BEHAVIORAL, PHYSIOLOGICAL, AND NEUROPSYCHOLOGICAL CORRELATES OF HOSTILITY

by

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(ABSTRACT)

This experiment tested three hypotheses linking the right cerebral regulation of hostility and physiological arousal. First, replication of previous research supporting heightened physiological (systolic blood pressure, diastolic blood pressure, and heart rate) reactivity among high hostile subjects was attempted. Second, a positive association between hostility and reactivity of facial valence and intensity to stress were expected. Last, hemispheric lateralization of cerebral activity in response to stress was measured.

Low- and high-hostile subjects were identified using the Cook Medley Hostility Scale (CMHS). All subjects completed the cold pressor paradigm and were videotaped before, during, and after the stressor for analysis of facial valence and intensity. Physiological measures (SBP, DBP, and HR) were recorded and dichotic listening procedures were administered before and after the stressor.

The primary finding of this research was greater right cerebral activation to stress among high-hostile subjects, as indicated by their enhanced intention to the left ear. Data further supported previous findings of heightened physiological reactivity to stress among high-hostiles. However, no hostility group differences on facial expression measures were found. Data suggest a positive relationship between right cerebral activity and cardiovascular arousal.

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This project is dedicated to my grandparents, Warren and Edith Quattlander and Kenneth and Mildred Demaree. Their love and support will be continuously cherished.

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An act of violent crime (including murder, forcible rape, violent robbery, and aggravated assault) occurred every 22 seconds in the United States during 1992 (Federal Bureau of Investigation, 1993). An estimated 23,760 murders (9.3 per every 100,000 citizens), 109,062 forcible rapes (42.8/100,000), 672,478 violent robberies (263.6/100,000), and 1,126,974 aggravated assaults (441.8/100,000) victimized our nation's citizens during that year (Federal Bureau of Investigations, 1993). A better understanding of hostility is apparent and has resulted in increased attention towards its correlates over the past two decades.

This paper will review prominent theories of hostility and negative affective lability. As will be discussed, the right cerebrum is widely considered a central mediator of these phenomena. To study hostility and its correlates, many scientists incorporate stress paradigms in their experimental design. Physiological measures -- heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP) -- are commonly used dependent variables which generally suggest greater increases of brain activity to stress among high-hostiles. However, these physiological measures may be right-cerebrum mediated. Therefore, collected data may indicate heightened right cerebral reactivity among high- relative to low-hostiles. This line of reasoning will be expanded and alternative dependent variables to assess brain laterality will be discussed. To conclude, an experiment that may help determine whether high-hostiles have greater right-cerebrum reactivity will be proposed.

Several lines of research have been pursued in the convergent literatures on the expressive or behavioral, and physiological dimensions of hostility. Prominent among these literatures is the investigation of anger expression. In recent reviews, heightened reactivity or lability of behavioral and physiological measures during stress has been a reliable and even robust correlate of hostility (e.g. Herridge & Harrison, 1994; Suarez & Williams, 1989; Weidner, Friend, Ficarotto, & Mendell, 1989; Hardy & Smith, 1988). While these correlates are well described, much work remains to be completed in the transition from a previously behavioral or cognitive model of hostility into a neuropsychological model of emotion and emotional lability. A basic foundation for the integration and extension of this research may exist within the framework of the study of rage (an aggressive attack accompanied by autonomic arousal) and pseudobulbar palsy (marked by spontaneous extreme affect display, like crying) (e.g. Demakis, Herridge & Harrison, 1994), both examples of negative affective lability.

This review will identify major theoretical perspectives of negative affective lability. First, neuroanatomical systems especially within the right cerebrum purported to mediate rage behavior and pseudobulbar palsy will be identified. Second, a neuropsychological approach to lability that may explain these processes more precisely will be described. Negative emotional processing, with an emphasis on hostility, will be seen primarily as a function of right cerebral activity. Last, clinical and experimental research will be reviewed which may help identify behavioral and physiological correlates of heightened right cerebral activity, as linked to hostility. Last, procedures to help determine whether there is greater right cerebrum reactivity to stress among high- relative to low-hostiles will be described.

Cognitive Models

Researchers have proposed primarily cognitive models to explain affective arousal and hostility. Krantz et al. (1986) discussed a model involving three primary factors -- stimulus characteristics, mediators, and physiological reactivity. Stimulus characteristics, such as anger and fear, produce a necessity for response. The mediator, or organism, encompasses an interaction between cognition and biological predisposition. One effect of this process is physiological reactivity. Krantz et al. (1986) successfully accomplished their goal: To make a primarily cognitive model of arousal. However, their limited description of biological traits left this model lacking.

Williams (1986) proposed a biopsychosocial model that suggested that the brain is developed from an interaction between personality, genes, and environment. The brain, then, sends messages to target organs to produce arousal. Williams (1986) made theoretical advances when he cited the brain as a primary mediator of arousal and hostility. Still, Williams (1986) used a "black box" approach, viewing the brain as an "input-output" organ, devoid of any specific processes occuring within it.

Anatomical Systems

Several anatomical systems have been identified in which dysfunction at specific loci have been correlated with emotional lability, including rage and/or pseudobulbar palsy. First, bilateral lesions of the bulbar motor nuclei, the neocortical upper motor neurons in particular, have produced pseudobulbar affect (Lieberman & Benson, 1977). Second, lesion of the diencephelon, basal forebrain, medial temporal lobe, or the brainstem tegmentum have yielded emotional lability (Brown, 1967; Contu & Drew, 1966; Sackheim, Greenberg, Weiman, Gur, Hungerbuhler, & Geschwind, 1982). Ross (1993) has also theorized that pathological affect may result from a combination of major depression and a right frontal opercula lesion, as supported by two case studies (Ross and Rush [1981], cases 1 and 3).

The hypothalamus was discovered as an important mediator to rage production (Moyer, 1987; Panksepp, 1982). The ablation of definite sites in the hypothalamus cause sham rage, suggesting that these frontal pathways to the hypothalamus may inhibit emotional lability. Previous experimental lesion studies with cats (Decsi & Nagy, 1974; Lu, Shaikh, & Siegal, 1992; Nagy & Decsi, 1974) and case studies with humans (Flynn, Cummings, & Tomiyasu, 1988; Sachdev, Smith, Matheson, & Last, 1992; Tonkonogy & Geller, 1992) support the hypothalamic inhibitory role on rage, pseudobulbar palsy, and emotional lability in general. Clearly, according to this line of research, the right cerebrum appears central in the mediation of negative affect expression. Disconfirming evidence does exist, however, and will be discussed in detail.

Neuropsychological Explanation

A neuropsychological explanation of hypothalamic rage suggests that the anterior right cerebrum may be responsible for the inhibition or regulation of autonomic functioning as well as the expression of hostility. The frontal lobe, and orbital-frontal cortex in particular, appears to decrease hostility levels (Butter, 1970). The orbital-frontal cortex has extensive interconnections with amygdaloid bodies of the anterior temporal region. The latter region has been frequently described as responsible for increasing hostility. Heilman et al. (1993) hypothesized that these two extensively interconnected regions interact with each other to yield a relatively conservative and stable aggression level among normals. Thus, ablation of right orbitofrontal regions or stimulation of right anteriomedial temporal regions may yield anger/aggression. Passivity or flattened affective expression may result from stimulation of right orbitofrontal regions or ablation of right anteriomedial temporal regions (Kalat, 1992). Similarly, we have found decreased orbital-frontal and increased right temporal beta activity in a homicidal patient using electroencephalagraphic techniques (Everhart, Demaree & Harrison, 1995).

Research within the areas of experimental and clinical neuropsychology is critical to understand the general roles of the two hemispheres. These literatures provide evidence that each cerebrum plays differing roles in the mediation of a person's emotional expression, physiological reactivity and recovery to stress. A review of relevent experimental research will precede a discussion of selected clinical findings.

Experimental Research

Facial expression has been associated with right cerebral activity. Ekman (1971) postulated the universality of facial expressions representing emotion (happy, sad, disgust, fear, surprise, anger, and interest). He explained this phenemonon as resulting from both cultural and physiological factors, similar to Izard's (1977) theory of facial expression. Some evidence supports the right cerebral mediation of facial expression. For example, Campbell (1978) first discovered that smiles were broader on the left side of the face, a region predominantly innervated by the right cerebrum. Borod and Caron (1980) replicated the finding by showing that both positive and negative emotional faces were more intense on the left hemiface.

Tucker and Frederick (1989), in their review of the relevant experimental literature, concluded that the right cerebrum is dominant for both posed and spontaneous facial expression, with relatively greater control of negative affect expression. Sackheim, Gur, and Saucey (1978) used split-half composites of different facial expressions and found that the left hemiface was rated as most intense, independent of the facial emotion. The right cerebrum, however, may be superior in negative rather than positive facial expression. Borod, Koff, and Buck (1986) discovered that posed negative facial expressions were rated as more intense on the left hemi-face than positive expression. Further, Davidson et al. (1990) used quantitative electroencephalagraphy recordings to conclude that spontaneous expressions of disgust and happiness correlated with simultaneously heightened right- and left- fronto-temporal activity, respectively.

Some research, however, did not support the role of facial affect expression on cerebral asymmetry. For example, some data may have suggested that spontaneous facial expression was not lateralized (Moscovitch and Olds, 1982; Ekman, Hager, and Friesen, 1981). These results may raise doubt in the predominant theory by suggesting that "true" emotional expression is not right-hemisphere mediated. Other research, in contrast, found asymmetry for both posed and spontaneous facial expression (Dopson, Beckwith, Tucker, & Bullard-Bates, 1984; Borod, Koff, & White, 1983).

The two cerebrums apparently differ in their ability to regulate physiological arousal and reactivity to stress. Wittling (1990) experimentally showed subjects an emotionally positive film to either their RVF or LVF. Right-cerebrum (left hemispace) presentation of the emotionally-laden film resulted in heightened BP beyond that which followed presentation to the left-cerebrum. Herridge and Harrison (1994) also found that subjects showed increased GSR on the left hemibody relative to the right when making posed emotional faces (including anger). These findings implicated the right cerebrum in BP, and perhaps cardiovascular, regulation. These physiological findings have been repeatedly replicated. Two prominent explanations for right cerebral mediation of physiological arousal have been proposed. Tucker and Williamson (1984) proposed that the right cerebrum may simply mediate physiological activity. Heilman (1982), on the other hand, speculated that the right cerebrum may have greater control of the subcortical systems, which are themselves largely responsible for arousal.

Clinical Research

Emotional expression in clinical investigations also appears to be associated with right cerebrum activity. For example, emotional verbalization was affected by lateralized brain dysfunction. Right cerebrum dysfunction produced expression deficits in affective verbal communication (Ross & Mesulam, 1979; Tucker, Watson & Heilman, 1976). Borod, Koff, Perlman-Lorch, and Nicholas (1986) further found that left cerebrum damage reduced the use of literal speech, whereas right cerebrum dysfunction decreased facial affect expression. Right-brain lesions may have caused monotonic, relatively non-affective verbalization (Kent & Rosenbek, 1982). However, these results demand cautious interpretation given the disconfirmatory experimental data previously discussed.

Clinical studies support right-cerebrum superiority in the mediation of physiological reactivity. Using galvanic skin response (GSR), Heilman, Bowers, and Valenstein (1993) determined that subjects with right cerebrum dysfunction experienced reduced arousal and reactivity. These researchers hypothesized that the right cerebrum is more closely associated with the subcortical systems responsible for arousal and intention. Dysfunction of the right cerebrum may have caused physiological and behavioral reactivity as evidenced by increased pseudobulbar lability (Heilman et al., 1993).

Hostility and its correlates

A basic understanding of the differing roles of the two hemispheres enables one to make specific predictions about the effects of right cerebrum overactivation on behavior, emotional expression, and physiological reactivity to stress. Most of the relevant literature is clinical in nature although some experimental evidence is provided in the area of emotional perception.

Hostility has been theorized to be central to right cerebrum activity (Kolb and Wishaw, 1990). Indeed, examination of lateralized neuropsychological impairments yielded a better than 84% correct identification rate of aggressive psychopaths, depressive patients, and normal controls under double blind conditions (Yeudall, 1977). Criminal psychopaths tended to have left-cerebrum damage purportedly leading to a predominantly right-cerebrum mediation of affect.

