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Women, Anger, and Cardiovascular Reactivity to Interpersonal Conflict

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A Thesis
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of
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Abstract

Women, Anger, and Cardiovascular Reactivity
to Interpersonal Conflict

Kim Louise Lavoie

The present study examined differences in affective response and cardiovascular reactivity (CVR) in 42 women who were exposed to one of two harassment protocols; (i) Self-Harass, where participants were themselves harassed during a math task, (ii) Friend-Harass, where participants observed the harassment of a close female friend while the friend engaged in a math task. Whereas the former represents a traditional harassment protocol involving criticism of the participant's instrumental performance, the latter involves observing an attack on a significant other. Due to the social pressure placed on women to not express their anger, and because it may be considered socially appropriate to express anger in defense of a significant other, it was hypothesized that experiencing anger during harassment of the self would create feelings of discomfort in women, and that this discomfort would lead to greater elevations in CVR in Self-Harass as compared to Friend-Harass participants. The results of the present study offered support for this hypothesis. Though participants reported feeling equally angry in both the Self-Harass and Friend-Harass conditions, only women who themselves were harassed exhibited elevated heart rate, cardiac output, systolic blood pressure, forearm blood flow, and reduced forearm vascular resistance as compared to women who observed the harassment of a close female friend or when no harassment occurred. Interestingly, feelings of guilt and depression were also only observed in these cardiovascularly hyperreactive Self-Harass women. These findings support previous research suggesting greater feelings of discomfort for women when faced with their anger in traditionally inappropriate

contexts. These findings also suggest that negative emotions such as depression and guilt may play a more important role than pure anger in moderating CVR in women during interpersonal conflict. The extent to which emotions such as depression confer risk for cardiovascular disease in women warrants further investigation.

Acknowledgments

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This thesis is dedicated to my parents, Lynn and Andre Lavoie.

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Women, Anger, and Cardiovascular Reactivity to Interpersonal Conflict

The notion that anger may have dangerous consequences for health is not new. As far back as 1772, Heberden, who was one of the first to clearly describe the symptoms of angina pectoris, implicated anger in the development of coronary heart disease (CHD). Later, psychoanalysts such as Alexander, French and associates (Alexander, 1950; Alexander, French, & Pollack, 1968) argued that conflicts about expressing anger were linked to heart disease. Unfortunately, the results of empirical tests of these hypotheses were inconsistent at best, and essentially lacked a physiologically credible rationale of how psychological events could translate into physical disease processes (Siegman, 1994). However, Cannon's (1932) research into the fight-flight response helped explain how psychological phenomena could influence the pathogenesis of disease. His research helped explain how emotions can play an important role in the transformation of psychological events into disease processes.

Most emotion theorists concede that joy, fear, sadness, and anger represent major human emotions (Ortony & Turner, 1990; Scherer, 1984; Shaver, Schwartz, Kirson, & O'Connor, 1987) . Of the three major negative emotions, fear, sadness, and anger, researchers have paid the least attention to anger (Siegman, 1994). Although the experience of being angry is a common, everyday phenomenon, the empirical study of anger and its physiological consequences has been relatively limited (Sharkin, 1996). This may have been related to the conceptual complexity of the anger construct, which has long been plagued by inconsistent and imprecise definitions, as well as confusion with other related constructs such as hostility and aggression (Sharkin, 1996; Houston, 1994). However, recent

improvements in the measurement of anger have contributed a great deal to our knowledge about the different ways anger can be experienced and expressed (Sharkin, 1996). There is a growing consensus among emotion theorists that anger, and emotion in general, is best regarded as a psychological construct comprising several aspects or components (Scherer, 1984; Averill, 1980; Izard, 1977; Lazarus, Averill, & Opton, 1970). These components include: a) a subjective feeling state, b) cognitive appraisal or evaluation of stimuli and situations, c) physiological arousal, d) motor expression, and e) a motivational component involving behavioral intentions or behavioral readiness (Scherer, 1984). Specifically, anger is considered an emotional state, ranging in intensity from irritation or annoyance to fury or rage (Spielberger, Johnson, Russell, Crane, Jacobs, & Worden, 1985). According to findings reported by Shaver et al. (1987), anger develops when something (usually another person) interferes with an individual's attainment of goals by reducing the individual's power, violating expectations, or frustrating goal-directed activities. Anger may also involve the perception of being subjected to unfair treatment or harm (Lazarus, 1991). According to de Rivera (1977), the individual makes the judgment that the reduction of power, frustration, or harm is illegitimate, and that the situation is contrary to what it "ought" to be given the social norms governing the situation. This leads to angry affect, the subjective or experiential component of this emotion, which is typically accompanied by physiological arousal, characteristic facial expression, and activation of impulses towards aggression (Rosenman, Wiest, & Swartz, 1994; Spielberger, Johnson, Russell, Crane, Jacobs, & Worden, 1985). These anger-generated impulses may also be characterized by any number of specific actions (e.g., hitting someone), action tendencies (e.g., an inclination to hit someone), and goals (e.g., wanting to hit someone) (Rosenman et al. 1994).

An increasingly important conceptual distinction in the anger literature is that between the experience and the expression of anger. Whereas the experience of anger involves the subjective feeling of angry affect, the expression of anger refers to the behavior which is exhibited subsequent to the arousal of anger (Smith, 1994). It is important to recognize that while both the experience and the expression of anger imply the occurrence of anger, they do not specify what overt responses people will make when they are angry. In general, people can respond to anger and anger-related feelings in one of two ways: they can express it outwardly, or they can inhibit overtly expressing such feelings (Houston, 1994). For example, Frijda, Kuiper, and ter Schure (1989) found that once angered, people would express angry feelings by exhibiting antagonistic behaviors such as assault or opposition, or simply "boil inside". However, Shaver et al. (1987) reported that anger also includes a self-control component, which may be revealed by a tendency to suppress angry feelings.

Anger Management Style and Cardiovascular Reactivity

Recent evidence suggests that the characteristic style with which an individual manages anger-related feelings and behaviors may be associated with adverse health consequences (Faber & Burns, 1996). In particular, research has indicated that anger-expression style may be associated with elevated cardiovascular reactivity (CVR) to stress (Miller, 1993; Siegman, 1993; Siegman, Anderson, Herbst, Boyle, & Wilkinson, 1992; Engbretson, Matthews, & Schier, 1989; Spielberger et al. 1985) and with the development of coronary heart disease (CHD) (Dembroski, McDougall, Costa, & Grandits, 1989; Hecker, Chesney, Black, & Frautschi, 1988) and coronary artery disease (CAD) (Siegman, Dembroski, & Ringel, 1987). However, evidence has been inconsistent with regard to which

anger-expression style is most adversely associated with cardiovascular arousal. Research comparing the psycho-physiological effects of anger suppression and anger expression has shown that in some studies, the tendency to suppress angry feelings (Miller, 1993; Vogele & Steptoe, 1993; Dembroski, MacDougall, Williams, Haney, & Blumenthal, 1985; MacDougall, Dembroski, Dimsdale, & Hacket, 1985) has been associated with elevated CVR during exposure to stress, whereas other studies (Burns & Katkin, 1993; Siegman, et al. 1992; VanEgren, Abelson, & Thornton, 1978) have shown that the tendency to express angry feelings has been associated with elevated CVR during exposure to stress.

Anger-In

Evidence for an anger-inhibition-CVR relationship was provided by Miller (1993). This study found that individuals who were defensive in their reporting of anger, as measured by high scores on the Marlowe-Crowne Social Desireability Scale (Crowne& Marlowe, 1964) and low scores on the Trait Anger Inventory (Spielberger, Jacobs, Russell, & Crane, 1983) and Anger Expression Scale (Spielberger et al. 1985), exhibited elevated cardiovascular responses to a shock avoidance video game task relative to individuals who were anxious in their reporting of anger, as measured by high scores on the Trait Anxiety Inventory (Spielberger, Gorsuch, & Luchene, 1970), high trait anger scores, and low social desirability scores, and relative to individuals who were overt in their reporting of anger, as measured by high Trait Anger scores and low social desirabiltiy scores. Additional evidence supporting a relationship between anger-inhibition and elevated CVR came from a study by Vogele & Steptoe (1993). These authors found that Anger-in, as measured by the Anger Expression Inventory (Spielberger et al. 1985) was shown to be related to elevated blood pressure responses in

adolescent boys with a family history of hypertension during mental arithmetic and mirror drawing tasks. Finally, a study by Hokanson, Burgess, and Cohen (1963) found that not expressing anger to a harasser resulted in significantly elevated blood pressure responses compared to participants who did express anger.

Anger-Out

Despite positive relationships between anger-inhibition and elevated CVR to stress, there is also a great deal of evidence supporting a relationship between the outward expression of anger and cardiovascular arousal. A study by Burns and Katkin (1993) reported that an anger-management style characterized by a tendency to express anger, as measured by the Anger-Expression Inventory (Spielberger et al. 1985) was related to elevated CVR during a reaction time task among men under conditions of interpersonal harassment. Also, Siegman and colleagues (1992) found that individuals who characteristically express anger outwardly exhibited elevated heart rate and blood pressure responses to anger provocation during a serial subtraction task. Similarly, Anger-out was found to correlate positively with elevated heart rate, and both systolic and diastolic blood pressure responses after participants were provoked and angered through harassment while performing a mathematical subtraction task (Boyle & Siegman, 1992). Additional evidence supporting a relationship between anger expression and elevated CVR was provided experimentally by Siegman, Anderson, and Boyle (1990). These authors examined the extent to which CVR could be amplified by modifying participants' expressive vocal behavior during angry interactions. The participants' speech rate and speech loudness were manipulated while they discussed nine neutral and nine anger-arousing events.

One third of these events were described in a loud and rapid voice, that is, in an angry voice, one third in a normal voice, and the remaining third in a soft-slow voice, or in a non-angry voice. These authors found that when participants discussed anger-arousing events, the greatest elevations in heart rate, systolic blood pressure, and diastolic blood pressure occurred during the fast-loud speech condition, that is, when participants expressed their anger, as compared to during the normal speech style condition and the slow-soft speech style condition. Based on these findings, these authors concluded that the expression of anger is associated with significant increases in cardiovascular arousal.

It is important to note that findings most consistently relating the outward expression of anger to elevated CVR have been found in studies which deliberately provoked anger in the participants (Burns & Katkin, 1993; Siegman et al. 1992; Boyle & Siegman, 1992; Siegman et al. 1991; Hokanson et al. 1963). Studies employing traditional laboratory stressors (e.g., mental arithmetic, stroop color-word task, cold-pressor) without an interpersonal harassment component have less consistently reported a relationship between anger-expression style and cardiovascular arousal (e.g., Mills, Schneider, & Dimsdale, 1989; Siegman, Dohm, & Gjesdal, 1988; Smith & Houston, 1987). For example, Siegman et al. (1988) found no significant correlations between participants' Buss Durkee Hostility Inventory (BDHI; Buss & Durkee, 1957) expression of anger scores and CVR during a serial subtraction task. However, when Siegman et al. (1992) conducted a similar study in which 39 participants were administered the same serial subtraction task under two conditons, once with harrassment and once without harassment, two significant correlations emerged: a positive correlation between the expression of anger and systolic blood pressure, and a positive correlation between the expression of anger and diastolic blood pressure-but only in the

harassed condition. A study by Boyle and Siegman (1992) replicated these findings using 80 participants. All participants were administered the Anger Expression Scale (Spielberger et al. 1985) and engaged in a serial subtraction task, with one half of the participants experiencing harassment. These authors found that Anger-out was correlated positively with both systolic and diastolic blood pressure, and heart rate reactivity, but only in the angered (harassed) group. Correlations between Anger-in and CVR were either not significant or negative. These findings have lead researchers to argue that in order for the relationship between anger expression and elevated CVR to emerge, it is essential that participants actually be angered (Siegman, 1994). The positive findings from studies using interpersonal stressors such as harassment (e.g., Burns & Katkin, 1993; Siegman et al. 1992; Boyle & Siegman, 1992) therefore offer support to the argument that interpersonally challenging stressors which are able to elicit anger are necessary to mediate a positive relationship between anger-expression and CVR. These findings also imply that the experience of angry affect must occur before the negative consequences of anger-expression can influence cardiovascular reactivity and increase risk for CHD (Siegman, 1994).

Preferred versus Nonpreferred Mode of Anger Expression

Just as research has shown a relationship between anger-expression style and CVR, there is also evidence to suggest that expressing anger in a manner which is inconsistent with one's characteristic style of anger expression may have negative consequences for health. An elaborate study by Engbreston, Matthews, and Scheier (1989) found that following harassment, blood pressure reactivity was significantly higher when male participants were unable to employ their preferred mode of dealing with anger, as compared to when participants were

permitted to employ their preferred mode of dealing with anger. Thus, these authors suggested that the extent to which anger expression influences cardiovascular disease would depend upon whether individuals are able to express their anger in a manner which is congruent with their preferred mode of anger expression (Engbreston et al. 1989).

Gender, Anger Management Style, and Cardiovascular Reactivity

In studies to date, research linking anger and anger-expression style to elevated CVR has been conducted almost exclusively with men, though the findings revealed from this research have been widely assumed to be applicable to women (Chesney, 1993). However, it has been suggested that under conditions of stress, anger management style will produce different patterns of CVR in men and women (Faber & Burns, 1996). For example, Burns and Katkin (1993) found that expressed anger, or Anger-out, was related to stress-induced increases in CVR only among men, and that neither Anger-in nor Anger-out was able to predict CVR among women. In a similar study by Siegman and Boyle (1992), expressed anger was found to be associated with elevated blood pressure responses to harassment only among men. All relationships between anger expression and CVR in women were not significant. In a study examining whether or not the expression of anger following provocation resulted in faster recovery from cardiovascular arousal, Lai and Linden (1992) reported that physiological recovery was associated with the outward expression of anger more strongly among men than among women. Similarly, Hokanson, Willers, and Koropsak (1968) found that men produced faster physiological recovery from harassment when they responded to provocation with aggressive responses, relative to responding with friendly responses. However, a reverse finding was

observed for women such that women produced faster recoveries when responding to provocation with friendly responses, relative to responding with aggressive responses. Taken as a whole, these findings indicate that gender differences in anger expression style and CVR to anger provoking situations do exist, and researchers have begun to offer a variety of hypotheses to explain these different findings. Recently, researchers have started to look at women's unique experience with anger in terms of what is known about women's socialization and gender differences in emotion (Kopper & Epperson, 1996; Powch & Houston, 1996).

