Hostility and Cardiovascular Regulation: An Investigation of Lateralized Pre- Motor Functions

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(ABSTRACT)

Behavioral and physiological correlates of hostility, such as cardiovascular lability and increased risk of cardiovascular disease, are vital when considering the possible health risks associated with high levels of hostility (Henry & Meehan, 1981; Matthew & Haynes, 1986; Johnson, 1990; Heller, 1993; Heilman, Bowers, & Valenstein, 1993; Demaree & Harrison, 1997; Demaree Harrison, & Rhodes, 2000; and Shenal & Harrison, 2001). By examining this issue through a functional cerebral systems approach, one is better able to conceptualize changes that occur when men with extreme hostility levels (e.g. high and low) carry out emotional regulation tasks. High and low hostile groups have been shown to differ in their auditory, visual, somatosensory, and motor processes. Moreover, they differ in lateralized cerebral functions within these modalities where high hostiles have shown a right cerebral/ negative affective bias while low hostiles have shown a left cerebral/ positive affective bias in perception and in motor functions to stress. Right cerebral activation in high hostiles has occurred with heightened reactivity and persistence in sympathetic tone and with cardiovascular changes in heart rate, blood pressure, and Galvanic skin response. In the present experiment, this systematic line of research (Harrison & Gorelczenko, 1990; Herridge & Harrison. 1996;Demaree & Harrison, 1997; Herridge, Harrison, & Demaree, 1997; Demaree, Higgins, Williamson, and Harrison, 2002; Williamson & Harrison, in press) was extended to the investigation of the premotor frontal eye fields using rapid directional eye movements toward the contralateral hemisphere. It was predicted that high hostiles would evidence right frontal deficits in lateral eye movements (LEM) resulting in decreased LEM toward and within the left hemispace. Moreover, concurrent processing of lateralized eye movements and regulation over cardiovascular responding was predicted to yield sympathetic dysregulation on leftward LEM (lLEM) and potentially parasympathetic dysregulation on rightward LEM (rLEM). Leftward LEM appeared to result in more fatigue effects

than rightward LEM. However, the primary behavioral hypothesis was not supported. Moreover, the directional relationship predicted between left side LEM and sympathetic tone was not found. Instead, LEM in either direction occurred with corresponding reduction in sympathetic blood pressure. Diametrically opposite results were found for the non- directional cold pressor stressor. High hostiles were found to be more reactive in their cardiovascular response to stress than the low hostiles.

Table of Contents

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It is vital to understand cardiovascular disease as the health risks associated with this disease are the leading cause of death, lowered quality of life, and health care costs in the United States (Friedman, 1981; Katzel & Waldstein, 2001). Cardiovascular health is a primary component in understanding disease risk, life expectancy, and quality of life. It has been noted that the expression of hostility, a component of Type A behavior, can be directly related to one's cardiovascular risk (Saul, 1956; Johnson, 1990; Katzel & Waldstein, 2001). Recent developments within the neuropsychological literature have advanced the understanding of the relationship between the brain and behavior, advancing neuropsychological understanding of cardiovascular risk factors and providing evidence for regulation by the frontal lobes (Luria, 1980; Suss & Benson, 1984; Tucker & Williamson, 1984; Heller, 1993; Heilman, Bowers, & Valenstein, 1993; Crews, Harrison, Rhodes, & Demaree, 1995; Shenal & Harrison, 2001; Williamson & Harrison, in press. Specifically within our laboratory, a functional cerebral systems model has been used to investigate the neuropsychology of hostility. This approach has allowed for a better understanding of the sensory, perceptual, motor, and pre- motor correlates of emotional cardiovascular lability in hostile and/ or violent prone individuals. Research highlights functional asymmetries within each sensory modality, including vision (Harrison & Gorelczenko, 1990; Herridge & Harrison. 1996), audition (Demaree & Harrison, 1997), somatosensory (Herridge, Harrison, & Demaree, 1997), motor (Harrison, 1991; Demaree, et al., 2002), and pre- motor (Demaree, Harrison, & Rhodes, 2000; Williamson & Harrison, in press) brain regions.

The purpose of the present experiment is to extend this systematic line of research to the pre- motor eye fields and to provide a replication test of research supporting differential cerebral activation (as noted by behavioral and physiological correlates) among high and low hostile men. This experiment should contribute to furthering the neuropsychological knowledge base on emotional regulation and cardiovascular control as a function of performance by a group displaying angry or cynical negative views towards others. It is important for the additional understanding that can be gained on a sample of hostile individuals who are at the highest risk for cardiovascular difficulties and, hence, increased mortality rates, cardiovascular disease, and factors that influence one's quality of life (Williams & Williams, 1994).

Hostility can lead to undesirable consequences for the individual with prominent tendencies toward this negative emotional valence. Specifically, hostility is an emotion in which an individual is seen as being in opposition to others, with a desire to harm or to negatively impact others, and the feeling that problems in the individual's life are due to other's interference (Saul, 1956; Smith, 1994). Hostility can be operationally defined as a constellation of actions and feelings directed toward others and the self. This collection of behaviors is the basis of hostility measures such as that of Cook and Medley (1954). Findings in our lab have indicated asymmetries in cerebral activation as a function of hostility. Moreover, individuals designated as high and low hostile differ in emotional regulation and cardiovascular lability in response to painful and/ or stressful situations.

A robust literature in health psychology has established a link between Type A behavior and cardiovascular reactivity. Hostility was found to be the predominant component underlying cardiovascular risk in this research (Matthew & Haynes, 1986; Johnson, 1990). Research has demonstrated that high hostile men (Suarez & Williams, 1989; Contrada, 1994; Demaree & Harrison, 1997; Demaree et. al., 2002; and Shenal & Harrison, 2001) and women (Emerson & Harrison, 1990; Harrison & Gorelczenko, 1990) exhibit increased cardiovascular lability in response to stress. Hostility, emotional regulation, and cardiovascular regulation will be reviewed and evaluated to support this position and the origins and rationale of the current experiment. The review will follow a functional cerebral systems model extending across sensory and motor systems.

Cardiovascular Lability.

The right hemisphere is primarily important to the regulation of sympathetic responses (e.g. heart rate and blood pressure acceleration), while the left hemisphere is more involved in the regulation of parasympathetic responses (e.g. heart rate and blood pressure deceleration). The right orbitofrontal region has been linked to inhibition of sympathetic tone (with disinhibition yielding increased heart rate and blood pressure), whereas the left orbitofrontal region has been proposed to inhibit or to regulate parasympathetic tone (with disinhibition yielding decreased heart rate and blood pressure) (Whittling, 1997).

Oppenheimer, et al. (1992), conducted a study on patients undergoing surgery, wherein the left and right insular cortex were stimulated. Dominance was found in the right side of the brain for the activation of a sympathetic response. Specifically it has been found that high hostiles experience activation of negative emotions, concurrent with lability in sympathetic tone resulting in increases in heart rate and blood pressure. Low hostiles have demonstrated indications of left cerebral activation with improved affective performance and sensory analysis within the right hemisphere along with cardiovascular correlates such as generally lowered blood pressure in response to stress (e.g. Demaree & Harrison, 1997; Herridge, et al., 1997).

A robust literature exists concerning the long-term effects of cardiovascular reactivity on an individual's health. A primary predictor of Type A behavior is hostility, which has been found to increase an individual's cardiovascular reactivity to stressful situations and to decrease the individual's ability to appropriately regulate the heart rate and blood pressure (Contrada, 1994; Dembroski & Williams, 1989; Harbin, 1989; Johnson, 1990). Individuals exhibiting high hostile behavioral characteristics tend to have a more labile heart rate that can lead to health risks and consequences (Manuck & Krantz, 1986). Thus, it is important to conduct further research and advance qualified theories that can advance our understanding of different aspects of hostility and cardiovascular risk.

Previously, we have replicated the now common finding that hostility is associated with increases in cardiovascular reactivity to cold pressor stress or pain (Demaree & Harrison, 1997; Demaree, Harrison, & Rhodes, 2000; and Shenal & Harrison, 200l; Demaree, et. al, 2002). Earlier we noted that effects such as heightened sympathetic tone and decreased motor efficiency may be seen as the right frontal region becomes more involved in processing/ regulating concurrent tasks and/or demands. These effects was proposed due to hypotheses generated by Harrison and colleagues (e.g. Herridge, Harrison, & Demaree, 1997), hypotheses extended by Whittling (1997), and from theories advanced by Kinsbourne and Hisock (1983)

Hostility in Functional Cerebral Systems

Visual. Harrison and Gorelczenko (1990) conducted an experiment in which men and women were classified as high or low hostile and were then asked to identify pictures of emotional (angry or happy) and neutral faces using a forced choice ("choose whether the face is happy or angry") reaction time task. The findings supported differences in cerebral activation based on behavioral correlates of visual appraisal of emotional faces. In this task, high hostile individuals exhibited a negative bias in the appraisal of neutral faces presented within the left visual field (e.g. neutral faces were more often identified as "angry" faces). Angry faces were processed more rapidly by all participants upon presentation within the left visual field, while symmetry was found in the processing of happy faces. The findings were especially interesting in that they could not have been predicted by either the Heilman theory or the Tucker theory alone. Herridge and Harrison, 1996, found that high hostile men are less accurate in emotional facial identification at the left visual field. Additionally, when placed under the stressful/ painful sensation of the cold pressor, low hostile individuals were found to be less accurate at identifying faces. High hostile men in the low stress baseline condition responded in a fashion similar to low hostile men in the high stress condition, suggesting decreased frontal regulatory capacity among the high hostile group.

Audition. Demaree and Harrison (1997) extended this line of research to auditory processing systems. Both high and low hostile men had a right ear advantage for the detection of speech sounds ("pa", "da", "ta", "ga") when dichotic listening procedures were used. The right cerebrum was differentially activated after exposure to a painful stimulus depending on the participant's designation as high or low hostile as indicated by behavioral (detection of sound location) and physiological (cardiovascular) measurements. The expectation of differential activation was supported as the low hostile group evidenced a shift to left cerebral activation that resulted in heightened right ear detection and maintenance of stable blood pressure after exposure to a pain stimulus. Hence, it appears that when exposed to the pain stimulus (cold pressor), low hostile men activate the left cerebrum as shown by a heightened right ear detection and stable blood pressure and heart rate, both indications of left cerebral activation. Right cerebral activation was noted in the high hostile group as the men reliably increased heart rate and systolic blood pressure and evidenced a heightened detection of speech sounds at the left ear after exposure to the stressor.

These findings were interpreted to support the hypothesis that high hostile men activate the right cerebrum in response to stress (showing a greater propensity for left ear detection of speech sounds and increased heart rate and blood pressure), while low hostile men activate the left cerebral region (maintaining stable heart rate and blood pressure and maintaining the right ear advantage for speech sounds) (Demaree & Harrison, 1997).

Somatosensory. Skin conductance or the Galvanic skin response (GSR) was recorded in an experiment designed to examine somatosensory processes. High and low hostile men were instructed to contract specific facial muscles that were rated as happy, sad, or neutral by others. The participants were coached in the proper facial configurations they would be expected to make and were fully trained before testing began. The highest level of GSR reactivity was noted in both groups when the participants were instructed to contract corrugator muscles (angry expression). This was followed by a lower GSR reactivity when zygomatic muscles were contracted (happy expression). Finally, a low level of GSR reactivity resulted from making a neutral facial expression. The results indicate that high hostile men exhibited increased GSR at the left hand and showed slower habituation at the left hand over trials. In contrast, low hostile men exhibited less conductance at the left hand and habituated more quickly at the left, regardless of instructions to make angry, happy, or neutral faces. (Herridge, Harrison, & Demaree, 1997).

Motor. Demaree, Higgins, Williamson, and Harrison (2002) assessed motor and premotor activation as indicated by grip strength, a motor task, and perseveration, a correlate of pre motor dysfunction (Damasio & Anderson, 1993). Both high and low hostile men were strongly right handed and were assessed through the use of a standard hand dynamometer. The proposed right frontal deficit in high hostile men was tested experimentally with the predictor of heightened flexor tone at the left upper extremity ("antigravity" posture). Results indicted that high hostile men showed significantly less flexor grip strength at the right hand as compared to the right hand measures of the low hostile group. Additionally, high hostile men demonstrated significantly increased flexor grip strength at the left hand than did the low hostile group. Indications and implications of this work are important when considering the proposed model of increased right posterior cerebral activation in high hostile groups. Again, the professed mechanism consists of decreased right frontal regulatory control (inhibition) over posterior (sensory) cerebral regions, postural reflexes (antigravity posturing mechanisms), and sympathetic tone (Harrison & colleagues, 1990- current).

Premotor. Fluency tasks have been initially attempted to assess premotor differences among high and low hostile men. Williamson and Harrison (in press) used a concurrent frontal challenge designed to task either left frontal or right frontal systems with predicted parasympathetic and sympathetic correlates among these groups. As predicted for this model, high hostile men demonstrated increased systolic blood pressure in response to a design fluency test (right frontal challenge), while a verbal fluency task (left frontal challenge) resulted in decreased systolic blood pressure. It was also noted that high hostile individuals made substantially more perseverative errors in the design fluency task and made more perseverative errors overall (Williamson & Harrison, in press). The results supported the proposed model of decreased right frontal regulatory mechanisms in hostile, violent prone individuals. Again, support was found through replication and through cognitive/ behavioral measures and cardiovascular measures.

Frontal Lobe Control and Emotional Regulation

Emotional regulation requires the ability to instigate, control, and inhibit responses to emotional stimuli. Different theories have been proposed concerning the specific neuroanatomical correlates of emotional activation and regulation in the brain, but there are a few theories that predominate in the current literature and scientific community.

Heilman, Bowers, and Valenstein (1993) proposed that the right cerebrum plays a heightened role in arousal and, therefore, emotion; hence, activation of the right cerebrum would result in increased arousal and possibly a display of emotional response. Support for this theory is noted in Borod, et al.’s 1988 experiment examining emotional control in the right hemisphere. An innovative technique was used in which participants were instructed to make emotional and neutral faces; the faces were then separated at the midline and a composite of the face mirroring each side was made. Their experiment demonstrated that both positive and negative emotions were significantly more intense on the left side of the face. This was found independent of the type of emotion (“happy” or “sad”) that the participant was instructed to make.