Continued advances in neuropsychology have refined our knowledge of psychopaths. Krynicki (1978) compared assaultive and nonassaultive delinquents using neuropsychological and EEG tests. He found that the former group had a heightened number of abnormal EEG recordings, particularly in the left fronto-temporal regions. Other research suggests that psychopaths show greater motor impulsiveness, poorer verbal memory, attention and concentration difficulties, poorer abstract thinking, and temporal sequencing problems (Berman and Siegal, 1976), indicative of frontal lobe dysfunction mainly attributable to the right hemisphere. Tucker and Frederick (1989) logically speculated that high-hostile behavior resulted from dominance of the undamaged hemisphere.

Because the right cerebrum may be associated with both negative emotion and physiological lability, it is not surprising that hostility has been associated with increased physiological reactivity to stress. Suarez and Williams (1989) found that high hostile men experienced greater reactivity as measured by HR, BP, and blood flow during an anagram task accompanied by harrassment than did low hostile men. Smith, Houston and Stucky (1984) found that high- and low-hostile individuals with low irritability differed in physiological response, as measured by BP, to a challenging mental task. High hostile subjects showed significantly increased reactivity to this cognitive stressor.

Schneider, Julius and Karunas (1989) echoed this finding by using high- and low-hostile male subjects. High hostile subjects showed heightened HR and BP reactivity to a cognitive stressor test in comparison to low hostile subjects. Siegman et al. (1992) found a positive correlation between hostility and BP reactivity during a serial subtraction task. This provided further evidence relating hostility and increased cardiovascular reactivity during stress. During an unsolvable anagram task, Weidner et al. (1989) found that high hostile men displayed greater SBP reactivity. In research with greater external validity, Jamner et al. (1991) studied paramedics during a 24-hour period. Both defensiveness and cynical hostility were found to contribute to cardiovascular reactivity, as indicated by HR and BP, during occupational stress. These have been particularly robust findings, as supported by meta-analysis of the hostility-physiological reactivity relationship (Suls and Wan, 1993).

Hostility also has been associated with increased persistence (decreased rate of return to baseline measures; Kalat, 1992) on physiological measures after stress. Our lab found GSR perseveration after subjects posed angry faces (Herridge & Harrison, 1994). Examination of black males lead Ernst et al. (1990) to conclude that manifest hostility is negatively associated with recovery of cardiovascular baseline after stress, produced by repeated mental demands. More important, Krynicki (1978) determined that increased perseveration errors on a visuomotor task helped identify patients with a history of multiple assaultive episodes from patients with only 0-2 assaultive incidents. Further, the neuropsychological data supports the notion that severe aggression may be correlated with left cerebrum dysfunction, leading to right cerebrum dominance. However, dysfunction of the right cerebrum may result in its overactivation and increased hostility.

Role of stress

The cold pressor test has historically been used to induce stress and purportedly to produce global increased cerebral activity. One indicator of this heightened arousal was increased physiological activity from cold pressor administration (Kalat, 1990).

High hostile subjects tended to exhibit greater physiological arousal to the cold pressor test relative to low hostile subjects. For example, Dembroski, MacDougall, Herd, and Shields (1979) found that high hostile Type A subjects showed greater HR and BP reactivity to the cold pressor than Type B subjects. Glass, McKinney, Hofschire, and Fedorko (1990) echoed these results by finding a positive association between hostility level and physiological reactivity (as indicated by HR, BP, total systemic resistance, and stroke volume index) to the cold pressor test.

Stress clearly has differing effects on high- and low-hostile persons. However, because physiological measures may tap right hemisphere activity, it remains uncertain whether the effect of stress on hostile individuals is best accounted for by greater reactivity by the entire brain or solely the right hemisphere.

Dichotic Listening Paradigm

The dichotic listening paradigm was designed to assess functional asymmetry for language, and will be used in this experiment to indicate cerebral asymmetry. An ear advantage is found when a greater proportion of stimuli presented to that ear is correctly reported by a subject. Contralateral cerebral superiority may be inferred for that type of stimulus (Springer, 1986). For example, several studies have found that the left hemisphere (right ear) is generally superior at processing auditorally-presented verbal stimuli for those without hearing disabilities (Snyder, Harrison & Gorman, 1994; Mondor & Bryden, 1992; Bryden, Free, Gagne & Groff, 1992; Ley and Bryden, 1982).

Previous research suggests that individuals show ear preferences contralateral to cerebral dominance. For example, Nebes and Nashold (1980) found that subjects were best able to attend to the ear ipsilateral to a cerebral hemispherectomy. Hugdahl, Wester and Asbjornsen (1990) has found additional evidence supporting this hypothesis using intracerebral brain-damaged subjects. Similarly, among normals, left- and right-handed subjects exhibited a right- and left-ear advantage, respectively (Jones & Sollner, 1982).

More important, individuals appear to show a greater contralateral ear advantage after enhanced cerebral arousal. For example, subjects who hear music (a left hemisphere function) perform better on number recall (another left hemisphere function) and dichotic listening tasks than those without musical priming (Morton, Kershner and Siegel, 1990).

In a particularly intriguing experiment, psychopaths were presented with competing auditory stimuli in both ears and asked to divide or direct their attention (Hare and McPherson, 1984) As expected, both groups showed a right ear advantage. Psychopaths, however, evidenced less right-ear superiority relative to normals. The authors suggest that decreased left hemisphere activity may account for these results.

Not all researchers, however, agree that differential results between low- and high-hostiles on dichotic listening tasks indicate brain activity differences. Instead, some have argued that these results support altered left cerebrum organization among high-hostiles. Nachshon (1973) suggested that research be performed incorporating evidence that the left cerebrum is not solely specialized for linguistic processing, but for analytical and sequential processing of both linguistic and nonlinguistic stimuli. For example, there exists a right ear advantage when musical stimuli (usually processed by the right cerebrum) are processed analytically (Bever and Chiarello, 1974). An experiment using linguistic, nonlinguistic, and analytic processes in groups of men ranging in hostility level was performed (Nachshon, 1988). Fifty-nine inmates were rated on the severity of their offenses (5 murderers, 23 violent, and 31 nonindexed offenders). These subjects underwent a dichotic listening paradigm and were presented with both verbal (digit) and analytically processed nonlinguistic (tonal) stimuli. Analytic processing was ensured by having the subjects compare four successively presented tones. As expected, the right ear (left cerebrum) was superior in digit identification relative to the left ear (right cerebrum). However, this advantage was significantly smaller for violent rather than nonindexed criminals. Nonviolent offenders also displayed a right ear advantage during the analytic test whereas violent offenders showed a left ear advantage. The researchers concluded that left cerebrum organization of violent offenders is different relative to their nonviolent counterparts.

Still, a right ear advantage is typically found for verbal stimuli. It is hypothesized that those with greater right relative to left cerebral activity would have an enhanced ability to intend to their left ear.

Rationale

As suggested by previous research, subjects with high hostility levels should have heightened right cerebrum activity to stress relative to low hostiles. Indeed, previous research suggested heightened behavioral and physiological reactivity to stressors, including the cold pressor test, among high-hostiles. It remains uncertain, however, whether stress produces greater activity levels among hostiles across both cerebrums or mainly within the right cerebrum. The dichotic listening paradigm is used to help determine whether high hostile subjects show greater overall or right cerebrum reactivity to stress relative to their low hostility counterparts.

This study was designed to replicate previous research supporting greater physiological reactivity among high hostile subjects. Hypotheses associating hostility level with both reactivity of facial valence and intensity to stress were tested. Last, hemispheric lateralization of cerebral activity in response to the cold pressor was tested.

Variables

The independent variable was self-reported hostility level (high or low).

Three dependent variables were used in this experiment. First, physiological indicators were SBP, DBP, and HR. Second, behavioral measures were subjects' valence and intensity of facial affect, as rated by "blind" researchers. Last, lateralization of brain activity was measured by ear advantages observed using a dichotic listening paradigm.

Hypotheses

Hypothesis 1: High hostile subjects will show greater physiological (SBP, DBP, HR) reactivity to stress than low hostile subjects.

Hypothesis 2: High hostile subjects will show greater reactivity of facial intensity and negative affective valence to stress than low hostile subjects.

Hypothesis 3: High hostile subjects will show an increased left ear advantage following stress than low hostile subjects indicating heightened right cerebral arousal.

Method

Subjects. Participants were right-handed males acquired from the undergraduate Psychology pool. Subjects must have self-reported no history of hearing aids, hearing problems (e.g. tubes in the ears or infections), major illness or head injury. Only males were used because it was essential to ensure as much homogeneity as possible within the experiment to draw conclusions based solely on independent variable differences. All subjects received course credit for their participation. All identifying materials collected from subjects were destroyed after data collection.

Subjects must have had no remarkable medical history to be eligible for inclusion in the experiment. Subjects with sufficient hemibody preference based on the Coren, Porac, &

Duncan laterality test, who additionally tested in both the top/bottom third on the Cook-Medley test were classified as high- or low-hostility level subjects, respectively.

Self-Report

During group testing, subjects first were required to read and sign an informed-consent form (Appendix A). A questionnaire assessing medical history (Appendix B) also was given. Subjects were then administered the Coren, Porac, and Duncan laterality test (Coren, Porac, & Duncan, 1979) (Appendix C) to determine hemibody preference. This self-report assessed right (-1) and left (+1) hemibody preference based on reported preferred use of either eye, ear, arm, and leg. Scores on the test range from a possible -13 to +13, indicating extreme left and right "handedness," respectively. A score of +5 was required for further participation in the experiment.

Subjects were then administered the Cook-Medley Hostility Scale (CMHS) (Cook & Medley, 1954) (Appendix D). The Cook-Medley is the most often used measure of hostility and shows validity as a predictor of medical, psychological, and interpersonal outcomes (Contrada & Jussim, 1992).

In addition, subjects were administered the Affect Intensity Measure (AIM) (Larson & Diener, 1981) (Appendix E) and the Affect Lability Scale (ALS) (Cocarro et al., 1991) (Appendix F).

Six administrations of group testing were held with a minimum of seven and a maximum of 24 subjects. Fifty subjects (twenty-five each) were classified as low- or high-hostile based on their answers on the Cook-Medley Hostility Scale and eligibility criteria.

Apparatus

The laboratory chamber was comprised of a chair facing a one-way mirror within a flat white curtain enclosure. Located in this chamber were the cold pressor and dichotic listening apparati. HR and BP assessment equipment were also located in this room. Video equipment was located in a separate sound-attenuated room.

Physiological. SBP, DBP, and HR was assessed using the Norelco Healthcare Electronic Digital Blood Pressure / Pulse Meter With Microphoneless Cuff (1985; Model HC3030). SBP and DBP were assessed using the oscillometric method. Accuracy of HR is reported to be within 2% or 1 beat per minute while BP is +/- 3 mm Hg of those auscultated (Norelco, 1985).

Video. A Panasonic WV-CD20 CCTV camera with a Panasonic WV-LA8B lens recorded the subjects' facial expressions during the experiment. The camera was located behind a one-way mirror in a sound attenuated adjacent chamber.

Hearing. Auditory acuity was assessed using the Qualitone Acoustic Appraiser (Model WR-C) and lightweight portable Qualitone TD-39 headphones.

Perceptual. A computer-synthesized audiotape, made by the Kresge Hearing Research Laboratory, of thirty pairs of concurrently voiced consonent vowels (CV) (ba, da, ga, ka, pa, ta) were played for each subject. This tape has been used as a dichotic listening device in numerous studies (e.g., Obrzut, et al., 1988). Stimuli were presented at about 75 dB by a Sony WM-F57 dual channel tape player using pioneer SE-30D(BK) headphones. The interstimulus interval was 6 seconds. The six CVs were printed as 2 cm black upper-case letters on a 96 X 144 cm index card displayed about .5 m in front of the subject.

Cold Pressor. The ice water for the CPT was maintained in a small ice cooler (Gott Corporation, model 1916/2) at 4 degrees Celsius. Water temperature was measured using a standard mercury thermometer (Fisher Scientific, model 14-985E).

Procedure

High and low hostility subjects were invited back for further participation in the experiment within a 1 month time period. Subjects entered the laboratory chamber and were requested to read and sign another informed-consent form (Appendix G). Auditory acuity was assessed by a pure-tone test using the Qualitone Acoustic Appraiser and lightweight portable Qualitone TD-39 headphones. To continue in the experiment, subjects had to correctly identify ten of twelve two-syllable words presented individually to each ear at 20 decibels.

