IS KEEPING IN OR LETTING OUT ANGER GOOD FOR YOUR HEART ?

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Abstract

Given the presumed importance of cardiovascular reactivity and the role of anger in the development of hypertension and coronary heart disease, this study is the first to jointly examine three related areas (i.e. gender effects, anger direction preference, and opportunity/no opportunity to aggress following an anger inducing situation). The present study tested the following hypotheses: a) that cardiovascular reactivity would vary as a function of subjects' gender and direction preference; b) that the rate of cardiovascular recovery would vary as a function of anger direction preference and opportunity/no opportunity to aggress; c) that the subjective feelings of anger after harassment would vary as a function of gender, anger direction preference, and opportunity/no opportunity to aggress; and d) that the evaluation of experimenter's competency and performance would vary as a function of anger preference. 56 females and 49 males executed a math task while being harassed for "poor performance". Next, they were randomly assigned to either write a negative evaluation of the frustrator or to copy a neutral paragraph and then to circle some letters in another paragraph. Heart rate and blood pressure were measured intermittently throughout. Subjects' preferred mode of anger expression (i.e. anger-in versus anger-out) had been previously assessed and cross validated by self as well as peer evaluations. Results indicated that gender was a better predictor than anger direction preference for cardiovascular reactivity to

harassment. Complex patterns of recovery were detected with intriguing sex differences. Results on male diastolic recovery were consistent with a matching hypothesis of anger direction preference but only for anger-out males. In addition, subjective anger for males was related to opportunity/no opportunity conditions, whereas females did not show such a relationship. Female anger-in's showed quicker systolic recovery than anger-out's. Lastly, the evaluation of experimenter's competency and performance did not vary as a function of anger preference. Therapeutic implications of the findings within the context of anger control as well as trends for future research are discussed.

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LITERATURE REVIEW

Cardiovascular diseases remain the leading causes of death in the Western hemisphere. Coronary heart disease (CHD) alone accounts for one-third of all deaths in the United States (Booth-Kewley & Friedman 1987). Established risk factors for CHD include age, blood pressure, serum cholesterol, cigarette smoking, diabetes, and family history of premature CHD (Stamler & Epstein 1972). Jenkins (1971) and Keys (1972) observed that the classical biological and lifestyle risk factors made up only about half of the CHD incidence in middle-aged American men. Disappointed by the power of the traditional physiological and lifestyle risk factors to account for the incidence of CHD, researchers turned to psychological variables.

TYPE A BEHAVIOR PATTERN

The implication of psychological variables in the pathogenesis of CHD was proposed nearly a century ago but had not been systematically investigated until the 1960's. In 1897 physician Osler believed that "the high pressure at which men live and the habit of working the machine to its maximum capacity are responsible for (arterial degeneration) rather than excess in eating and drinking" (Osler 1894). This turned out to be an oversimplified concept and a more refined behavioral stereotype of a potential CHD victim first emerged as having the Type A Behavior Pattern (TABP) in the early 1960's (Friedman & Rosenman 1959). A decade ago, the predominant

view of a type A individual was one who was "aggressively involved in a chronic incessant struggle to achieve more and more in less and less time, and if required to do so against the opposing efforts of other things or other persons" (Friedman & Rosenman 1974). The core elements underlying this constellation of overt behavioral manifestation are extremes of aggressiveness, easily aroused hostility, a sense of time urgency, and competitive achievement striving (Rosenman 1978). The three most common assessment methods include the Structured Interview, the Jenkins Activity Survey, and the Framingham Type A Scale (Matthews 1982).

Subsequent epidemiological studies demonstrated a link between the TABP and CHD. The Western Collaborative Group Study showed that the ratio of CHD incidence was 1.87 for Type A males between the age of 39-49 years old, and was 1.98 for Type A males between the age of 50-59 years old. These ratios were computed after the adjustment for all the risk factors were made (Rosenman, Brand, Jenkins, Friedman, Straus, & Wurm 1975). In another epidemiological study by Haynes, Feinleib & Kannel (1980) working Type A women were twice as likely to develop CHD than their Type B counterparts, and Type A housewives were three times as likely to develop CHD than Type B housewives. In a prognostic study, Type A score was the strongest single predictor of recurrent CHD (Jenkins, Zyzanski & Rosenman 1976). In 1977, the National Heart, Lung, and Blood Institute(NHLBI) recognised the importance of the relationship between TABP and CHD and concluded that TABP, as a risk factor, was of the same magnitude as age, smoking, and serum cholesterol.

However findings of the study by Shekelle, Hulley, Neaton, Billings, Borhani, Gerace, Jacobs, Lasser, Mittelmark, & Stamler (1982) failed to support the argument that TABP could predict the incidence rate of CHD.

Furthermore, the Aspirin Myocardial Infarction study (1985) was also unable to associate TABP with increased risk of recurrent major coronary events. Neither could Case, Heller, Case, & Moss (1985) find a relationship between TABP and the long term outcome of myocardial infarction. In an overview, Dembroski & Costa (1988) concluded that global TABP was no longer a reliable predictor of CHD.