Opposing Heilman's viewpoint, Tucker & Williamson (1984) theorize a balance between the right and the left cerebrum. This "balance theory" notes the probability that the right cerebrum regulates negative emotional responses, while the left cerebrum controls positive emotional responses. Moreover, Tucker and Williamson proposed that activation or deactivation of one of the cerebrums would lead to a display of the dominant functional response for the activated hemisphere. For example, right cerebral activation would yield a negative emotional bias; left cerebral activation would yield a positive emotional expression. Support for Tucker's view is noted in research such as that of Demakis and Harrison (1994) whose results note a shift in activational balance to the right hemisphere under stressful and/ or arousal provoking situations and that of Borod, et al (1992) who noted that the right hemisphere evidenced an affinity when identifying emotional words.

A primary task of the frontal lobes is the regulation and the deregulation of emotional perception and expression with dysregulation or emotional lability resulting from decreased regulatory capacity of this brain region. Dysregulation of emotional perception or expression would occur through decreased capacity or through heightened processing demands within the frontal lobes. This would result in a reduced ability to inhibit responses to affective sensory stimuli, inability to control emotional lability, and potentially altered social behaviors (Heilman et al., 1993;Tucker & Williamson, 1984, Davidson, Putnam, & Larson, 2000).

The functional cerebral systems model predicts differential structural and functional activation of the brain when involved in certain tasks. A common example of this is seen in the frontal lobes where it is accepted that there is hemispheric specialization in function. According to Tucker and Williamson (1984), a main correlate of frontal lobe activation is access of the left hemisphere under positive affect conditions and the right hemisphere under negative affective conditions. Tucker also notes that the frontal lobes serve a regulatory function, especially of emotional processing and of activation of the posterior brain regions.

The premotor cortex is anterior to the motor cortex and is intimately involved in intentional preparatory movements interconnecting with the somatosensory strip for kinesthesia or kinesthetic functioning. The premotor cortex also has extensive connections with the basal ganglia or caudate head for the precise inhibition and smooth transitional control over sequential movements (Brodal, 1981; Kandel, Schwartz, & Jessell 1991; Sadato, et. al., 1996). The frontal eye fields are located bilaterally in Brodmann's area eight and have important connections with numerous cerebral regions such as the motor association cortex (Damasio, 1993; Mesulam, 2000). Thus, it follows that this would be a logical area in which to further examine and extend previous research.

Functional Cerebral Space

Asymmetry in cerebral function can be seen at a variety of levels. Notably, laterality differences are seen as a function of age (Alden, Billings, & Harrison, 1991; McDowell, Harrison, & Demaree, 1994; Emerson, et al., 2001), repetitive exertion and inertia (Harrison & Pauly, 1990), gender and depression (Crews & Harrison, 1994), and habituation phenomenon (Harrison, 1990) just to name a few. As the scope of this paper is not of the magnitude to adequately cover this topic, concentration will be placed on functional cerebral asymmetry in emotion, specifically as a function of hostility.

One method of assessing cerebral functions is through the use of dual concurrent task methodology. It has been argued (Kinsbourne & Hisock, 1983) that dual concurrent tasks and requirements will yield interference of the secondary task as a function of the proximal use of several brain regions or "functional cerebral space". Concurrent task demands may result in interference effects through the addition of processing demands placed on specific components within a functional neural system. Alternately, priming effects might occur with easier tasks as the activation increases in the brain region. This might result in increased activation and potentially improved performance in this part of the system. However, decreased ability to perform may be noted with more demanding tasks or when there is decreased capacity within this brain region yielding an interference effect. In other words, the interference effect would be seen as the brain attempts to initiate, perform, and inhibit concurrent responses or sensory analysis, resulting in a decreased ability to perform the secondary task. Dual tasks might include performing more than one motor task at the same time. However, recently we have proposed that concurrent processing demands may include more diverse secondary task demands such as frontal lobe control over sympathetic or parasympathetic cardiovascular response (Herridge, Harrison, & Demaree, 1997;

Demaree, Harrison, & Rhodes, 2000; Everhart, Shenal, & Harrison, 1999; Williamson & Harrison, 2002). Potentially, cardiovascular response regulation may be differentially sensitive to concurrent cognitive or affective demands (e.g., control of pain, reading, etc). Interference would occur if the tasks both employ proximal functional cerebral systems. (Bryden & Ley, 1983).

Several studies have purported to show evidence of priming and interference effects. In an experiment by Demakis and Harrison (1994), subvocal rehearsal of neutral and affective words was required of the participants and the effects of this rehearsal on describing faces as “happy” or “angry” was examined. Interference effects were noted as participants listened to speech sounds and attempted to identify faces in the right visual field. However, priming effects were seen as participants identified faces in the left visual field. The findings were interpreted as providing support for hypothesized brain activation resulting in priming or interference effects based on the location and the extent of prior activation to a given task.

In 1991, Harrison conducted a study in which dual task interference was examined through concurrent reading and tapping tasks. In this experiment, the participant was required to make tapping motions on a keyboard with either the proximal (elbow) or the distal (index finger) upper extremity under conditions of reading (interference condition) and no reading (no- interference condition). Anatomical differences in the extent of contralateral control for proximal and distal body regions were used to predict functional differences in dual task interference at these body regions. The findings support the viability of the dual task model as the percentage of interference corresponded with anatomical projections to the proximal and distal limb locations. Moreover, the predictor of heightened left proximal limb interference concurrent with reading was confined. This prediction could only have been derived from previously established percentages for contralateral and ipsilateral anatomical projections to these regions anatomical projection (Brodal, 1981).

Rapid alternating movement (RAM) tasks are commonly used to assess motor control. In this type of movement a participant alternatively shifts from one movement to the next in a repetitive fashion using a part of the body (e.g. fingers, hands, feet, etc.) and often while involved in a concurrent task. This research has been completed in finger tapping (Shimoyama, Ninchoji, & Uemura, 1990; Harrison, 1991; Sadato, et. al.

1996;), proximal and distal tapping of the upper extremities (Harrison, 1991), and tapping of the hands and feet (Kauarnen and Vanharanta, 1996). Currently, the proposed project will extend this research to rapid eye movements to the left and right hemispace.

Hypotheses

The purpose of the current experiment was to examine the effects of contralateral rapid lateral eye movements (LEM) on heart rate, blood pressure, and number of directional eye movements. More specifically, group differences were expected with right frontal dysregulation proposed for the high hostile men.

Due to cardiovascular risks, it is important for research such as the current experiment to be conducted in order to advance understanding of cardiovascular regulation and emotional control, both of which are important to physical and psychological health. The current project attempted to build upon previous literature and research and move forward to examine pre- motor functioning through the effects of directional rapid lateral eye movements (LEM) on hemispheric activation in high and low hostile men. Former research provided support for dynamic right cerebral activation in high hostile men and dynamic activation of the left cerebral regions in low hostile men. Additionally, different patterns of activation in lateralized functioning such as blood pressure and heart rate are noted, dependant upon hostility designation and stress condition. Hence, the current experiment evaluated hemispheric activation, measured by heart rate, blood pressure, and lateral eye movement rate in high and low hostile men both before and after exposure to a painful stimulus.

There are hypotheses of differences in behavioral measures among the groups (high and low hostile). It was expected that high and low hostile men would differ in their abilities to make rightward LEM (rLEM) and leftward LEM (lLEM). The difference in aptitude to look in particular directions was predicted to result in baseline differences (pre- stressor) and robust differences post stressor.

Additionally, significant differences in physiological recordings were expected between the groups. It was expected that high and low hostile men would have similar resting heartrate and blood pressure, but that under conditions of eye movement and stressor (cold pressor) cardiovascular reactivity would differ significantly. It was expected that leftward LEM would result in increased sympathetic tone, while rightward LEM would demonstrate increased parasympathetic tone in both groups. After exposure to the cold pressor stimuli, it was expected that the high hostile men would evidence significantly increased heartrate and blood pressure, while the low hostile men would show indications of stable or decreased heartrate and blood pressure. It was theorized that these changes would support the notion of differential cerebral activation between a left hemisphere specific and a right hemisphere specific task.

Method

Participants

The research proposed was submitted to and approved by the Psychology Department Human Subjects Committee and by the Institutional Review Board of Virginia Polytechnic Institute and State University. Group screening was conducted to identify and to invite participation from qualified individuals. Approximately 59 participants qualified for, agreed to continue, and participated in the experiment. Due to changes in CMHO scale scores that excluded some participants, mechanical failure, and ensuring equal groups, final analyses consisted of 18 men per group (based on the group definitions described below).

Group Classification

Fifty- nine male college students, aged 18- 22, were recruited from the introductory psychology pool at Virginia Polytechnic Institute and State University. All participants exhibited strong right- hemibody preference as determined by a self-report lateral preference inventory, which is a behaviorally validated questionnaire (Coren, Porac, & Duncan, 1979). This questionnaire consists of thirteen items, which assess four types of lateral preference (hand, foot, eye, and ear). The self- report items were scored positive one for “right”, negative one for “left”, and zero for “both” (either right or left). Scores can range between negative and positive thirteen with the criterion for strongly right- hemibody preference and inclusion in the current study being a score of positive eight or above (see Appendix A).

Hostility was determined by self- report using the Cook Medley Hostility Scale (Cook & Medley, 1954). The cutoff for inclusion in the high hostile group was a score of twenty- nine or above on this measure, while the low hostile group consisted of those scoring nineteen or less on this measure. These grouping criteria have been successfully used in previous research and group screenings within our lab (Harrison &

Gorelczenko, 1990; Harrison, 1991; Demaree & Harrison, 1997; Demaree, et al, 2002; Williamson & Harrison, in press). It is the measure used most frequently to determine self- reported levels of hostility and has been shown to be a valid and reliable predictor of an individual's medical, psychological, and interpersonal functioning (Conrada & Jussim, 1992) (see Appendix B).

Participants completed a form relating their medical history. Exclusion was based on reported neurological disorder, psychiatric illness, and/ or alcohol or drug use in the past 48 hours. The medical history questionnaire is composed of 14 questions that concern the individual's experience of head trauma, drug use, medical conditions, and other factors (see Appendix C). This self- report measure has been used in past experiments to determine necessary exclusionary criteria (e.g. Crews & Harrison, 1994, Harrison & Gorelczenko, 1990)

In addition to the exclusionary measures described above, the Beck Depression Inventory- II (BDI- II) (Beck, 1972) and the State Trait Anxiety Inventory (STAI) (Speilberger, 1968) were included and used for descriptive purposes only. The BDI- II (Appendix D) is a questionnaire that is used in both research and clinical populations to assess current mood of the participant and to screen for personal injury threats. This inventory is often used in clinical and research oriented settings and has been found to reliably indicate the current emotional valence of the individual (Corey, 1996). A procedural guideline was in place and would have been strictly adhered to if a participant endorsed suicidal ideation (see Appendix D, question "I"). Prior to completing the BDI, the participant was informed (via the consent form) of the procedures in place to ensure his safety if the question concerning suicidality was highly endorsed. If a participant were to endorse the question concerning suicidal ideation, confidentiality would have been broken; the person would have been contacted, provided with numbers of crisis hotlines in the area, and encouraged to contact these services. Additionally, a call would have been made informing the proper agencies of the individual's intent to harm himself.

The State Trait Anxiety Inventory (STAI) assesses an individual's current anxiety level and was included to more accurately describe the sample population (see Appendix E). Both questionnaires are included in order to increase similarity and comparability between the current and previous research.

Apparatus

Physiological Measures. Systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) were assessed throughout the experiment using a Korotkoff automated digital blood pressure/ pulse meter with cuff (Model # SD- 700 A, IBS Corporation) or a CAS Medical Group Oscillomate monitor (Model 840). Inflation level was set at 30 mmHg above the individual's expected blood pressure. Exhaust rate was preset to 3 mmHg providing for a minimal error range of ± 3 mmHg. The assessment procedures adhered to the basic guidelines of the Association for the Advancement of Medical Instrumentation and the American Heart Association (see Harrison, Gorelczenko, & Kelly 1988; Harrison & Kelly, 1987). The participant's left arm was partially extended, supported, and positioned at the level of the fourth intercostal space with the palm facing upward. The cuff was positioned at the upper left arm with the transducer located over the brachial artery about 2.5 cm above the antecubital space. Arterial location was determined by palpation. Each reading was immediately repeated to determine the stability of the reading. This criterion was completed before proceeding with each manipulation. All procedures have been used previously in research and hence support the validity of this method.

Behavioral Measures. Two video cameras were used. The first, a Panasonic video camera (Model # PV-S350) was located in front of the participant and focused directly on the eyes. This video camera was attached with standard cables to a 21-inch Sony television in the adjoining room where the researcher monitored the experiment. The second camera was mounted on the ceiling and focused on the participant from approximately a 45% angle. The second camera was also attached by standard cables to a television in the observation room. This camera provided an overall indication of the participant's posture and behavior during the testing. Instructions were provided using a CD player with speakers attached. One of the speakers was located directly behind the participant's head in the testing room, while the other was located in the observation room.

The participant's head was supported by a chin rest and forehead support. The support was located at a comfortable level tailored to each participant and the head and neck were kept in natural alignment. The placement of the chin and forehead support assisted the participant in remaining still during the rapid lateral eye movement trails.

During videotaped replay of the experiment, a mechanical counter (Manufacturer, Lafayette; Model #27156016) was used to record rapid lateral eye movements (LEM). When a small button is depressed, the counter records one successful completion of the rapid lateral eye movements. After each ten-second trial, the number of LEM was recorded and the counter was reset. Observer reliability was assured (see below).

Testing was conducted in a sound attenuated room that was arranged symmetrically about the participant. The participants were seated in a comfortable, padded chair surrounded by flat white walls. The room included a chair, desk, testing materials, and equipment (e.g. video camera, cold pressor apparatus, and a chin rest and forehead support). The participant was monitored through an observation window and via two television monitors; all instructions were given using an intercom.

Cold Pressor. The cold pressor stimulus was an insulated container, about 45.72 centimeters X 30.48 centimeters X 30.48 centimeters. The container was filled with ice and water and kept at a constant temperature of 0 degrees Celsius (range of 3 degrees). Temperature was measured with a standard mercury thermometer. The container was located at the level of the heart next to the participant's left arm.

Procedure

During the pre- screening procedure, the participants were asked to take the Laterality Questionnaire, the Medical History Questionnaire, and the Cook Medley Hostility Scale (CMHO Scale). After the scores were computed, participants were asked to participate in the remainder of the study. All participants were screened for and excluded if there was a history of neurological problems or learning disability. Participants were also excluded for visual or hearing deficits unless these were corrected through medical/ optical devices. Glasses and / or contacts were worn throughout habituation and testing procedures at the participant's discretion.