Experiment 1 consisted of three (3) parts -- Prestress, Stress, and Poststress Phases.

Prestress Phase. Participants were fitted for BP and HR readings. The blood pressure monitor was strapped to each subject's right upper-arm. The researcher left the laboratory and gave the following instructions: "Please take about one minute to become accustomed to your surroundings. Please sit still in the chair and face forward towards the opening in the screen before you." The videotape concurrently recorded the subjects' facial expressions during the one minute baseline. Facial affect intensity was rated using a retrospective playback of the videotape by "blind" researchers using a five point likert scale (1 = no intensity; 3 = moderately intense; 5 = extremely intense) (Kring, Smith, & Neale, 1989). These researchers also assessed the valence of the subjects' facial expressions (positive or negative). Inter-rater reliability was assessed by correlating researcher ratings of the subjects' facial intensities and valences. Preliminary training of the raters was conducted with an overall criteria of reliability of .90 or above. Heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP) data was collected twice in succession at the end of the two minute baseline period. To determine the accurate reading, a third reading was taken if the first two readings differed by 6 beats per minute (HR) or 20 mm Hg for either SBP or DBP.

A brief training phase introduced the dichotic listening procedures. The experimenter read and pointed to each of the six phonemes on the index card and had the subject repeat each phoneme. Headphones were used for the auditory presentation of five phonemes. The subject was instructed to state the phoneme that they heard. The researcher provided corrective feedback. The subject had to correctly identify four of the five phonemes to continue participation.

Subjects were then told:

> You are about to hear thirty trials of syllables. You will hear a syllable in one ear and another syllable in the opposite ear, and it will sound like two people talking to you at the same time. Your job is to listen very carefully and point to the syllable on the chart that you hear most clearly.

After thirty trials, the experimenter gave the following instructions:

> You are about to hear thirty trials of words. You will hear a syllable in one ear and another syllable in the opposite ear, and it will sound like two people talking to you at the same time. Your job is to listen very carefully and point to the syllable on the chart that you hear in your <u>left</u> ear.

The experimenter tapped lightly on the left earphone to ensure that the subject understood the instructions. After thirty trials, the experimenter gave the following instructions:

> You are about to hear thirty trials of words. You will hear a syllable in one ear and another syllable in the opposite ear, and it will sound like two people talking to you at the same time. Your job is to listen very carefully and point to the syllable on the chart that you hear in your <u>right</u> ear.

The experimenter, as before, lightly tapped on the subject's right earphone to ensure his understanding of the instructions. All responses were recorded.

Stress Phase. Subjects were then given the following instructions:

> When you are instructed, please place your left hand in the water to a point about one inch above your wrist. You will be asked to keep your hand in the water for 45 seconds. Although this may be difficult, please try your hardest to keep your hand in the water until instructed to take it out. Do you have any questions? O.K., begin.

During the forty-five second cold pressor test, subjects' facial expressions were videorecorded for future analysis of valence and intensity, as previously described. After forty-five seconds, the subjects were asked to remove their hand from the water.

Poststress Phase. The subjects were then asked to "Please take about one minute to relax. Please sit still in your chair and face forward towards the opening in the screen in front of you." Facial expressions were videorecorded during the one minute relaxation period for future analysis of valence and intensity, as previously described. Subjects'

HR, SBP, and DBP were then assessed and recorded following the procedures in the Prestress Phase.

The dichotic listening procedure was performed according to the procedures outlined in the Prestress Phase and, again, using the separate condition (focus right, and focus left).

Both headphone position and directions to "focus left" and "focus right" were counterbalanced between subjects. The order of directions (focus left and focus right) were maintained within each subject (Baseline and Posttest Phases).

Subjects were then asked to answer a short self-report questionnaire (Appendix H) and were thoroughly debriefed.

Analyses

T-tests were conducted to assess differences between high- and low- hostility subjects on descriptive measures -- CMHS, AIM, ALS, and Coren, Porac, and Duncan's handedness questionnaire.

Multivariate analysis of variance (MANOVA) was performed on physiological variables (HR, SBP, DBP) to address reactivity to the cold pressor test: GROUP2 X (CONDITION2 X SUBJECT).

Independent ANOVAs assessed the reactivity of subjects' facial valence and intensity: GROUP2 X (CONDITION3 X SUBJECT).

For each subject, the Percentage of Correct responses (POC) index was calculated for hearing accuracy during the dichotic listening paradigm using the following formula:

$$POC = (pR - pL) / (pR + pL)$$

where:
pR = proportion of correctly identified right-ear stimuli
pL = proportion of correctly identified left-ear stimuli

The POC score ranges from +1 (perfect right ear advantage) to -1 (perfect left ear advantage). Independent ANOVAs were conducted on dichotic listening variables -- POC, and number of correctly identified stimuli presented to both the left and right ear: GROUP2 X (Condition2 X Focus3 X SUBJECT).

RESULTS

Descriptive Measures

To compare groups (low- and high-hostiles) on descriptive measures, t-tests were conducted on scores obtained on the Cook-Medley Hostility Scale, Affect Intensity Measure, Affect Lability Scale, and Coren, Porac, and Duncan's Laterality Questionnaire. Table 1 provides a summary of group means and standard deviations for each measure.

High-hostiles scored significantly higher on the CMHS (M = 31.56, SD = 2.97) than did low-hostiles (M = 14.88, SD = 3.7), $t(48) = 17.57$, $p < .05$. In addition, high-hostiles scored significantly lower on the ALS (M = 82.8, SD = 22.39) relative to their low-hostile counterparts (M = 107.04, SD = 31.39), $t(48) = 3.11$, $p < .05$.

On the Coren, Porac, and Duncan Laterality Questionnaire, high-hostiles (M = 8.2, SD = 2.83) did not have significantly different scores relative to low-hostiles (M = 9.32, SD = 2.81), $t(48) = 1.4$, $p > .05$. Low- (M = 133.72, SD = 11.18) and high-hostiles (M = 136.16, SD = 9.36) did not markedly differ on the AIM, $t(48) = .84$, $p > .05$.

Dichotic Listening

Independent analyses of variance (ANOVAs) were performed on three dependent variables obtained during the dichotic listening paradigm -- percent of correct responses (POC) score, number of correctly identified stimuli in the left ear, and number of correctly identified stimuli in the right ear. POC scores were first analyzed to help assess general trends of ear dominance. The number of syllables identified at each ear were then analyzed to more specifically test for altered cerebral arousal. Group means and standard deviations of POC scores are displayed on Table 2 and independent ANOVA results are depicted on Table 3. All pairwise comparisons were made using Tukey's Studentized Range Test (Winer, 1971) to control for experimentwise error rate.

Recall that POC scores were obtained by the calculation below:

$$POC = (pR - pL) / (pR + pL)$$

where:
pR = proportion of correctly identified right-ear stimuli
pL = proportion of correctly identified left-ear stimuli

The POC score ranges from +1 (perfect right ear advantage) to -1 (perfect left ear advantage).

For POC scores, a three-factor, mixed design analysis of variance (ANOVA) was performed with a fixed factor of group (low- and high-hostile) and the repeated measures of condition (pre- and post-stress) and focus (no focus, focus right, and focus left). The condition X focus interaction was significant, $\underline{F}(2,94) = 5.8$, $\underline{p} < .05$ (see Figure 1). A main effect of focus was also significant, $\underline{F}(2,96) = 18.76$, $\underline{p} < .05$. Specifically, all three mean POC scores for each focus were significantly different from each other. The group X condition interaction also approached significance, $\underline{F}(1,48) = 3.96$, $\underline{p} = .0524$, eta-square = .08 (see Figure 2). No other main or interaction effects neared statistical significance.

To analyze the number of stimuli correctly identified by the left ear (indicative of right cerebral activation), a three-factor, mixed design analysis of variance (ANOVA) was performed with a fixed factor of group and the repeated measures of condition and focus (see Table 3). Group means and standard deviations of left-ear syllable identification is presented on Table 4. One main and two interaction effects were significant. The main effect of focus was significant, $\underline{F}(2,96) = 17.48$, $\underline{p} < .05$. Specifically, the number of correctly identified stimuli by the left ear during each focus was significantly different relative to the number identified during the other two focus conditions. As seen on Figure 3, the group X condition interaction was also significant, $F(1,48) = 7.01$, $p < .05$, suggesting greater right-ear intention among high-hostiles after stress induction. In addition, the condition X focus interaction, $F(2,94) = 4.27$, $p < .05$ was significant (see Figure 4).

To analyze the number of stimuli correctly identified by the right ear (indicative of heightened left cerebral arousal), a three-factor, mixed design analysis of variance (ANOVA) was performed with a fixed factor of group and the repeated measures of condition and focus (see Table 3). Group means and standard deviations of right-ear syllable identification is presented on Table 5. Only a main effect of focus was statistically significant, $F(2,96) = 18.54$, $p < .05$. Specifically, the number of correctly identified stimuli by the right ear during each focus was significantly different relative to the number identified during the other two focus conditions. No other effects were significant.

Physiological

Group means and standard deviations of physiological measures (SBP, DBP, and HR) are displayed on Table 6. Independent analyses of variance (ANOVAs) were performed on the three physiological variables -- SBP, DBP, and HR.

Independent ANOVA results are depicted on Table 7. All pairwise comparisons were made using Tukey's Studentized Range Test.

For SBP, a two-factor, mixed design analysis of variance (ANOVA) was performed with a fixed factor of group (low- and high-hostile) and repeated measure of condition (pre- and post-stress). The main effect of condition was statistically significant, $F(1,48) = 43.94$, $p < .05$. That is, SBP was significantly higher during the poststress condition. In addition, the main effect of group approached significance, $F(1,48) = 3.43$, $p = .0703$, with high-hostiles having greater SBP.

To analyze DBP, a two-factor, mixed design analysis of variance (ANOVA) was performed with a fixed factor of group and repeated measure of condition (see Table 7). The main effect of condition was significant, $F(1,47) = 10.25$, $p < .05$, with subjects having greater DBP during the poststress condition.

A two-factor, mixed design analysis of variance (ANOVA) with a fixed factor of group and repeated measure of condition was conducted to analyze HR (see Table 7). The main effect of condition was found to be statistically significant, $F(1,47) = 8.86$, $p < .05$, with subjects having greater HR during the poststress condition. A group X condition interaction was additionally found significant, $F(1, 47) = 7.07$, $p < .05$ (see Figure 5).

Behavioral

Two research assistants were trained to code subjects' facial intensity (1 = no intensity, 3 = moderate intensity, and 5 = extreme intensity) and valence (1 = positive, 2 = negative) from videotape collected during experimentation. Pearson inter-rater correlation coefficients were .87 for intensity and .82 for valence. Group means and standard deviations of valence and intensity are displayed on Table 8. For the purpose of analysis, the research assistants' rating were averaged together such that:

$$\text{Facial Valence} = (\text{Rater 1 rating} + \text{Rater 2 rating}) \,/\, 2$$
$$\text{Facial Intensity} = (\text{Rater 1 rating} + \text{Rater 2 rating}) \,/\, 2$$

Independent ANOVA results are depicted on Table 9. All pairwise comparisons were made using Tukey's Studentized Range Test.

For facial intensity, a two-factor, mixed design analysis of variance (ANOVA) was performed with a fixed factor of group (low- and high-hostile) and repeated measure of condition (prestress, stress, and post-stress). The main effect of condition was statistically significant, $F(2,95) = 73.75$, $p < .05$. Specifically, facial intensity during the stress condition was significantly different than during the pre- and post-stress conditions.

A two-factor, mixed design analysis of variance (ANOVA) was performed with a fixed factor of group and repeated measure of condition for facial valence (see Table 9). No significant main or interaction effects were found.

Self-Report

At the completion of the experiment, subjects 1) indicated the intensity of the cold-pressor paradigm (1 = not intense, 3 = moderately intense, and 5 = extremely intense), and 2) whether they felt they were low- or high-hostile relative to other Virginia Tech undergraduates (see Appendix H). The latter variable was coded for accuracy (1 = accurate identification, 0 = inaccurate identification). Group means and standard deviations for these variables are found on Table 10.

Relative to low-hostiles (M = .88, SD = .332), high-hostiles (M = .20, SD = .408) were significantly less accurate when assessing their own hostility level, $t(48)$ = 6.46, $p < .05$. Low- (M = 2.72, SD = .792) and high-hostiles (M = 2.72, SD = 1.137) did not differ on self-reported intensity of the cold-pressor paradigm, $t(48)$ = .00, $p > .05$.