Researchers have resorted to different routes in trying to explain the ambiguous relationship of TABP and CHD. Williams (1987) observed that the unique characteristics of the populations in epidemiological studies, such as the size of Type A sample, the nature and severity of CHD or even age, might have confounded the findings that led to negative results. Matthews (1982), on the other hand, argued that the diverse assessment methods ranging from the Structured Interview to self-report measures with only limited common methodology complicated the picture. Booth-Kewley and Friedman (1987) argued that the Structured Interview as an assessment method was superior to the Jenkins Activity Survey. In addition, there are conceptual problems involving the construct of TABP itself and it is not clear which are the crucial elements implicated in the pathogenesis of coronary heart disease. The ultimate question of whether or not there is a casual link between TABP and CHD still needs to be adequately addressed.

Nevertheless, a review panel on coronary-prone behavior and CHD (1981) suggested a couple of possible mechanisms. The first model assumed that Type A behavior caused CHD through stress-related autonomic neuroendocrine mechanisms. The second model postulated that there were central mechanisms underlying both TABP and CHD.

Disappointed by the predictive power of TABP, researchers like Linden (1987) go so far as to suggest that attention should be directed away from the global TABP and research should concentrate on better defined and validated coronary-prone behavior patterns. Whichever stand researchers take, it is unanimously agreed that hostility emerges as the best demonstrated toxic component in coronary-prone behavior.

ANGER AND HOSTILITY - A CRUCIAL COMPONENT OF CHD ?

Hostility is not only related to CHD but is also associated with other illnesses. Two retrospective studies concluded that rheumatoid patients and lung cancer patients had problems expressing negative affect, especially anger and hostility (Harburg, Kasl, Tabor & Cobb, 1969; Kissen, 1967). The first evidence that the hostility and anger components of Type A behavior might be important was derived from a reanalysis of the Structured Interview data from the Western Collaborative Group Study. Patients with coronary atherosclerosis (CAD) under 50 years old had high scores on items related to hostility and anger and speech stylistics (Matthews, Glass, Rosenman & Bortner 1977). Cross-sectional studies revealed that hostility scores were significantly associated with various cardiovascular disease endpoints. For example, a significant positive relationship was found between Type A patients' hostility scores (Ho) on Cook-Medley Scale of the Minnesota Multiphasic Personality Inventory (MMPI) and the severity of their coronary occlusions (Williams, Haney, Gentry, & Kong 1978). Williams, Haney, Lee, Kong, Blumenthal, & Whalen (1980) observed that CAD patients had a significant relationship with the high scores on the Ho scale. Along a similar line,

Shekelle, Gale, Ostfeld, & Paul (1983) and Barefoot, Dahlstrom and Williams (1983) documented the familiar pattern that high Ho scores were associated with increased CHD and mortality rates. Even in studies showing a negative relationship between the global TABP and various cardiovascular disease end points, data reanalyses still exhibited that potential for hostility and a tendency to avoid expressing anger overtly were significantly associated with the severity of CAD (Dembroski, MacDougall, Williams, Haney, Blumenthal, 1985; MacDougall, Dembroski, Dimsdale, Hackett, 1985). Williams (1987) therefore concluded from the epidemiologic evidence that the general psychological domain of hostility, cynicism, and anger has been demonstrated to be consistently associated with increased risk of an array of disease end points from CAD to CHD. Dembroski and Costa (1988) in an overview made a similar conclusion that hostility was implicated in the pathogenesis of CHD.

Parallel to the cross-sectional studies, prospective studies also pointed in a similar direction that anger and hostility were related to various CHD endpoints. In a study by Shekelle, Gale, Ostfeld & Paul (1983) men with Ho scores of 10 or less had a lower 10-year incidence of first major CHD events than men with higher scores. In that same study, there was also a significant relationship between Ho scores and the risk of death from all causes. In a related study by Julius, Harburg, Cottington & Johnson (1986), an individual's expression of anger was also related to all-cause mortality; anger suppressors were at least twice as likely as non-anger suppressors to die over the 12-year follow up. Hypertensives who suppressed their anger were five times as likely to have died during the follow up than their counterparts who expressed their anger. In a separate 25-year follow-up prospective study, Ho scores predicted subsequent mortality from all causes as well as CHD among 255 alumni of a medical school (Barefoot, Dahlstrom & Williams 1983). Theorell, Lind & Floderus (1975) observed that hostility was a consistent

predictor of myocardial Infarction in a 13-month prospective study. Friedman, Harris, and Hall (1984) acknowledged that the essential element of the TABP shifted from the sense of time urgency a decade ago to the hostility component. The conception of an empathetic, active, and fast-paced life style is no longer regarded as unhealthy. They argued that coronary prone individuals could be found in both Type A's and Type B's behavior pattern; it depended on their coping styles. In short, the subgroup of hostile, competitive people who were also expressive and dominant but in an anxious, threatened negative sense, and the subgroup of tense overcontrolled people who were unexpressive and inhibited but might explode under sufficient challenge were most susceptible to CHD.

In addition, no known mechanism has been identified. In terms of the actual mechanism, Williams, Barefoot & Shekelle (1985) postulated that the psychological characteristics of anger, hostility, and cynicism could be translated into disease process through the chronic elevations of cardiovascular and neuroendocrine systems.