The Socialization of Anger in Women

Literature in the area of gender and emotion suggests that men and women have been socialized to view anger differently (Shields, 1987). Although women are believed to experience greater emotionality than men, the emotional female is not the angry female (Deaux & Lewis, 1983). Shields (1987) argues that treating emotionality as a global tendency ignores the fact that not all types of emotion are invariably associated with girls and women. Anger or aggressiveness, in contrast to nearly all other emotions, is considered a typically male response. As such, it has been argued that men are socialized for competitive and aggressive roles that permit, and even encourage, the outward expression of anger, and women are socialized for nurturing and supportive roles that discourage the outward expression of anger (Mirowsky & Ross, 1995; Golombok & Fivush, 1994; Gordon, 1989; Lerner, 1985).

In support of gender-specific socialization of anger is evidence of greater social pressure by parents on girls than on boys to control and manage their experience and display of anger (Fivush, 1989; 1991). Research has shown that

while parents both accept and encourage anger and aggression in boys, they discourage anger and aggression in girls (Fivush, 1989). Moreover, when daughters become angry, they are encouraged not to express their anger, but to restore harmonious relations with the person who made them angry. Sons, on the other hand, are encouraged to confront and retaliate against the person who made them angry (Fivush, 1991). Finally, there is evidence to suggest that the association between anger and maleness, and between other emotions (e.g., happiness, sadness, fear) and femaleness, has been well learned by the preschool age (Birnbaum, Nosanchuk, & Croll, 1980).

Gender Differences in the Experience and Expression of Anger

Although evidence supporting the differential socialization of anger in women is quite clear, the results of studies examining gender differences in the experience and expression of anger are inconsistent.

With regard to the experience of anger, research shows that men and women report experiencing similar levels of anger (Stoney & Engbreston, 1994; Averill, 1983). For example, Shields (1984) found no differences in the degree to which anger was reported to be felt by men or women. Additionally, studies which have employed Spielberger's Trait Anger scale have generally reported similar levels of trait anger among males and females (Engbreston & Matthews, 1992; Girdler, Turner, Sherwood, & Light, 1990; Spielberger et al. 1983). Finally, Averill (1982) found that women become as angry as frequently and as intensely as men, and for much of the same reasons. Therefore, despite socialization factors which have discouraged anger in women, women appear to experience anger to the same degree as men.

Results from studies examining gender differences in the expression of

anger are generally mixed. Because men have been socialized for aggressive roles that encourage the expression of anger, and women have been taught that expressing anger is socially inappropriate, it has been assumed that men are typically Anger-out and women are typically Anger-in (Kopper & Epperson, 1996; Stoney & Engbreston, 1994). The assumption that women are more likely to suppress their anger and men are more likely to express their anger has received some empirical support. For example, the Framingham Heart Study found that middle-aged women were more likely to inhibit anger expression as compared to middle-aged men (Haynes & Feinleib, 1980). In addition, a study by Biaggio (1980) found that males tended to score higher on subscales of the Buss-Durkee Hostility Inventory (BDHI; Buss & Durkee, 1957) that measured a tendency to show aggressive expression of anger, whereas females tended to score higher on subscales that measured a tendency to inhibit anger expression. Finally, results from a meta-analytic review by Eagly and Steffen (1986) found that men were more likely to engage in aggressive anger expression behaviors, such as verbal assault, relative to women.

Other studies, however, have failed to find gender differences in anger expression. For example, in a community-based sample of middle-aged men and women, there were no gender differences in Anger-in or Anger-out scores as measured by Spielberger's Anger Expression Scale (Engbreston & Matthews, 1992). Similarly, Greenglass and Julkunun (1989) and Thomas and Williams (1990) found no gender differences in anger expression or anger suppression scores in two samples of college students. Kopper and Epperson (1991) also found no significant gender differences in the expression of anger; however, consistent relationships were observed between sex role identity (e.g., masculinity and femininity) and anger proneness, anger expression, anger suppression, and

anger control. Specifically, masculine sex role types were more prone to anger, more likely to express anger outward, less likely to suppress anger, and less likely to control their expression of anger. Conversely, feminine sex role types were least likely to express anger outwardly and most likely to suppress anger and to attempt to control the expression of anger. These findings were replicated by Kopper and Epperson (1996), who found that gender role was significantly related to anger expression and anger suppression. Specifically, femininity was negatively correlated with aggressive acting out and positively correlated with anger suppression, and masculinity was positively correlated with aggressive acting out.

Taken together, the results of studies examining gender differences in the experience and expression of anger are inconclusive. In general, the bulk of evidence suggests that men and women may experience anger to similar degrees, but may differ with respect to the manner in which their anger is expressed.

The Uncomfortable Experience of Anger

It has been suggested that as a consequence of socialization, women experience social pressure not to express their anger (Smith, Ulch, Cameron, & Cumberland, 1989). For example, society has imposed a derogative vocabulary to describe anger in women, using such words as "petulant", "bitchy", and "out of control" (Shields, 1986). Also, Tavris (1982) found that women were more likely to be condemned for displaying anger, relative to men.

Because women are socialized to suppress anger, but appear to experience anger to the same degree as men, it has been argued that feeling or showing anger represents an uncomfortable experience for women, as compared to men (Kopper & Epperson, 1996; Shields, 1987). In fact, there is evidence to suggest that

women more frequently report negative emotions (e.g., shame, depression, guilt, etc.) in response to their anger than do men (Deffenbacher, Oetting, Thwaites, Lynch, Baker, Stark, Thacker, & Eiswerth-Cox, 1996). Specifically, Deffenbacher and colleagues (1996) compared the frequencies with which high and low trait-anger individuals experienced negative consequences as a result of their anger. These researchers found that women who scored high on trait-anger more frequently reported negative emotions such as depression and guilt stemming from their anger as compared to men who scored high on trait-anger. Similar findings were reported by Averill (1982), who found that women reported a greater tendency to feel hurt as a result of their anger as compared to men.

Recent evidence suggests that women may feel more comfortable with the experience of anger when they believe that they have a legitimate reason for feeling angry (Anderson & Lawlor, 1995; Shields, 1987). Given that women are socialized for supportive and protective roles (Golombok & Fivush, 1994), women may feel more comfortable with the experience and outward expression of anger when a significant other is threatened as opposed to themselves. Because acknowledging and exhibiting anger in response to the perceived mistreatment of a significant other is compatible with women's socialization to experience responsibility for others (Mirowsky & Ross, 1995), it is conceivable that feeling angry and expressing anger in such a context may be considered legitimate grounds for anger expression in women. Therefore, by being in a situation where anger may be seen as socially appropriate for women, experiencing anger would not lead to conflict or feelings of discomfort in women.

In summary, it has been shown that while society both accepts and encourages anger in men, anger in women is frequently looked down upon by others. Because expressing anger is not seen as socially appropriate for women,

women have been socialized to generally inhibit the experience and outward expression of anger. Given that women seem to get angry as intensely and as frequently as men but feel social pressure to deny their anger, it is conceivable that being angry represents an uncomfortable experience for women. Feeling angry may create a conflictual situation where women are expected to behave in a manner which is inconsistent with their subjective experience. It has therefore been suggested that women may feel more comfortable with the experience and expression of anger in situations where it may be socially acceptable for them to be angry. Given that women are socialized for supportive and protective roles, it has been suggested that women may feel more comfortable with the experience and expression of anger when a significant other is threatened as opposed to themselves.

The purpose of the present study was to examine the role of social context in moderating the relationship between affective responding and cardiovascular reactivity in women. In this study, women were either harassed themselves, or observed the harassment of a close female friend. Given that feeling and expressing anger in defense of a significant other may be considered socially acceptable for women, observing the harassment of a close friend would create a socially acceptable outlet for women to freely experience and express anger, and not lead to feelings of discomfort. Because feeling and expressing anger in response to harassment of the self may not be seen as socially acceptable for women, experiencing anger would be more conflictual for harassed women by creating feelings of discomfort. It was therefore hypothesized that this discomfort would lead to greater elevations in CVR in women who themselves were harassed, compared to women observing the harassment of a close friend. A wide

range of cardiovascular measures, reflecting both cardiac and vascular reactivity, were recorded while participants and their friend engaged in successive 9-minute mathematical subtraction tasks. Previous research examining CVR and anger in women has typically focused on a limited number of physiological measures (e.g., blood pressure and heart rate), thus excluding relevant vascular measures such as forearm blood flow, forearm vascular resistance, and total peripheral resistance. It is not known to what extent the exclusion of these cardiovascular measures may have affected previous results linking anger to CVR. This design represents a unique departure in research protocol from previous studies examining anger and cardiovascular reactivity to anger-provocation in women.

Method

Participants:

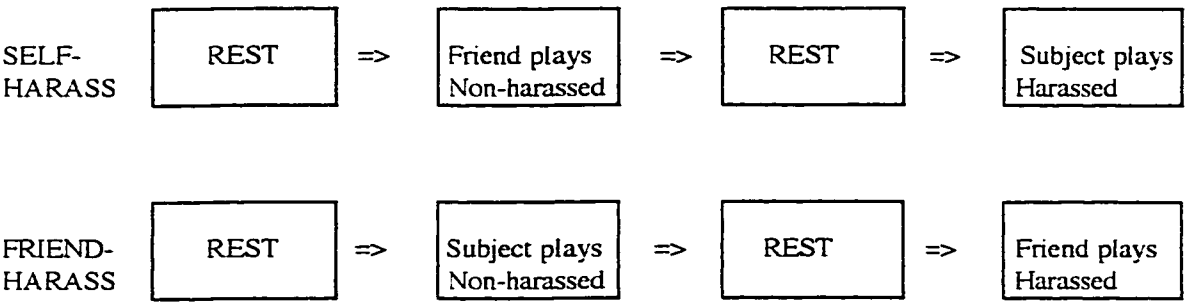
A total of 42 healthy, normotensive female students between the ages of 18 and 35 years were recruited from the student population of Concordia University. Each interested participant completed a health questionnaire and a parental health questionnaire, stating their own and their parent's health and blood pressure status (see Appendices A and B). Individuals were excluded from participating in the actual laboratory study if they reported any physical or psychological health problems or regularly used medication which affects blood pressure. Once selected, all participants recruited a close female friend to participate in the study with them. All participants were randomly assigned to one of two harassment conditions: (1) Self-Harass: the participant observed her friend engage in a mathematical subtraction task without harassment; then engaged in the mathematical subtraction task herself while being harassed through anger-provoking statements; or (2) Friend-Harass: the participant engaged in the mathematical subtraction task without harassment; then observed her friend engage in the mathematical subtraction task while her friend was harassed through anger-provoking statements. A diagram of the study design and protocol is presented in Figure 1.

Measures and Apparatus:

Though both the participant and her friend were instrumented identically for physiological recording, only signals for the participant were actually recorded. Measurements of systolic and diastolic blood pressure (in mm Hg) were

Figure 1:

Diagram of study design and protocol.


SELF-
HARASS
REST
=>
Friend plays
Non-harassed
=>
REST
=>
Subject plays
Harassed
FRIEND-
HARASS
REST
=>
Subject plays
Non-harassed
=>
REST
=>
Friend plays
Harassed

obtained at one minute intervals using the IBS Automated Blood Pressure and Pulse Rate Monitor SD-700 A (IBS Corporation,Waltham, Mass, USA). The blood pressure cuff was placed on the participant's left thigh. Blood pressure values were corrected for the distance from the heart level according to the manufacturer's instruction. Heart rate (HR: in bpm), cardiac output (CO: in ml/min.), total peripheral resistance (TPR: in dyne-sec.cm -5) and stroke volume (SV: in ml) values were obtained non-invasively using a Minnesota Impedence Cardiograph (Model 304A, Instrumentation for Medicine, Greenwich, Conn, USA), an INTEL IBM compatible personal computer, EKG spot electrodes, and the Cardiac Output Program (C.O.P., Bio-impedence Technology, Chapel Hill, North Carolina, USA). Within every minute, 50 seconds of recordings were obtained and ensemble averaged. A tetrapolar electrode-band configuration was used. The inner two recording electrode-bands were placed around the base of the participant's neck and around the thorax over the tip of the xiphoid process. The outer two electrode-bands were placed around the neck and the thorax at least 3 cm apart from each of the inner electrode bands.

The ECG signal was recorded independently using three spot electrodes. Two electrodes were placed on opposite sides of the rib cage at approximately the level of the seventh rib. The ground electrode was placed on the right hip bone. The ECG signal was filtered through a Coulbourn Instrument bandpass filter (Coulbourne Instruments, Lehigh Valley, Penn, USA) and then routed to the Minnesota Impedence Cardiograph.