Discussion

The present research compared low- and high-hostile subjects from an undergraduate population on self-report, behavioral, physiological, and brain laterality measures. Relative to low-hostiles, high-hostiles scored significantly higher on the CMHS.

The dichotic listening paradigm was used in this research to assess cerebral asymmetry as a function of hostility, stress, and focus. A significant main effect of focus was found in all three dependent variables accrued using this paradigm -- POC score, and the number of syllables correctly identified by both the left and right ears. This is not surprising given the subjects changing instructions to intend to stimuli presented to a specific ear. Further analysis of these data, however, may suggest differential cerebral asymmetry between groups.

Data collected from the dichotic listening procedure supported the a priori hypothesis of greater right-cerebrum reactivity to stress among high-hostiles. For POC scores, the group X condition interaction approached significance. As seen on Figure 2, high-hostiles showed heightened left-ear dominance after stress relative to low-hostiles. This enhanced left-ear dominance, particularly after stress, may suggest heightened right-cerebral arousal among high-hostiles (Springer, 1986). The group X condition interaction on POC scores may not have reached significance for two reasons. First, this research may have used too few subjects, thereby reducing power. Second, nonsignificant differences between groups on right-ear syllable identification to stress may have reduced changes in POC scores.

The number of stimuli correctly identified by the left ear further indicated heightened right-cerebrum reactivity to stress among the high-hostile subjects. Analysis of this dependent variable yielded a strong group X condition interaction (see Figure 3). Because of the greater number of contralateral bifurcations in the auditory pathway, the number of identified stimuli presented to the left ear may have been the strongest indicator of right-cerebrum arousal used in this research. This data may, then, support the notion that high-hostiles show heightened right cerebral reactivity to stress relative to low-hostiles.

Excluding the aforementioned main effect of focus, no other significant effects were found when analyzing the number of correctly identified stimuli presented to the right ear. Specifically, both groups showed small, nonsignificant increases in the number of identified right-ear syllables after stress. This may suggest similar left cerebrum activity between groups. Nonsignificant left cerebral reactivity to stress may be cautiously inferred from these data. Furthermore, the similarity between groups on this right-ear measure likely reduced the statistical significance of the group X condition effect of POC scores.

Taken together, the dichotic listening data may support greater right cerebral reactivity to stress among high-hostiles. This may be supported by the group X condition effect of POC scores, especially given the deflation of the effects significance due to the similar right-ear syllable identification between groups. Furthermore, the strong group

X condition interaction of left-ear syllable identification may best indicate heightened right cerebral reactivity among high-hostiles. Evidence of heightened right cerebral arousal to stress was not obtained.

As previously discussed, physiological arousal may indicate heightened right cerebrum activity (Wittling, 1990; Herridge and Harrison, 1995). Data collected during this research on three physiological measures (HR, SBP, and DBP), in conjunction with other findings from this research, may suggest greater right-cerebrum arousal among high-hostiles.

As expected, significant main effects of condition were found on HR, SBP, and DBP. Specifically, subjects showed greater physiological arousal after stress. These data may reflect heightened brain activity, particularly within the right cerebrum, after stress. Enhanced strutiny of physiological data may yield more detailed conclusions supporting cerebral asymmetry differences between low- and high-hostile subjects.

The significant group X condition interaction on HR may support heightened right cerebral reactivity to stress among high-hostiles (see Figure 5). Unexpectedly, however, these data were not strengthened by the nonsignificant group X condition interaction effects for SBP and DBP. This nonsignificance may partially result from the law of initial values (LIV) (Wilder, 1931, 1957), with high-hostile subjects showing reduced reactivity due to higher initial values

(Furedy and Scher, 1989). Taken together, these findings may subtly suggest heightened physiological reactivity among high-hostiles. Using previous research positively relating right-cerebrum arousal and physiological reactivity, these data may further suggest heightened right cerebral reactivity to stress.

A positive relationship between right-cerebrum arousal and cardiovascular activity is seen in this research. Furthermore, data suggest enhanced right cerebral reactivity to stress among high-hostiles. This may help explain the robust link between hostility and cardiovascular disease (Kubany et al., 1994; Treiber et al., 1989; Lee and Cameron, 1987). That is, high-hostiles may react to stressors with heightened right cerebral arousal, perhaps inducing greater physiological lability and cardiovascular disease.

Because HR data was only collected during pre- and post-stress conditions, the group X condition interaction may be attributable to greater physiological perseveration, rather than reactivity, among high-hostiles. This interpretation, too, is consistent with previous hostility research (Herridge and Harrison, 1994; Ernst et al., 1990). Future research may benefit from physiological data collection during stress induction, as well.

Facial valence was a central dependent variable used to indicate cerebral asymmetry. Heightened negative affect was expected during stress from high- relative to low-hostiles.

The group X condition interaction of facial valence was not significant, however. This behavioral data clearly does not support the a priori hypothesis of heightened right cerebral arousal among high-hostiles. It does, however, replicate previous research supporting the notion that spontaneous negative affect may not be mediated by the right cerebrum (Moscovitch & Olds, 1982; Ekman, Hager, & Friesen, 1981).

The main effect of condition on facial intensity was expected. Subjects showed greater intensity during the stress condition relative to prestress and poststress periods. While no interaction effects were found, this adds to mounting evidence that stress produces greater arousal in the brain.

The collected data strongly suggest heightened brain activity from stress. Indeed, main effects of condition were significant for SBP, DBP, HR, and facial intensity. Each of these findings replicate previous research using stress paradigms (Julius and Karunas, 1989; Siegman et al., 1992; Weidner et al., 1989). This increased arousal, as well as nonsignificant changes of right-ear syllable identification after stress, may promote the inference that high-hostiles have heightened right-cerebrum activity rather than reduced arousal of the left cerebrum, particularly after stress. This research does not support the hypothesis of left cerebrum dysfunction among high-hostiles (Krynicki, 1978). It does, on the other hand, provide evidence for heightened right cerebral arousal (Kolb and Wishaw, 1990; Everhart, Demaree and Harrison, 1995).

Experimental findings must not be generalized outside of the research population, however. Subjects showed no signs of major illness, head trauma, or neurological impairment. One must not conclude that left cerebrum dysfunction can not produce heightened hostility. This may occur.

This study has uncovered data consistent with the proposed hypotheses. High-hostiles had a consistent left-ear bias after stress when compared to their low-hostile counterparts. Further, both groups showed heightened physiological arousal after stress, and high-hostiles had statistically greater HR reactivity to the cold-pressor. Taken together, these data suggest that cerebral reactivity to stress among high-hostiles may be primarily centered in the right-cerebrum.

High-hostiles were significantly less accurate when identifying their own hostility level. This data, consistent with poor self-awareness, is perhaps attributable to right parietal dysfunction (Kolb and Wishaw, 1990). The parietal lobe is located superior, but proximal, to the amygdaloid bodies purportedly responsible for increased aggression. Poor self-awareness, perhaps from right parietal overactivation, may be an interesting correlate (and perhaps causal agent) of heightened hostility. This self-report data must be evaluated extremely critically as subject response may be affected by self-presentation bias.

While results of this experiment were interesting, use of paradigms more sensitive to brain lateralization may be used to enhance the probability of obtaining more furtive, statistically significant data. Because of the relatively large number of ipsilateral bifurcations associated with audition, dichotic listening may conservatively reflect hemispheric differences of cerebral activity. Indeed, it is possible that the trend of dichotic listening data obtained in this experiment may actually suggest greater brain asymmetry differences between groups. Tachistoscope and quantitative electroencephelography (QEEG) paradigms, in part because of their relatively noninvasive procedures, may be better indicators for experiments with similar dependent variables.

To strengthen results from this experiment, additional research perhaps using the aforementioned paradigms is recommended. More furtive data supporting a group by condition interaction on cerebral activity may yield dual benefits. First, like Yeudall (1977), greater right-hemisphere reactivity to stress may help indicate a greater likelihood of hostile behavior. Second, since biofeedback has been found effective to control brain activity (Tyson, 1987; Mathew, Mishra, and Kumaraiah, 1987; De Pascalis and Silveri, 1986), therapy to promote decreased right-cerebrum activity may assist individuals with hostility problems.

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Table 1: Means and Standard Deviations for CMHS, AIM, ALS, and CPD.

	Low-Hostile		High-Hostile	
Questionnaire	MEAN	SD	MEAN	SD
CMHS	14.88	3.70	31.56	2.97
AIM	133.72	11.18	136.16	9.36
ALS	107.04	31.93	82.80	22.39
CPD	9.32	2.81	8.20	2.83

Table 2. Means and SD of POC Scores by Group, Condition, and Focus.

	Low-Hostile		High-Hostile	
	Mean	SD	Mean	SD
Pre-Stress				
No Focus	.094	.185	.067	.276
Focus Left	.016	.346	-.055	.346
Focus Right	.204	.292	.276	.295
Post-Stress				
No Focus	.155	.300	.108	.379
Focus Left	-.003	.381	-.140	.341
Focus Right	.305	.265	.257	0.37

Table 3. Independent ANOVA Results for POC Scores, and Number of Correctly Identified Syllables Presented to the Left and Right Ears.

Source	df	SS	MS	F	p
POC Scores					
Group	(1,48)	.1376	.1376	.45	<.5066
Cond	(1,48)	.0135	.0135	.61	<.4393
GroupXCond	(1,48)	.0879	.0879	3.96	<.0524
Focus	(2,96)	4.6825	2.3412	18.76	<.0001**
GroupXFocus	(2,96)	.1674	.0837	.67	<.5138
CondXFocus	(2,94)	.1608	.0804	5.80	<.0042**
GrpXCdXFoc	(2,94)	.0306	.0153	1.10	<.3355
Left Ear					
Group	(1,48)	13.6533	13.6533	.26	<.6114
Cond	(1,48)	.0133	.0133	.00	<.9533
GroupXCond	(1,48)	27.0000	27.0000	7.01	<.0110*
Focus	(2,96)	722.0067	361.0033	17.48	<.0001**
GroupXFocus	(2,94)	14.6867	7.34	0.36	<.7017
CondXFocus	(2,94)	26.4467	13.2233	4.27	< .0168*
GrpXCdXFoc	(2,94)	5.5800	2.7900	.90	<.4097
Right Ear					
Group	(1,48)	44.5833	44.5833	.86	< .3583
Cond	(1,48)	7.0533	7.0533	1.42	< .2388
GroupXCond	(1,48)	6.4533	6.4533	1.30	<.2595
Focus	(2,96)	865.6067	432.8033	18.54	<.0001**
GroupXFocus	(2,96)	43.7267	21.8633	.94	<.3955
CondXFocus	(2,94)	23.6867	11.8434	3.76	<.0342*
GrpXCdXFoc	(2,94)	2.0533	1.03	.79	<.6328

* $p < .05$ ** $p < .01$

Table 4. Means and Standard Deviations of Stimuli Identified by Left Ear by Group, Condition, and Focus.

	Low-Hostile		High-Hostile	
	Mean	SD	Mean	SD
Pre-Stress				
No Focus	11.24	2.55	11.48	3.63
Focus Left	12.44	4.49	12.72	4.52
Focus Right	9.88	3.56	8.84	3.46
Post-Stress				
No Focus	10.48	3.78	11.20	4.87
Focus Left	12.60	5.04	14.20	5.16
Focus Right	8.64	3.09	9.40	4.79

Table 5. Means and Standard Deviations of Stimuli Idenfied by Right Ear by Group, Condition, and Focus.

	Low-Hostile		High-Hostile	
	Mean	SD	Mean	SD
Pre-Stress				
No Focus	13.98	3.40	13.45	4.43
Focus Left	12.70	4.67	10.60	3.99
Focus Right	15.85	4.21	15.86	4.57
Post-Stress				
No Focus	14.02	3.52	13.59	4.37
Focus Left	12.36	4.67	11.12	4.11
Focus Right	16.04	4.39	15.94	4.65

Table 6. Means and SD of Physiological Variables by Group and Condition.

	Low-Hostile		High-Hostile	
	Mean	SD	Mean	SD
Pre-Stress				
SBP	123.56	7.05	127.48	8.78
DBP	78.20	9.37	77.96	13.30
HR	68.04	8.13	69.08	9.69
Post-Stress				
SBP	131.04	9.86	135.80	10.96
DBP	82.64	13.10	85.52	17.10
HR	68.40	10.42	78.48	12.23

Table7. Independent ANOVA Results for Physiological Measures.