HOSTILITY AND ESSENTIAL HYPERTENSION

Essential hypertension is a major risk factor for CHD (Kannel,1974; Linden,1984). The literature accumulated on the role of anger and hostility in essential hypertension has covered a longer time span than that in coronary heart disease (Diamond 1982). Fifty years ago, Franz Alexander (1939) had already proposed that the hypertensive individual was one with inhibited and poorly expressed rage and anger. Shapiro (1960) hypothesized that the inhibited negative affect expressed itself through the autonomic nervous

system with an increase in norepinephrine leading to acute and eventually chronic hypertension. However no one exactly knows the etiology and pathogenesis of essential hypertension (Von Eiff,1970; Linden,1984). Out of the many but not neccessarily conflicting mechanistic hypotheses, the proposal of an elevated sympathetic nervous system in response to environmental stress together with the psychological variables of anger and hostility emerge as predominant in this review.

Laboratory studies showed that baselines and reactivity of blood pressure to stressful tasks were greater among hypertensives than among controls (Mckegney & Williams (1967); Nestel (1969)). It has also been shown that normotensives of hypertensive parentage exhibit exaggerated blood pressure responses to stressful stimuli, reflecting a genetic component to essential hypertension (Davies,1970; Manuck, Proietti, Rader, Polefrone,1985; Shapiro,1961). Jorgensen & Houston (1986) observed that normotensives with a positive family history of hypertension coupled with a particular personality pattern of high denial and suppression of emotions had the greatest cardiovascular responsiveness during the experimental tasks. The authors suggested that sympathetic nervous system hyperreactivity might be influenced by heredity and personality factors. Further evidence demonstrating the importance of hostility came from a study which showed that individuals reporting high levels of hostility had elevated systolic blood pressure reactions to experimental stimuli, regardless of their clinical hypertension status (Steptoe, Melville & Ross 1984). It has also been shown that suppressed hostility was prominent in high renin essential hypertensives (Julius, Esler & Randall (1975)). Esler, Julius, Zweifler, Randall, Harburg, Gardiner & DeQuattro (1977) suggested either that an elevation of plasma renin activity was related to the suppression of hostility as a persistent reaction pattern, leading to the chronic elevation of sympathetic nervous

system or that an increase in sympathetic nervous system caused the suppression of anger.

In addition, recent empirical evidence showed that it was not only the subjective feelings of anger and hostility but also the coping mechanisms of these negative emotions that were related to essential hypertension. Two studies simultaneously showed that borderline hypertensives with suppressed angry feelings termed anger-in exhibited greater cardiovascular reactivity than controls (Schneider, Egan, Johnson, Drobny & Julius,1986; Perini, Muller, Rauchfleisch Battegary & Buhler,1986). Hokansen, Burgess and Cohen (1967) observed that individuals, when subjected to frustration in controlled circumstances, had a quicker recovery of blood pressure to baseline if given a chance to discharge their anger.

Davies (1971) and Kidson (1973) both pointed out that there were a number of methodological weaknesses associated with the hypertension literature. The selection bias of hypertensive subjects, the personality patterns of hypertensives being a result of the disorder, and the inadequate control of medication are cases in point. Nevertheless, Light (1987) in a literature review made several conclusions: 1) there was a consistently positive relationship between hypertension and both anger-in and anger-out; 2) heredity and stress in the environment were closely associated with essential hypertension; 3) potential hypertensives and hypertensives showed excessive cardiovascular reactivity to laboratory stress. This is consistent with Diamond's contention (1982) that anger and suppressed hostility seem to play an important role in the development of hypertension. The last note pertaining to hypertension in the literature that is worth mentioning is the accumulated evidence on the lack and/or inadequate social competence among the potential and actual hypertensive victims (Linden &

Feuerstein,1981; 1983); Morrison, Bellack & Manuck,1985).

Essential hypertension and CHD are believed to have separate etiology and pathogenesis, although the former can be a risk factor for the latter. Nevertheless, the two disorders do share some commonalities. Both are characterized by sympathetically mediated cardiovascular hyperreactivity in response to stress. In addition, the psychological variables of anger and hostility seem to be implicated in both areas (Linden 1987). Diamond (1982) believed that emotional behavior can be a mediating link between psychological factors and pathophysiological processes.

ANGER, HOSTILITY, AND AGGRESSION SYNDROME

The convergence of the literature on TABP or coronary prone behavior pattern in relation to CHD, and the psychological factors involved in relation to essential hypertension appear to show that hostility is one of the factors. Spielberger, Johnson, Russell, Crane, Jacobs and Worden (1985) were quick to point out that there is considerable ambiguity and inconsistency with regard to how the constructs of hostility and anger are defined, and even less agreement on how they should be measured. They collectively called anger, hostility, and aggression the AHA syndrome. Spielberger, Jacobs, Russell, and Crane (1983) proposed the following definitions: 1) anger refers to an "emotional state that consists of feelings that vary in intensity, from mild irritation or annoyance to fury and rage; 2) whereas hostility is a set of attitudes involving angry feelings that "motivate aggressive behaviors directed toward destroying objects or injuring other people; 3) hostile aggression refers to behavior motivated by anger, whereas instrumental aggression refers to

aggressive behavior toward removing an obstacle between an aggressor and a goal, and angry feeling are not involved. Others researchers like Siegel (1985), however, feel that such a distinction is not essential.

