley & Lang, 2000) as well as individual differences based on introversion and extraversion (Stelmack, Achorn, & Michaud, 1977; Stelmack, 1990). While studies have demonstrated the effects of aversive stimuli on emotional systems within the brain (Zald & Pardo, 2002), limited research has focused on the effect of a continuous (i.e. non-startle) aversive auditory stimulus on self-rated negative emotions, before and after stimulus. This study combined the aforementioned variables into a unique design and a measure of self-rated health was also recorded.

Based on the researcher's hypotheses, only a few were supported. First, participants who fell into the introversion group indeed rated lower on their self-rated health scores. The introverts also had significantly higher heart rates than extraverts, regardless of stimulus condition. Secondly, participants in the control group (receiving the neutral stimulus) indeed did not show significant changes in blood pressure (systolic or diastolic) or heart rate. Participant in the experimental group did not rate higher on negative emotions and there were no differences based on personality. There were also no significant changes pre to post stimulus on blood pressure (systolic and diastolic) and heart rate. Basically, the aversive stimulus failed to produce any significant effects, though these results may be due to the timing of the post stimulus recordings.

APPENDIX B

The Eysenck Extraversion Scale

Please rate the degree to which you agree or disagree with each of the following statements using the following 5 point scale:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

- _____ 1) I tend to keep in the background at social events.
- _____ 2) I prefer to work with others rather than alone.
- _____ 3) I get embarrassed easily.
- _____ 4) I really try to avoid situations in which I must speak to a group.
- _____ 5) I am strongly motivated by the approval or interest of others.
- _____ 6) I often daydream.
- _____ 7) I find it easy to start conversations with strangers.
- _____ 8) I particularly enjoy meeting people who know their way around the social scene.
- _____ 9) I would rather read a good book or watch television than go out to a movie.
- _____ 10) I spend a lot of time philosophizing and thinking about my ideas.
- _____ 11) I prefer action to thought and reflection.
- _____ 12) I am often uncomfortable in conversations with strangers.
- _____ 13) I am mainly interested in activities and ideas that are practical.
- _____ 14) I would prefer visiting an art gallery over attending a sporting event.
- _____ 15) I enjoy open competition in sports, games, and school.
- _____ 16) I make my decisions by reason more than by impulse or emotion.
- _____ 17) I have to admit that I enjoy talking about myself to others.
- _____ 18) I like to lose myself in my work.
- _____ 19) I sometimes get into arguments with people I do not know well.
- _____ 20) I am very selective about who my friends are.

APPENDIX C

Self-Rated Health Survey

Below are questions that reflect physical health status. In each case, please indicate your current health using the following 7 point scale:

		Rather	Neither	Good		
Very Poor	Poor	Poor	Nor Poor	Fair	Good	Very Good
1	2	3	4	5	6	7

_____ 1) How would you rate your general health status?

_____ 2) How do you regard your health?

_____ 3) How would you assess your general health status compared to that of others of your own age?

APPENDIX D

Emotional Assessment Scale

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel right now, that is, in the present moment.

Very Slightly or Not at All 1	A Little 2	Moderately 3	Quite a Bit 4	Extremely 5
_____ Surprised			_____ Ashamed	
_____ Afraid			_____ Worried	
_____ Disgusted			_____ Disturbed	
_____ Angry			_____ Joyful	
_____ Guilty			_____ Frightened	
_____ Anxious			_____ Amazed	
_____ Sad			_____ Sickened	
_____ Delighted			_____ Annoyed	
_____ Scared			_____ Humiliated	
_____ Astonished			_____ Nervous	
_____ Repulsed			_____ Hopeless	
_____ Mad			_____ Happy	

APPENDIX E

Omron BP785 10 Series Upper Arm Monitor (BP785)

A non-invasive semi-automatic oscillometric blood pressure device. Oscillometric measurements have been shown to be just as reliable as auscultatory method mercury sphygmomanometer. Initial cuff inflation pressure exceeds the systolic arterial pressure, and then is reduced below diastolic pressure for approximately 40 seconds. The values of systolic and diastolic pressure are computed using an algorithm; the computed results are displayed electronically.

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