Source	df	SS	MS	F	p
SBP					
Group	(1,48)	470.89	470.89	3.43	<.0703
Cond	(1,47)	1560.25	1560.25	43.94	< .0001**
GroupXCond	(1,47)	4.41	4.41	.12	<.7261
DBP					
Group	(1,48)	43.56	43.56	.16	<.6918
Cond	(1,47)	900.00	900.00	10.25	<.0024**
GroupXCond	(1,47)	228.01	228.01	7.07	<.4093
HR					
Group	(1,48)	412.09	412.09	2.32	<.1341
Cond	(1,47)	285.61	285.61	8.86	<.0046**
GroupXCond	(1,47)	228.01	228.01	7.07	<.0107*

** $p < .01$ * $p < .05$

Table 8. Means and SD of Facial Expression Variables by Group and Condition.

	Low-Hostile		High-Hostile	
	Mean	SD	Mean	SD
Facial Valence				
Prestress	1.80	.382	1.80	.323
Stress	1.84	.314	1.92	.187
Poststress	1.90	.250	1.86	.307
Facial Intensity				
Prestress	1.40	.456	1.38	.415
Stress	2.46	.889	2.34	.932
Poststress	1.24	.357	1.44	.464

Note. For Facial Valence. 1=positive, 2=negative.
For Facial Intensity, ratings are based on a five-point likert scale.

Table 9. Independent ANOVA Results for Facial Valence and Intensity.

Source	df	SS	MS	F	p
Facial Val.					
Group	(1,48)	.0067	.0067	.05	<.8245
Cond	(2,95)	.2133	.1067	1.58	<.2107
GroupXCond	(2,95)	.0933	.0467	.69	<.5028
Facial Int.					
Group	(1,48)	.0150	.0150	.02	<.8851
Cond	(2,95)	35.77	17.885	73.75	<.0001**
GroupXCond	(1,47)	.67	.335	1.38	<.2562

** $p < .01$

Table 10. Means and SD of Self-Reported Stress of Cold-Pressor and Accuracy of Group Identification.

	Low-Hostile		High-Hostile	
	Mean	SD	Mean	SD
Reported Stress	2.72	.792	2.72	1.137
Group Accuracy	.88	.332	.20	.082

Note. For reported stress, ratings are based on five-point likert scale.
For group accuracy, means represent percentage of accurate responses / 100.

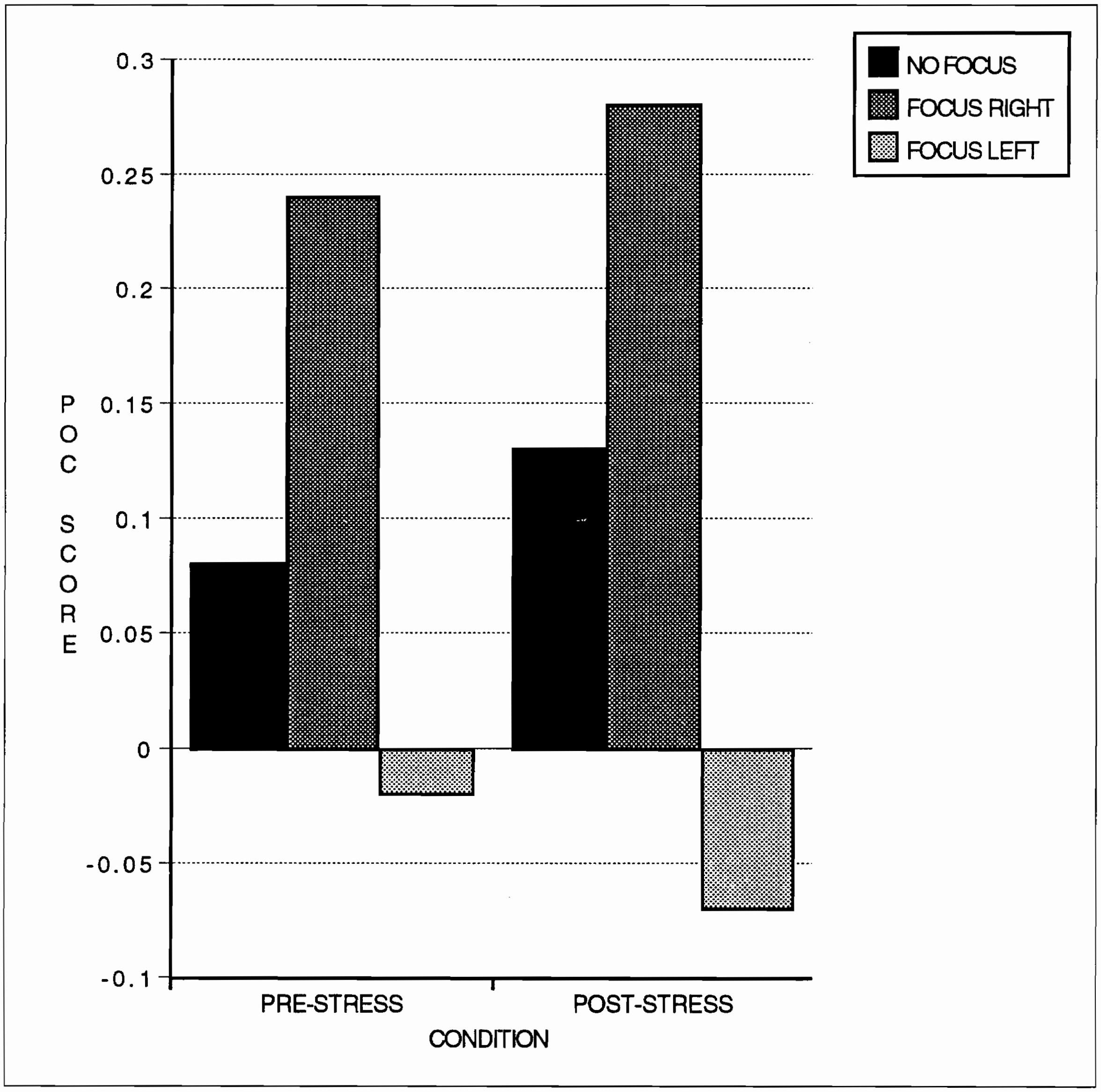

Figure 1. POC Score X Condition X Focus.

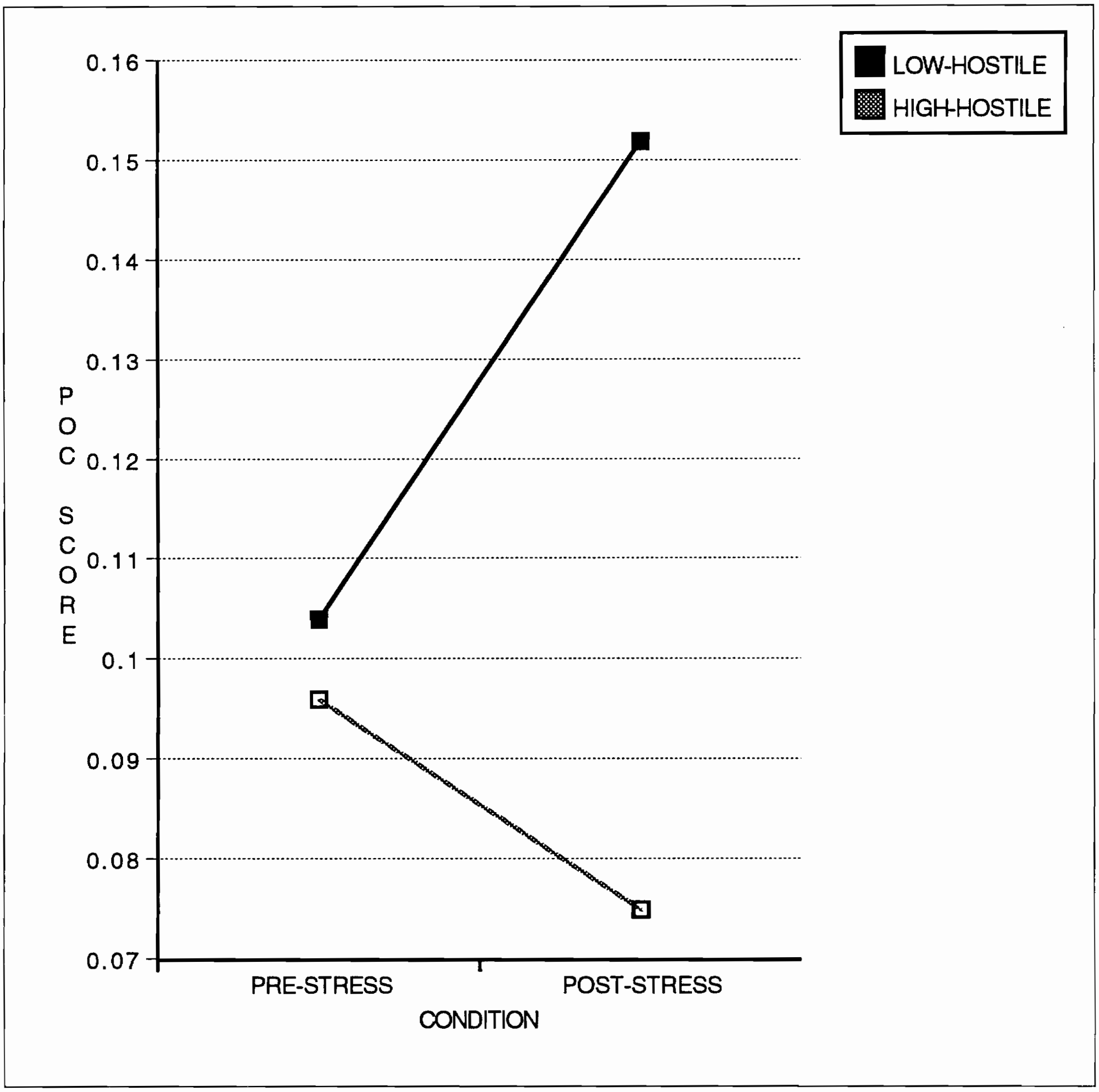

Figure 2. POC Score X Group X Condition.

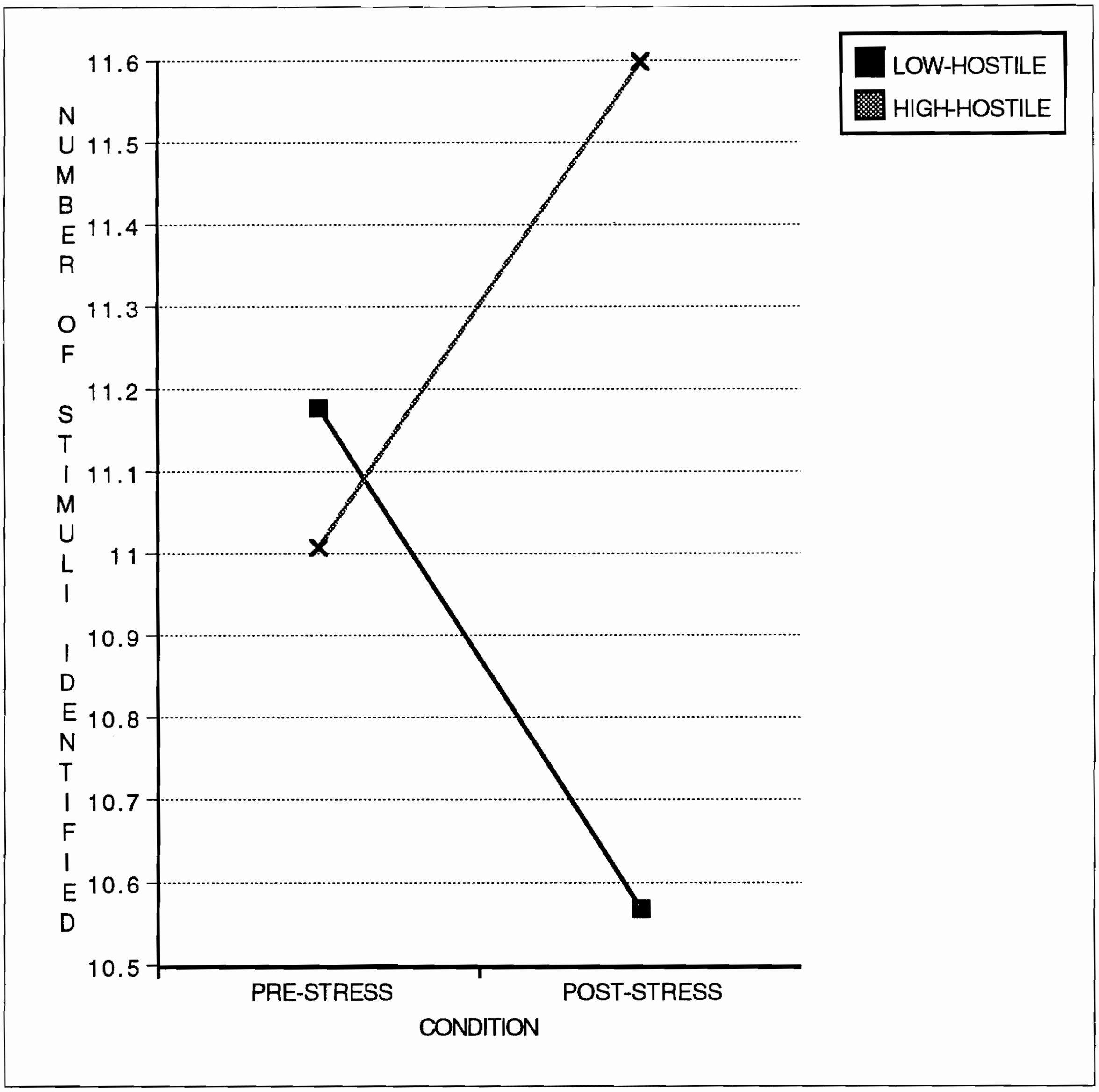

Figure 3. Number of Stimuli Identified by Left Ear X Group X Condition.