For the purpose of the current study, anger is singled out to be researched in relation to autonomic arousal when confronted with a frustration-provoking situation. It was chosen because it is a key element of hostility in the etiology of CHD and essential hypertension. Also, anger, as opposed to, hostility is to be more easily instigated among subjects in a standard laboratory situation.

However, Siegel (1985) and Dembroski, MacDougall & Williams (1986) contended that anger itself is not a unidimensional concept. Frequency, duration, magnitude, the range of situations to which an individual responds with anger, the mode of expression, and the extent of hostility in the individual's outlook are all aspects of the multidimensional concept of the anger construct. There is evidence to show that self-reported anger was inversely related to social desirability and social approval (Carver, 1978; Conn & Crowne, 1964). As shown in the following, the mode of expression has recently been a popular research topic and there are questions concerning the conflicting evidence as to whether holding in anger or expressing anger overtly is healthier to the heart.

PSYCHOPHYSIOLOGIC REACTIVITY IN CHD AND ESSENTIAL HYPERTENSION

It has been well documented that stressful stimuli often trigger substantial responses of the autonomic and neuroendocrine systems. The magnitude of such responses vary greatly among individuals. Indeed, it has been proposed that physiologic responsivity to behavioral challenges may be implicated in the development or clinical expression of CHD and essential hypertension through the cardiovascular and/or endocrine correlates of the sympathetic nervous system (Manuck & Krantz 1984). One pertinent proposed mechanism was that repeated physiologic reactions involving excessive heart beat and/or pressure responses to behavior stressors promoted arterial injury through hemodynamic forces such as turbulence and sheer stress (Manuck, Kaplan & Clarkson 1983). A prospective study showed that the magnitude of subjects' diastolic blood pressure responses to cold pressor test was significantly associated with development of CHD in a 23-year follow up. The potency of the prediction actually exceeded that of the more traditional factors (Keys, Taylor, Blackburn, Brozed, Anderson & Somonson 1971).

CONVERGENCE OF EMPIRICAL EVIDENCE CONCERNING REACTIVITY TO ANGER PROVOCATION, AND TO ANGER COPING STYLES

Generally speaking, there is a consensus on the importance of anger on

the development of coronary heart disease and essential hypertension. It also appears that the way a person expresses this subjective feeling of anger (i.e. anger-in vs anger-out) has an impact on the cardiovascular system. Although no known mechanism linking this psychological variable with the various cardiovascular disease endpoints has been identified, exaggerated cardiovascular responses during behavioral challenge have been proposed as a possible mechanism. A number of studies completed in 1960's and early 1970's examined not only the cardiovascular reactivity and the subjective feelings of anger as a result of harassment, but also the cathartic effects on physiological arousal. These studies concentrated on the situational factors affecting arousal release and were not concerned with individual differences like Anger-in/ Anger-out preference or risk for heart disease.

In the 1960'S Hokanson and his co-workers executed a number of studies on anger provocation and the "cathartic effect" following aggression. Serial subtraction with repeated interruptions and harassment was a popular anger provocation method (Baker & Schaie, 1969; Hokanson & Burgess,1962; Hokanson, Burgess & Cohen,1963) and it has also been demonstrated to reliably induce anger in subjects (Gambaro & Rabin, 1969; Hokanson & Shetler,1961). Moreover, the results consistently showed that frustrating procedures produced great cardiovascular reactivity, although, no agreement was reached concerning the most sensitive cardiovascular indice, be it systolic or diastolic blood pressure (Gambaro & Rabin,1969; Hokanson & Shelter,1961). Nevertheless, reliable and rapid recovery of task-induced physiological reactions were obtained following subsequent aggression (i.e. an opportunity to express one's anger toward the harasser) on the part of subjects, be it physical, such as giving electroshocks to the harasser, or verbal, as in a written evaluation of the frustrator (Hokanson & Burgess,1962a, 1962b; Hokanson, Burgess & Cohen,1963; Hokanson &

Shelter, 1961).

Research shows that situational variables also affect the outcome. Hokanson and Shelter (1961) observed that with a high status frustrator (i.e. a visting professor as opposed to an undergraduate assistant), frustrated undergraduate subjects who were not given a chance to aggress still showed a rapid return from physiological arousal at the end of the experiment. They concluded that reduction of arousal occurred when subjects made appropriate responses, that is, overt aggression toward a frustrator of equal or lower status or withdrawal with a high status frustrator. It also seemed that overt aggression (i.e. application of electric shocks and verbal disapproval) was more powerful than covert ones (i.e. fantasy and unharmful signaling) in bringing down post-aggression arousal (Baker & Schaie 1969).