On entry into the testing room, participants took the Beck Depression Inventory (BDI) and the State Trait Anxiety Inventory (STAI) and again completed the Cook Medley Hostility Inventory to establish stability of the measurement at the test session. If a participant no longer met criteria for his group on the day of testing, his scores were excluded from data analysis. Completion of the self- report measures allowed time for habituation to the testing chamber. After the measures were completed, the training phase of the experiment commenced.

Training consisted of each participant being coached in the process of rapid lateral eye movements (LEM). Training continued until the participant met a training criterion of ten or more LEM within a ten second trial. Pilot testing has shown that this criterion is easily met and indicates an understanding of the proper procedure to be employed. Pilot data collected on seven right- handed men resulted in a mean of 15.9 leftward LEM within 10 seconds and 16.1 rightward LEM within 10 seconds. Before the experiment, the researcher described the LEM procedure; during training and the experiment the participant was observed to ensure that proper eye movements were being made.

For the experiment, participants in each group were instructed to make LEM from midline to 20 degrees visual angle to the left. They continued to make leftward LEM for five, ten second trials. They were then exposed to the cold pressor stimulus for 45 seconds. Following this exposure, they completed another five, ten second trials to the left. Trials to the right then commenced. The participant made five, ten second trials to the right, followed by 45 seconds of cold pressor stress, and then another five, ten second trials of rightward LEM. They were instructed to make all eye movements as quickly as possible from the time that they heard the command to begin until they heard the signal to stop. The participant's head was fixed in position with the chin placed in a standard chin rest and the forehead supported.

Instructions to participants were composed of the following:

> Today, I will be asking you to make some movements with your eyes, to place your hand in some ice water, and to allow your blood pressure and heart rate to be taken. Before we begin, I would like to teach you the eye movements that I am interested in seeing you perform today. First, I would like you to focus your eyes directly ahead; this is the midline. Now, I would like you to look to the right. Notice the bright piece of paper to the right? Try to move your eyes there and then back to the midline as quickly as possible. Please make sure that when you do this, your head does not move; only your eyes should move. Good.

> Now I would like you to move your eyes back and forth from the right back to the midline as quickly as possible. You will hear me say “start”; this will be your signal to begin and to continue making the same eye movements as quickly as possible. After a short amount of time, you will hear the word “stop”; this will be your signal to stop making eye movements. Are you ready? Good.
>
> Now, I’d like you to do the same thing, only looking to the left. Again, when you hear the word “start”, you should look to the left and then look quickly back to the center. You should continue doing this as quickly as possible until you hear me say, “stop”.
>
> During the experiment, I’ll be asking you to make these eye movements to the left or to the right. You should start looking when you hear me say, “start” and stop when you hear me say “stop”. I’ll ask you to do this several times; the behavior will be the same, the only difference will be in the direction your eyes move. You will be prompted each time with a direction to look and verbal signals when you should start and stop. Do you have any questions?

All instructions were given via an intercom located in the testing chamber. All instructions and verbal prompts were recorded and replayed from a CD in an attempt to control for possible variability in the researcher’s tone of voice. Moreover, standardization was maintained across and between all participants.

By instructing and observing the LEM behaviors of the participants, the researcher was able to ensure that proper LEM technique was employed. As the participant was engaged in the procedures of the study, the researcher observed. After the participant completed all trials, two researchers counted and recorded the data for each trial using a playback of the videotaped LEM. This helped to ensure accuracy of the count. Reliability criterion was met and the data gathered was used if there is 100% agreement between the first and second counts. Recounts of the recorded data by both researchers independently continued until the reliability criterion was met.

The first participant was instructed to make rapid LEM to the left (pre stress). The participant completed five left- sided trials of 10 seconds each. He was then exposed to the cold pressor stimulus for 45 seconds. Immediately after exposure to the cold pressor, the participant completed another five, 10-second trials of LEM to the left (post stress). The participant then made five, 10 second trials of LEM to the right (pre stress), received 45 seconds of the cold pressor, then completed an additional five, 10 second trials of rightward LEM (post stress). Direction of LEM was counterbalanced across participants within group.

When instructed, participants placed their left hand and wrist in the cold pressor for 45 seconds. After each cold pressor exposure, the participant was asked to remove his hand and rest it over the open container. Blood pressure and heart rate were measured twice before and after each portion of the experiment (see above).

Results

Descriptive Measures

High and low hostile groups were compared on descriptive measures using ANOVAs. Scores were compared on the Cook- Medley Hostility Scale (CMHO Scale) and the Laterality Questionnaire (Coren, Porac, & Duncan). As expected, participants in the high and low hostile groups did not score equally on the CMHO Scale. Specifically, the high hostile group (Mean = 35.06, SD = 6.00) scored higher than the low hostile group (Mean = 13.06, SD = 4.84) on the CMHO Scale. On the Laterality Questionnaire, the high hostile group (Mean = 9.33, SD = 9.78) and the low hostile group were similar (Mean = 10.83, SD = 8.10). On the Beck Depression Inventory, the mean of the high hostile group was approximately nine, while the low hostile group scored approximately four. On the State Trait Anxiety Inventory, the mean of the high hostile group was 40, while low hostile men scored approximately 32.

The Beck Depression Inventory (BDI) resulted in a mean of 9.22 for the high hostile group (SD = 5.99). The low hostile group evidenced a mean of 4.06 (SD = 4.84) on the BDI. On the State Trait Anxiety Inventory (STAI), the high hostile group mean was 40.17, with a standard deviation of 9.78. Low hostile participants produced a mean of 32.39, with a standard deviation of 8.10 on this measure. As these two inventories were merely used to better describe the group members, they were not entered into analyses in any way.

Behavioral Measures

Behavioral data were analyzed using a four factor mixed design ANOVA with the fixed effect of group (high and low hostile) and with repeated measures of condition (pre and post stressor), direction (left and right LEM), and trial (first through fifth). All post hoc comparisons were made using Tukey's Studentized Range Test (Winer, 1971). The criterion for significance was set at $p \leq .05$. For behavioral data, main effects for condition and trial were found. Additionally, an interaction effect of direction by trial was noted. No other main effects or interaction effects were reliable.

The main effect for condition within the LEM data set resulted from significant differences between participant performance at pre- and post- stressor reading $F(1,34) = 18.76$, $p = .0001$. In the post- stressor condition, participants made more LEM than at the pre- stressor condition. At the pre- stressor condition, the mean LEM was 16.41. Post stressor recordings indicated a mean LEM of 16.84.

For the main effect of trial, significant differences in LEM were noted. $F(4,34) = 15.45$, $p < .0001$. These differences were significant in post hoc comparisons between the first (17.17) and the second (16.78) trial. The first trial was also significantly greater than the third (16.37), the fourth (16.42), and the fifth (16.38) trial. The second trial was also found to be significantly different from the third, the fourth, and the fifth trial. The third, the forth, and the fifth trial were not significantly different from one another.

The interaction effect of direction by trial resulted from significant differences between rightward and leftward LEM and as a function of level of trial. $F(4,34) = 3.57$, $p = .008$. This interaction effect can be seen in Table 1 and in Figure 1. At the leftward LEM direction, the first trial is statistically significant from the second, the third, the fourth, and the fifth trial. Also within the leftward LEM direction, the second trial is statistically significant from the third, the fourth, and the fifth trial. The third, the fourth, and the fifth trial in the leftward LEM direction are not statistically significant from one another. As with the leftward LEM, the first trial of rightward LEM is statistically significant from the second, the third, the fourth, and the fifth trial. However, the second, third, fourth, and fifth trial are not statistically significant from one another in the rightward LEM direction.

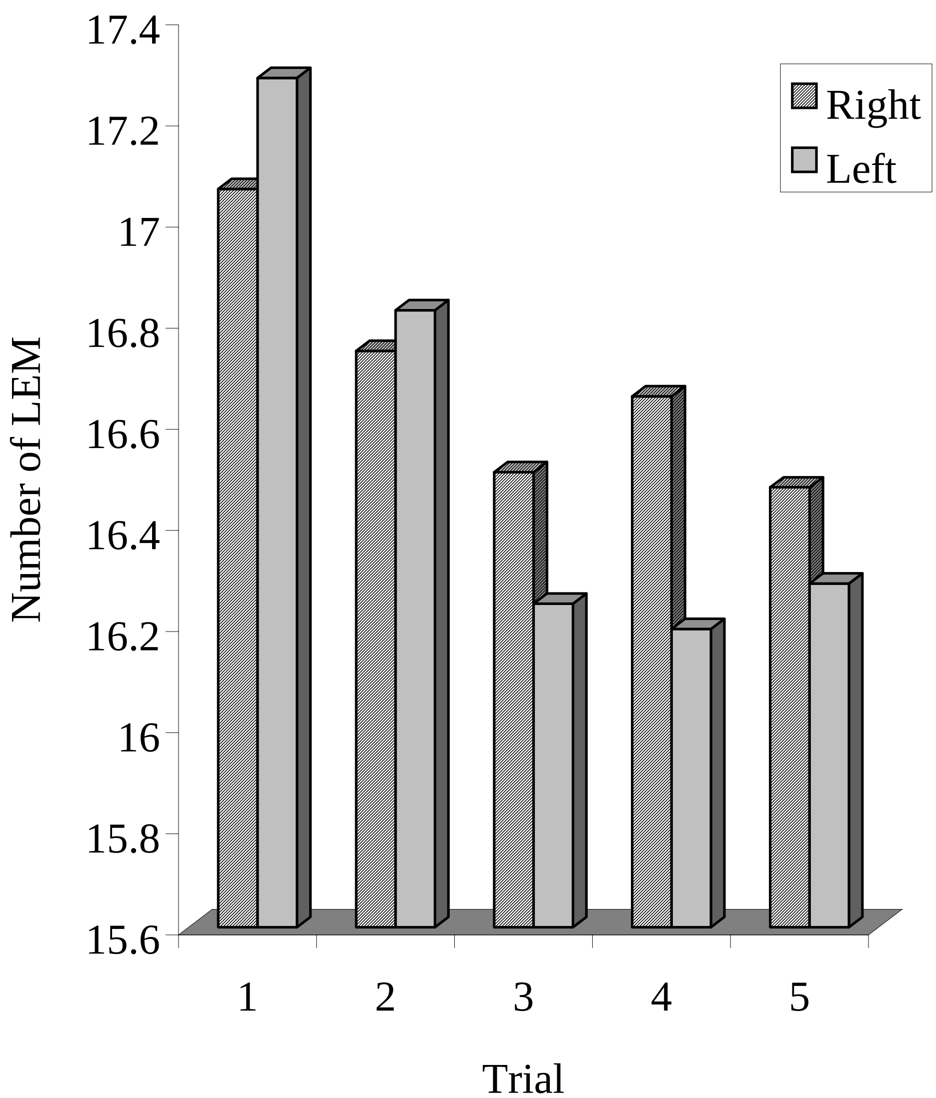
Table 1.

The Total Number of LEM for Leftward and Rightward Directions as a Function of Direction and Trial

	Direction			
	Left LEM		Right LEM	
	Mean	SD	Mean	SD
Level of Trial				
First	17.28	3.62	17.06	3.63
Second	16.82	3.29	16.74	3.21
Third	16.24	3.13	16.50	3.58
Fourth	16.19	3.32	16.65	3.29
Fifth	16.28	3.26	16.47	3.48

Figure 1.

Direction by Trial Interaction for LEM



Physiological Measures.

The physiological data were analyzed using a five factor mixed design ANOVA with the fixed effect of group (high and low hostile) and with the repeated measures of set (the first LEM set, the cold pressor set, and the second LEM set), condition (pre and post stressor), direction (left and right), and trial (one and two). Separate ANOVAs were performed on systolic blood pressure, diastolic blood pressure, and pulse rate data. All post hoc comparisons were made using Tukey's Studentized Range Test (Winer, 1971). The criterion for significance was set at $p \leq .05$.

Significant main effects for the systolic comparisons were noted for direction, set, and trial. The main effect of direction was found to be reliable, $F(2,34) = 5.51$, $p = .006$, with no directional LEM cold pressor (Systolic blood pressure = 117.46) producing a significantly higher blood pressure than either the rightward LEM condition (systole = 114.98) or the leftward LEM condition (systole = 114.73). There was no significant difference among the rightward and the leftward LEM for systolic blood pressure comparisons.

For the main effect of set, $F(2,34) = 12.19$, $p < .0001$, the cold pressor set (systole = 117.46) yielded heightened systolic blood pressure over the first LEM set (115.96) and the second LEM set (systolic blood pressure = 113.75). Additionally, the first and the second LEM set were significantly different with reduced systolic blood pressure in the second set of LEM.

Finally, the main effect of trial was found to be reliable, $F(1,34) = 21.92$, $p < .0001$. For this effect, the first trial (systole = 116.62) was significantly elevated over the second trial (systole = 114.82).

A significant two-way interaction was found for direction and condition, $F(2,34) = 9.88$, $p = .0002$. The interaction effect is depicted in Figure 2 and Table 2. Within each condition (pre- and post- stressor), LEM (left, right) produced significantly lower systolic blood pressure. After the cold pressor, systolic blood pressure was significantly elevated. Additionally, at the post- stressor condition, the cold pressor stressor recording was significantly greater than either of the LEM trials.

The interaction effect of direction by trial revealed differences between no direction cold pressor, rightward and leftward LEM across trial, $F(2,34) = 4.65$, $p = .013$. Conditions of rightward LEM and cold pressor resulted in significantly different systolic blood pressures. Trial 1 differed significantly across each level of condition in systolic blood pressure comparisons. Trial 2 also differed reliably across each level of condition. This interaction effect can be seen in Table 3 and in Figure 3.

The two- way interaction of set and condition was statistically significant for systolic blood pressure $F(2,34) = 8.46$, $p = .0005$. Numerous significant differences are evident within this interaction. The pre- and post- stressor recordings within each set are significantly different from one another. Additionally, systolic blood pressure measurements at each post- stressor condition were significantly different. Within pre–stressor conditions, the first LEM trial is significantly different from the cold pressor and the second LEM trial. This interaction can be seen in Table 4 and in Figure 4.