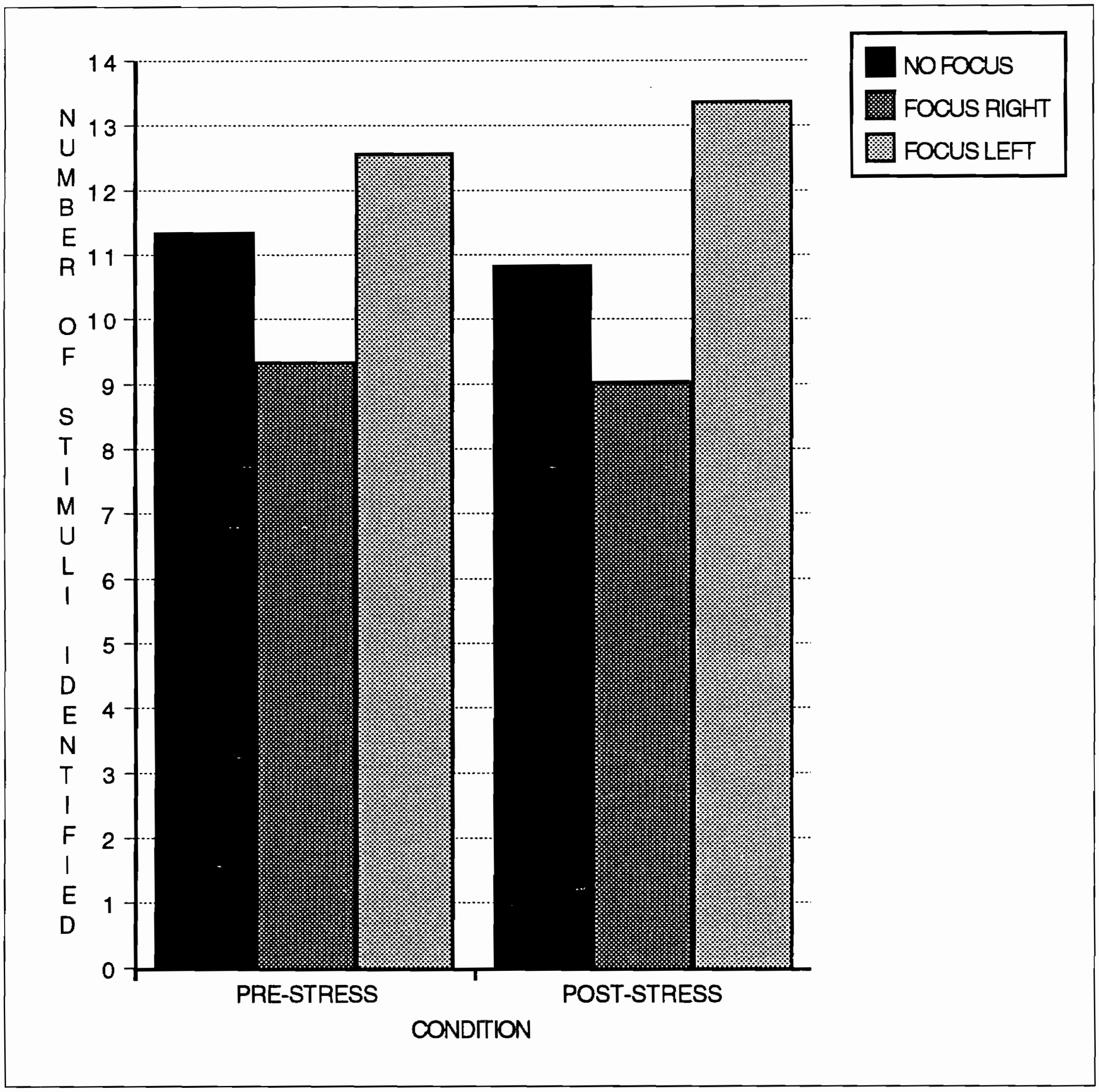

Figure 4. Number of Stimuli Identified by Left Ear X Condition X Focus.

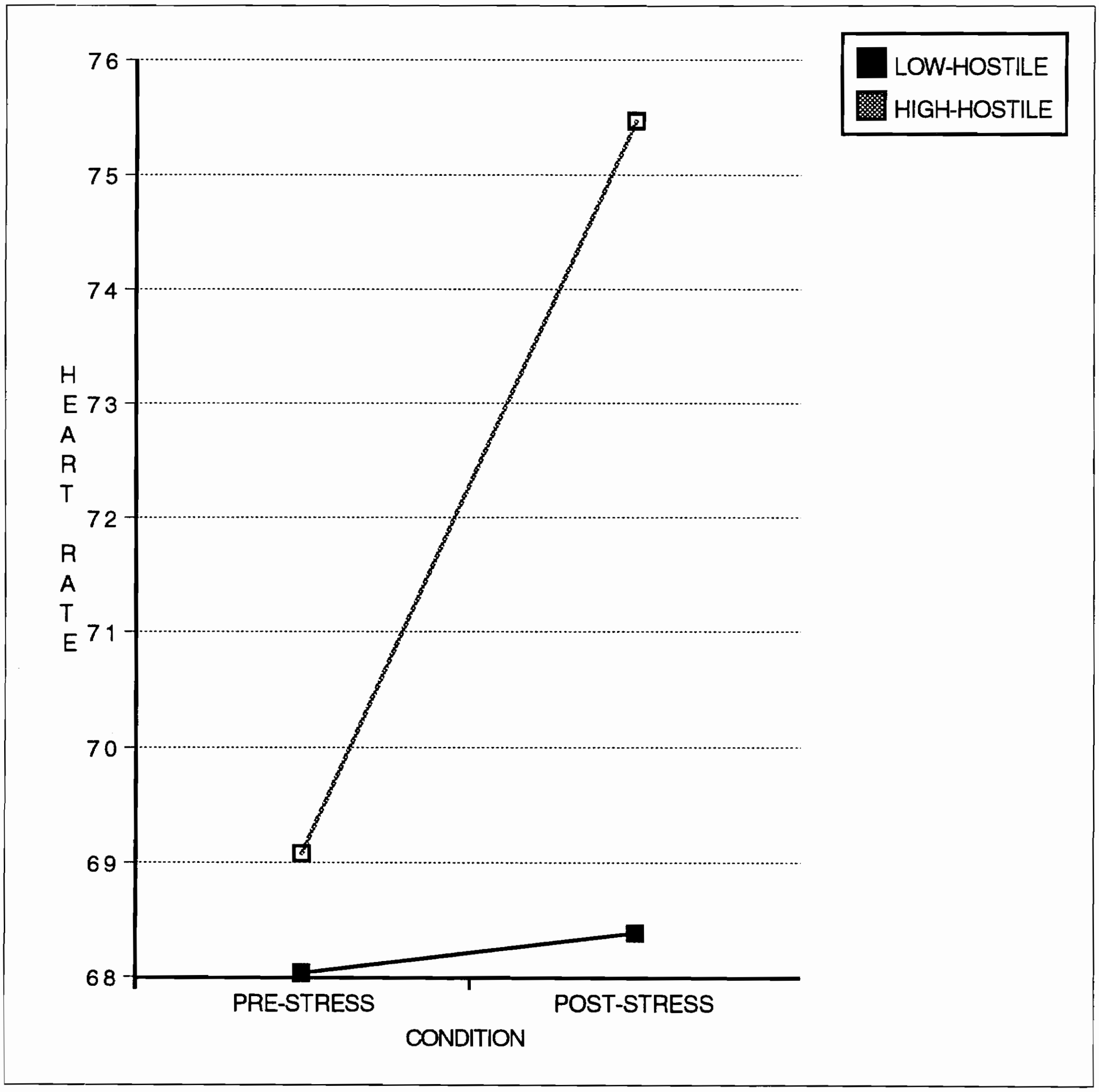

Figure 5. Heart Rate X Group X Condition.

Appendix A

INFORMED CONSENT FOR PARTICIPANTS OF INVESTIGATIVE PROJECTS

Title of Project: Behavioral, Physiological and Neuropsychologcal Correlates of the Cold Pressor Test.

Experiment Number: 1032-94

1. PURPOSE OF EXPERIMENT

You are invited to participate in a study to obtain data on measures purportedly associated with stress.

2. PROCEDURE TO BE FOLLOWED IN THE STUDY

To accomplish the goals of this study, you will be asked to complete five questionnaires. Later, you may be called by telephone and asked to participate further in this research.

3. ANONYMITY OF SUBJECTS AND CONFIDENTIALITY OF RESULTS

Identifying information will be kept strictly confidential. At no time will the researchers release your personal information from the study to anyone other than individuals working on the project without your written consent. The information you provide will have your name removed and only a subject number will identify you during analyses and any written reports of the research.

4. DISCOMFORTS AND RISKS FROM PARTICIPATING IN THE STUDY

You may feel some embarrassment from answering the questionnaires. You may omit any questions that you feel embarrassing. If, after you have left the experiment, you have any problems associated with this study please call Dr. David W. Harrison, Ph.D. (231-4422) so that he may assist you directly or direct you to appropriate services.

5. EXPECTED BENEFITS

Your participation in the project will help determine scores that may identify normal individuals as having relatively high or low levels of hostility for future research.

No guarantee of benefits has been made to encourage you to participate.

6. FREEDOM TO WITHDRAW

You are free to withdraw from this study at any time without penalty. If you choose to withdraw, you will not be penalized by reduction in points or grade for Psychology 2004. There are alternative choices for receiving extra credit for your course.

7. EXTRA CREDIT COMPENSATION

For participation in this study you will receive one point extra credit for Psychology 2004.

8. USE OF RESEARCH DATA

The information from this research may be used for scientific or educational purposes. It may be presented at scientific meetings and/or published and reproduced in professional journals or books, or used for any other purpose that Virginia Tech's Department of Psychology considers proper in the interest of education, knowledge, or research.

9. APPROVAL OF RESEARCH

This project has been approved by the Human Subjects Committee of the Department of Psychology and by the Institutional Review Board of Virginia Tech.

10. SUBJECT'S PERMISSION

I have read and understand the above description of the study. I have had an opportunity to ask questions and have had them all answered. I hereby acknowledge the above and give my voluntary consent for participation in this study.

I further understand that if I participate I may withdraw at any time without penalty.

I understand that if I have any questions regarding this research and its conduct, I should contact any of the persons named below.

Heath A. Demaree Primary Researcher	231-6914 Phone
David W. Harrison, Ph.D. Faculty Advisor	231-4422 Phone
Richard M. Eisler, Ph.D. Chair, HSC	231-7001 Phone
Ernest R. Stout Chair, IRB	231-9359 Phone

Subject's Signature:__________________________ Date:________

Subject's ID:____________________ Subject's Telephone #:__________________

Appendix B

Medical History Questionnaire

NAME:______________________________ I.D. #:______________________

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 "Yes" answers below.