Forearm blood flow (FBF: in ml/min/100ml) was measured using venous occlusion plethysmography in the left forearm and recorded using Coulbourne Instruments, amplifiers, transducers, the Coulbourne Videograph system (Coulbourne Instruments, Lehigh Valley, Penn, USA) , and an AT computer. The

forearm rested on a rigid but comfortable support angled approximately 45 degrees above heart level. A mercury-in-silastic-two strain gauge was placed around the participant's left forearm approximately 5 cm below the antecubital crease. The gauge was held in place with the help of a clasp that allowed for calibration by adjusting the length of the gauge. Two blood pressure cuffs were also placed on the arm. One blood pressure cuff was placed distal to the gauge and around the wrist and the second was placed on the upper arm. During the recording of forearm blood flow, the circulation to the hand was occluded one minute before venous occlusion by inflating the wrist cuff above the participant's maximum systolic blood pressure. Venous occlusion was achieved by inflating the upper arm cuff to a pressure of 45 mm Hg for 15 seconds. The wrist cuff inflation was performed manually and the upper arm cuff inflation was done with the help of a Hokanson AG 101 Automated Cuff Inflator (D. E. Hokanson Inc., Bellevue, Wash, USA) by the experimenter who was housed in another room. Blood flow measures were derived from changes in the forearm circumference resulting from the inflow of blood while venous return was blocked. Forearm blood flow is based on the assumption that percentage change in arm circumference may be doubled to yield a percentage change in arm volume (Whitney, 1953).

Forearm vascular resistance (FVR: in units) values were calculated by dividing forearm blood flow measurements by the corresponding mean arterial blood pressure values.

Mathematical Subtraction Task

The mathematical subtraction task (math-task) consisted of the Computerized Subtraction Version 1.21 computer program (Turner, Sherwood & Lutz, 1989), an IBM compatible PC computer, and a Truemouse Model TX 300

computer mouse. The 9-minute math-task, divided into three 3-minute trials, consists of a series of mathematical subtraction equations presented with either correct or incorrect solutions. During each task, a total of 180 equations are presented with either correct or incorrect solutions. Each equation is presented for a duration of three seconds. The participant responds by pressing the right computer mouse button if she thinks the answer is correct or by pressing the left button if she thinks the answer on the screen is incorrect. If the participant's answer is correct the computer emits a high pitched tone indicating that the participant has responded accurately. If the participant's answer is incorrect the computer emits a low pitched tone indicating that the participant has responded inaccurately. If the participant does not respond within the three seconds, they are given an incorrect score and no tone is emitted. The math task is designed in such a way that each participant will attain a 50 to 60 percent correct response rate. That is, equations become easier or more difficult depending on each participant's performance.

State Affect Measure

To assess changes in affective state, each participant and her friend completed a mood questionnaire (see Appendix C) at baseline and following their successive performances on the math task. Participants and their friends had to rate their current level of happiness, sadness, irritation, anger, annoyance, relaxation, anxiety, tension, depression, guilt, nervousness, and agreeableness by marking a continuous 10 cm. horizontal line as instructed by the experimenter. This measure has been used previously in similar studies to assess changes in affective state (e.g., Miller, Dolgoy, Friese, Sita, Lavoie, & Campbell, in press; Miller, Dolgoy, & Friese, 1997; Lavoie, Campbell, Miller, Dolgoy, Friese,

& Sita, 1996).

Friendship Qualities Scale

In order to assess friendship quality, each participant and her friend completed the Friendship Qualities Scale (Bukowki, Hoza, & Boivin, 1994) (see Appendix D). Participants and their friends had to rate on a five-point Likert-type scale the quality of their friendship according to five meaningful dimensions of friendship relation. These dimensions are companionship, closeness, help/aid, security, and conflict. Assessments of reliability indicated a high level of internal consistency within each dimension, ranging from .71 to .86 (Bukowki, Hoza, & Boivin, 1994).

Procedure:

Each participant participated in a 1 1/2 hour laboratory session. Participants were asked to refrain from smoking and drinking coffee for four hours preceding the testing session. Prior to the beginning of the experimental session, participants were told that the purpose of the study was to investigate the effects of friendship on cognitive and physiological performance. Participants were informed that they and their friend would engage in successive computerized mathematical subtraction tasks. They were told that they would each receive ten dollars for completing the experiment, and an extra five dollars if they obtained a cumulative score of 50% or higher on the math task. They were informed that the computer would give them feedback on their performance on each of the three math-task trials, with their cumulative score being presented following completion of the task. Participants were told that the criterion score of 50% was easy to obtain, and was primarily employed to ensure motivation during

the task. participants were informed that their individual performances would be examined, and that they were not competing against each other or working together. All participants were kept blind as to the true purpose of the experiment.

Upon entering the laboratory room, participants and their friends were seated in adjacent armchairs and were instrumented for physiological recording by Experimenter A (female) and Experimenter B (female). Experimenter A remained in the testing room and explained the math-task to the participant, while Experimenter B returned to the control room. Following the calibration of the physiological apparatus, Experimenter A returned to the control room and the participant and her friend rested for 14 minutes. During the last four minutes of rest, cardiovascular baseline responses were recorded for the participant. The participant and her friend then completed the state affect scale.

Participants were randomly assigned to either the Self-Harass or Friend-Harass condition. For participants in the Self-Harass condition the following procedure was then implemented. Experimenter A entered the testing room to start the math task. Participants then observed their friend engage in the math task and Experimenter A remained courteous and professional throughout the three 3-minute trials. Participants were able to observe their friend's performance on the task, which was pre-set to increase slightly from just above 50% to 65% over the three trials, roughly corresponding to their actual performance. Because the math task is designed so that each participant will attain a 50 to 60 percent correct response rate, these values were considered convincing reflections of the participant's probable true performance. After the math task was completed, the participant and her friend completed the state affect scale a second time, and then rested for six minutes. As Experimenter A re-entered the testing room to start the

math task for the participant, Experimenter B called her back to the control room, stating that the impedence signals were "no longer clear". Experimenter A excused herself and exited to the adjacent control room, leaving the door ajar. In a voice loud enough to be overheard, Experimenter B told Experimenter A to return to the testing room to check the participant's physiological equipment to make sure that everything was secured properly. After replacing the participant's spot electrodes and checking the participant's equipment several times, Experimenter A, feigning frustration, returned to the control room. After looking over the impedence signals herself, Experimenter A stated loudly that Experimenter B had carelessly "forgotten" to "recalibrate the impedence signals", which was why the signals were not clear. In a loud voice, Experimenter A stated angrily that she was in a rush and indicated her extreme aggravation for having wasted so much time. Experimenter B apologized sincerely to Experimenter A, and promised to correct the problem immediately. Experimenter A, feigning anger and irritation, entered the testing room and started the math task.

During the math task, Experimenter A delivered six anger-provoking statements to the participant at predetermined intervals. Sample statements include: "It's really not that hard, you know!" and "I think you could go faster!" (see Appendix E). Participants' math task scores were pre-set to decrease slightly from just above 50% to 41% over the three trials, irrespective of their performance. Their final cumulative score was 46%, which was just below the criterion score required to receive the extra five dollars. All participant comments were ignored unless the participant indicated that she wanted to stop the experiment. After the math task was completed, Experimenter A told the participant that she did not attain the criterion score, and quickly exited the

testing room. In a voice loud enough to be overheard, Experimenter A angrily told Experimenter B that she had to leave right away and that Experimenter B would have to complete the experiment alone. Experimenter A quickly exited the laboratory, while Experimenter B instructed the participant and her friend to complete the state affect scale for the third time. The testing session ended following a final six minute rest period. All participants were then debriefed about the deception, the purpose of the harassment, and the true rationale for the experiment. Participants who reported feeling suspicious about the harassment manipulation were excluded from the final data set. No participants had to excluded for this reason. All participants and their friends were each paid fifteen dollars for their participation.

For participants in the Friend-Harass condition, an identical procedure was implemented with the following modification: participants first engaged in the math task without harassment, and then observed their friend engage in the task while their friend was harassed through the same anger-provoking statements. The study was approved by the Human Ethics Committee of Concordia University. All participants gave informed and written consent (see Appendix F).

Data Reduction and Analyses

Cardiovascular measures recorded during the testing sessions were reduced in the following manner. For each cardiovascular measure, values collected during baseline were averaged to obtain a mean baseline value. Similarly, values obtained during the two 9-minute math tasks were averaged to obtain two mean math-task values. To facilitate stress analyses, baseline-stress change scores were calculated by subtracting mean baseline cardiovascular values from the mean math-task value. For each affective measure, values

collected during the rest period were considered baseline-affect values. To facilitate stress-analyses, baseline-stress change scores were calculated by subtracting baseline-affect values from the values obtained following the two math tasks. Change scores were used in all cardiovascular stress analyses given the uncertainty regarding validity of impedence-derived volume measures when absolute values are employed (Sherwood, Allen, & Fahrenberg, 1990). Post-hoc comparisons were conducted using the Student-Newman Keuls test.

Results

Participant Characteristics

To assess whether participants differed in age, height, and weight as a function of harassment condition, a series of one-way analyses of variance (ANOVAs) were conducted for Self-Harass and Friend-Harass participants using mean age, height, and weight values. No group differences in age, weight, or height were observed. Means and standard errors of age, height, and weight by harassment condition are presented in Table 1.

Friendship Quality Analysis

To assess whether participants differed in friendship quality as a function of harassment condition, as series of one-way ANOVAs were conducted for Self-Harass and Friend-Harass participants using mean Friendship Quality subscale values. No group differences in companionship, closeness, help, security, or conflict were observed, indicating that participants in the Self-Harass and Friend-Harass conditions did not differ in friendship quality. Means and standard errors of companionship, closeness, help, security, and conflict values by harassment condition are presented in Table 2.

Cardiovascular Analyses I

Baseline Analyses

To assess whether there were baseline (pre-task) differences across harassment condition, a series of one-way ANOVAs was conducted for Self-Harass and Friend-Harass participants on each of the following cardiovascular measures: heart rate (HR), cardiac output (CO), stroke volume (SV), systolic blood pressure (SBP), diastolic blood pressure (DBP), forearm blood flow (FBF), forearm

Table 1

Mean Age, Weight, Height and Standard Errors as a Function of Self-Harass and Friend-Harass Conditions

	Self-Harass	Friend-Harass
Age (yrs)	21.9 (0.5)	22.7 (0.5)
Weight (kg)	56.1 (1.8)	58.8 (2.5)
Height (m)	1.65 (0.1)	1.68 (0.8)

Table 2

Means and Standard Errors of Friendship Qualities Subscales for Self-Harass and Friend-Harass Participants

	Self-Harass	Friend-Harass
Companionship	24.71 (0.8)	23.28 (1.2)
Closeness	33.05 (1.0)	33.52 (1.2)
Security	38.86 (0.9)	39.33 (1.3)
Help	52.76 (1.3)	53.90 (1.5)
Conflict	17.71 (0.5)	17.90 (0.5)

vascular resistance (FVR), and total peripheral resistance (TPR). No group differences in resting cardiovascular values were observed. Means and standard errors of baseline cardiovascular values by harassment condition are presented in Table 3.

Stress Analyses

To assess the effects of harassment and target of harassment on cardiovascular reactivity to stress, a series of 2 (harass vs. non-harass) x 2 (self vs. friend) ANOVAs were conducted using baseline-stress change scores for each cardiovascular measure. Means and standard errors of baseline-stress change scores by harassment and target of harassment are presented in Table 4.

The analyses yielded significant harassment x target of harassment interactions for heart rate ($F(1, 39) = 51.35$, $p < .001$), cardiac output ($F(1, 39) = 17.39$, $p < .001$), systolic blood pressure ($F(1, 36) = 110.81$, $p < .001$), forearm blood flow ($F(1, 24) = 20.24$, $p < .001$), and forearm vascular resistance ($F(1, 12) = 19.45$, $p < .001$). Post hoc analyses indicated that participants who themselves were harassed (self-harass condition) exhibited significantly greater elevations in HR, CO, SBP, FBF, and significantly greater reductions in FVR compared to participants who observed the harassment of their friend (friend-harass condition), or when no harassment occurred. Thus, as hypothesized, Self-Harass participants showed elevated cardiovascular responses as compared to Friend-Harass participants. The significant two-way interactions for CO, SBP, and FBF are presented in Figures 2, 3, and 4 respectively.