It is interesting to note that in aggression studies that involved male and female subjects, female participants acted very differently from their male counterparts. Vantress and Williams (1972) conducted an aggression study with female subjects that failed to support the earlier results that counter aggression led to catharsis. Frustrated female participants were significantly more aroused than non-frustrated ones on systolic blood pressure (SBP), but, the opportunity to aggress did not result in more rapid systolic blood pressure recovery than was found in the no-opportunity group. In a study that involved both male and female subjects, out of the three types of responses, namely shock, reward or no response as counter aggression conditions, shock counterresponse predicted a dramatic drop in systolic pressure subsequent to frustration in males. As for females, none of the responses differentiated recovery rates. It seemed that aggressive counterresponse in an interpersonal provocation accompanied by a relatively rapid return of SBP to prefrustration level was valid only for males (Hokanson & Edelman 1966). The most

dramatic study that showed the sexual differences in physiological reactivity to counter-aggression responses was conducted by Hokanson, Willers & Koropsak (1968). The study had three phases. In the first phase, female subjects interacting with a female confederate of equal status had a reliably faster return to baseline if they made a friendly counter response to shock. By contrast, male subjects interacting with a male confederate of equal status showed a reliably quicker recovery following aggressive counterresponses to shock. In the second phase, conditioning was employed for both sexes and there was a decline in recovery time following subjects' "natural" counter aggression tendencies. In the extinction phase, a return of pre-conditioning response patterns was observed. This study neatly demonstrated that avoidance learning can modify our reactions to counter aggression responses. The sex differences in counter aggression responses could be attributed to social learning and conformity to social expectancy in that only males were expected to act aggressively when attacked.

The aggression literature of the 1960's investigating situational variables paved the way for the more recent studies in CHD examining cardiovascular reactivity as a function of Type A/B topography and anger provocation because both of them shared a very similar research paradigm. That is, subjects were put through competitive and frustrating tasks and attempts were made to relate either situational variables or personality variables to the cardiovascular responses.

In this second group of studies, the following characteristics were noted. First, tasks different from serial subtraction were used as competitive stimuli and yet the most common means of frustration were still interruptions and harassment (Diamond, Schneiderman, Schwartz, Smith, Vorp & Pasin, 1984;

Glass, Lake, Contrada, Kehoe & Erlanger,1983; Glass, Krakoff, Contrada, Hilton, Kehoe, Mannucci, Collins, Snow & Elting,1980; Van Egeren, Abelson & Thornton,1978). Second, manipulation checks indicated that the harassment was indeed anger inducing (Glass et al,1983; Van Egeren et al, 1978). Third, all four of these studies used male subjects only.

If Type A Behavior Pattern had the discriminant validity to predict CHD prone subjects, then one would expect, according to the hypothesis of overreactivity, Type A's to be more aroused than Type B's in a stressful laboratory task. However, there were mixed results concerning the predictive power for Type A/B topograpy in cardiovascular reactivity (Diamond et al,1984; Glass et al,1980). Nevertheless, studies indicated complex relationships between TABP, anger, anger coping (i.e. anger-in vs anger-out) and physiological reactivity. Diamond et al (1984) documented a positive relationship between Type A anger-out, high self- reported hostility and blood pressure elevations. In contrast, Type B, low hostile subjects with suppressed anger were associated with lower reactivity. Glass et al (1983), on the other hand, found that feelings of anger were positively correlated with high initial reactivity, whereas potential for hostility, an index of the outward display of hostile impulses during the Structured Interview showed an inverse relationship. Van Egeren et al (1978) designed a mixed motive interpersonal study between subjects and a confederate under four conditions: predictable/cooperative, unpredictable/cooperative, predictable/exploitative, and unpredictable/exploitative. The results replicated the literature on catharsis that the more exploitation subjects had on the confederates, the lower his diastolic blood pressure was at the end of the experiment. Interestingly, the psychological variable of guilt and certainty/uncertainty concerning the consequences of exploiting the confederate and level of exploitativeness all were functions of post-harassement change of

cardiovascular arousal. As a result, the greater the subjects' aggression guilt, the less anger he expressed at the end of the task and the less he exploited the confederate. The authors also concluded that harassment was uniquely associated with systolic changes and anger expression with diastolic change.

With regard to the role of emotional expressiveness, Friedman and Booth-Kewley (1987), as well as Linden (1987) and Matthews (1986), found that diagnosis of Type A Behavior by the Structured Interview appeared to gain its predictive validity by taking the emotional expressiveness into account. Moreover, the low affectively expressive Type A's and the high expressive Type B's were less healthy than the high expressive Type A's and the low expressive Type B's (Friedman, Hall, and Harris (1985)). The studies in essential hypertensives (Harburg et al, 1973, 1979; Gentry et al, 1981, 1982) suggested that elevated blood pressure and hypertension are associated with holding "anger in". This evidence again underlies the importance of emotional expressiveness on cardiovascular activity. Gentry and his co-workers (1982) also investigated the relationship between anger expression and blood pressure. Three types of anger coping responses were identified and examined: anger-in was characterized by an avoidance of the conflict situation and suppression of anger; anger-out involved the letting out anger to the attacker; whereas the reflective coping style was associated with the direction of attention from anger to problem solving. Results showed that anger-out subjects had lower diastolic and systolic blood pressures than anger-in's. In general, the odds of being a hypertensive was 1.64 for anger-in's compared to the anger-out's. The strength of this ratio was comparable to that of race, sex, and socioecological stress (Gentry, Chesney, Gray, Hall & Harburg 1982). However, in a separate study, it was shown that both anger-in's and anger-out's tended to have significantly higher blood pressure than those who used a reflective response. Also, reflective response was employed more by women

than men (Harburg, Blakelock, Goeper 1979). Gentry et al (1982) commented that a drawback of such studies was the lack of situation-specific anger responses since the two reported findings were only correlational.