1. Severe head trauma/injury	Yes	No
2. Stroke	Yes	No
3. Learning disabilities (problems with reading, writing, or comprehension)	Yes	No
4. Epilepsy or seizures	Yes	No
5. Paralysis	Yes	No
6. Neurological surgery	Yes	No
7. Other neurological/nervous system problems	Yes	No
8. Alcohol or drug problems	Yes	No
9. Using alcohol or drugs (other than for prescribed purposes) at present	Yes	No
10. Past psychological/psychiatric problems	Yes	No
11. Are you currently taking any prescription medications/drugs?	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. Hearing problems	Yes	No

Please explain "Yes" responses:

____

____

____.

Appendix C

Handedness Questionnaire

Subject #:__________

Circle the appropriate number after each item.

	Right	Left	Both
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 wanted to pick up a pebble with your toes, which foot would you use?	1	-1	0
If you had to step up onto 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	0
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 their chest?	1	-1	0
Into which ear would you place the earphone of a transistor radio?	1	-1	0

# of Right + # of Left = Total Score

_______ + _______ = _______

Is mother left or right hand dominant?_______

Is father left or right hand dominant? _______

Appendix B

Directions: If a statment 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 have often had to take orders from someone who did not know as much a 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 would 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 to lose it.	T	F
11.	I commonly wonder what hidden reason another person may have for doing 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 beggers.	T	F
15.	Some of my family have habits that bother and annoy 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 he can get in this world.	T	F

19.	No one cares much what happens to you.	T	F
20.	I can be friendly with people who do things which 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 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 saying or doing 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 ask people for advice.	T	F
33.	I am not easily angered.	T	F
34.	I have often met people who were supposed to be experts who were no better than I.	T	F
35.	I would certainly enjoy beating a crook at his own game.	T	F
36.	It makes me think of failure when I hear of the success of someone I know well.	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 that 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 had 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 about 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 credit for good work but are able to pass off mistakes onto 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 already made up on a subject. T F

49. Sometimes I am sure that other people can tell what I am thinkng. T F

50. A large number of people are guilty of bad sexual conduct. T F

A. I. M.

Appendix E

DIRECTIONS: The following questions refer to emotional reactions to typical life events. Please indicate how YOU react to these events by filling in the appropriate number on your answer sheet, using the following scale

Never	Almost Never	Occasion-ally	Almost Always	Always
1	2	3	4	5

Please base your answers on how YOU react, NOT on how you think others react or how you think a person should react.

165. When I accomplish something difficult I feel delighted or elated.
166. When I feel happy it is a strong type of exuberance
167. I enjoy being with other people very much
168. I feel pretty bad when I tell a lie.
169. When I solve a small personal problem, I feel euphoric.
170. My emotions tend to be more intense than those of most people.
171. My happy moods are so strong that I feel like I'm in heaven
172. I get overly enthusiastic.
173 If I complete a task I thought was impossible, I am ecstatic.
174. My heart races at the anticipation of some exciting event.
175. Sad movies deeply touch me.
176. When I'm happy it's a feeling of being untroubled and content rather than being zestful and aroused.
177 When I talk in front of a group for the first time my voice gets shaky and my heart races.
178 When something good happens, I am usually more jubilant than others.
179. My friends might say I'm emotional.
180. The memories I like the most are those times I felt content and peaceful rather zestful and enthusiastic.
181. The sights of someone who is hurt badly affects me strongly.
182. When I'm feeling well it's easy for me to go from being in a good mood to being really joyful.
183. "Calm and cool" could easily describe me.
184. When I'm happy I feel like I'm bursting with joy.
185. Seeing a picture of some violent car accident in a newspaper makes me feel sick to my stomach.
186. When I'm happy I feel energetic.
187. When I receive an award I become overjoyed.
188. When I succeed at something, my reaction is calm contentment.
189. When I do something wrong I have strong feelings of shame and guilt.
190. I can remain calm even on the most trying days.
191. When things are going good I feel "on top of the world"
192. When I get angry it's easy for me to still be rational and not overreact.

Never	Almost Never	Occasion-ally	Almost Always	Always
1	2	3	4	5

193. When I know I have done something very well, I feel relaxed and content rather than excited and elated.
194. When I do feel anxiety it is normally very strong.
195. My negative moods are mild in intensity.
196. When I am excited over something I want to share with everyone.
197. When I feel happiness, it is a quiet type of contentment.
198. My friends would probably say I'm a tense or "high - strung " person.
199. When I'm happy I bubble over with energy.
200. When I feel guilty, this emotion is quite strong.

CONTINUE ON ANSWER SHEET 2.

---

1. I would characterize my happy moods as closer to contentment than to joy.
2. When someone compliments me, I get so happy I could "burst".
3. When I am nervous I get shaky all over.
4. When I am happy the feeling is more like contentment and inner calm than one of exhilaration and excitement.

Appendix F

Instructions: This questionnaire is designed to find out about people's moods. Using the scale below, select the letter that best describes how descriptive each item is of you.

Very characteristic of me, extremely descriptive	Rather characteristic of me, quite descriptive	Rather uncharacteristic of me, quite undescriptive	Very uncharacteristic of me, extremely undescriptive
A	B	C	D

For each item, circle only one answer.

1. My sleeping patterns shift from times when I sleep perfectly well to times when I have insomnia and can't sleep well at all.

   A B C D

2. There are times when I feel very restless and then shortly afterwards I will not feel very restless at all.

   A B C D

3. There are times when I am so nervous that I feel light-headed and/or dizzy and then soon afterwards I feel so sad that I have difficulty getting motivated to do anything.

   A B C D

4. I frequently shift back and forth between worrying more than other people and not worrying much more than anyone else.

   A B C D

5. At times I feel just as relaxed as everyone else and then within minutes I become so nervous that I feel light-headed and dizzy.

   A B C D

6. There are times when I get very involved in activities which I later regret and which I quickly lose interest in.

   A B C D

7. I switch back and forth between being more talkative than usual and having only a normal amount of interest in talking.

   A B C D

Very characteristic of me, extremely descriptive	Rather characteristic of me, quite descriptive	Rather uncharacteristic of me, quite undescriptive	Very uncharacteristic of me, extremely undescriptive
A	B	C	D

8. There are times when I have very little energy and then soon afterwards I have about the same energy level as most people.

A B C D

9. I find that my enjoyment in my daily activities frequently changes from times when I enjoy these daily activities to other times when I couldn't care less about these activities.

A B C D

10. There are times when all I can think about is how worthless I am and then very soon afterwards all I can think about are the things that I am worried about.

A B C D

11. My sleeping habits frequently shift from times when I could sleep all day long to times when I do not have much of a need to sleep at all.

A B C D

12. One minute I can be feeling O.K. and the next minute I'm tense, jittery and nervous.

A B C D

13. Sometimes I feel guilty about things and then they suddenly stop bothering me.

A B C D

14. I frequently switch from being able to control my temper very well to not being able to control it very well at all.

A B C D

15. It's very common for me to be extremely angry about something and then to suddenly feel like my normal self.

A B C D

16. Many times I feel very nervous and tense and then I suddenly feel very sad and down.

A B C D

Very characteristic of me, extremely descriptive	Rather characteristic of me, quite descriptive	Rather uncharacteristic of me, quite undescriptive	Very uncharacteristic of me, extremely undescriptive
A	B	C	D

17. Sometimes I go from feeling extremely anxious about something to feeling very down about it.

    A B C D

18. My mood shifts rapidly from times when I feel about average to times when I could laugh and joke all day long.

    A B C D

19. There are times when I feel moderately optimistic about the future and then shortly afterwards I feel quite pessimistic about the future and what it will bring.

    A B C D

20. I shift back and forth from feeling perfectly calm to feeling uptight and nervous.

    A B C D

21. There are times when I feel perfectly calm one minute and then the next minute the least little thing makes me furious.

    A B C D

22. I shift back and forth between feeing depressed and "down in the dumps" to feeling "on edge" and irritable.

    A B C D

23. Frequently, I will be feeling O.K. but then I suddenly get so mad that I could hit something.

    A B C D

24. I switch back and forth between having a great deal of interest in sexual activities and having very little or no interest in sex.

    A B C D

25. Sometimes I can think clearly and concentrate well one minute and then the next minute I have a great deal of difficulty concentrating and thinking clearly.

    A B C D

Very characteristic of me, extremely descriptive	Rather characteristic of me, quite descriptive	Rather uncharacteristic of me, quite undescriptive	Very uncharacteristic of me, extremely undescriptive
A	B	C	D

26. I switch back and forth between being able to sleep perfectly well and being so nervous that I can hardly sleep at all.

    A B C D

27. I switch back and forth from wanting to be with lots of people to wanting to socialize to the same degree as most other people.

    A B C D

28. There are times when I have felt "on edge" and irritable and other times shortly afterwards when I have felt comfortable and relaxed.

    A B C D

29. Sometimes I feel depressed one minute and then I shift to feeling elated the next minute.

    A B C D

30. There are times when I feel extremely worthless and then suddenly I will start feeling wonderful about myself and my accomplishments.

    A B C D

31. Sometimes I find myself feeling perfectly O.K. one minute and then the next minute I'll be crying.

    A B C D

32. My level of optimism shifts frequently from times when I am extremely optimistic to times when I have about the same level of optimism as everyone else.

    A B C D

33. There are times when I am so mad that I can barely stop yelling and other times shortly afterwards when I wouldn't think of yelling at all.

    A B C D

34. I switch back and forth between being extremely energetic and having so little energy that it's a huge effort just to get where I'm going.

    A B C D

Very characteristic of me, extremely descriptive	Rather characteristic of me, quite descriptive	Rather uncharacteristic of me, quite undescriptive	Very uncharacteristic of me, extremely undescriptive
A	B	C	D

35. My mood frequently shifts from feeling O.K. to feeling extremely happy and "on top of the world".

    A B C D

36. There are times when I feel absolutely wonderful about myself but soon afterwards I often feel that I am just about the same as everyone else.

    A B C D

37. I shift back and forth between worrying about many things and having very little interest in almost anything.

    A B C D

38. Sometimes I feel so sad that all I want to do is sleep but then soon afterwards I might feel so nervous that I can hardly sleep at all.

    A B C D

39. My productivity level frequently shifts from times when I am no more productive than anyone else to times when I feel extremely productive.

    A B C D

40. My appetite frequently changes from times when it's either increased or decreased to times when it's perfectly normal.

    A B C D

41. There are times when I'm so mad that my heart starts pounding and/or I start shaking and then shortly afterwards I feel quite relaxed.

    A B C D

42. I shift back and forth between being very unproductive and being just as productive as everyone else.

    A B C D

43. Sometimes I feel extremely energetic one minute and then the next minute I might have so little energy that I can barely do a thing.

    A B C D

Very characteristic of me, extremely descriptive	Rather characteristic of me, quite descriptive	Rather uncharacteristic of me, quite undescriptive	Very uncharacteristic of me, extremely undescriptive
A	B	C	D

44. I switch back and forth between feeling perfectly calm and feeling some or all of the following: my heart pounding or racing, an upset stomach, or difficulty breathing.

A B C D

45. There are times when I have more energy than usual and more than most people and then soon afterwards I have about the same energy level as everyone else.

A B C D

46. At times I feel that I'm doing everything at a very slow pace but then soon afterwards I feel that I'm no more slowed down than anyone else.

A B C D

47. I switch back and forth between thinking unusually clearly and very creatively to thinking no more creatively and clearly than anyone else.

A B C D

48. My sleeping patterns frequently shift from times when I have difficulty falling asleep to times when I don't have much of a desire to sleep at all.

A B C D

49. At times I have difficulty thinking or concentrating but then soon afterwards I think a lot about all of the things that I'm worried about.

A B C D

50. There have been many times when I've been so mad that I "snap" at people all day long but then soon afterwards I have a lot more tolerance for people.

A B C D

51. There are times when I love being with lots of people but then soon afterwards I prefer to be alone and not see anyone.

A B C D

Very characteristic of me, extremely descriptive	Rather characteristic of me, quite descriptive	Rather uncharacteristic of me, quite undescriptive	Very uncharacteristic of me, extremely undescriptive
A	B	C	D

52. My level of interest in sex seems to change frequently and quickly; I'll have a great deal of interest in sex one minute and then the next minute my level of sexual interest is about the same as everyone else's.