The set by trial interaction was significant for systolic blood pressure $F(6, 34) = 3.76$, $p = .03$. Within each set (first LEM, cold pressor, and second LEM) all first and second trials varied reliably. Furthermore, the first trial of the first LEM was significantly different from the first trial of the cold pressor set and the second LEM set. Similarly, on the first trial, the cold pressor differed significantly from the first trial of the second LEM set. The second trial of the first LEM set was statistically significant from the cold pressor and final LEM set. The second trial of the cold pressor condition was statistically significant from the second trial of the final LEM condition. This interaction of set by trial is shown in Table 5 and Figure 5.

Table 2.

Summary of Group Means and Standard Deviations for the Direction by Condition Interaction for Systolic Blood Pressure (mmHg)

	Condition			
	Pre- Stressor		Post- Stressor	
Direction	Mean	SD	Mean	SD
Right	115.51	13.67	114.46	13.68
Left	115.49	13.21	113.96	12.81
None	114.94	14.38	119.99	14.33

Figure 2.

The Direction by Condition Interaction for Systolic Blood Pressure (mmHg)

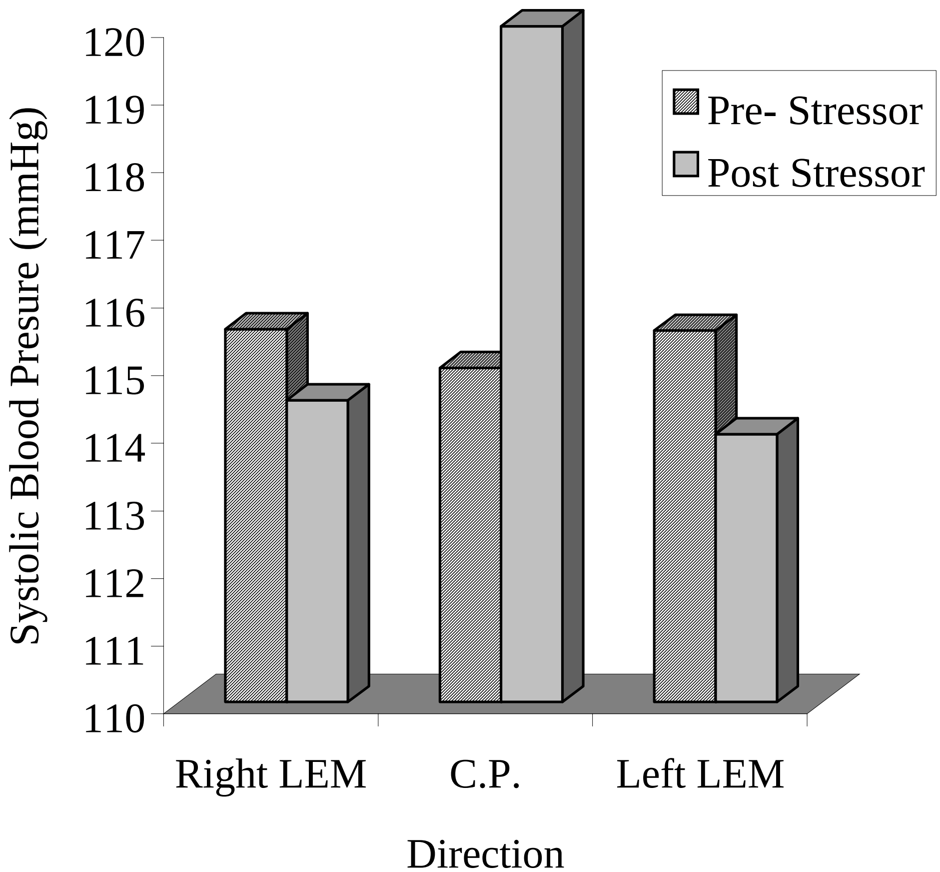


Table 3.

Summary of Group Means and Standard Deviations for the Direction by Trial Interaction for Systolic Blood Pressure (mmHg)

	Trial			
	1		2	
Direction	Mean	SD	Mean	SD
Right	115.79	13.74	114.17	13.59
Left	114.88	12.96	114.58	13.11
None	119.19	15.10	115.71	13.81

Figure 3.

The Direction by Trial Interaction for Systolic Blood Pressure (mmHg)

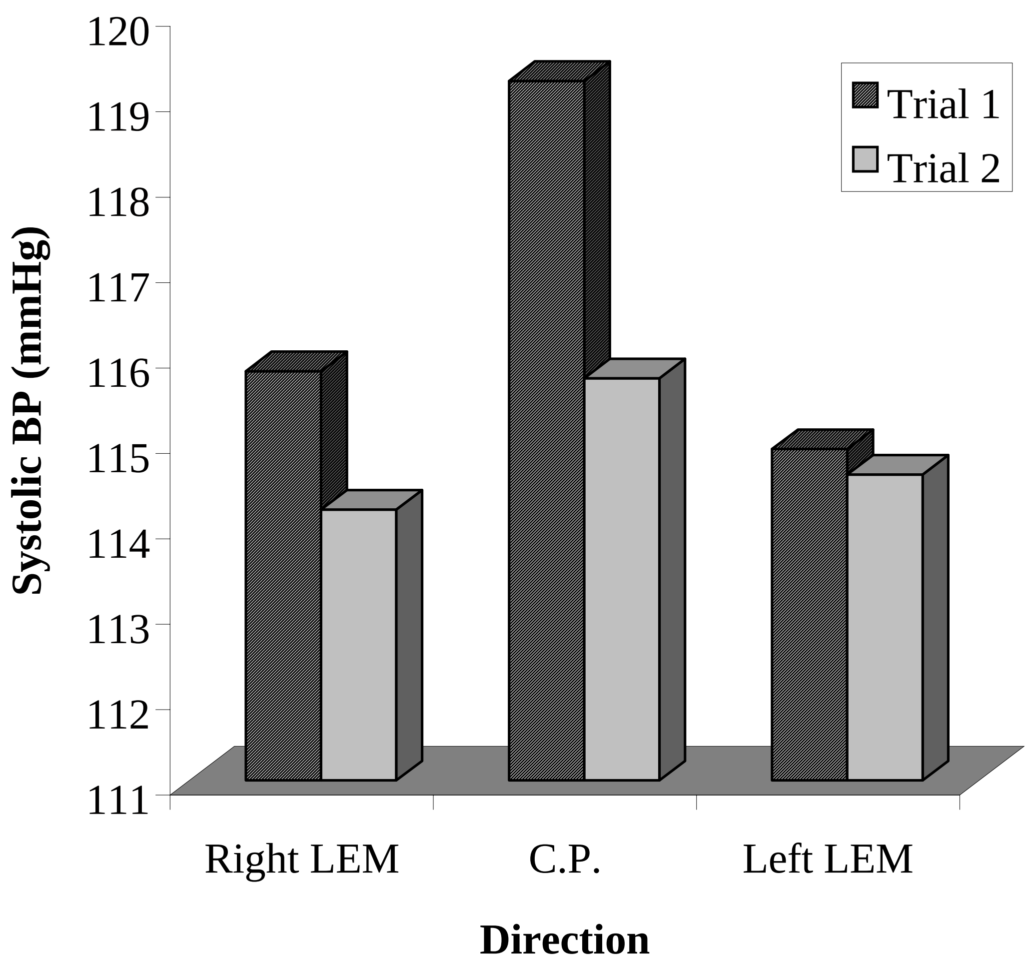


Table 4.

Summary of Two- Way Set by Condition Interaction for Systolic Blood Pressure (mmHg)

	Set					
	First LEM		Cold Pressor		Second LEM	
Condition	Mean	SD	Mean	SD	Mean	SD
Pre- Stressor	116.56	14.76	114.94	14.38	114.44	11.89
Post- Stressor	115.35	14.40	119.99	14.33	113.06	13.01

Figure 4.

The Set by Condition Interaction for Systolic Blood Pressure (mmHg)

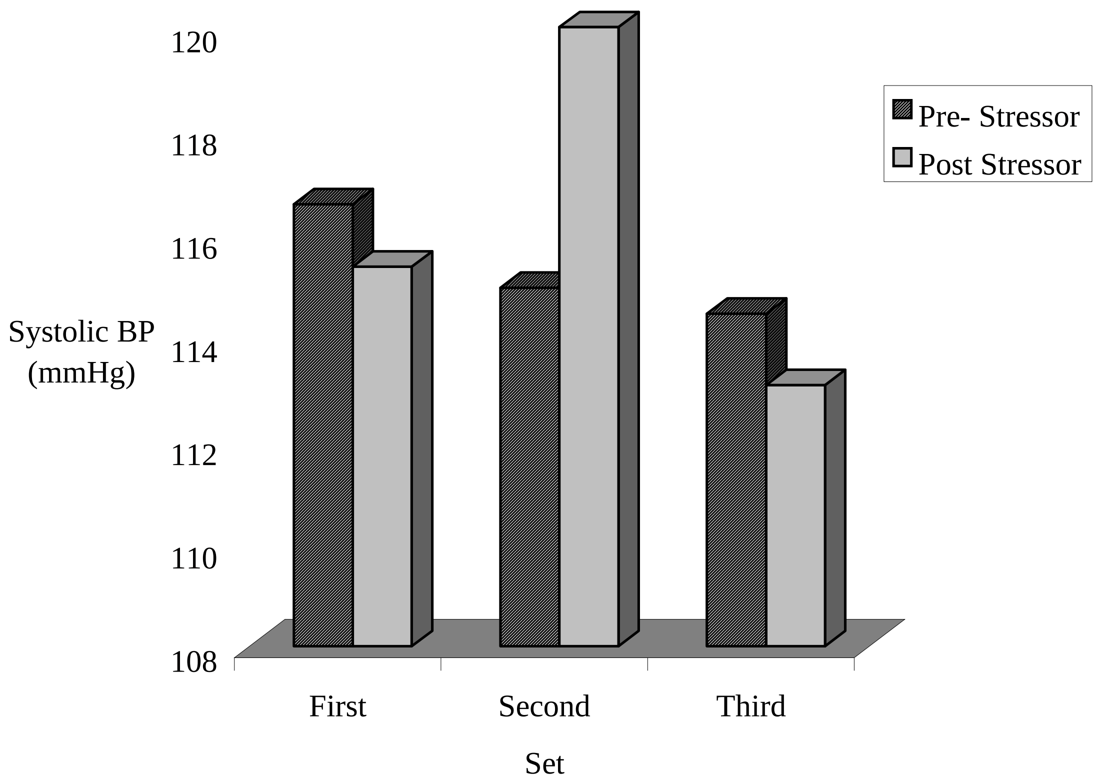


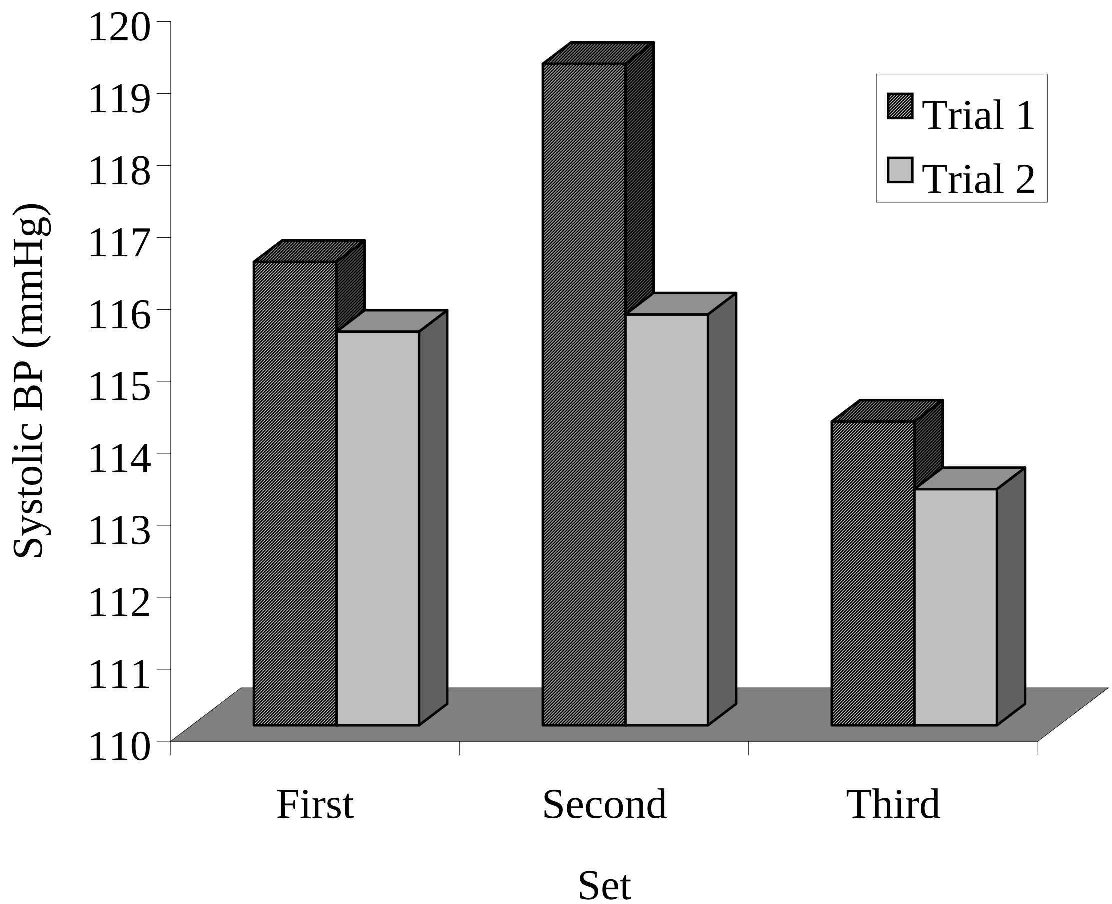
Table 5.

Summary of Two- Way Set by Trial Interaction for Systolic Blood Pressure (mmHg)

	Set					
	First LEM		Cold Pressor		Second LEM	
Trial	Mean	SD	Mean	SD	Mean	SD
First	116.44	14.51	119.19	15.10	114.22	12.01
Second	115.47	13.68	115.71	13.81	113.28	12.92

Figure 5.

Two- Way Set by Trial Interaction for Systolic Blood Pressure (mmHg)



A final two– way interaction of condition and trial was significant using systolic blood pressure F (1,34) = 7.10, p = .01. This interaction is depicted in Table 6 and in Figure 6. Post hoc comparisons indicate that, in the post- stressor condition, the first and second trials differ significantly. Additionally, the first trial in the post- stressor condition differs from first trial in the pre- stressor condition.