In reaction to the comment made by Gentry et al (1982), Engebretson, Matthews, & Scheier (in press) were the first group of researchers to examine cardiovascular reactivity as a function of anger direction preference in males in a controlled laboratory setting. In addition, they tried to reconcile the differences in the literature pertaining to the relationship between anger expression and reactivity through a matching hypothesis. They hypothesized that after both anger-in's and anger-out's were harassed, those who were allowed to express their anger consistent to their anger direction preference would have the fastest cardiovascular recovery. In other words, after anger provocation, anger-in's who were given an opportunity not to show their anger and anger-out's who were given an opportunity to show their anger would exhibit more rapid recovery from physiological arousal. Findings showed the following: 1) that anger-in's and anger-out's did not display initial baseline differences in heart rate and systolic and diastolic blood pressure; 2) that harassment was effective in arousing subjective anger; and 3)that the matching hypothesis was supported in that anger-in's writing positive evaluations and anger-out's writing negative evaluations had significant reductions in systolic blood pressure during recovery. This study had several limitations. Firstly, these findings were limited to males. Secondly, it was notclear why writing a positive evaluation of the frustrator was considered as compatible and matched with an anger-in response. Thirdly, a self-reported anger preference as a grouping criterion might not be valid because of social desirability biases (Linden, Paulhus, & Dobson, (1986)).

SUMMARY OF LITERATURE REVIEW

To summarise the literature review, the following conclusions were drawn.

A) Epidemiological, cross-sectional, and laboratory studies have put the predictive power of the global concept of TABP under question. However, anger and hostility are now considered to be implicated in the etiology and pathogenesis of CHD and essential hypertension.

B) Cardiovascular over-reactivity still lacks strong prospective validation, but nevertheless is presumed to be a precursor for CHD and essential hypertension.

C) There is evidence showing that harassment in a laboratory situation reliably triggers cardiovascular arousal and subjective feelings of anger. Counter aggression on the part of a male frustrated subject facilitated a rapid return to baseline in systolic blood pressure in seven out of ten studies; enhanced diastolic blood pressure recovery in two out of ten studies; and enhanced systolic as well as diastolic in one out of ten studies, thus suggesting that most studies ruled out the investigations of both systolic and diastolic recovery. It is worthy noting that only one out of these ten studies examined the effects on both systolic and diastolic blood pressures. Frustated female subjects ,unlike males, did not show "cathartic" effects (i.e. enhanced recovery) subsequent to counter aggression. In other words, men and women have different physiologic responses following instructions to make counter aggression.

E) There was only one study in the literature that examined cardiovascular reactivity and recovery on both systolic and diastolic blood pressures as a function of individual differences on anger direction preference and an oppourtunity/no opportunity to aggress within the context of experimental provocation. Results unique to this study indicated that males who expressed their anger consistent to their habitual responses exhibited the quickest systolic recovery, thus suggesting a "matching" effect for trait and situational factors in the study by Engebretson, et al (in press). A summary of studies that employed Hokanson's laboratory anger release paradigm and that are directly relevant to the current study is presented in Table 1.

TABLE 1 : Summary Of Studies With Hokanson's Anger-Releasing Paradigm

Author and year of Publication	Sample size and student Characteristics	Manipulation and Associated changes in dependent variables	Recovery Design	Conlusions
Hokanson and Shetler (1961)	N = 56 undergraduate students in an introductory psychology class	-Design : high/low frustration by high/low status of the frustrator by opportunity/no opportunity to aggress -Harassment task : to count backwards from 99 to 1 by two either with or without repeated interruptions and harassment -only Systolic Blood Prssure (SBP) was examined as the depentent variable ; 12.4 mm Hg increase was noted	- to administer electric shocks in an interpersonal guessing situation	- frustration led to significantly greater systolic increases than no frustration condition with both high and low status experimenter - subjects frustrated by a low status experimenter and given an opportunity to aggress showed a return of blood pressure to baseline - subjects frustrated by a low status experimenter and given no opportunity to aggress showed greater systolic elevations - subjects frustrated by a high status experimenter manifested a return of blood pressure to baseline in both conditions of opportunity and no opportunity to aggress