The analyses further revealed a significant harassment x target of harassment interaction ($F(1, 36) = 32.79$, $p < .001$) for diastolic blood pressure. Post hoc comparisons indicated that DBP elevations were significantly greater in participants who themselves were harassed (self-harass condition) and when

Table 3

Mean Cardiovascular Baseline Scores and Standard Errors as a Function of Self-Harass and Friend-Harass Conditions

	Self-Harass	Friend-Harass
HR (bpm)	71.7 (2.1)	68.2 (1.2)
CO (l/min)	3.2 (0.3)	2.7 (0.2)
SV (ml)	117.4 (6.2)	113.9 (5.6)
SBP (mmHg)	101.8 (1.6)	104.9 (2.1)
DBP (mmHg)	64.4 (1.5)	64.4 (1.3)
FBF (ml/min/100ml)	3.3 (0.3)	2.7 (0.2)
FVR (units)	26.3 (4.1)	34.6 (2.6)
TPR (dyne-sec.cm^{-5})	813.6 (47.9)	1149.1 (290.23)

Table 4

Mean Cardiovascular Baseline-Stress Change Scores and Standard Errors as a Function of Harassment and Target of Harassment

		Non-Harass	Harass
HR (bpm)	Self	7.9 (1.1)	15.8 (2.2)
	Friend	8.7 (5.5)	1.2 (3.8)
CO (l/min)	Self	0.7 (0.1)	1.4 (0.3)
	Friend	0.6 (0.1)	0.03 (0.1)
SV (ml)	Self	-1.8 (0.9)	-3.1 (2.1)
	Friend	-4.7 (1.6)	-1.8 (1.9)
SBP (mmHg)	Self	4.9 (1.7)	16.1 (2.0)
	Friend	7.8 (0.9)	3.9 (1.1)
DBP (mmHg)	Self	2.8 (1.7)	7.6 (2.3)
	Friend	9.4 (5.4)	4.2 (1.2)
FBF (ml/min/100ml)	Self	0.3 (0.2)	1.5 (0.4)
	Friend	0.6 (0.3)	-0.2 (0.3)
FVR (units)	Self	2.4 (1.5)	-4.9 (2.4)
	Friend	-2.9 (1.9)	3.2 (1.8)
TPR (dyne-sec.cm-5)	Self	-28.7 (18.3)	-11.0 (26.2)
	Friend	-126.2 (168.0)	-26.8 (69.0)

Figure 2:

Mean cardiac output baseline-stress change scores and standard errors as a function of harassment and target of harassment

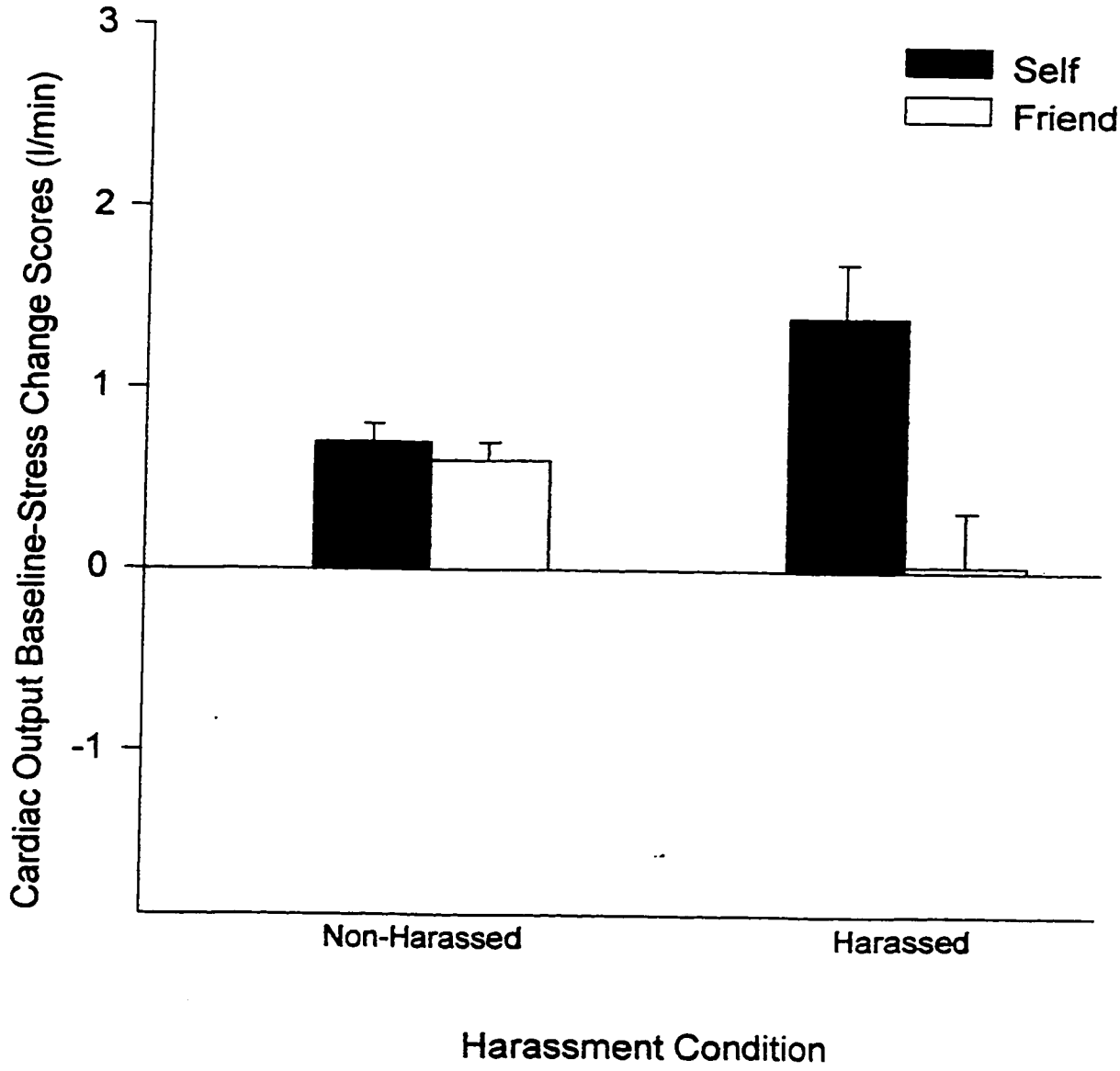

3
2
1
0
-1
Cardiac Output Baseline-Stress Change Scores (l/min)
Self
Friend
Non-Harassed
Harassed
Harassment Condition

Figure 3:

Mean systolic blood pressure baseline-stress change scores and standard errors as a function of harassment and target of harassment

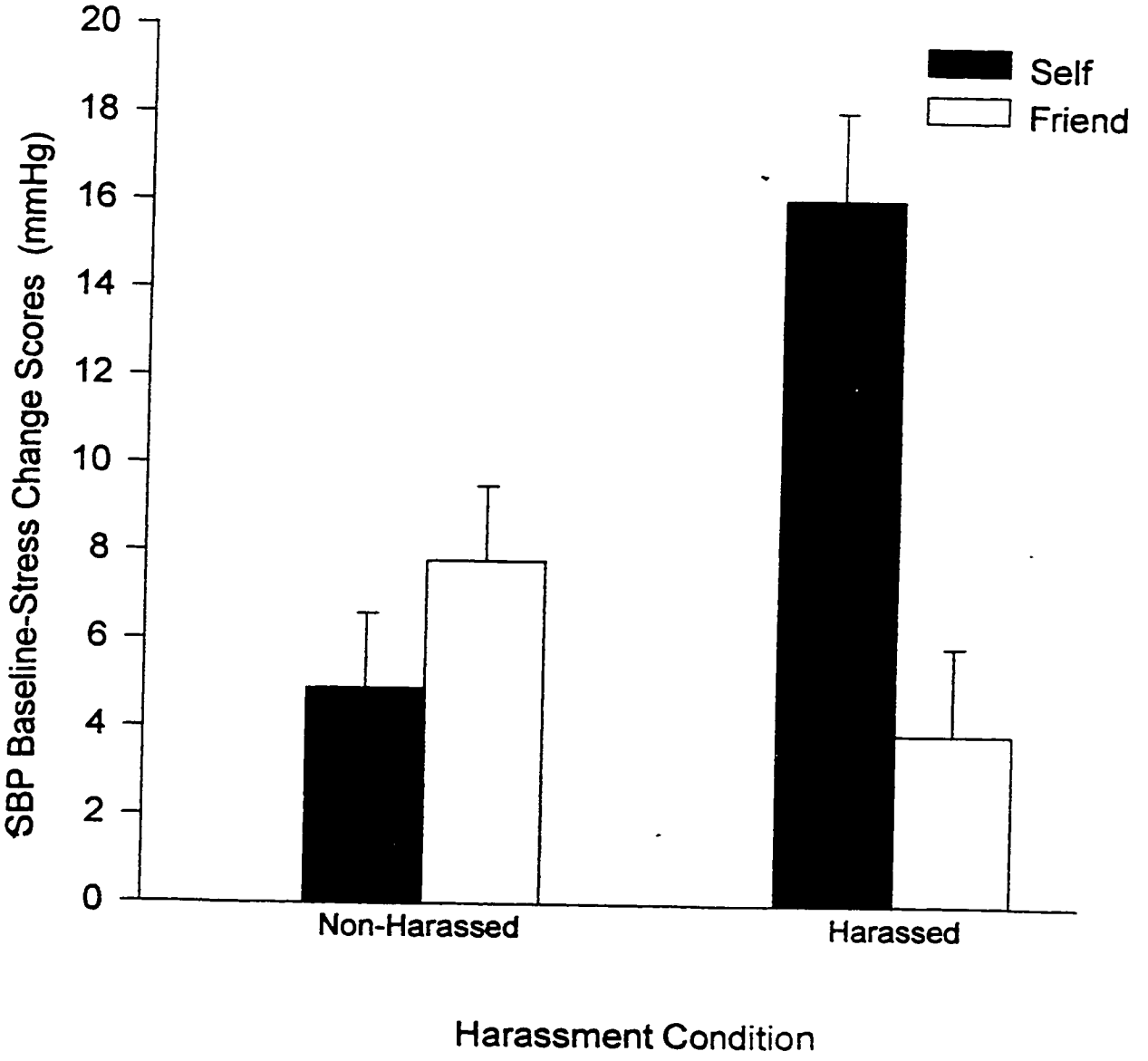
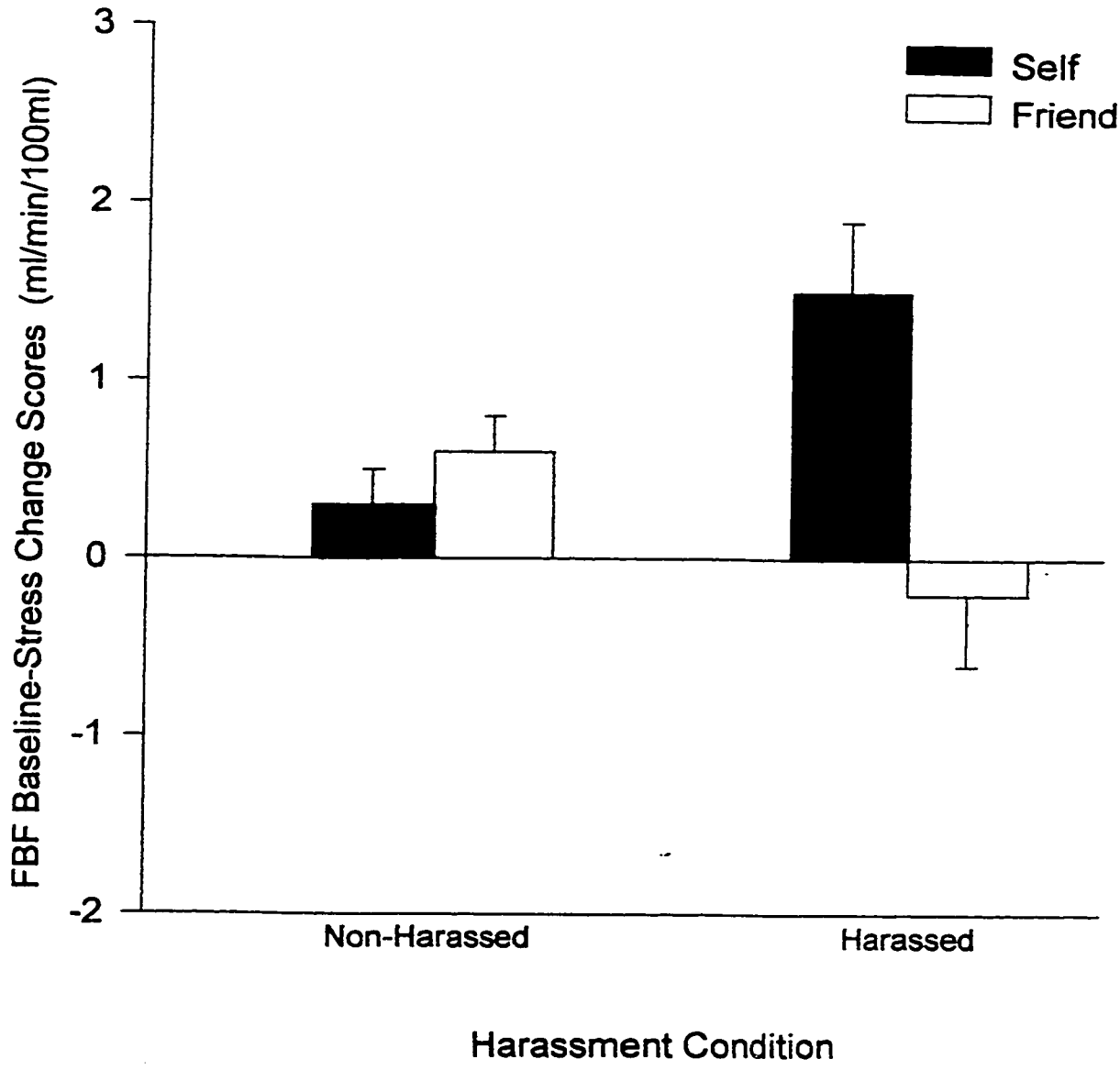

20
18
16
14
12
10
8
6
4
2
0
SBP Baseline-Stress Change Scores (mmHg)
Self
Friend
Non-Harassed
Harassed
Harassment Condition

Figure 4:

Mean forearm blood flow baseline-stress change scores and standard errors as a function of harassment and target of harassment


3
2
1
0
-1
-2
FBF Baseline-Stress Change Scores (ml/min/100ml)
Self
Friend
Non-Harassed
Harassed
Harassment Condition

participants observed their friend engage in the task without harassment, as compared to participants who observed their friend being harassed (friend-harass condition) and when participants themselves engaged in the task without harassment.

No significant main effects or interactions for harassment or target of harassment were observed for stroke volume or total peripheral resistance.

State Affect Analyses

Baseline Analyses

To assess whether there were baseline (pre-task) differences in state-affect values, a series of one-way ANOVAs were conducted for Self-Harass and Friend-Harass participants on each of the 13 affect measures (agreeable, angry, annoyed, anxious, depressed, discouraged, guilty, happy, irritated, nervous, relaxed, sad, and tense). A significant main effect ($F(1, 40) = 5.79$, $p < .02$) for happy was found, indicating that participants in the Friend-Harass condition were significantly more happy than participants in the Self-Harass condition prior to exposure to harassment or non-harassment. No other group differences in baseline state affect values were observed. Means and standard errors of baseline state affect values by harassment condition are presented in Table 5.