The group by condition by trial interaction was significant F (1,34) = 6.52, p = .02. Within the high hostile group, the first trials of the pre- and post- stressor conditions were significantly different from one another. The post- stressor conditions were also significantly different from the second trials. Within the post- stressor condition, the first and second trials were significantly different from one another in the high hostile group. Within the low- hostile group, the first and second trials in the pre- stressor condition differed from one another. Similarly, the first and second trials in the post- stressor condition for the low- hostile group were significantly different from one another. The post- stressor condition of the high hostile group in trial one differed from the post- stressor condition of the first trial in the low hostile group. The first trial of the high hostile group in pre- stressor condition was statistically significant from the low hostile, pre- stressor condition of the first trial. For inspection of other reliable comparisons, please consult Table 7 and Figure 7.

Finally, for systolic blood pressure the set by condition by trial interaction effect was significant F (2,34) = 19.66, p < .0001. Reliable comparisons are shown in Table 8 and in Figure 8. The most important significant differences for the purpose of this experiment are noted here. For the first trial, the pre- stressor conditions were significantly different in the first LEM set, in the cold pressor set, and in the second LEM set. For the second trial, post stressor conditions differed within the second LEM set. The first trials of the pre- stressor condition were significantly different at the first LEM, cold pressor, and second LEM sets. The first trials of the post- stressor condition were also significantly different in the first LEM, the cold pressor, and the second LEM sets. For further comparisons, please consult Table 8 or Figure 8.

Table 6.

Summary of Two- Way Condition by Trial Interaction for Systolic Blood Pressure (mmHg)

	Condition			
	Pre- Stressor		Post- Stressor	
Trial	Mean	SD	Mean	SD
First	115.68	13.39	117.56	14.65
Second	114.94	14.09	114.69	12.89

Figure 6.

Two- Way Condition by Trial Interaction for Systolic Blood Pressure (mmHg)

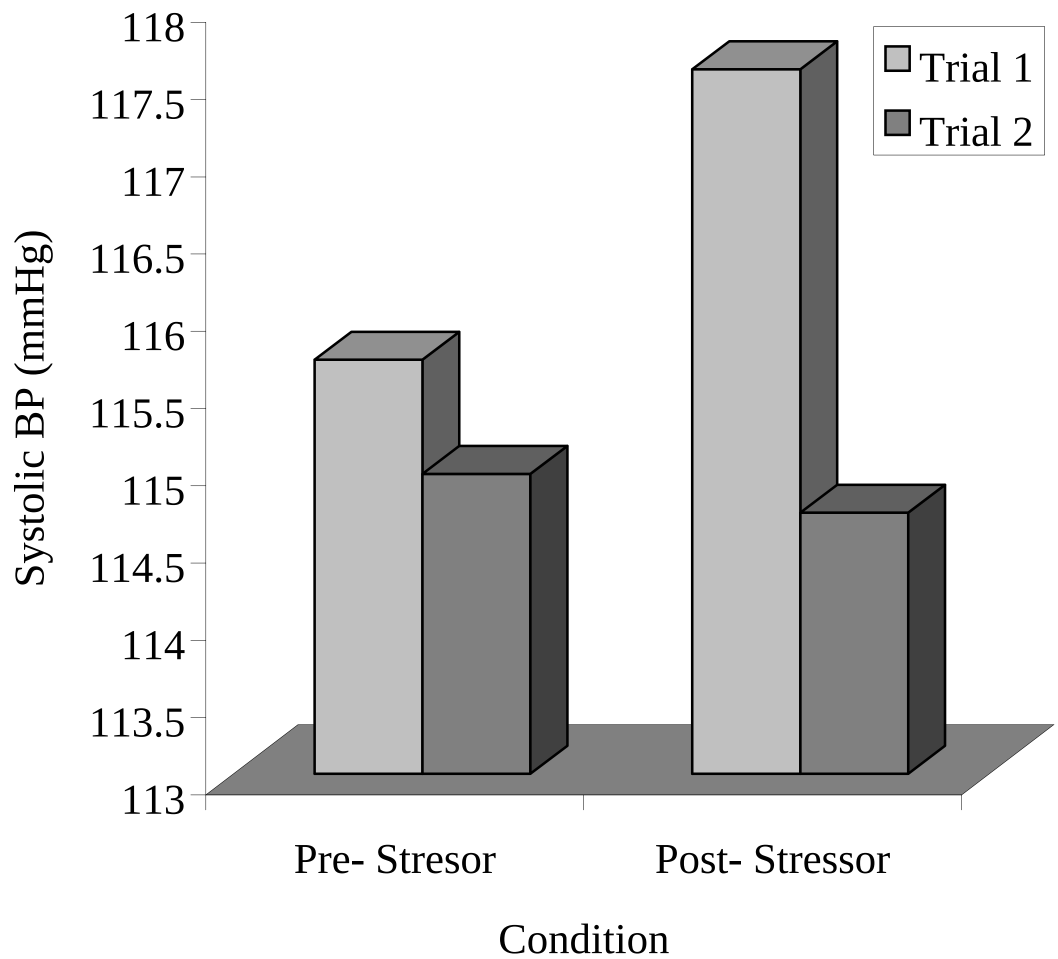


Table 7.

Summary of the Group by Condition by Trial Interaction for Systolic Blood Pressure (mmHg)

	Group							
	High Hostile				Low Hostile			
	First Trial		Second Trial		First Trial		Second Trial	
Condition	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Pre- Stressor	116.76	14.16	117.19	14.48	114.60	12.55	112.69	13.37
Post- Stressor	120.09	15.24	116.36	13.14	115.06	13.65	113.01	12.48

Figure 7.

Three- Way Group by Condition by Trial Interaction for Systolic Blood Pressure (mmHg)

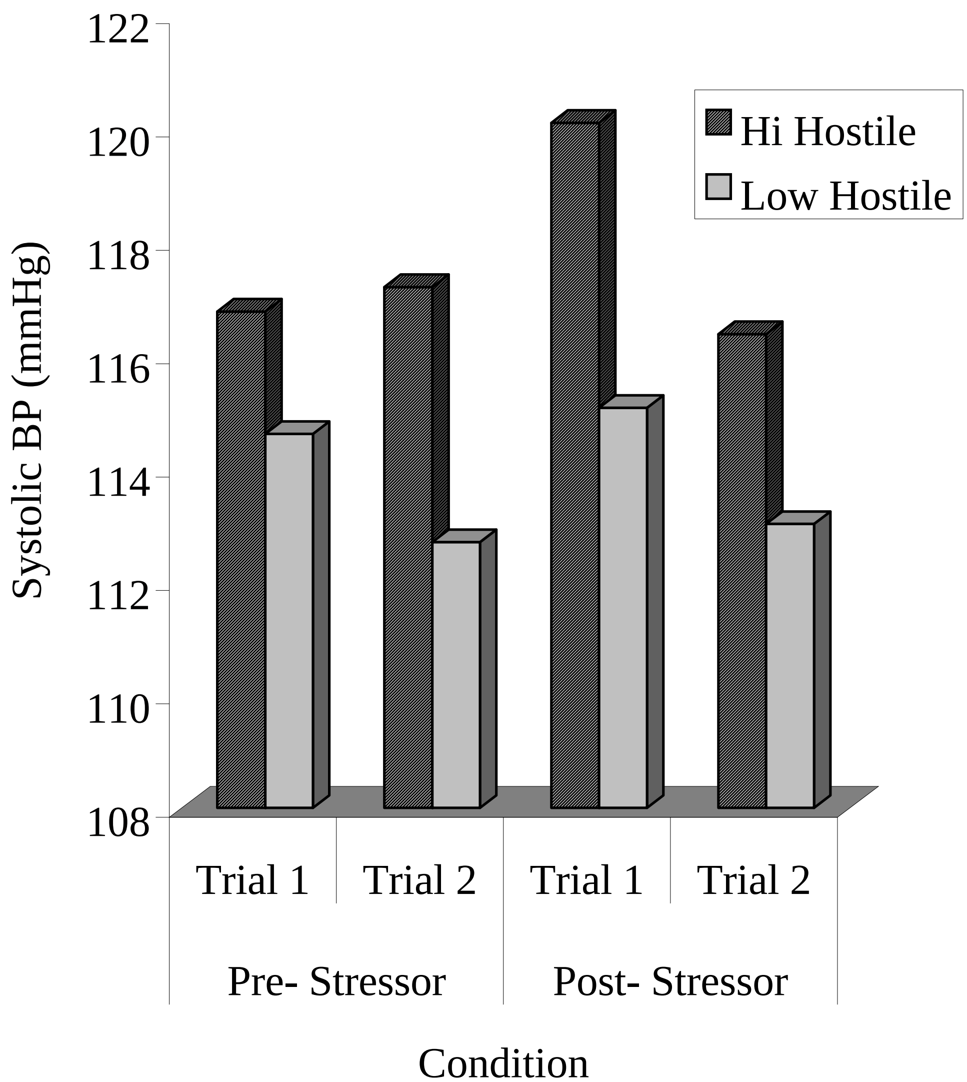


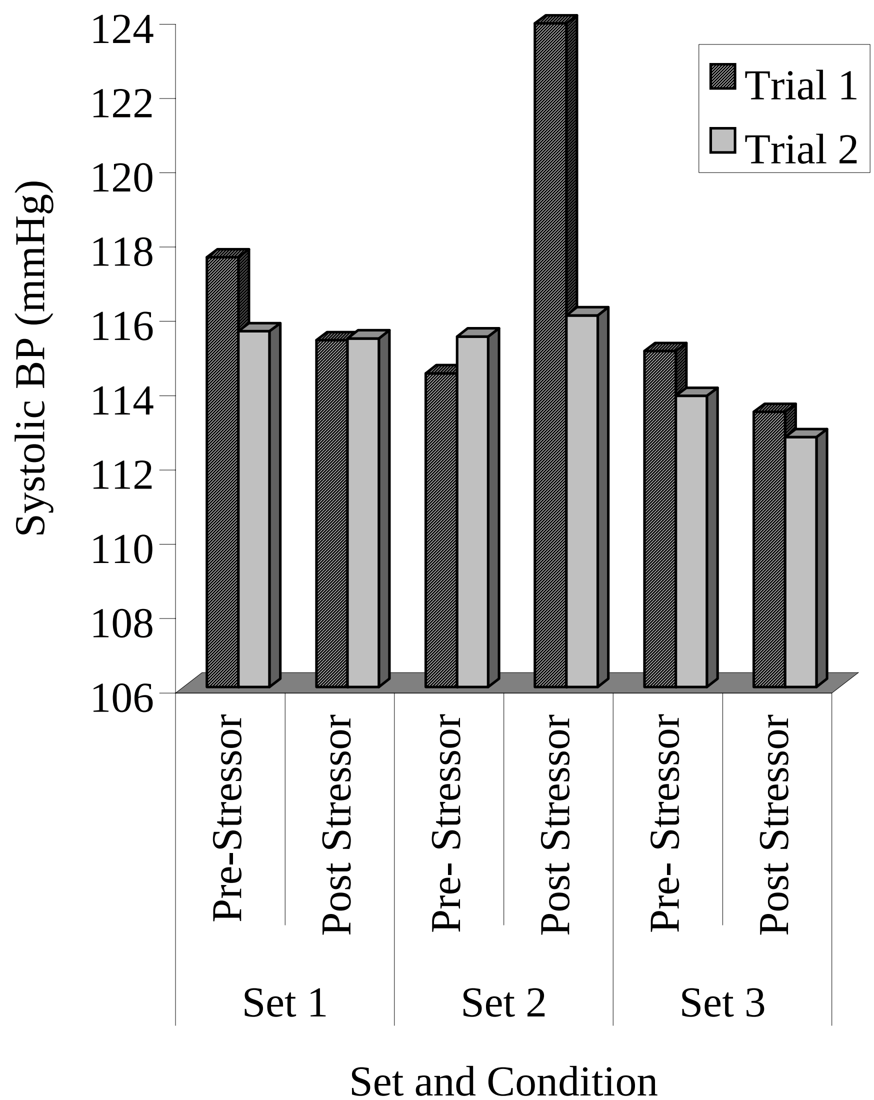
Table 8.

Summary of the Set by Condition by Trial Interaction for Systolic Blood Pressure (mmHg)

	Condition							
	Pre- Stressor				Post- Stressor			
	Trial 1		Trial 2		Trial 1		Trial 2	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Set								
First LEM	117.55	15.17	115.57	14.39	115.33	13.84	115.38	13.04
Cold Pressor	11.44	13.67	115.43	15.14	123.86	15.06	116.00	12.43
Second LEM	115.04	11.00	113.83	12.77	113.40	12.96	112.72	13.14

Figure 8.

The Set by Condition by Trial Interaction for Systolic Blood Pressure (mmHg)



For diastolic data, the main effect of direction and the interaction of group by condition differed significantly. The main effect of direction was reliable F (2,34) = 2.87, p = .06 at post hoc comparisons. For this effect, the no direction cold pressor (Mean = 63.38) produced a higher diastolic blood pressure than the leftward LEM (Mean = 66.45). The group by condition interaction for diastolic blood pressure was found to be statistically significant F (2,34) = 6.01, p = .02. For the high hostile group, the post- stressor condition yielded greater diastolic blood pressure than the low hostile group. Similarly, the post- stressor condition of the high hostile group was greater than that of the low hostile group. For the low hostile group, pre- and post- stressor conditions were significantly different with the pre- stressor condition being greater than the pre- stressor condition. The differences are shown in Figure 9 and Table 9.

Finally, for heart rate, a significant main effect of condition was apparent as well as a two- way interaction of set by condition. The main effect of condition was reliable F (1,34) = 18.77, p = .0001, with the pre- stressor condition (Mean = 78.48) yielding heightened hear rate over the post- stressor condition (Mean = 76.84).

The set by condition interaction was reliable, F (2,34) = 4.16, p = .02. Specifically, for the cold pressor set and the second LEM set, pre- and post- stressor conditions differed. Within the pre- stressor condition, the first LEM set and the cold pressor set were significantly different. Finally, all sets differed significantly for the post- stressor heart rates. For further comparisons, see Table 10 and Figure 10.

Table 9.

The Group by Condition Interaction for Diastolic Blood Pressure (mmHg)

	Group			
	High Hostile		Low Hostile	
Condition	Mean	SD	Mean	SD
Pre- Stressor	70.75	12.63	63.47	11.19
Post- Stressor	69.98	14.36	65.45	11.49

Figure 9.