Author and year of Publication	Sample size and student Characteristics	Manipulation and Associated changes in dependent variables	Recovery Design	Conlusions
Hokanson and Burgess (1962)	N = 48 female = 36 male college students	-Design : high/low status by ego threat/block goal by opportunity /no opportunity as independent variables -Harassment task : to count backwards from 100 to 0 by 2 either with or without interruptions and harassment -SBP and heart rate were examined as the dependent variables ; - ego threat : 12.9 mmHg SBP and 9.9 beats increase - goal blocking : 14.7 mmHg SBP and 11.6 beats increase - no frustration : 4.7 mmHg SBP and 4.1 beats increase	- to fill out a questionnnaire about the experimenter	-catharsis obtained with ego threats and goal blocking groups who were given an opportunity to aggress -catharsis was not obtained in groups who were assigned to the high status experimenter
Hokanson, Burgess and Cohen (1963)	N = 50 female = 30 male college subjects	-Design : high/low frustration by opportunity/no opportunity to aggress -Harassment task : to count backwards from 100 to 0 by 2 either with or without interruptions and harassment -only SBP was examined and frustrated subjects showed an increase of 15.6 mmHg, whereas non-frustrated subjects manifested an increase of 4.9 mmHg	-to adminster electric shocks in an interpersonal guessing game	-counter aggression led to significant reduction in SBP -aggression to substitute targets did noy result in faster recovery

Author and year of Publication	Sample size and student Characteristics	Manipulation and Associated changes in dependent variables	Recovery Design	Conlusions
Baket and Schale (1969)	N = 128 male undergraduates	-Design : counteraggress alone/in the presence of another subject by overt/ covert means of aggression -Harassment task : to count backwards from 99 to 1 either with or without interruptions and harassment -SBP as a dependent variable was examined ; and increase of 8 mmHg was observed	-Overt means of aggression included electric shocks and verbal disapproval -Covert means of aggression included Fantasy-Card 8BM and TAT as well as unharmful signals	-Overt counteraggression was significantly more effective than covert ones
Vantress and Williams (1972)	80 female students from introductory psychology classes	-Design : frustration/no frustration by opportunity/ no opportunity by presence/ absence of the frustrator in the opportunity -Harassment task : to count backwards from 100 to 0 by 2 either with or without goal blocking -only SBP was examined ; the mean increase was 17.0 mmHg and 3.5 mmHg for frustrated and non-frustrated subjects, respectively	-asking subjects to fill out a questionnaire on the experimenter's competence	-opportunity to aggress did not lead to a greater reduction in SBP then no opportunity -presence of frustrator, regradless of opportunity or no opportunity to aggress, led to a significantly higher SBP maintenance

Author and year of Publication	Sample size and student Characteristics	Manipulation and Associated changes in dependent variables	Recovery Design	Conlusions
Hokanson and Burgess (1962)	80 subjects : 56 female 24 male college students	-Design : frustration/no frustration by aggression/ no aggression -Harassment task : to count backwards from 1000 to 0 by 2 either with or without interruptions and harassment -Heart rate and SBP, as the dependent variable were examined ; -frustrated group showed an increase of 10.3 mmHg SBP and 9.0 heart beats -non-frustrated group showed an increase of 3.2 mmHg SBP and 0.75 heart beat	-to either nod or shock the experimenter in an interpersonal guessing game	-counter aggression reduced physial arousal -physical and verbal aggression were significantly more effective than covert aggression in the reduction oof SBP and heart rate during the recovery phase
Hokanson and Edelman (1966)	12 male 16 female undergraduate	-Design : female/male by opportunity/no opportunity -Harassment task : constant shocking by the frustrator -only SBP was examined ; the mean increase was 6 -10 mmHg	-subjects gave electric shocks to the frustrator	-counter aggression led to significantly faster return to recovery for males -catharsis was not obtained with females

Author and year of Publication	Sample size and student Characteristics	Manipulation and Associated changes in dependent variables	Recovery Design	Conlusions
Gambaro and Rabin (1969)	80 males undergraduates	-Design : frustration/no frustration by aggression/ no aggression -Harassment task : to count backwards from 99 to 1 by 2 either with or without interruptions and harassment -Diastolic blood pressure(DBP), as the dependent variable was examined ; mean increases were 10 and 1 mmHg for frustrated and no frustrated groups, respectively	-to either shock or not shock the frustrator	-harassment was effective in arousing anger and DBP -shocking frustrator led to significantly faster recovery -shocking non-frustrator did not lead to significantly reduction in DBP
Hokanson, Willers, and Koropsak (1968)	study 1 : 10 female undergraduates	-Design : to countercondition subjects' 'natural' response through shocking -only DBP, the only dependent variable was examined	-subject's aggressive (shock) responses were followed by a friendly (reward) event and vice versa	-females showed reliably faster return to baseline when they made a friendly counter-response to shock during the baseline -they, however, showed "cathartic-like tension reductions" associated with aggression during the conditioning phase

Author and year of Publication	Sample size and student Characteristics	Manipulation and Associated changes in dependent variable	Recovery Design	Conlusions
	study 2 : 11 male undergraduates	-Design : to countercondition subjects' 'natural' response through shocking -only DBP, the only dependent variable, was examined	-subject's aggressive (shock) responses were followed by a friendly (reward) event and vice versa	-males showed faster recovery when they made aggressive(shock) responses during the baseline -they, however, showed cathartic-like recovery when they made friendly counter-responses to shock during the conditioning phase
Engebretson, Mathews, and Scheier (in press)	N = 81 male undergraduates	-Design : harassment/no harassment by positive evaluation/negative evaluation by anger-in/ anger-out -Harassment task : while the subject was tracing an irregular pattern using a metal pointer, he was interrupted and harassed by his fellow subject/ frustrator who acted as his coach -Heart rate , SBP and DBP were examined as the dependent variables	-subjects were to complete either a positive or a negative evaluation	-matching hypothesis associated with SBP held up for males