Stress Affect Analyses

To assess the effects of harassment and target of harassment on the affective response to stress, 2 (harass vs. non-harass) x 2 (self vs. friend) ANOVAs were conducted using baseline-stress change scores for each affective measure. Means and standard errors of baseline-stress change scores by harassment and target of harassment are presented in Table 6.

Table 5

Mean State-Affect Baseline Scores and Standard Errors as a Function of Self-Harass and Friend-Harass Conditions

	Self-Harass	Friend-Harass
Agreeable	7.2 (0.5)	7.5 (0.6)
Angry	0.8 (0.3)	0.4 (0.1)
Annoyed	2.3 (0.5)	1.3 (0.3)
Anxious	3.9 (0,7)	4.1 (0.8)
Depressed	0.7 (0.3)	0.7 (0.3)
Discouraged	1.5 (0.4)	1.6 (0.6)
Guilty	1.0 (0.4)	0.7 (0.4)
Happy	6.8 (0.3)	8.2 (0.5)
Irritated	2.1 (0.4)	1.3 (0.4)
Nervous	3.2 (0.6)	2.7 (0.6)
Relaxed	7.1 (0.5)	6.9 (0.7)
Sad	1.5 (0.4)	0.9 (0.3)
Tense	4.1 (0.5)	3.6 (0.6)

Table 6

Mean State-Affect Baseline-Stress Change Scores and Standard Errors as a Function of Harassment and Target of Harassment

		Non-Harass	Harass
Agreeable	Self	-0.84 (0.5)	-2.17 (0.8)
	Friend	-1.76 (0.7)	-2.74 (0.6)
Angry	Self	0.86 (0.5)	2.41 (0.7)
	Friend	1.21 (0.6)	2.03 (0.6)
Anxious	Self	1.84 (0.6)	1.15 (0.9)
	Friend	-0.05 (0.9)	-0.37 (1.1)
Annoyed	Self	0.65 (0.3)	2.61 (0.8)
	Friend	1.38 (0.4)	3.28 (0.6)
Tense	Self	2.11 (0.6)	0.82 (1.0)
	Friend	1.93 (0.8)	0.33 (0.8)
Nervous	Self	2.68 (0.7)	-0.02 (0.9)
	Friend	1.65 (0.8)	0.27 (1.2)
Relaxed	Self	-1.52 (0.7)	-2.60 (1.0)
	Friend	-2.40 (0.6)	-1.23 (1.0)
Discouraged	Self	2.72 (0.6)	3.12 (0.9)
	Friend	1.96 (0.7)	2.03 (0.7)
Depressed	Self	0.61 (0.2)	1.53 (0.5)
	Friend	0.75 (0.5)	0.41 (0.3)
Happy	Self	-0.56 (0.5)	-1.85 (0.8)
	Friend	-1.85 (0.7)	-2.17 (0.6)
Sad	Self	0.11 (0.3)	0.75 (0.4)
	Friend	0.50 (0.5)	0.85 (0.6)
Irritated	Self	0.46 (0.4)	2.48 (0.8)
	Friend	1.63 (0.7)	2.58 (0.8)
Guilty	Self	0.43 (0.3)	1.70 (0.6)
	Friend	0.17 (0.1)	0.23 (0.3)

The analyses revealed significant harassment main effects for angry ($F(1, 40) = 6.08$, $p < .02$), annoyed ($F(1, 40) = 10.63$, $p < .002$), irritated ($F(1, 40) = 7.60$, $p < .009$), nervous ($F(1, 40) = 13.58$, $p < .001$), tense ($F(1, 40) = 4.87$, $p < .03$), and agreeable ($F(1, 40) = 5.13$, $p < .03$). Participants reported feeling significantly more angry, annoyed, irritated, nervous, tense, and significantly less agreeable when either they or their friend was harassed, as compared to when no harassment occurred. The harassment main effect for anger is presented in Figure 5.

The analyses further revealed significant harassment x target of harassment interactions for feelings of depression ($F(1, 40) = 4.03$, $p < .05$) and guilt ($F(1, 40) = 5.29$, $p < .02$), indicating that participants who themselves were harassed (self-harass condition) reported feeling significantly more depressed and guilty as compared to participants who observed their friend being harassed (friend-harass condition), and when no harassment occurred. Therefore, participants were equally angered in both conditions, but only Self-Harass participants reported feeling guilty and depressed following harassment. These findings lend support to the argument that Self-Harass participants experienced greater discomfort with their anger as compared to Friend-Harass participants. The significant two-way interactions for depressed and guilty are presented in figures 6 and 7 respectively.

Cardiovascular Analyses-II

This experiment was designed in such a way that the harassment protocol always followed the non-harassment condition. This design was implemented due to concerns about potential affective carry-over effects. Specifically, due to the potential affective consequences of harassment, prior exposure to harassment could not ensure affective neutrality during a subsequent non-harassment condition. As such, participants in the Friend-harass condition always observed

Figure 5:

Mean angry baseline-affect-stress change scores and standard errors as a function of harassment and target of harassment

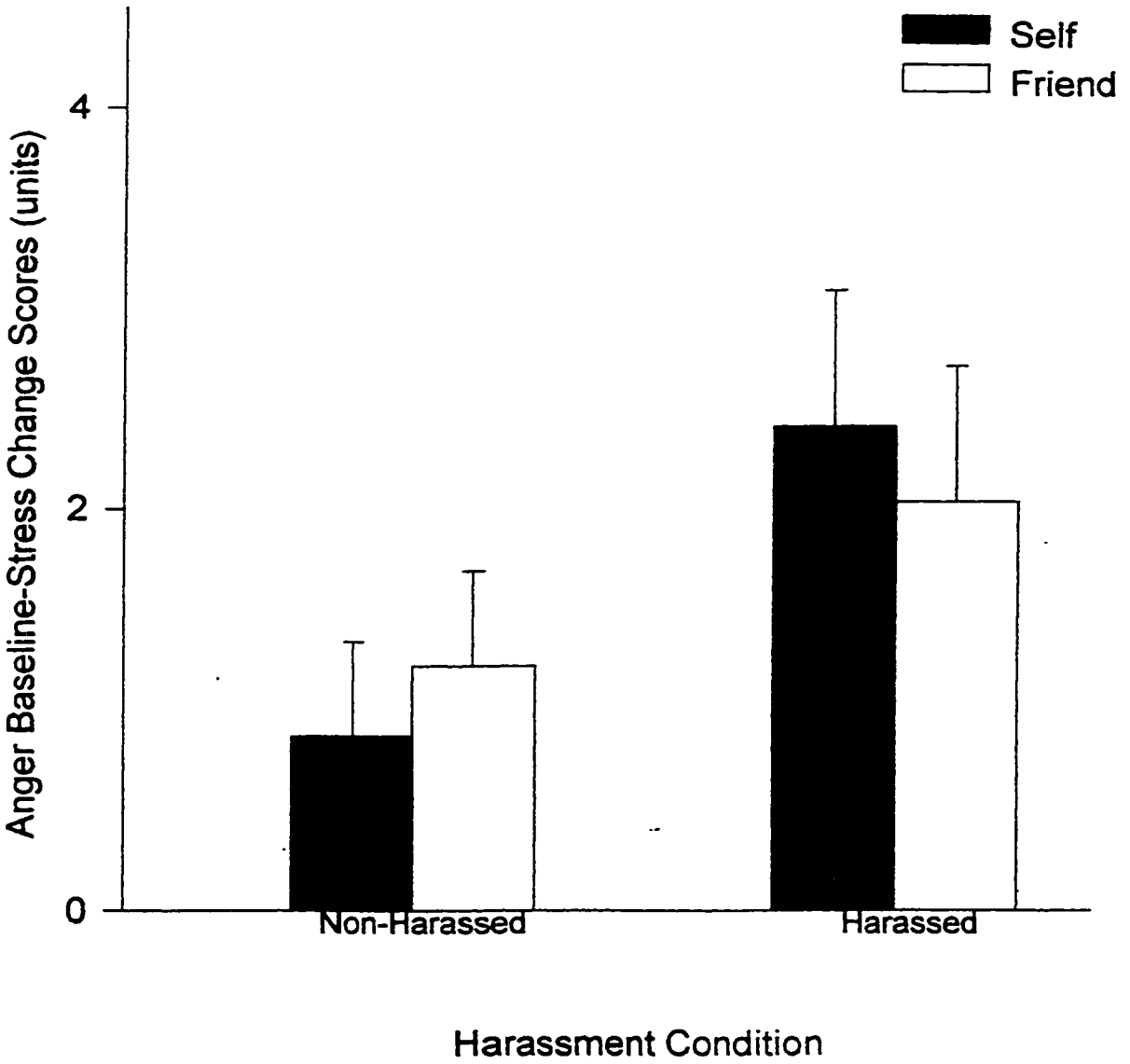

Self
Friend
Anger Baseline-Stress Change Scores (units)
4
2
0
Non-Harassed
Harassed
Harassment Condition

Figure 6:

Mean depressed baseline-affect-stress change scores and standard errors as a function of harassment and target of harassment

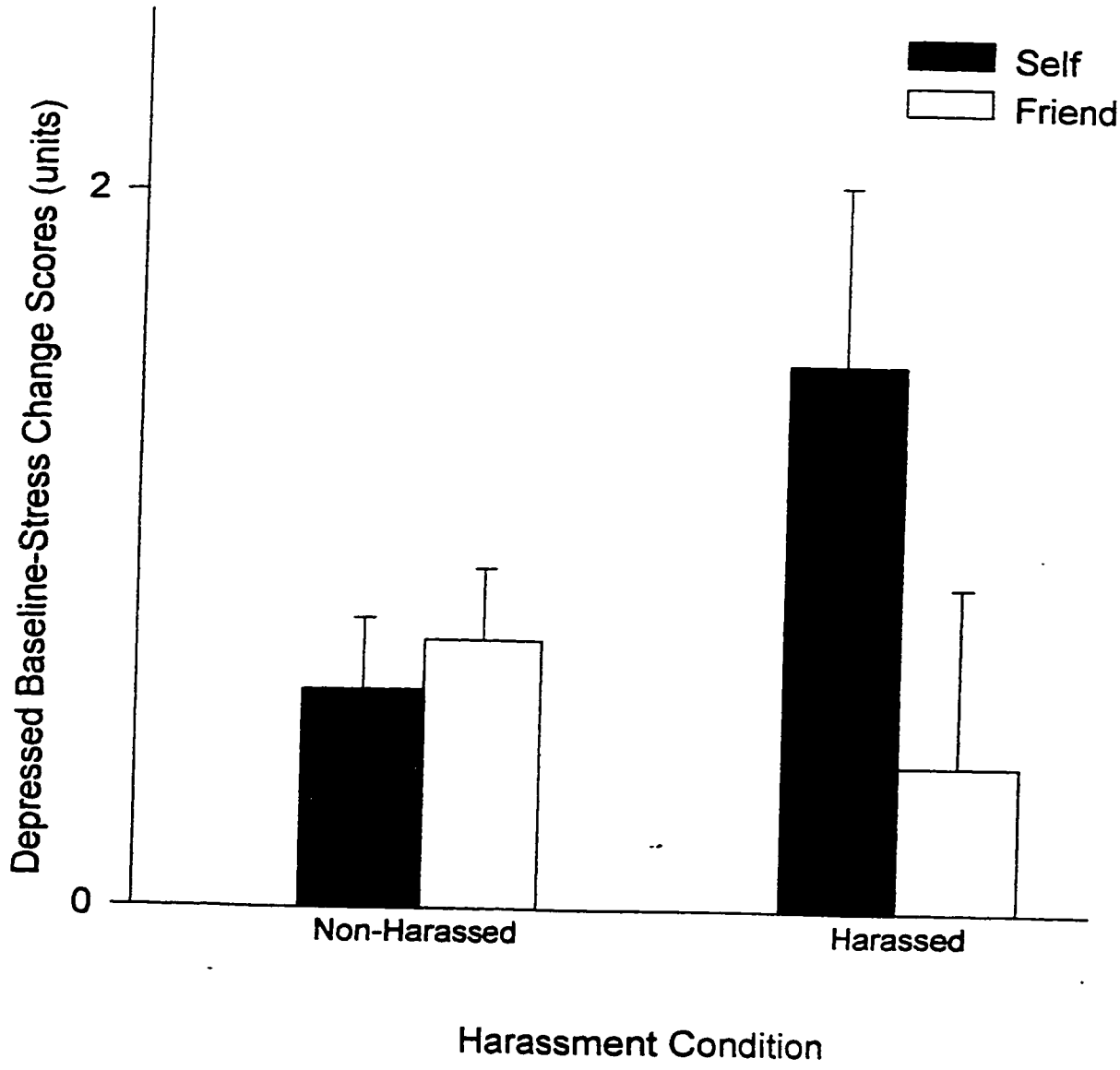
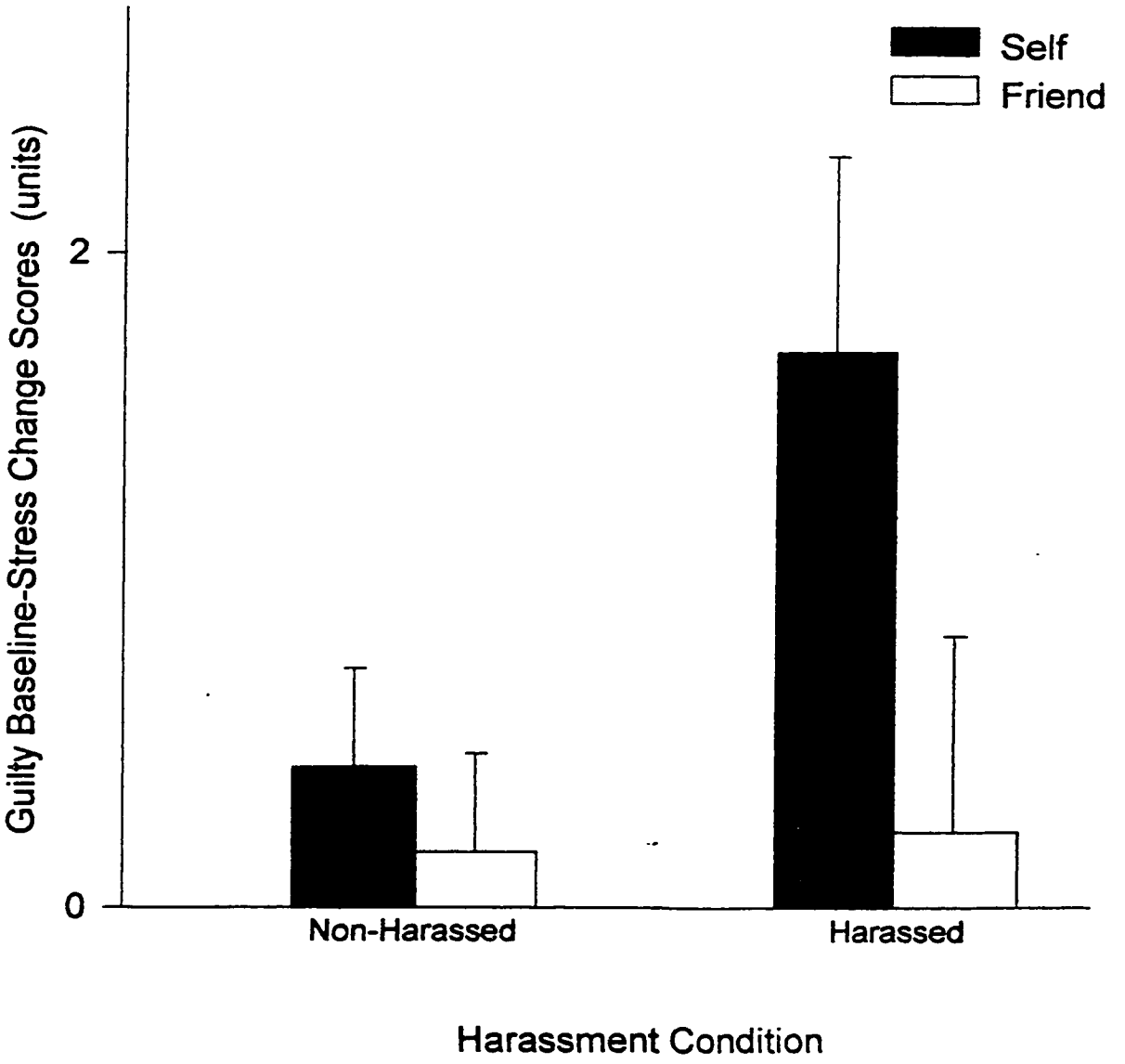