The Group by Condition Interaction for Diastolic Blood Pressure (mmHg)

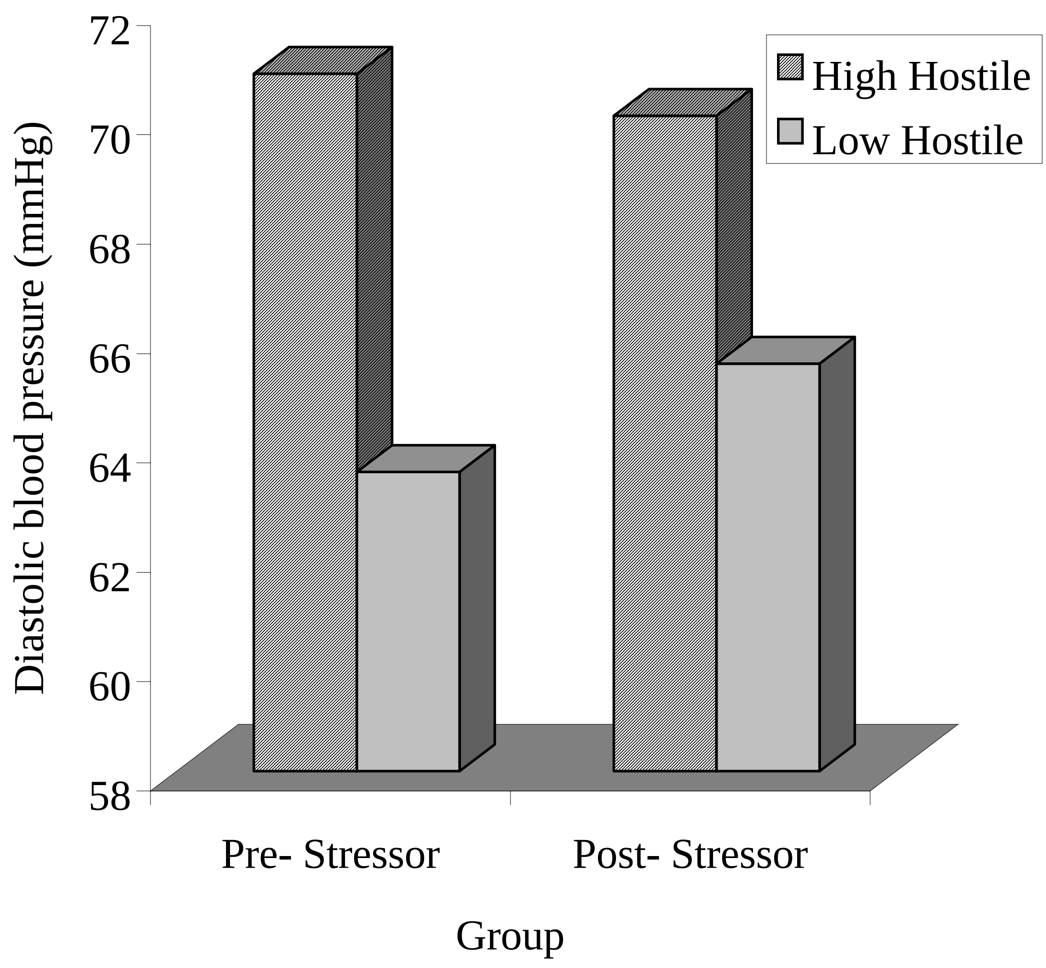


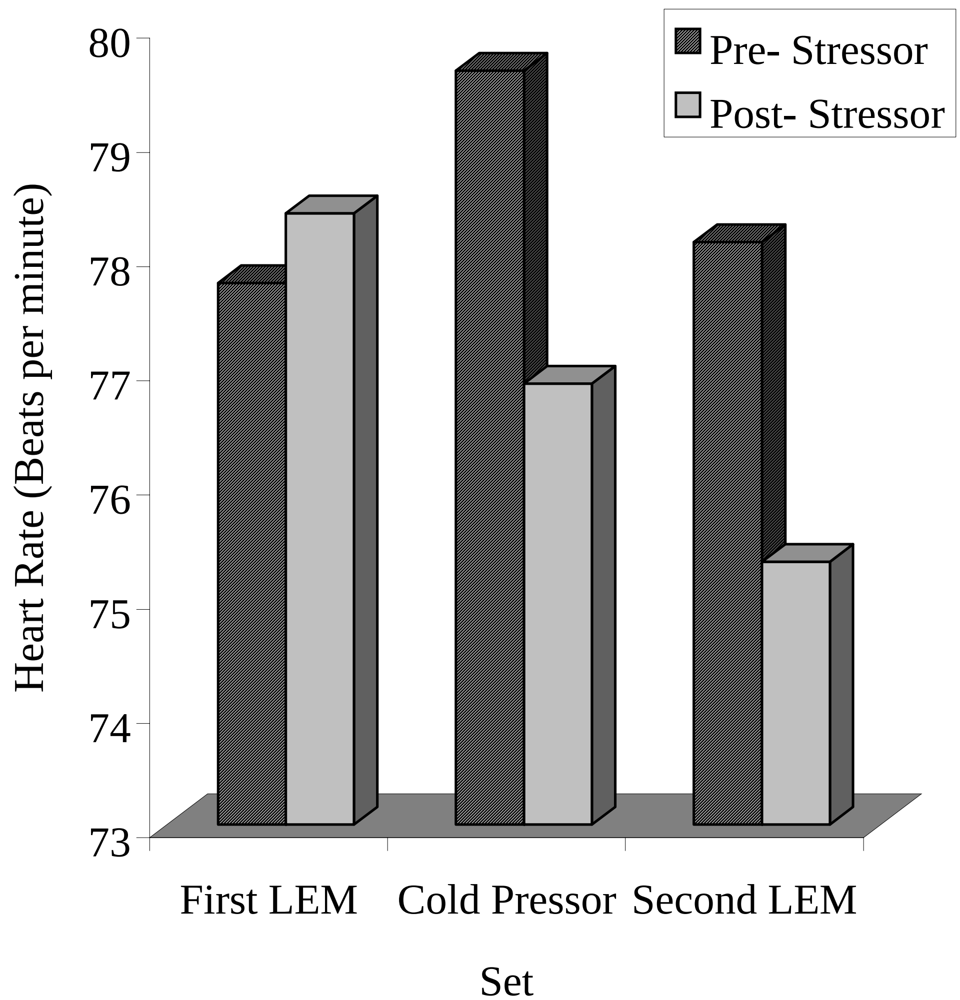
Table 10.

The Set by Condition Interaction for Heart Rate (Beats per minute)

	Set					
	First LEM		Cold Pressor		Second LEM	
Condition	Mean	SD	Mean	SD	Mean	SD
Pre- Stressor	77.74	13.10	79.60	12.74	78.10	12.33
Post- Stressor	78.36	12.60	76.86	15.04	75.30	12.49

Figure 10.

The Set by Condition Interaction for Heart Rate (Beats per Minute)



Discussion

The present research compared high and low hostile men from an undergraduate population on descriptive, behavioral, and physiological measures. Participants were assigned to high and low hostile groups based on their responses (resulting in extreme scores) to the CMHO scale. A robust reaction of increased cardiovascular response to the cold pressor was supported by this experiment. Additionally, significant differences indicating altered performance on various tasks indicated differential activation by various factors. Leftward LEM results indicate that this set as a tendency to produce fatigue more quickly in participants than rightward LEM. Additionally, it was found that LEM in either direction resulted in lowered systolic blood pressure. Cold pressor stressor, however, yielded significantly heightened systolic blood pressure. Overall, it was found that high hostile men were more reactive in cardiovascular response than low hostile men. Thus, the primary findings of this research indicate that high hostile men are more reactive to stressors than low hostile men and that they exhibit this increased reactivity both behaviorally and physiologically.

The hypothesis of group differences in overall number of LEM was not supported. However, the main effect of condition and trail and the interaction effect arising from direction by trial, indicate that the experimental manipulations of these factors was great enough to influence the number of LEM produced by the participants.

Behaviorally, condition (pre- and post- stressor) resulted in reliable differences. Specifically, the post- stressor condition resulted in more LEM than in the pre- stressor condition. Cold pressor stressor produced increase in LEM consistant with a heightened activation of frontal regions. Additionally, it may be that functional cerebral systems and dual space theories (Kinsbourne & Hisock, 983) provide some explanation for this effect. The dual space theory indicates that concurrent activation of cerebral location in close physical or functional proximity can result in interference effects at high levels or priming effects at moderate levels. The cold pressor stressor appeared to act as a priming agent, resulting in increased bidirectionally specific eye movements. Alternatively, interference effects could result in decreased regulating influence of the frontal eye fields over reflexive visuomotor systems resulting in increased reflexive orienting responses to irrelevant visual events. This does not appear to be the case in this experiment as heightened rate of LEM was bidirectionally specific and intentional rather than reactive to imposed visual events within the peripheral array. Indeed, every effort had been made to minimize variation and to maximize redundancy within the periphery at the right and the left hemispace.

The main effect of trial resulted in significant differences, most notably among the first and second trial and the first trial from the third, the fourth, and the fifth trials. This finding corresponds with clinical observations of heightened rate of left hand fatigue in hand grip strength and finger tapping tasks (Harrison & Pauly, 1990; Shimoyama, et al., 1990; Crews & Harrison, 1994). Thus, preliminary support was found for extending laterality investigation of motor strength and fatigue to lateralized eye movements.

The interaction effect of direction by trial mirrored the previous results. In this interaction leftward trials one and two were increased over three, four, and five. Similarly, trial one and two of the rightward LEM yielded a greater number of LEM than trial three, four, and five. This appeared to provide further support for explanations previously discussed.

Within the systolic blood pressure and diastolic data, the main effect of direction was reliable. In this effect, the cold pressor condition resulted in significantly greater systolic blood pressure and greater diastolic blood pressure than either of the LEM sets. The main effect of direction was not significant within the pulse rate ANOVA. The significance of the systolic and diastolic blood pressure indicates that the cold pressure induces greater cardiovascular reactivity than LEM.

The main effect of set was significant for systolic blood pressure comparisons only. In this effect, cold pressor resulted in greater systolic blood pressure than both trials of LEM. Additionally, the first trial of LEM was significantly greater than the second LEM set. The results appear to support the idea that cold pressor acts as a stressor, significant to result in heightened blood pressure. Following the same logic, it appears that the first trial of LEM also acts as a sufficient stressor to produce significant differences in systolic blood pressure.

The main systolic blood pressure effect of trial resulted in the first trial being greater than the second, consistant with an interpretation of habituation or reduction in activation over trials using this measure. More of this will be discussed in a later section concerning experimental limitations.

The interaction effect of direction by condition was significant for systolic blood pressure. This interaction indicated that LEM (left and right) lowered blood pressure from pre- to post- stressor conditions. The cold pressor however, raised systolic blood pressure. This is consistant with hypotheses of cold pressor stressor effects on blood pressure comparisons. However, this did not collaborate with *a priori* predictions that leftward LEM would raise and rightward LEM would lower blood pressure. It may be that the leftward LEM in this experiment was not sufficient to raise blood pressure, or it may be that the physiology behind finite eye movements precludes adequate test of the hypothesized interaction.

It was predicated that leftward LEM would dysregulate sympathetic tone, resulting in increased blood pressure. Additionally, it was expected that high hostile men would make significantly fewer LEM at the left than at the right in post- stressor conditions. This expectation of decreased production of leftward LEM in the high hostile group post- stressor arises from the expectation and previous findings that dysregulation of the right frontal hemisphere leads to decreased ability of the individual to regulate heart rate and blood pressure and to complete tasks similarly to pre- stressor conditions. This hypothesis was not supported. Instead, diametrically opposite effects were found where LEM, regardless of direction, resulted in lowered blood pressure. Methodologically, one might conclude that LEM with rhythmic oscillation of the eye and, thus, frontal activation may have an effect entirely different from that proposed. If this is correct, then constant or more elevating frontal eye field stress will be required to test the functional cerebral systems hypothesis.

The direction by trial interaction was significant for systolic blood pressure. Within this interaction, it was found that systolic blood pressure at trial one of the cold pressor was greater than systolic blood pressure resulting from trial one of LEM (both leftward and rightward). Additionally, the first trial of the rightward and leftward LEM directions was not significantly different from one another. This interaction is important as it indicates the effect of directional eye movements and cold pressor stressor on heart rate. This finding is consistant with previous discussions concerning the heightened effects of cold pressor on systolic heart rate.

The set by condition interaction was significant for systolic blood pressure and for heart rate. For both of these comparisons, the most important systolic result is that systole at the pre- stressor conditions was reduced as a function of the post- stressor conditions in LEM. However, diametrically opposite effects resulted from the cold pressor stressor. Additionally, within systolic comparisons, at post- stressor comparisons, the cold pressor was greater than the LEM (both first and second set), and the first LEM set was greater than the second. Pulse comparisons revealed that pre-stressor conditions were greater than post- stressor conditions in the cold pressor and second LEM category. (The first LEM set showed a trend toward this effect, but did not quite reach statistical significance.) These findings continue to add support to the notion of differential cardiovascular regulation in tasks that require the participant to cope with dual tasks (e.g. regulation of the heart and a task such as directional eye movements).

The set by trial interaction was significant for systolic blood pressure. This interaction showed that, for each set, the first trial differed from the second. This possibly occurred due to problems with experimental design that resulted in a lack of more stringent reliability criterion. The cold pressor set resulted in heightened systolic blood pressure over the first and second LEM sets. Additionally, the first LEM set was greater than the second LEM set. This interaction leads to the possibility that cold pressure acts as a sufficient stressor to significantly raise systolic blood pressure. The difference in first and second LEM set may be attributable to the effects of stress placed on participants from attempting to complete the LEM task.

The condition by trial interaction was significant in systolic blood pressure comparisons. Within this interaction, the first trial of the pre- stressor condition resulted in a lower systolic blood pressure than that of the post- stressor condition. This may indicate that all conditions were sufficiently stressful to cause a significant rise in systolic blood pressure.

The three- way interaction of group by condition by trial was significant for systolic blood pressure comparison. For this significant effect, high hostile men at post- stressor, trial one, showed an increased blood pressure beyond that at all other conditions and trials. This indicates that high hostile men may be experiencing a heightened reactivity to stressors. This is consistant with current literature on hostility and reactivity and with previous experiments in our laboratory (e.g. Oppenheimer, et al., 1992; Demaree & Harrison, 1997; Shenal & Harrison, 2001).