A B C D

53. I switch back and forth between hardly needing much sleep at all and requiring about the same amount of sleep as most people.

A B C D

54. My preference for social activity shifts back and forth between times when I enjoy other people and times when I'd prefer to be by myself and not see anyone.

A B C D

Appendix G

INFORMED CONSENT FOR PARTICIPANTS OF INVESTIGATIVE PROJECTS

Title of Project: Behavioral, Physiological and Neuropsychological Correlates of the Cold Pressor Test

Experiment Number: 1032-94

1. PURPOSE OF EXPERIMENT

You are invited to participate in a study about the effects of stress. This research attempts to determine the effects of hostility on physiological, expressive (facial expression), and brain-related reactivity to response to the cold pressor task.

The listening part of this study helps assess the activity level of the right and left sides of your brain. This research is designed to assess how the cold pressor test may affect the brain's activity level.

2. PROCEDURE TO BE FOLLOWED IN THE STUDY

You will be asked to wear a pair of headphones and identify when you hear a tone. This will help the researchers assess your hearing ability.

You will also be asked to undergo a stress condition called the cold pressor test. During this task, you will be asked to keep your hand in ice water for 45 seconds. The cold pressor paradigm is the primary method used to assess cardiovascular reactivity and has been a component in over 1000 research articles. It is the most widely accepted method to induce cardiovascular changes in humans.

You will be hooked up to heart rate and blood pressure equipment to be monitored and recorded before and after the cold pressor test. This will help determine physiological reactivity to the cold pressor test.

Your face and facial expression will be intermittently videotaped throughout the procedure. You will not be informed when videotaping occurs. All videotape material will be kept in Derring 5076 D and will be destoyed no later then September 1, 1995.

Before and after the cold pressor test, you will be required to wear headphones and identify words that are presented to you. Again, this will help the researchers determine activity of the left and right sides of the brain.

You will also be required to answer a short questionnaire about your experiences with the "cold pressor" test and your perception of your own emotions.

3. ANONYMITY OF SUBJECTS AND CONFIDENTIALITY OF RESULTS

Identifying subject information will be kept strictly confidential. At no time will the researchers release your personal information from the study to anyone other than individuals working on the project without your written consent. The information you provide will have your name removed and only a subject number will identify you during analyses and any written reports of the research.

You will be intermittently videotaped throughout the experiment. These videos will be reviewed by Heath A. Demaree, the principal investigator, and two undergraduate research assistants for coding purposes. The videotapes will be stored in Room 5076D and will be destroyed no later than September 1, 1995

4. DISCOMFORTS AND RISKS FROM PARTICIPATING IN THE STUDY

You may feel some discomfort during this experiment due to your participation in the "cold pressor" procedure. The water will be cold and may be painful. You may also experience some discomfort related to the inflation of the blood pressure cuff.

Safeguards that will be used to minimize your discomfort include the continuous opportunity to terminate the experiment without penalty to yourself (losing your extra credit points) should you ever feel uncomfortable. A thorough debriefing discussing any issues that may be of concern to you will also be provided at the end of the experiment. At that time you will be given ample opportunity to ask any additional questions about the research that you may feel were inadequately addressed by our debriefing. If, after the experiment, you have any problems associated with this study please call Dr. David W. Harrison, Ph.D. (231-4422) so that he may either assist you directly or direct you to appropriate services.

5. EXPECTED BENEFITS

Your participation in the project may help identify several correlates of hostility. The effects of hostility on physiological, expressive (facial expression) and brain-related reactivity to stress will be assessed.

No guarantee of benefits has been made to encourage you to participate.

You may receive a synopsis or summary of this research when completed. Please leave a self-addressed envelope if you are interested in receiving this information.

6. FREEDOM TO WITHDRAW

You are free to withdraw from this study at any time without penalty. If you choose to withdraw, you will not be penalized by reduction in points or grade for Psychology 2004. There are alternative choices for receiving extra credit for the course evaluation.

7. EXTRA CREDIT COMPENSATION

For participation in this study you will receive one point extra credit for Psychology 2004.

8. USE OF RESEARCH DATA

The information from this research may be used for scientific or educational purposes. It may be presented at scientific meetings and/or published and reproduced in professional journals or books, or used for any other purpose that Virginia Tech's Department of Psychology considers proper in the interest of education, knowledge, or research.

9. APPROVAL OF RESEARCH

This project has been approved by the Human Subjects Committee of the Department of Psychology and by the Institutional Review Board of Virginia Tech.

10. SUBJECT'S PERMISSION

I have read and understand the above description of the study. I have had an opportunity to ask questions and have had them all answered. I hereby acknowledge the above and give my voluntary consent for participation in this study.

I further understand that if I participate I may withdraw at any time without penalty.

I understand that if I have any questions regarding this research and its conduct, I should contact any of the persons named below.

Heath A. Demaree Primary Researcher	231-6914 Phone
David W. Harrison, Ph.D. Faculty Advisor	231-4422 Phone
Richard M. Eisler, Ph.D. Chair, HSC	231-7001 Phone
Ernest R. Stout Chair, IRB	231-9359 Phone

Subject's Signature:______________________________ Date:________

Subject's ID:____________________________________

Appendix H

Please circle the most appropriate answer to each of the following questions.

1.) How stressful was putting your hand in the cold water (1 = not stressful at all, 3 = moderately stressful, 5 = extremely stressful)?	1 2 3 4 5
2.) Relative to other Virginia Tech undergraduates, do you feel that you are low or high in hostility?	Low High

April, 1995

Vita

Heath A. Demaree

PERSONAL INFORMATION

Born: May 13, 1971, Bronxville, NY

Marital Status: Single

Business Address: Department of Psychology
Virginia Polytechnic Institute
and State University
Blacksburg, Virginia 24061-0436

Business Phone: (703) 231-6914
Home Phone: (703) 552-1215

EDUCATION

B.A. Princeton University, 1993 (cum laude)

Major field of study: Psychology

Title of thesis: Motivation in baseball.

Major advisor: Nancy Cantor

M.S. Master of Science candidate, 1993-present
Degree exprected, April, 1995

Virginia Polytechnic Institute and State University

Title of thesis: Behavioral, physiological, and neuropsychological correlates of hostility.

Major advisor: Dr. David W. Harrison

HONORS AND AWARDS

1993	Cum laude, Princeton University, 1993
1991-1993	Departmental Representative, elected
1989	Who's Who in American Colleges and Universities
1989	Highest Honors, Scarsdale High School

CLINICAL TRAINING

1994- Neuropsychological Assessment Practicum Team
Psychological Services Center
Virginia Tech, Blacksburg, Virginia
Graduate level practicum team specializing in the assessment and treatment of neuropsychological disorders related to head stroke, learning disability, and headaches.
Approximate number of hours: 125
Supervisor: Dr. David W. Harrison

1994- Clinical Practicum Team
Psychological Services Center
Virginia Tech, Blacksburg, Virginia
Graduate level practicum team specializing in the assessment and treatment of excessive anger/ aggression expression, marital conflict, and relationship issues.
Approximate number of hours: 125
Supervisors: Dr. Richard Eisler, Dr. Ellie Sturgis

1994 Paid therapist, summer position
Psychological Services Center, Blacksburg, Virginia
Responsibilities included the assessment and treatment of a variety of psychological disorders, including depression, anxiety, learning disability (LD), attention deficit disorder (ADD), and relationship problems.
Approximate number of hours: 500
Supervisor: Dr. Richard M. Eisler

1993-1994 Clinical Practicum Team
Psychological Services Center
Virginia Tech, Blacksburg, Virginia
Graduate level practicum team specializing in assessment and treatment of a variety of psychological disporders, including depression, anxiety, headaches, relationship and marital problems, LD, ADD, and school phobia.
Approximate number of hours: 250
Supervisors: Dr. Jack Finney, Dr. Robert Stephens

1992-1993 Therapist, summers
Independent households, Westchester County, N. Y.
Responsible for the creation and implementation of behavior modification protocols for autistic children, ages 4 to 8.
Approximate number of hours: 200
Supervisor: Dr. Marcia Gables

1991 Volunteer Therapist, summer
New York Hospital -- New York Medical Center
White Plains, New York
Responsible for patient intakes and discharges, leadership of group discussion meetings, and assorted clerical duties.
Approximate number of hours: 300

EMPLOYMENT

1994- Supervisor
Psychological Services Center
Virginia Tech, Blacksburg, Virginia
Responsible for therapeutic duties, including the supervision of graduate clinician records / progress and maintenance of Physiology Laboratory.

1994- Co-director
Virginia Tech Anger Control Clinic
Virginia Tech, Blacksburg, Virginia
Responsible for the creation and maintenance of clinic. Job entails client recruitement from several locations (court-, undergraduate-, and shelter-referrals). Clinic specializes in neuropsychological, behavioral, and cognitive assessment, treatment, and research.
Co-directors: Dr. Richard Eisler, Dr. Ellie Sturgis

1994- Paid therapist, summer position
Psychological Services Center, Blacksburg, Virginia
(previously discussed)

1993-1994 Teaching Assistant
Virginia Tech, Blacksburg, Virginia
Taught four (4) Introduction to Psychology laboratories and received an average of 3.8/4.0 overall teacher ratings.

1992-1993 Therapist, summers
Independent households, Westchester County, N. Y.
(previously discussed)

1991 Volunteer Therapist, summer
New York Hospital -- New York Medical Center
White Plains, New York
(previously discussed)

PROFESSIONAL ACTIVITES

Membership

American Psychological Association (Division 40), student affiliate
The National Academy of Neuropsychology, student affiliate
Sigma Xi, The Scientific Research Society, associate member

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Cortical, subcortical, and autonomic correlates or impulsivity, especially in relation to hostility; methods in neuropsychology, psychophysiology, and psychopharmacology.

REFEREED PUBLICATIONS

Refereed Articles

Crews, Jr., W. D., Harrison, D. W., Rhodes, R. D. & Demaree, H. A. (1994). Hand fatigue asymmetry in the motor performances of women with depressed mood. Manuscript submitted for publication.

Demaree, H. A., Crews, W. D. Jr., & Harrison, D. W. (in press). Topographical brain mapping in depression following mild closed head injury: A case study. Journal of Neurotherapy.

Everhart, E., Demaree, H. A. & Harrison, D. W. (1994). Topographical brain mapping: Hostility following closed head injury. Manuscript submitted for publication.

McDowell, C. L., Harrison, D. W., & Demaree, H. A. (in press). Is hemispheric decline a function of aging? International Journal of Neuroscience.

Refereed Abstracts and Conference Proceedings
(one-page publications)

Crews, Jr., W. D., Harrison, D. W., Rhodes, R. D. & Demaree, H. A. (1994). Effects of depressed mood on women's hand dynomometer performance. Manuscript submitted for publication.

Demaree, H. A., Crews, W. D. Jr., & Harrison, D. W. (in press). Topographical brain mapping in depression following mild closed head injury: A case study. Archives of Clinical Neuropsychology.

Demaree, H. A. & Harrison, D. W. (submitted). Serotonin and hostility. Archives of Clinical Neuropsychology.

Everhart, E., Demaree, H. A. & Harrison, D. W. (1994). Topogrsphical brain mapping: Hostility following closed head injury. Manuscript submitted for publication.

PRESENTATIONS AND PAPERS

National Meetings

Crews, Jr., W. D., Harrison, D. W., Rhodes, R. D. & Demaree, H. A. (1995). Hand fatigue asymmetry in the motor performances of women with depressed mood. Annual meeting of the Virginia Psychological Association, Alexandria, VA.

Demaree, H. A., Crews, W. D. Jr., & Harrison, D. W. (1994). Topographical brain mapping in depression following mild closed head injury: A case study. Annual meeting of the National Academy of Neuropsychology, Orlando, FL.

Demaree, H. A. & Harrison, D. W. (submitted). Serotonin and hostility. Annual meeting of the National Academy of Neuropsychology, San Fransisco, CA.

Everhart, E., Demaree, H. A. & Harrison, D. W. (1995). Topographical brain mapping: Hostility following closed head injury. Annual meeting of the American Psychological Association, New York, NY.

GRANTS SUBMITTED

1994 Behavioral, physiological, and neuropsychological effects of alcohol consumption. National Institute of Mental Health, $10,000. Prinipal Investigator.