Self
Friend
Depressed Baseline-Stress Change Scores (units)
2
0
Non-Harassed
Harassed
Harassment Condition

Figure 7:

Mean guilty baseline-affect-stress change scores and standard errors as a function of harassment and target of harassment


Self
Friend
Guilty Baseline-Stress Change Scores (units)
2
0
Non-Harassed
Harassed
Harassment Condition

their friend being harassed *after* they had already engaged in the math task without harassment. It is therefore conceivable that due to the participant's prior exposure to the task, the present finding of greater CVR in Self-Harass versus Friend-Harass participants may have been due to some attenuation of physiological response in the participant by the time they came to observe their friend being harassed. In order to rule out this explanation, we examined the cardiovascular reactivity of an additional 20 participants who were randomly assigned to one of two harassment conditions in which they or their friend was harassed immediately following baseline. Participants were exposed to the same harassment protocol as the initial sample.

Baseline Analyses

To assess whether there were baseline differences across harassment condition, a series of one-way analyses of variance (ANOVAs) was conducted for each cardiovascular measure. A significant main effect ($F(1, 17) = 16.28, p < .001$) for forearm blood flow was found, indicating that participants who themselves were harassed exhibited significantly greater FBF responses than participants who observed the harassment of their friend prior to exposure to harassment or non-harassment. No group differences in resting HR, CO, SV, SBP, DBP, FVR, or TPR values were observed. Means and standard errors of baseline cardiovascular values by harassment condition are presented in Table 7.

Stress-Analyses

To assess the effects of target of harassment (self vs. friend) on cardiovascular reactivity to stress, a series of one-way ANOVAs were conducted using baseline-stress change scores for each cardiovascular measure. Means and

Table 7

Mean Cardiovascular Baseline Scores and Standard Errors as a Function of Target of Harassment

	Self	Friend
HR (bpm)	69.9 (2.4)	66.0 (2.4)
CO (l/min)	9.8 (0.9)	7.8 (0.6)
SV (ml)	141.4 (14.6)	118.4 (7.7)
SBP (mmHg)	101.3 (2.7)	96.4 (4.0)
DBP (mmHg)	65.1 (2.3)	63.6 (2.8)
FBF (ml/min/100ml)	4.2 (0.4)	2.2 (0.23)
FVR (units)	23.4 (6.4)	38.2 (4.1)
TPR (dyne-sec.cm^{-5})	691.0 (71.7)	789.4 (73.8)

standard errors of baseline-stress change scores by harassment condition are presented in Table 8.

The analyses revealed significant main effects for target of harassment for systolic blood pressure ($F(1, 19) = 10.75$, $p < .001$), diastolic blood pressure ($F(1, 19) = 8.47$, $p < .01$), and forearm blood flow ($F(1, 19) = 11.24$, $p < .003$), indicating that participants who themselves were harassed exhibited significantly greater elevations in SBP, DBP, and FBF compared to participants who observed the harassment of their friend. Although reactivity values for HR and CO did not reach significance, the means were in the expected direction favoring greater reactivity in participants who themselves were harassed. No significant main effects were observed for stroke volume, forearm vascular resistance, or total peripheral resistance.

Overall, the pattern of cardiovascular reactivity observed in the second sample was consistent with that observed in the initial sample, indicating that the greater reactivity in the Self-Harass as compared to the Friend-Harass participants was not due to attenuation of cardiovascular reactivity.

Table 8

Mean Cardiovascular Baseline-Stress Change Scores and Standard Errors as a Function of Target of Harassment

	Self	Friend
HR (bpm)	11.5 (2.8)	8.1 (1.0)
CO (l/min)	0.9 (0.3)	0.6 (0.2)
SV (ml)	-7.1 (4.6)	-5.9 (2.9)
SBP (mmHg)	13.3 (2.1)	5.8 (1.9)
DBP (mmHg)	9.9 (1.8)	5.0 (1.7)
FBF (ml/min/100ml)	2.0 (0.6)	0.4 (0.2)
FVR (units)	-1.9 (1.9)	-3.6 (3.5)
TPR (dyne-sec.cm-5)	31.4 (26.4)	12.4 (30.6)

Discussion

The present study examined differences in affective response and CVR in women who were exposed to a harassment protocol where participants themselves were harassed (Self-Harass) during a math task, or a harassment protocol where participants observed the harassment of a close female friend (Friend-Harass) while the friend engaged in a math task. Whereas the former represents a traditional harassment protocol involving criticism of the participant's instrumental performance, the latter involves observing an attack on a significant other. Due to the social pressure placed on women to deny their anger, and because it may be considered socially appropriate to express anger in defense of a significant other, it was hypothesized that experiencing anger during harassment of the self would create feelings of discomfort in women, and that this discomfort would lead to greater elevations in CVR in Self-Harass as compared to Friend-Harass participants. The results of the present study offered support for this hypothesis. Though participants reported feeling equally angry, irritated, and annoyed in both the Self-Harass and Friend-Harass conditions, only participants who themselves were harassed exhibited elevated CVR to anger-provocation. Interestingly, feelings of guilt and depression were also only observed in these cardiovascularly hyperreactive Self-Harass participants. These findings lend support to the argument that Self-Harass participants experienced greater discomfort with their anger as compared to Friend-Harass participants, which may have contributed to the elevated CVR observed in the Self-Harass group.

Anger, Cardiovascular Reactivity, and Negative Emotions

The present findings are consistent with those reported by Lai & Linden

(1992), who found that women's self-reported state anger changes and heart rate and systolic blood pressure recovery were synchronous indicating that as self-reported anger decreased, physiological recovery from harassment increased. Thus, outside of a socially acceptable context for expressing anger, decreased feelings of anger decreased CVR. The present findings are also consistent with research conducted by Hokanson et al. (1968), who demonstrated that while men produced faster physiological recovery from harassment when they responded to provocation with aggressive responses, women produced faster recoveries when responding to provocation with friendly responses. It is reasonable to speculate that responding to provocation with friendly responses is consistent with the traditional view of anger inhibition in women, whereby women would deny the experience of anger in order to behave according to society's expectations of the feminine role. Men, on the other hand, would recover faster when responding with aggressive responses, because responding aggressively to provocation would be consistent with socialization factors which accept anger expression in men. Taken together, these findings lend support to the argument that experiencing and/or expressing anger, without a socially acceptable reason for doing so, may result in elevated CVR and confer risk for cardiovascular disease.

Interestingly, the present findings revealed that although participants reported feeling equally angry, irritated, and annoyed in both the Self-Harass and Friend-Harass conditions, only participants who themselves were harassed reported feeling guilty and depressed, as compared to participants who observed the harassment of their friend. These findings are consistent with previous research showing that women experience more negative emotions (e.g., shame, guilt, and depression) as a result of their anger than do men (Deffenbacher et al. 1996; Averill, 1982). These findings also support previous research suggesting

discomfort for women when experiencing anger in traditionally inappropriate contexts (Tavris, 1982). Of interest is that elevations of guilt and depression were observed exclusively in participants in the Self-Harass condition, i.e., in the same participants who exhibited elevated CVR to stress. This lends support to the argument that negative emotions experienced as a result of the experience of anger may have contributed to the greater CVR observed in Self-Harass as opposed to Friend-Harass participants. The fact that Friend-Harass participants did not report feeling guilt or depression following harassment indicates that women may indeed feel more comfortable feeling and expressing anger in response to an attack on a significant other. Being angry in such a situation may be seen as socially acceptable for women, thus minimizing the likelihood of experiencing social reprimands as a result of their anger, and the negative emotions associated with the experience of anger. As such, Friend-Harass participants would not have experienced as much discomfort with their anger, and explains the lower increases in CVR observed in Friend-Harass as compared to Self-Harass participants.

These findings also indicate that negative emotions such as guilt and depression may play a moderating role between anger and the development of cardiovascular disease in women. In fact, there is evidence to suggest that anger, in particular expressed anger, may influence the development of depression in women. Frank, Carpenter, and Kupfer (1988) reported that expressed anger and hostility were related to increases in the incidence of recurrent depression among women, but was unrelated to recurrent depression in men. Given that women are twice as likely to develop depressive syndromes as men (Somervell, Leaf, Weissman, Blazer, & Bruce, 1989), it seems reasonable to speculate that anger, because of its apparent relationship to negative emotions such as depression and

guilt, may be a cardiovascular risk factor affecting women in particular. In light of the present findings, a closer examination of the anger-depression-CVR relationship seems warranted.

Anger, Cardiovascular Reactivity, and Gender Differences in Emotion

The results of the present study are similar to those involving men, in that women who are harassed show elevated patterns of cardiovascular reactivity as compared to non-harassed participants. However, contrary to results obtained with men (e.g., Burns & Katkin, 1993; Boyle & Siegman, 1992), the elevated cardiovascular reactivity observed in participants who were themselves harassed does not appear to be directly related to anger, because women observing the harassment of their friend reported similar levels of anger as those participants who were themselves harassed, but the Friend-Harass participants were not more reactive as compared to the non-harass controls. Because only women who themselves were harassed reported feelings of depression and guilt following harassment, it is reasonable to speculate that the greater reactivity observed in Self-Harass participants could have been related to the experience of these negative emotions. Clearly, more research is needed to elucidate such a relationship.

Additional Findings and Recommendations for Future Research

Several additional findings are noteworthy. First, consistent with previous research employing traditional harassment protocols (e.g., Burns & Katkin, 1993; Lai & Linden, 1992; Boyle & Siegman, 1992; Siegman et al. 1991; Hokanson et al. 1963), deliberately provoking anger led to elevated CVR in participants relative to pretask baseline values. This lends further support to the argument that in order

for the relationship between anger and CVR to emerge, it is essential that participants actually be angered. Second, it is important to note that the finding of greater CVR in Self-Harass as compared to Friend-Harass participants was not due to weaker friendship relations among Friend-Harass participants and their friends. Analyses of friendship quality revealed no differences on any dimension of friendship quality between Self-Harass and Friend-Harass groups, thus eliminating lack of attachment between participants and their friends in the Friend-Harass condition as an explanation for the observed pattern of results. Third, the greater cardiovascular reactivity observed in participants who were themselves harassed during the math task versus watching while their friend engaged the math task while harassed could not simply be due to their performance on the task, since their reactivity was elevated compared to participants who simply engaged in the math task without harassment. Finally, because Friend-Harass participants always observed their friend being harassed after they had already engaged in the math task without harassment, there was a concern that the greater cardiovascular reactivity observed in participants who themselves were harassed may have been due to an attenuation of physiological response in Friend-Harass participants by the time they came to observe their friend being harassed. However, the examination of an additional 20 participants experiencing harassment immediately following baseline revealed an overall pattern of CVR which was consistent with that observed in the initial sample. Thus, the greater reactivity in the Self-Harass as compared to the Friend-Harass condition was not due to attenuation of cardiovascular reactivity in Friend-Harass participants.