The final significant systolic interaction was that between set, condition, and trial. Within this interaction, the first trial of the first LEM, cold pressor, and second LEM differed from one another. Similarly, the post- stressor conditions of the first trial also differed significantly from one another. This continues to provide support that the stressors proposed (*a priori*) and administered (LEM and cold pressor) were sufficient to result in significantly altered blood pressure for systolic readings.

Finally, the interaction of group and condition was significant for diastolic comparisons. Within this interaction, the high hostile group evidenced increased blood pressure over that of the low hostile group. This follows previously stated hypotheses that the high and low hostile group members differ on their reactivity to cardiovascular stressors.

Results were expected to replicate and expand upon previous findings with high hostiles exhibiting a post stressor increase in heart rate and blood pressure and a decrease in leftward LEM, while low hostiles remained essentially the same after cold pressor stressor. Neither the theories of Heilman nor those of Tucker can completely account for the results observed in the current experiment. In Heilman's theory, the right hemisphere is expected to control the majority of emotional responses. Tucker, on the other hand, notes that there is a balance between the right and left hemisphere, such that positive emotion is typically relegated to the left while the right controls negative emotional valence. Current findings indicate that high and low hostile individuals reacted similarly when making both rightward and leftward eye movements. This result indicts that group differences which might have been proposed by either Tucker or Heilman's theories do not apply in the case of the frontal eye fields. This may be in part due to lateral eye movements that were not sufficient to produce expected response, or it may be that the physical and functional systems involved in these eye movements may have a differing behavioral and cardiovascular response than would have been predicted in other systems (e.g. vision, audition, somatosensory, motor, or premotor).

Though the results of this experiment are interesting, this research had some limitations and could have been improved in some important ways. First, heart rate and blood pressure data were collected approximately 26 times throughout the experiment. Numerous participants related that this was painful. Due to experimental design and *a priori* hypotheses, the current design was deemed necessary, however, the possibility remains that this may have added the confound of painful stimulation, which was not intended.

Due to multiple participants who qualified (via CMHO Scale) at pre- screening to continue in the experiment, and then did not qualify on the day of the experiment, it may be important to determine if another measure may give greater reliability and validity. If possible, this may ensure that the grouping variables are consistant across time and that any significant difference found are, therefore, more reliable.

In summary, high hostility is associated with increased risk of cardiovascular disease as this group tends to react to stressors with increased cardiovascular response (Saul, 1956; Matthew & Haynes, 1986; Johnson, 1990; Demaree & Harrison, 1997). As such, it is important to understand behavioral and physiological components of highly hostile individual's reaction to concurrent tasks of blood pressure and heart rate regulation and various behavioral tasks (e.g. fluency, grip strength, or LEM, to name just a few). In the current experiment, predictions of group differences were made for both behavioral and physical data. Though the effects did not occur as expected, significant results are intriguing and present a new way of interpreting the line of questioning which provided the theoretical basis for this experiment. In the frontal eye fields, it was discovered that leftward LEM was more likely to indicate fatigue effects than the rightward LEM. Secondly, LEM, theorized to be a stressor in this task, produced diametrically opposite results than did the cold pressor as a stressor. Finally, overall, high hostile men were more reactive in cardiovascular measures than low hostile participants. Though some problems in experimental design were apparent, it seems that this research will add to current views on functional cerebral systems and the interaction of high hostility with cardiovascular reactivity.

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Appendix A

Laterality Questionnaire

Subject #: ______________________________

Circle the appropriate number after each item.

With which hand would you throw a ball to hit a target?	1	-1	0
With which hand do you draw?	1	-1	0
With which hand do you use an eraser on paper?	1	-1	0
With which hand do you remove the top card when dealing?	1	-1	0
With which foot do you kick a ball?	1	-1	0
If you had to pick up a pebble with your toes, which foot would you use?	1	-1	0
If you had to step up on a chair, which foot would you place on the chair first?	1	-1	0
Which eye would you use to peep through a keyhole?	1	-1	0
If you had to look into a dark bottle to see how full it was, which eye would you use?	1	-1	9
Which eye would you use to sight down a rifle?	1	-1	0
If you wanted to listen to a conversation going on behind a closed door, which ear would you place against the door?	1	-1	0
If you wanted to listen to someone's heartbeat, which ear would you place against his or her chest?	1	-1	0
Into which ear would you place you earphone of a transistor radio?	1	-1	0

Of Right + # of Left = Total Score

__________ + _________ = ____________

Is mother right or left hand dominant? ___________

Is father right or left hand dominant? __________

Appendix B

Direction: If a statement is true or mostly true, as pertaining to you, circle the letter T. If a statement is false, or usually not true about you, circle the letter F.

Try to give a response to every statement.

1. When I take a new job, I like to be tipped off on who should be gotten next to.	T	F
2. When someone does me wrong, I feel I should pay him back if I can, just for the principle of the thing.	T	F
3. I prefer to pass by school friends, or people I know but have not seen for a long time, unless they speak to me first.	T	F
4. I often had to take orders from someone who did not know as much as I did.	T	F
5. I think a great many people exaggerate their misfortunes in order to gain the sympathy and help of others.	T	F
6. It takes a lot of argument to convince most people of the truth.	T	F
7. I think most people lie to get ahead.	T	F
8. Someone has it in for me.	T	F
9. Most people are honest chiefly through the fear of getting caught.	T	F
10. Most people will use somewhat unfair means to gain profit or an advantage, rather than lose it.	T	F
11. I commonly wonder what hidden reason another person may have for dong something nice for me.	T	F
12. It makes me impatient to have people ask my advice or otherwise interrupt me when I am working on something important.	T	F
13. I feel that I have often been punished without cause.	T	F
14. I am against giving money to beggars.	T	F
15. Some of my family has habits that bother me very much.	T	F
16. My relatives are nearly all in sympathy with me.	T	F
17. My way of doing things is apt to be misunderstood by others.	T	F

18. I don't blame anyone for trying to grab everything they can get in this world.	T	F
19. No one cares what happens to you.	T	F
20. I can be friendly with people who do things I consider wrong.	T	F
21. It is safer to trust nobody.	T	F
22. I do not blame a person for taking advantage of someone who lays himself open to it.	T	F
23. I have often felt that strangers were looking at me critically.	T	F
24. Most people make friends because friends are likely to be useful to them.	T	F
25. I am sure that I am being talked about.	T	F
26. I am likely not to speak to people until they speak to me.	T	F
27. Most people inwardly dislike putting themselves out to help other people.	T	F
28. I tend to be on guard with people who are somewhat more friendly than I had expected.	T	F
29. I have sometimes stayed away from another person because I feared doing or saying something that I might regret afterwards.	T	F
30. People often disappoint me.	T	F
31. I like to keep people guessing what I'm going to do next.	T	F
32. I frequently as people for advice.	T	F
33. I am not easily angered.	T	F
34. I have often met people who are supposed to be experts who were no better than I.	T	F
35. It makes me think of failure when I hear of the success of someone I know well.	T	F
36. I would certainly enjoy beating a crook at his own game.	T	F
37. I have at times had to be rough with people who were rude or annoying.	T	F
38. People generally demand more respect for their own rights than they are willing to allow for others.	T	F
39. There are certain people whom I dislike so much I am inwardly pleased when they are catching it for something they have done.	T	F

40. I am often inclined to go out of my way to win a point with someone who has opposed me.	T	F
41. I am quite often not in on the gossip and talk of the group I belong to.	T	F
42. The man who ha the most to do with me when I was a child (such as my father, step- father, etc.) was very strict with me.	T	F
43. I have often found people jealous of my good ideas just because they had not thought of them first.	T	F
44.When a man is with a woman, he is usually thinking of things related to her sex.	T	F
45. I do not try to cover up my poor opinion or pity of a person so that he won't know how I feel.	T	F
46. I have frequently worked under people who seem to have things arranged so that they get credit for good work, but are able to pass off mistakes to those under them.	T	F
47. I strongly defend my own opinions as a rule.	T	F
48. People can pretty easily change me even though I thought that my mind was made up on a subject.	T	F
49.Sometimes I am sure that other people can tell what I'm thinking.	T	F
50. A large number of people are guilty of bad sexual conduct.	T	F

Appendix C

Medical History Questionnaire

Have you ever experienced or been diagnosed with any of the following or are you experiencing any of the following at present? Please circle the appropriate response and explain any “yes” answers below.

1. Severe head trauma/ injury	Yes	No
2. Eye Surgery	Yes	No
3. A “lazy” or “weak” eye	Yes	No
4. Stroke	Yes	No
5. Learning disabilities (problems of reading, writing, or comprehension)	Yes	No
6. Epilepsy or seizures	Yes	No
7. Paralysis	Yes	No
8. Neurological Surgery	Yes	No
9. Other neurological/ nervous system problems	Yes	No
10. Using alcohol or drugs (other than for prescribed purposes) at the present	Yes	No
11. Past psychological/ psychiatric problems	Yes	No
12. Are you currently suffering from any medical conditions or illnesses	Yes	No
13. Arthritis	Yes	No
14. Any head or lung problems	Yes	No
15. Reynaud’s Syndrome	Yes	No
16. Any cardiac (heart) problems	Yes	No

Please explain any “yes” responses:

Appendix D

Beck Depression Inventory- II

Instruction: This questionnaire consists of 21 groups of statements. Please read each group of statements carefully and then pick out the one statement in each group that best describes the way you have been feeling during the **past two weeks, including today.** Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item "P" (Changes in Sleeping Pattern) or item "R" (Changes in Appetite).

[The Beck Depression Inventory, p. 62-66, was removed March 22, 2010 GMc]

Appendix E

State Trait Anxiety Inventory

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

1. I feel calm…………………………………………………..……1 2 3 4
2. I feel secure…………………………………………..………1 2 3 4
3. I feel tense……………………………………………………..1 2 3 4
4. I am regretful……………………………………………………1 2 3 4
5. I feel at ease…………………………………………………...1 2 3 4
6. I feel upset………………………………………………………1 2 3 4
7. I am presently worrying over possible misfortune feel rested…….1 2 3 4
8. I feel rested……………………………………………………1 2 3 4
9. I feel anxious…………………………………………………1 2 3 4
10. I feel comfortable……………………………………………..1 2 3 4
11. I feel self- confidant…………………………………………..1 2 3 4
12. I feel nervous…………………………………………………1 2 3 4
13. I am jittery……………………………………………………... 1 2 3 4
14. I feel “high strung” ……………………………………………...1 2 3 4
15. I am relaxed…………………………………………………...1 2 3 4
16. I feel content………………………………….…………..…1 2 3 4
17. I am worried…………………………………………………..1 2 3 4
18. I feel over- excited and “rattled” ………………………………..1 2 3 4
19. I feel joyful……………………………………………………..1 2 3 4
20. I feel pleasant…………………………………………………..1 2 3 4

Appendix F

INFORMED CONSENT FOR PARTICIPANTS OF INVESTIGATIVE PROJECTS (Pre-Screening)

Title of Project: Cardiovascular Regulation in Men: An Investigation of Lateralized Pre- Motor Functions

Experiment Number: HSC # 02- 220, IRB # 02- 592

1. **PURPOSE OF THE EXPERIMENT:** To obtain normative data on self-reported emotion and cardiac factors.

2. **PROCEDURE TO BE FOLLOWED IN THE STUDY:** Participants for the study will be identified after completion of three questionnaires that will be administered via a secured web site. Qualified participants will be contacted and requested to continue based on their questionnaire results.

3. **ANONYMITY OF SUBJECTS AND CONFIDENTIALITY OF THE RESULTS:** Identifying information will be kept confidential and will not be released to anyone other than individuals directly working on the project. The information you provide will have your name removed and is given a number. Information will only be associated with a subject number that will be used during analysis and written reports of the research.

4. **DISCOMFORT AND RISKS FROM PARTICIPANTING IN THE STUDY:** Some of the questionnaires may contain material that you find embarrassing or uncomfortable to answer. You may omit any questions that you find embarrassing or uncomfortable. If you have any questions after leaving the experiment or have any problems associated with the study, you

may contact the researcher or Dr. David W. Harrison (231- 4422) and he will assist you directly or direct you to appropriate services.

5. **EXPECTED BENEFITS:** No guarantee of benefits has been made to encourage your participation. If you like, we will provide you with the results of your blood pressure readings.

6. **FREEDOM TO WITHDRAW:** You are free to withdraw from the study at any time without penalty and your decision to withdraw will not affect your psychology course grade or application of points.

7. **EXTRA CREDIT COMPENSATION:** You will receive one point extra credit for your psychology course by participation in this portion of the study. If your responses indicate you are eligible for further participation, additional points will be added dependant upon your continued participation.

8. **USE OF RESEARCH DATA:** The information gathered from this study will be used for scientific and/ or educational purposes. The findings may be presented at scientific meetings and/ or published and reproduced in professional journals or books. The findings may also be used for other purposes that Virginia Tech's Department of Psychology deems proper in the interest of education. Knowledge, and research

9. **APROVAL OF RESEARCH:** This project has been approved by the Human Subjects Committee of the Department of Psychology and the Institutional Review Board of Virginia Tech

10. **PARTICIPANT'S PERMISSION:** I have read and understand the above description of the study. I have had the opportunity to ask questions and all

have been answered in an appropriate manner. I hereby acknowledge the above and voluntarily give my consent to participant in this study. I realize that I may withdraw at any time without penalty and that I may contact one of the people listed below at any time if I have questions regarding the study.

Allison L. Beck 231- 6914
Primary Researcher

David W. Harrison, Ph.D. 231- 4422
Faculty advisor

Jack Finney 231- 6670
Department Chair, Department of Psychology

David Moore, Ph.D. 231- 4991
Chair; Institutional Review Board, Research Division

Subject's Signature:___________________________________ Date:___________

Subject's ID__________________________ Subject's Telephone #________________

Appendix G

INFORMED CONSENT

(Testing Day)

Title of Project: Cardiovascular Regulation in Men: An Investigation of Lateralized Pre- Motor Functions
Experiment Number: HSC # 02- 220, IRB # 02- 592

1. **PURPOSE OF THE EXPERIMENT:** To learn more about emotion and cardiac regulation

2. **PROCEDURE TO BE FOLLOWED IN THE STUDY:** Participants for the study will be asked to complete questionnaires. The experiment will then be started. Some minor discomfort may be involved in the completion of this experiment as you place your hand in ice water for a short time. You will be asked to make rapid eye movements in the experiment. Your blood pressure and heart rate will be evaluated and recorded numerous times during the course of the experiment.

3. **ANONYMITY OF SUBJECTS AND CONFIDENTIALITY OF THE RESULTS:** Identifying information will be kept confidential and will not be released to anyone other than individuals directly working on the project without your written consent. The information you provide will have your name removed and is given a number. Information will only be associated with a subject number that will be used during analysis and written reports of the research. If you indicate that you intend to harm yourself or someone else, you will be encouraged to seek help, confidentiality will be broken, and the appropriate agencies will be informed.

4. **DISCOMFORT AND RISKS FROM PARTICIPANTING IN THE STUDY:** Some of the questionnaires may contain material that you find embarrassing or uncomfortable to answer. You may omit any questions that you find embarrassing or uncomfortable. Additionally, you may experience some mild to moderate discomfort during the course of this experiment. This should be relatively minor discomfort lasting no longer than a few minutes. If you have any questions after leaving the experiment or have any problems associated with the study, you may contact the researcher or Dr. David W. Harrison (231- 4422) and they will assist you directly or direct you to appropriate services.

5. **EXPECTED BENEFITS:** Your participation in this project will aid in the understanding emotion and brain activation. No guarantee of benefits has been made to encourage your participation.

6. **FREEDOM TO WITHDRAW:** You are free to withdraw from the study at any time without penalty and your decision to withdraw will not affect your psychology course grade or application of points.

7. **EXTRA CREDIT COMPENSATION:** You will receive three points extra credit for your psychology course by participation in this portion of the study.

8. **USE OF RESEARCH DATA:** The information gathered from this study will be used for scientific and/ or educational purposes. The findings may be presented at scientific meetings and/ or published and reproduced in professional journals or books. The findings may also be used for other purposes that Virginia Tech's Department of Psychology deems proper in the interest of education, knowledge, and research

9. **APROVAL OF RESEARCH:** This project has been approved by the Human Subjects Committee of the Department of Psychology and the Institutional Review Board of Virginia Tech

10. **PARTICIPANT'S PERMISSION:** I have read and understand the above description of the study. I have had the opportunity to ask questions and all have been answered in an appropriate manner. I hereby acknowledge the above and voluntarily give my consent to participant in this study. I realize that I may withdraw at any time without penalty and that I may contact one of the people listed below at any time if I have questions regarding the study.

Allison L. Beck 231- 6914
Primary Researcher

David W. Harrison, Ph.D. 231- 4422
Faculty advisor

Jack Finney 231- 6670
Department Chair, Department of Psychology

David Moore, Ph.D. 231- 4991
Chair; Institutional Review Board, Research Division

Subject's Signature:___________________________________ Date:___________

Subject's ID__________________________ Subject's Telephone #________________

Curriculum Vitae

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PERSONAL DATA:

Permanent Home Address:	385 Bowen Dr. Savannah, TN 38372
Permanent Home Phone:	(731) 925-5040
Home Address:	602 Washington Street Apartment #11 Blacksburg, VA 24060
Home Phone:	(540) 961-7040
Cell Phone:	(540) 357-1598
Email Address:	albeck@vt.edu

EDUCATION:

Virginia Polytechnic Institute
2000- 2003

Master's Degree, 2003
Clinical Psychology
Neuropsychological Area of Concentration
Thesis Title "*Hostility and Cardiovascular Regulation: An Investigation of Lateralized Pre-Motor Functions*"

Lipscomb University
1996- 2000

B.A., 2000, *Cumulative GPA 3.65*
Major GPA 3.9
Psychology Major; English/ German Minors

WORK EXPERIENCE:

July 2003- Present

Cardiology and Gastroenterology Divisions
Department of Veterans Affairs Medical Center
1970 Roanoke Boulevard

Salem, Virginia 24153

Clinical Research Coordinator (Dr. Jarmukli and Dr. van der Linden)

-Patient contact and administrative duties in major pharmaceutical studies (listed in following section). Coordinated all areas of studies (e.g. investigator meetings, regulatory documents, case report forms, queries, adverse and serious adverse events, and communicating with patients, colleagues, and investigators).

May 2003- Present

Respond
Lewis Gale Psychiatric Center
1902 Braeuburn Dr.

Salem, Virginia 24153

Assessment Specialist (On- call and in office)

-Evaluated patients in crisis situation (e.g. suicidal, homicidal, or psychotic). Staffed the information with a psychiatrist and assisted in decision for inpatient admission or referral to outpatient services. Also, facilitated patient transfers, precertified patients, and admitted patients. Assessments for adults and children seeking substance abuse, intensive inpatient, and intensive outpatient treatments.

December 2001- December 2003

Neuropsychological and Counseling Services
P.O. Box 10382
Blacksburg, VA 24062-0328

General Office Manager & Neuropsychological Technician

-Contacted and scheduled clients, facilitated medical billing and referrals, updated medical records, and conducted neuropsychological screenings and testing. Assisted the doctor with clients in a variety of settings, including standardized testing, quantitative electroencephalograph measures, and syndrome analysis.

Aug. 2002- May 2003

Virginia Polytechnic Institute and State University

Graduate Teaching Assistant (Advanced Developmental Psychology)

-Assisted the primary professor with development of assignments, class facilitation, student meetings, grading of written assignments, and development of student writing skills.

August 2000- May 2002

Virginia Polytechnic Institute and State University

Teaching Assistant (Undergraduate Recitation Sections)

-Planned and taught introductory Psychology Recitation sections during each semester. Developed lesson plans, determined and graded assignments, and assisted with primary course interaction.

<u>RESEARCH PROTOCOLS:</u>

THINRS The Home INR Study, 2003- present

ACTIVE Atrial Fibrillation Clopidogrel Trial with Irbesartan for the Prevention of Vascular Events, 2003- present

RESCUE A Prospective, Open- Label, Randomized, Parallel Group Investigation to Evaluate the Efficacy and Safety of Enoxaparin versus Unfractionated Heparin in Subjects who Present to the Emergency Room with Acute Coronary Syndrome, 2003- present

WARCEF Warfarin versus Aspirin in Reduced Cardiac Ejection Fraction, 2003- present

SHIRE study SPD 476- 301; A Phase III, Randomized, Multi-Center, Double- Blind, Parallel- Group, Placebo- Controlled Study to Evaluate the Safety and

Efficacy of SPD476 (Mesalazine) Given Twice Daily (2.4 g/day) versus SPD476 Given as a Single Dose (4.8 g/day) in Subjects with Acute Mild to Moderate Ulcerative Colitis, 2003- present

SPD476- 303; A Phase III, Randomized, Multi-Center, Open-Label, 12 to 14 Month Extension Study to Evaluate the Safety and Tolerability of SPD476 (Mesalazine) Given Once Daily versus Twice Daily for the Maintenance of Ulcerative Colitis is Remission, 2003- present

DYSPEPSIA A Phase II B, Multi- Center, Randomized, Double- Blind, Placebo-Controlled, Parallel- Group, Dose Ranging Study of YM443 in Subjects with Functional Dyspepsia, 2004- present.

<u>CLINICAL EXPERIENCE:</u>

Jan. 2001- May 2003

Psychological Services Center
Department of Psychology
Virginia Polytechnic Institute and State University

3110 Price's Fork Road, Blacksburg, Virginia 24061

Graduate Clinician (Neuropsychological Assessment Team)

- Conducted Neuropsychological assessments, made diagnoses of disorders, and provided feedback to patients, families, and other team members.

Jan. 2001- September 2002

Psychological Services Center
Department of Psychology
Virginia Polytechnic Institute and State University

3110 Price's Fork Road, Blacksburg, Virginia 24061

Graduate Clinician (Clinical Work)

-Treated adult, adolescent, and family complaints for various psychological disorders and dysfunctions. Also, tested for Attentional disorders and offered recommendations.

Feb. 2000- *Regional Intervention Program (RIP)*

May 2000 ***Nashville, TN***

<u>Assistant</u>

-Worked with children age two to five, addressing inappropriate behaviors. Responsible for observing and noting behaviors, making recommendations for changes, and communicating with the parents. Also assisted in any classroom or area that required additional assistance.

RESEARCH AND TEACHING EXPERIENCE:

Aug. 2000- May 2003	*Virginia Polytechnic Institute and State University* **Research (Individual and Team member)** -Conducted personal research and collaborated with others on numerous projects for presentation at various conferences and for publication in journals. Supervised undergraduate assistants in completion of data gathering and coding. Completed master's thesis examining hemispheric activation in high and low hostile men, utilized cardiovascular measures and SAS statistical analysis program.
Nov. 1998- May 1999	*Lipscomb University* **Independent Researcher** -Researched, determined appropriate measures, conducted questionnaire studies, and presented the findings of the link between optimism and performance in high school students. Presentation titled "*The effects of stress on college students*".

PUBLICATIONS, PRESENTATIONS, AND RESEARCH:

Publications:

Harrison, D.W., Beck, A.L., Vendemia, J.M., & Walters, R.P. (In press, pending final review). Ambient sensory conditions: Modifications of receptive speech deficits in left side stroke patients using bright light. Perceptual and Motor Skills.

Presentations:

Beck, A.L., Mollet, G.A., Faster, P.S., Walters, R.P. & Harrison, D.W. (March, 2002). Thalamic syndrome: Multimodal hallucinations. Presented at the Annual Research Symposium, Blacksburg, VA.

Mollet, G.A, Emerson, C.S., Beck, A.L., & Harrison, D.W. (March, 2002). Frontal lobe dysfunction in anxious- depressed boys. Presented at the Annual Research Symposium, Blacksburg, VA.

Beck, A.L.& Harrison, D.W. (2002, October). Should psychophysiological measurement (QEEG) be part of the neuropsychological evaluation? Poster session presented at the National Academy of Neuropsychologists, Miami, FL

Walters, R., Beck, A.L., & Harrison, D.W. (2002, October). An analysis of tactile deficits: In patients reporting visual formaesthesias. Poster session presented at the National Academy of Neuropsychologists: Miami, FL

Higgins, D, Beck, A.L., Williamson, J, Foster, P., & Harrison, D.W. (2001, May). Frontal lobe deterioration: evidence from sex differences in aging effects. Poster session presented at the annual meetings of the Southeastern Psychological Association: Atlanta, GA.

Williamson, J., Higgins, D, Beck, A.L., & Harrison, D.W. (2001, May). Grip strength and fatigue as a function of age. Poster session presented at the annual meetings of the Southeastern Psychological Association, Atlanta, GA.

Beck, A.L. & Harrison, D.W. (2001, November). The importance of EEG in a neuropsychological evaluation. Poster session presented at the annual meeting of the Virginia Psychological Association, Roanoke, VA.

Beck, A.L. & MacWhinney, B. (2000, May). Evoked response potential in college students. Poster session presented at the annual Southeastern Psychological Association Conference, New Orleans, LA.

Turner, P.E. & Beck, A.L. (1999, May). Optimism and perfectionism in a sample of high school students. Poster session presented at the annual area- wide conference, Nashville, TN.

Beck, A.L. & Turner, P.E. (1998, April). The effects of stress on college students. Poster session presented at the annual area- wide conference, Nashville, TN.

Beck, A.L., Tucker, L.B., White, R.P., & Van Haaren F. (1998, April). Effects of high level illumination on the antinociceptive effects of morphine. Annual area- wide conference, Nashville, TN.

RELEVANT EXPERIENCES/ HONORS / AWARDS/:

Good Clinical Practice Training, Employee Education System, Salem Veterans Affairs Medical Center, 2003

VA Cyber Security Awareness, Employee Education System, Salem Veterans Affairs Medical Center, 2003

Human Participants Protection Education for Research Teams, National Institutes of Health (NIH), Salem Veterans Affairs medical Center, 2003

Carillon Medical Center IRB Informed Consent, Research, and Vulnerable Populations Seminar, 2003

HIPPA Training for Researchers: HIPPA and Clinical Trials, Salem Veterans Affairs Medical Center, 2003

Transportation of Dangerous Goods training, Salem Veterans Affairs Medical Center, 2003

Phlebotomy training, Salem Veterans Affairs Medical Center, 2003

Summa Cum Laude, Bachelor of Arts, Lipscomb University, 2000

Psi Chi Psychology Honor Society, 1997-2000; President, Lipscomb University, 1998

Dean's List*/ Honor Roll**, Lipscomb University, (2 semesters*; 1 semester**)

Stroop Award (Top Senior Psychology Student), Psychology Department, Lipscomb University, 1999

Associate Student of Trinity College, Oxford University, Trinity College- Oxford University, England, Fall 1999; One primary and two secondary tutorials in

Psychology (approximately 15 hours credit at American Universities; Grades, Alpha)

Determining areas of interest for study (Physiology and Psychology and Psychological Measurements) and following these in a series of tutorials with Oxford professors from the Department of Experimental Psychology. Joined four different research teams and explored various fields of concentrations such as eating habits, handedness, and psychological factors.

Chosen to Attend the CNBC (Center for the Neural Basis of Cognition) Summer Research Program, Joint program between The University of Pittsburgh and Carnegie Mellon University, Pittsburgh, PA, Summer 1999; Ten students selected from across the nation along with one international student conducted research in labs at the university of Pittsburgh and Carnegie Mellon, attended symposiums and lectures, and presented research in meetings attended by students and faculty members.

Honed my research skills, attended seminars in various areas, and interacted with some of the most prominent researchers in the state. Worked with Dr. Brian MacWhinney exploring facets of the Evoked Response Potential. Program was funded by the National Science Foundation and conducted jointly by faculty at the University of Pittsburgh and Carnegie Mellon University. Paper and presentation titled "*Evoked response potential in college students*".

Named to Who's Who Among American College Students, 1999

Selected to Attend Undergraduate Research Program at the University of Florida, Gainesville, University of Florida, Summer 1998; Ten Students selected from across the nation to conduct research in Biopsychology labs in Florida; Mentor, Frans Van Haaren; Director, Neil Rowland

Became involved in all aspects of a major research project. I was a part of research, development, implementation, and subsequent write- up of the experiment. The paper was submitted to the Journal of Pain and I presented the findings at a regional conference in May of 1999. Presentation and paper titled "*Effects of high level illumination on the antinociceptive effects of morphine*".

Selected to Study Abroad With Lipscomb University, Vienna, Austria, Fall, 1997

Provost Scholarship (100% tuition), Lipscomb University, 1996-2000

PROFESSIONAL AFFILIATIONS 2000- 2004:

American Psychological Association (graduate member)
National Association of Neuropsychologists (graduate member)
Virginia Psychological Association (graduate member)
Society for Psychophysiological Research (graduate member)

REFERENCES:

Available upon request