The principal advantage of the present study is that the design represents a unique departure in research protocol from previous studies examining anger and

cardiovascular reactivity to anger provocation in women. This study is the first of its kind to examine affective responses and CVR in women while observing the harassment of a significant other. Given that women are socialized to refrain from expressing anger, except in situations where it may be socially acceptable, future studies examining anger in women would benefit by further exploring affective and physiological reactions in women observing the harassment of family members, spouses, or children. For ethical reasons, harassment protocols provocative enough to elicit anger feelings leading to verbal or physical outbursts were not employed. However, ethical considerations do not preclude design variations which provide a) an opportunity for participants to give direct, negative verbal or written feedback to a harasser, or b) informing participants a priori that the harasser will learn about the negative feedback. It may be beneficial for future studies to employ such design variations, which would permit a more direct examination of the relationship between anger expression and cardiovascular reactivity in women.

Regarding limitations, the present study was limited by the reliance upon self-report of state anger, as well as by the use of a healthy undergraduate sample. Future research should include broader samples of age, socioeconomic status, education level, and ethnicity in order to increase the generalizability of findings.

Concluding Remarks

In conclusion, the major finding of the present study was that while participants reported feeling equally angry when participants themselves were harassed and when participants observed the harassment of their friend, only women who themselves were harassed exhibited greater cardiovascular responses as compared to women who observed the harassment of a close female friend or

when no harassment occurred. Interestingly, feelings of guilt and depression were also only observed exclusively in these cardiovascularly hyperreactive participants. These findings suggest that negative emotions such as depression and guilt may play a more important role than pure anger in moderating cardiovascular reactivity in women during interpersonal conflict. These findings further support previous research suggesting discomfort for women when faced with their anger in traditionally inappropriate contexts. The extent to which emotions such as depression confer risk for cardiovascular disease in women warrants further investigation.

References

Alexander, F. G. (1950). Psychosomatic Medicine. New York: Norton.

Alexander, F. G., French, T. M., & Pollack, G. H. (1968). Psychosomatic specificity: Experimental study and results. Chicago: The University of Chicago Press.

Anderson, S. F., & Lawlor, K. A. (1995). The anger recall interview and cardiovascular reactivity in women: an examination of context and experience. Journal of Psychosomatic Research, 39, 335-343.

Averill, J. R. (1983). Studies on anger and aggression: Implications for theories of emotion. American Psychologist, 38, 1145-1160.

Averill, J. R. (1980). A constructivist view of emotion. In R. Plutchik & H. Kellerman (Eds.), Theories of Emotion (pp. 305-339). San Diego, CA: Academic Press.

Averill, J. R. (1982). Anger and Aggression. New York: Springer-Verlag.

Biaggio, M. K. (1980). Assessment of anger arousal. Journal of Personality Assessment, 44, 289-298.

Birnbaum, D. A., Nosanchuk, T. A., & Croll, W. L. (1980). Children's stereotypes about sex differences in emotionality. Sex Roles, 6, 435-443.

Boyle, S., & Siegman, A. W. (1992). Dimensions of anger expression and CVR in angered men. Unpublished manuscript, University of Maryland, Baltimore County.

Bukowski, W. M., Hoza, B., & Boivin, M. (1994). Measuring friendship quality during pre- and early adolescence: The development and psychometric properties of the Friendship Qualities Scale. Journal of Social and Personal Relationships, 11, 471-484.

Burns, J. W. & Katkin, E. S. (1993). Psychological, situational, and gender predictors of cardiovascular reactivity to stress: A multivariate approach. Journal of Behavioral Medicine, 16, 445-465.

Buss, A. H. & Durkee, A. (1957). An inventory for assessing different kinds of hostility. Journal of Consulting Psychology, 21, 343-349.

Cannon, W. B. (1932). The wisdom of the body. New York: Norton.

Chesney, M. A. (1993). Social isolation, depression, and heart disease: Research on women broadens the agenda. Psychosomatic Medicine, 55, 426-433.

Crowne, D. P., & Marlowe, D. (1964). The Approval Motive: Studies in Evaluative Dependence. New York: Wiley.

Deaux, K., & Lewis, L. L. (1983). Assessment of gender stereotypes: Methodology and components. Psychological Documents, 13, Ms. No. 2583.

Deffenbacher, J. L., Oetting, E. R., Thwaites, G. A., Lynch, R. S., Baker, D. A., Stark, R. S., Thacker, S., & Eiswerth-Cox, L. (1996). State-trait anger theory and the utility of the Trait Anger Scale. Journal of Counselling Psychology, 43, 131-148.

Dembroski, T. M., MacDougall, J. M., Costa, P. T., & Grandits, G. A. (1989). Components of hostility as predictors of sudden death and myocardial infarction in the Multiple Risk Factor Intervention Trial. Psychosomatic Medicine, 51, 514-522.

Dembroski, T. M., MacDougall, J. M., Williams, R. B., Haney, T. L., & Blumenthal, J. A. (1985). Components of Type A, hostility, and anger-in: Relationship to angiographic findings. Psychosomatic Medicine, 47, 219-233.

de Rivera, J. (1977). A structural theory of emotions. New York: International Universities Press.

Eagly, A. H., & Steffen, V. J. (1986). Gender and aggressive behavior: A

meta-analytic review of the social psychological literature. Psychological Bulletin, 100, 309-330.

Engbreston, T. O., & Matthews, K. A. (1992). Dimensions of hostility in men, women, and boys: Relationships to personality and cardiovascular responses to stress. Psychosomatic Medicine, 54, 311-323.

Engbreston, T. O., Matthews, K. A., & Scheier, M. F. (1989). Relations between anger expression and cardiovascular reactivity: Reconciling inconsistent findings through a matching hypotheses. Journal of Personality and Social Psychology, 57, 513-521.

Faber, S. D., & Burns, J. W. (1996). Anger management style, degree of expressed anger, and gender influence cardiovascular recovery from interpersonal harassment. Journal of Behavioral Medicine, 19, 31-53.

Fivush, R. (1991). Gender and emotion in mother-child conversations about the past. Journal of Narrative Life History, 1, 325-341.

Fivush, R. (1989). Exploring sex differences in the emotional content of mother-child conversations about the past. Sex Roles, 20, 675-691.

Frank, E., Carpenter, L. L., & Kupfer, D. J. (1988). Sex differences in recurrent depression: Are there any that are significant? American Journal of Psychiatry, 145, 41-45.

Frijda, N. H., Kuipers, P., & ter Schure, E. (1989). Relations among emotion, appraisal, and emotional action readiness. Journal of Personality and Social Psychology, 57, 212-228.

Girdler, S. S., Turner, J. R., Sherwood, A., & Light, D. C. (1990). Gender differences in blood pressure during a variety of behavioral stressors. Psychosomatic Medicine, 50, 321-329.

Golombok, S., & Fivush, R. (1994). Gender Development. New York:

Cambridge University Press.

Gordon, S. L. (1989). The socialization of children's emotions: Emotion culture, competence, and exposure. In C. Saarni & P. Harris (Eds.), Children's Understanding of Emotion (pp. 319-349). New York: Cambridge University Press.

Greenglass, R. R., & Julkunun, J. (1989). Construct validity and sex differences in Cook-Medley hostility. Personality and Individual Differences, 10, 209-218.

Haynes, S. G., & Feinleib, M. (1980). Women, work, and coronary disease: Prospective findings from the Framingham Heart Study. American Journal of Public Health, 70, 133-141.

Heberden, W. (1772). Some account of a disorder of the breast. Medical Transactions Royal College of Physicians, 2, 59.

Hecker, M. H., Chesney, M. A., Black, G. W., & Frautschi, N. (1988). Coronary prone behaviors in the Western collaborative group study. Psychosomatic Medicine, 50, 153-164.

Hokanson, J. E., Willers, K. R., & Koropsak, E. (1968). The modification of autonomic responses during aggressive interchanges. Journal of Personality, 36, 386-404.

Hokanson, J. E., Burgess, R., & Cohen, M. F. (1963). Effects of displaced aggression on systolic blood pressure. Journal of Abnormal and Social Psychology, 67, 214-218.

Houston, B. K. (1994). Anger, hostility, and psychophysiological reactivity. In A. W. Siegman. & T. W. Smith (Eds.), Anger, Hostility, and the Heart (pp. 97-115). Hillsdale, NJ: Erlbaum.

Izard, C. E. (1977). Human Emotions. New York: Plenum Press.

Kopper, B. A., & Epperson, D. L. (1996). The experience and expression of

anger: Relationships with gender, gender role socialization, depression, and mental health functioning. Journal of Counseling Psychology, 43, 158-165.

Kopper, B. A., & Epperson, D. L. (1991). Women and anger: Sex and sex-role comparisons in the expression of anger. Psychology of Women Quarterly, 15, 7-14.

Lai, J. Y., & Linden, W. (1992). Gender, anger expression style, and opportunity for anger release determine cardiovascular reaction to and recovery from anger provocation. Psychosomatic Medicine, 54, 297-310.

Lavoie, K., Campbell, T., Miller, S., Friese, M, Dolgoy, L., & Sita, A. (1996, March). Hostility moderates sodium consumption and cardiovascular response to stress. Poster presented at the Fourth International Congress of Behavioral Medicine, Washington, DC.

Lazarus, R. S. (1991). Emotion and adaptation. New York: Oxford University Press.

Lazarus, R. S., Averill, J. R., & Opton, E. M. (1970). Towards a cognitive theory of emotion. In M. B. Arnold (Ed.), Feelings and emotions. New York: Academic Press.

Lerner, H. G. (1985). The dance of anger. New York: Harper & Row.

MacDougall, J. M., Dembroski, T. M., Dimsdale, J. E., & Hacket, T. (1985). Components of Type A, hostility, and anger-in: Further relationships to angiographic findings. Health Psychology, 24, 137-152.

Miller, S. B., Friese, M., Dolgoy, L., Lavoie, K., & Campbell, T. (in press). Hostility, sodium consumption, and cardiovascular response to stress. Psychosomatic Medicine.

Miller, S. B., Dolgoy, L., & Friese, M., (1996, March). Hostility and Family History of CVD Predict Cardiovascular Reactivity and Health-Risk Behaviors.

Paper presented at the Annual Meeting of the Society for Behavioral Medicine, Washington, DC.

Miller, S. B. (1993). Cardiovascular reactivity in anger-defensive individuals: The influence of task demands, Psychosomatic Medicine, 55, 78-85.

Mills, P. J., Schneider, R. H., & Dimsdale, J. E. (1989). Anger assessment and reactivity to stress. Journal of Psychosomatic Research, 33, 379-382.

Mirowsky, J., & Ross, C. E. (1995). Sex differences in distress: Real or artifact? American Sociological Review, 60, 449-468.

Ortony, A., & Turner, T. J. (1990). What's basic about emotions? Psychological Review, 97, 315-331.

Powch, I. G., & Houston, B. K. (1996). Hostility, anger-in, and cardiovascular reactivity in white women. Health Psychology, 15, 200-208.

Rosenman, I. J., Wiest, C., & Swartz, T. S. (1994). Phenomenology, behaviors, and goals differentiate discrete emotions. Journal of Personality and Social Psychology, 67, 206-221.

Scherer, K. R. (1984). Emotion as a multicomponent process: A model and some cross-cultural data. In P. Shaver (Ed.). Review of Personality and Social Psychology: Emotions, Relationships, and Health (pp.37-63). London: Sage.

Sharkin, B. S. (1996). Understanding anger: Comment on Deffenbacher, Oetting, et al. (1996), Deffenbacher, Lynch, et al. (1996), and Kopper and Epperson (1996). Journal of Counseling Psychology, 43, 166-169.

Shaver, P., Schwartz, J., Kirson, D., & O'Connor. (1987). Emotion knowledge: Further exploration of a prototype approach. Journal of Personality and Social Psychology, 52, 1061-1086.

Sherwood, A., Allen, M. T., & Fahrenberg, J. (1990). Methodological guidelines for impedance cardiography. Psychophysiology, 27, 1-23.

Shields, S. A. (1987). Women, men, and the dilemma of emotion. In P. Shaver & C. Hendrick (Eds.), Sex and Gender (pp. 229-250). Newbury Park, CA: Sage.

Shields, S. A. (1984). Distinguishing between emotion and nonemotion: Judgments about experience. Motivation and Emotion, 8, 355-369.

Shields, S. A. (1986). Are women "emotional"? In C. Tavris (Ed.), Every Woman's Emotional Well-Being. Garden City, New York: Doubleday.

Siegman, A. W. (1994). From Type-A to hostility to anger: Reflections on the history of coronary-prone behavior. In A. W. Siegman. & T. W. Smith (Eds.), Anger, Hostility, and the Heart (pp. 1-21). Hillsdale, NJ: Erlbaum.

Siegman, A. W. (1993). Paraverbal correlates of stress: Implications for stress identification and stress management. In L. Goldberger & S. Breznitz (Eds.), Handbook of Stress: Theoretical and Clinical Aspects. New York: The Free Press.

Siegman, A. W., Anderson, R., Herbst, J., Boyle, S., & Wilkinson, J. (1992). Dimensions of anger-hostility and cardiovascular reactivity in provoked and angered men. Journal of Behavioral Medicine, 15, 257-272.

Siegman, A. W., Anderson, R. W., & Boyle, S. (1991, March). Repression, impression management, trait anxiety, and cardiovascular reactivity in men and women. Paper presented at the Annual Meeting of the Society for Behavioral Medicine, Washington, DC.

Siegman, A. W., Dohm, F.A., & Gjesdal, J. (1988, April). The effects of repressive coping style on the relationship between hostility, neuroticism, and cardiovascular reactivity. Symposium paper presented at the Annual Meeting of the Society of Behavioral Medicine, Boston, MA.

Siegman, A. W., Dembroski, T. M., & Ringel, N. (1987). Components of

hostility and the severity of coronary artery disease. Psychosomatic Medicine, 48, 127-135.

Smith, K. C., Ulch, S. E., Cameron, J. E., & Cumberland, J. A. (1989). Gender-related effects in the perception of anger expression. Sex Roles, 20, 487-499.

Smith, T. W. (1994). Concepts and methods in the study of anger, hostility, and health. In A. W. Siegman. & T. W. Smith (Eds.), Anger, Hostility, and the Heart (pp. 23-42). Hillsdale, NJ: Erlbaum.

Smith, T. W., & Houston, K. (1987). Hostility, anger expression, cardiovascular responsivity, and social support. Biological Psychology, 24, 39-48.

Somervell, P., Leaf, P., Weissman, M., Blazer, D., & Bruce, M. (1989). The prevalence of major depression in black and while adults in 5 United States communities. American Journal of Epidemiology, 130, 725-735.

Spielberger, C. D., Gorsuch, R., & Luchene, R. (1970). Manual for the State-Trait Anxiety Inventory (Self Evaluation Questionnaire). Palo Alto, CA: Consulting Psychologists Press.

Spielberger, C. D., Johnson, E. H., Russell, S. F., Crane, R. J., Jacobs, G. A., & Worden, T. J. (1985). The experience and expression of anger: Construction and validation of an anger expression scale. In M. A. Chesney & R. H. Rosenman (Eds.), Anger and hostility in cardiovascular and behavioral disorders (pp. 5-30). New York: McGraw-Hill /Hemisphere.

Spielberger, C. D., Jacobs, G, Russell, S., & Crane, R. (1983). Assessment of Anger: The state-trait anger scale. In J. N. Butcher & C. D. Spielberger (Eds.). Advances in Personality Assessment (Vol. 2). Hillsdale, NJ, LEA.

Stoney, C. M., & Engbreston, T. O. (1994). Anger and hostility: Potential mediators of the gender difference in coronary heart disease. In A. W. Siegman. &

T. W. Smith (Eds.), Anger, Hostility, and the Heart (pp. 225-237). Hillsdale, NJ: Erlbaum.

Tavris, C. (1982). Anger: The Misunderstood Emotion. New York: Simon & Shuster.

Thomas, S. P., & Williams, R. L. (1990, April). Gender differences in modes of anger expression: Health implications. Paper presented at the 11th Annual Meeting of the Society of Behavioral Medicine, Chicago, IL.

Van Egren, L. F., Abelson, J. L., & Thornton, D. W. (1978). Cardiovascular consequences of expressing anger in a mutually-dependent relationship. Journal of Psychosomatic Research, 22, 537-548.

Vogele, C., & Steptoe, A. (1993). Anger inhibition and family history as modulators of cardiovascular responses to mental stress in adolescent boys. Journal of Psychosomatic Research, 17, 503-514.

Whitney, R. J. (1953). The measurement of volume changes in human limbs. Journal of Physiology, 121, 1-27.

Appendix A

Participant Health Questionnaire

Participant Health Questionnaire

Name: _____ Age:_____ Phone:_____

Major subject studied:_____
Minor subject studied:_____

Please answer all of the following questions carefully.

Have you had any medical or surgical problems during the last year?
Yes _____ No _____
Please specify: _____
Do you suffer from any chronic illnesses?
Yes _____ No _____
Please specify: _____
Do you now, or have you ever had high blood pressure?
Yes _____ No _____
Please specify: _____
Do you have diabetes? Yes _____ No _____
Have you ever had kidney trouble of any kind?
Yes _____ No _____
Please specify: _____
Do you suffer from epilepsy? Yes _____ No _____
Have you ever had liver trouble of any kind?
Yes _____ No _____
Please specify: _____
Do you have asthma? Yes _____ No _____
Do you now suffer from bronchitis or do you suffer from chronic bronchitis?
Yes _____ No _____

Have you ever had a fainting spell? Yes _____ No _____
If yes, please explain: _____

Are you presently, or have you ever been treated for psychological or psychiatric reasons? Yes _____ No _____
If yes, please explain briefly: _____
_____

Please list any medication that you are presently taking and the reason for taking it: _____

Please give the date (or approximate date) of your last medical check-up:
_____

Signature: _____ Date: _____

Appendix B

Parental Health Questionnaire

Parental Health Questionnaire

Name:

_____

Last First Middle

Present address and telephone number:

_____

Address Phone

_____

City Province Postal Code

Date of birth: _____

Month Day Year

The following questions refer to your biological parents. Have either of your parents ever suffered

a. angina or heart pain _____ _____ _____ _____

Father Mother Neither Don't know

b. a heart attack _____ _____ _____ _____

Father Mother Neither Don't know

c. a stroke _____ _____ _____ _____

Father Mother Neither Don't know

Do either of your parents have

a. high blood pressure _____ _____ _____ _____

Father Mother Neither Don't know

b. some other significant circulatory problem? _____

(if yes, please describe: _____)

c. diabetes _____ _____ _____ _____

Father Mother Neither Don't know

d. kidney disease _____ _____ _____ _____

Father Mother Neither Don't know

Do either of your parents take medication for high blood pressure?

_____ _____ _____ _____

Father Mother Neither Don't know

Appendix C

State Affect Questionnaire

State Affect Questionnaire

HOW ARE YOU FEELING RIGHT NOW?

Indicate on each of the scales below by marking a vertical stroke through the line at the appropriate point.

Not at all Nervous	_____	Very Nervous
Not at all Agreeable	_____	Very Agreeable
Not at all Happy	_____	Very Happy
Not at all Tense	_____	Very Tense
Not at all Anxious	_____	Very Anxious
Not at all Relaxed	_____	Very Relaxed
Not at all Discouraged	_____	Very Discouraged
Not at all Annoyed	_____	Very Annoyed
Not at all Sad	_____	Very Sad
Not at all Irritated	_____	Very Irritated
Not at all Angry	_____	Very Angry
Not at all Depressed	_____	Very Depressed
Not at all Guilty	_____	Very Guilty

Appendix D

Friendship Qualities Scale

FRIENDSHIP ACTIVITY QUESTIONNAIRE

We want to ask you some questions about you and your friend so we can know what your friend is like. We have some sentences we would like you to read. Please tell us whether this sentence describes your friendship or not. Some of the sentences might be really true for your friendship while other sentences might not be very true for your friendship. We simply want you to read the sentence and tell us how true the sentence is for your friendship. Remember, there are no right or wrong ways to answer these questions, and you can use any of the numbers on the scale.

After each sentence there is a scale that goes from 1 to 5.

"1" means the sentence is probably <u>not true</u> for your friendship,

"2" means that it might be true,

"3" means that it is usually true,

"4" means that it is very true,

"5" means that it is <u>really</u> true for your friendship.

Circle the number on the scale that is best for you. Be sure to read carefully and answer as honestly as possible.

1. My friend and I spend a lot of our free time together.
   Not True 1-------2-------3-------4-------5 Really True

2. My friend gives me advice when I need it.
   Not True 1-------2-------3-------4-------5 Really True

3. My friend and I do things together.
   Not True 1-------2-------3-------4-------5 Really True

4. My friend and I help each other.
   Not True 1-------2-------3-------4-------5 Really True

5. Even if my friend and I have an argument we would still be able to be friends with each other.
   Not True 1-------2-------3-------4-------5 Really True

6. My friend and I hang out together.
   Not True 1-------2-------3-------4-------5 Really True

7. If other people were bothering me, my friend would stick up for me.
   Not True 1-------2-------3-------4-------5 Really True

8. Our friendship is just as important to me as it is to my friend.
   Not True 1-------2-------3-------4-------5 Really True

9. I can trust and rely on my friend.	Not True Really True 1-------2-------3-------4-------5
10. My friend helps me when I am having trouble with something.	Not True Really True 1-------2-------3-------4-------5
11. If my friend had to move away I would miss her.	Not True Really True 1-------2-------3-------4-------5
12. If I couldn't figure out how to do something, my friend would try to help me.	Not True Really True 1-------2-------3-------4-------5
13. Sometimes it seems that I care more about our friendship than my friend does.	Not True Really True 1-------2-------3-------4-------5
14. When I succeed at something my friend is happy for me.	Not True Really True 1-------2-------3-------4-------5
15. There is nothing that could come between our friendship.	Not True Really True 1-------2-------3-------4-------5
16. Sometimes my friend does things for me or makes me feel special.	Not True Really True 1-------2-------3-------4-------5
17. When my friend and I have an argument, she can hurt my feelings.	Not True Really True 1-------2-------3-------4-------5
18. When I have not been with my friend for a while, I really miss her.	Not True Really True 1-------2-------3-------4-------5
19. If somebody tried to push me around my friend would help me.	Not True Really True 1-------2-------3-------4-------5
20. I can get into fights with my friend.	Not True Really True 1-------2-------3-------4-------5
21. My friend would stick up for me if someone was harassing me.	Not True Really True 1-------2-------3-------4-------5
22. When we have free time, my friend and I usually do something together or spend time together.	Not True Really True 1-------2-------3-------4-------5
23. If I have a problem at school, work, or in my personal life, I can talk to my friend about it.	Not True Really True 1-------2-------3-------4-------5
24. My friend can bug me or annoy me even though I ask her not to.	Not True Really True 1-------2-------3-------4-------5

25. If I needed a little money my friend would loan it to me.
Not True 1-------2-------3-------4-------5 Really True

26. I think of things for us to do more often than my friend does.
Not True 1-------2-------3-------4-------5 Really True

27. If I said I was sorry after I had a fight with my friend she would still stay mad at me.
Not True 1-------2-------3-------4-------5 Really True

28. My friend helps me with things that are difficult or that need two people.
Not True 1-------2-------3-------4-------5 Really True

29. My friend and I go out with each other after school/work and on weekends.
Not True 1-------2-------3-------4-------5 Really True

30. Sometimes my friend and I just sit around and talk about things like school, sports, and other things we like.
Not True 1-------2-------3-------4-------5 Really True

31. If I have questions about something my friend would help me get some answers,
Not True 1-------2-------3-------4-------5 Really True

32. Even if other persons stopped liking me, my friend would still be my friend.
Not True 1-------2-------3-------4-------5 Really True

33. I know that I am important to my friend.
Not True 1-------2-------3-------4-------5 Really True

34. My friend would help me if I needed it.
Not True 1-------2-------3-------4-------5 Really True

35. Being friends is more important to me than it is to my friend.
Not True 1-------2-------3-------4-------5 Really True

36. If there is something bothering me I can tell my friend about it even if it is something I cannot tell to other people.
Not True 1-------2-------3-------4-------5 Really True

37. Things are usually pretty even in our friendship.
Not True 1-------2-------3-------4-------5 Really True

38. My friend puts our friendship ahead of other things.
Not True 1-------2-------3-------4-------5 Really True

39. When I have to do something that is difficult I can count on my friend for help.
Not True 1-------2-------3-------4-------5 Really True

40. If my friend or I do something that bothers the other one of us we we can make up
Not True 1-------2-------3-------4-------5 Really True

41. My friend and I can argue a lot.

Not True Really True
1-------2-------3-------4-------5

42. My friend and I disagree about many things.

Not True Really True
1-------2-------3-------4-------5

43. If my friend and I have a fight or argument we can say "I'm sorry" and everything will be alright.

Not True Really True
1-------2-------3-------4-------5

44. I feel happy when I am with my friend.

Not True Really True
1-------2-------3-------4-------5

45. My friend likes me as much as I like her.

Not True Really True
1-------2-------3-------4-------5

46. I think about my friend even when she is not around.

Not True Really True
1-------2-------3-------4-------5

Appendix E

Anger-Provoking Statements

Anger-Provoking Statements

The nine minute mathematical subtraction task was divided into three trials of three minutes each. At the beginning of each trial and halfway through each three minute period, the following statements were delivered to the participant (Self-Harass condition) or her friend (Friend-Harass condition):

Trial 1:

1. Did you understand the instructions?
2. The right button is correct, the left button is incorrect.

Trial 2:

3. I think you could go faster.
4. At this rate, you won't get the bonus.

Trial 3:

5. It's really not that hard, you know.
6. Oh-well.

Appendix F

Informed Consent Form

Informed Consent Form

RESEARCH PROJECT CONDUCTED AT CONCORDIA UNIVERSITY
ON BEHALF OF DR. SYDNEY MILLER

We would like you to participate in a study investigating the effects of female friendship on cardiovascular and cognitive performance. In this study, physiological changes and performance will be examined in response to engaging in a mathematical task while your friend is sitting next to you. Your friend will also experience the same procedure while you sit next to her. During the experiment, changes such as increases in heart rate and blood pressure will occur. These changes will only be temporary, returning to normal immediately after the experiment and causing no harmful effects.

Your participation will require you to:

1) attend a laboratory session which will last approximately 1 1/2 hours
2) engage in a mathematical subtraction task during the lab session
3) permit the measurement of several physiological responses including heart rate and blood pressure, which will be recorded through safe, painless, non-invasive means, & which will only require the placement of transducers on the skin
4) complete a package of questionnaires following the experimental procedure

You (and your friend) will each be paid $10.00 for your participation, plus an extra $5.00 bonus each for obtaining a cumulative score of at least 50% on the math task. This remittance will be paid right after you and your friend have completed your package of questionnaires.

All information that we obtain about you (and your friend) is strictly confidential and will not be seen by anyone who is not a member of the research team. Ultimately, all data will be coding using participant numbers rather than names.

Your participation in this study is completely voluntary and you will be free to withdraw from the study at any time.

Once you have carefully studied and understood this form, you may sign it in indication of your free consent and agreement to participate in the study.

Thank-you.

NAME (PLEASE PRINT):_____
SIGNATURE: _____
DATE: _____
EXPERIMENTER'S SIGNATURE _____