As pointed out by Engebretson et al (in press) it is important to reconcile inconsistent findings regarding anger expression. Generally speaking, there are three areas in the literature of cardiovascular reactivity in a controlled laboratory setting that are clearly related but have not previously been examined jointly. Firstly, it has frequently been frequently assumed that a self report of anger direction preference is an accurate reflection of the person's overt behavior when acutely angry, despite the fact that self-report of emotional states is heavily confounded by response sets (Linden, Paulhus, & Dobson, (1986)). Secondly, there is only one study that looked at cardiovascular reactivity and cardiovascular recovery following post-experimental counter aggression as a function of anger direction preferences (i.e. a within-subject factor) in an anger provoking situation; this study investigated only male subjects whose anger preferences were not cross validated (Engebretson et al, in press). Since we know that females exhibit physiologically distinct responses subsequent to counter-aggression (Hokanson & Edelman (1966)) and that anger direction preference influences counter-aggression recovery for male subjects (Engebretsen et al., in press), there is reason to suspect that autonomic responses might be a function of not only the gender differences but also long-neglected within-in subject factors like natural anger direction preference. Thirdly, the literal interpretation of an anger-in response has been to hold in anger but its' operational definition for laboratory studies has never been looked at closely. There are questions as to what behaviors actually constitute an anger-in action. Engebretson et al (in press) defined an anger-in behavior as writing a positive evaluation of the frustrator, without giving any theoretical or empirical reasons. It seems that holding in anger implies primarily the avoidance of a confrontation, rather than expressing positive emotions about the harasser. In search for clarification to the proposed questions, these three clearly related areas were

jointly examined in the current study. The design for the present study examined the interactions of sex and anger expression preference (anger-in vs anger-out) in an anger-inducing situation followed by opportunity/no opportunity to aggress on the part of the frustrated subject. Since anger-out is characterised by a tendency to lash out on the attacker, it was operationally simulated as an opportunity and encouragement to aggress. On the other hand, anger-in is characterised by a tendency to hold back angry feelings and was operationally simulated as a lack of opportunity to aggress.

THE HYPOTHESES

The following hypotheses were investigated in the present study:

1) Cardiovascular reactivity to harassment as a function of subject's gender and anger direction preference. It was hypothesized that male subjects would not display significant differences in reactivity to harassment as a function of their anger direction preference. For female subjects, it was unknown how anger-in's versus anger-out's would react because of the lack of empirical work with this population.

2) Cardiovascular reactivity at the post-harassment phase as a function of gender, anger direction preference, and opportunity/no opportunity to aggress. It was postulated that groups of anger-in's given no opportunity to aggress and anger-out's given an opportunity to aggress (i.e. matched conditions) would show rapid recovery of autonomic activity as opposed to the other two groups who had to act contrary to their anger expression tendencies (i.e. mismatched conditions). Potential sex differences were to be explored.

3) The subjective feelings of anger after harassment and recovery as a function of gender, anger, opportunity/no opportunity to aggress. It was hypothesized that the group that showed the least amount of anger at the end of the experinment were the anger-out's who had the opportunity to give negative evaluations of the frustrator.

4) The evaluation of experimenter's competency and performance as a function of anger preference. It was not clear how the anger-in group versus the anger-

out group would react to aggression opportunity, given that there were no negative consequences to be anticipated.

METHOD

Subjects

Participants from whom complete data were obtained were 49 male and 56 female undergraduates from introductory psychology classes. Their mean age was 19 with a standard deviation of 3. The selection criteria were based on: 1) no established hypertension, that is >140 mmHg for SBP and/or >90 mmHg for DBP; 2) no cardioactive medication; 3) cross validation on both self and peer evaluations on one's anger direction preference.

Procedure

Packages of questionnaires containing questions on personal history of hypertension and heart disease as well as anger direction preference were distributed to potential subjects in introductory Psychology classes. In addition, the same set of questions on anger direction preference was provided in an envelope for peer evaluation to guarantee confidentiality. Potential subjects were instructed to give the questionnaires in the envelope to someone whom they know very well (i.e. family members or peers) for peer evaluation. Individuals who completed peer evaluations had to seal the envelope, before returning it to subjects. Approximately, 80% of all students addressed agreed to participate in this screening. Anger-in's were selected only if both they and their peers endorsed more Anger-in than Anger-out items. Anger-out's were selected only if both they and their peers rated higher Anger-out than Anger-in tendencies. It was found that the concordance rate between self and peer

evaluations was 80%. 27 subjects were excluded from the study because the cross validation indicated inconsistent anger direction preferences. Among the rejected, 8 were males and 19 were females. Those subjects who met the cross-validation criteria all fulfilled the other two criteria, i.e., the lack of hypertension, heart disease, and/or use of cardioactive medication. The final sample of 56 male and 49 female subjects were invited to the laboratory. The breakdown of the total sample was: 15 female anger-in's with the opportunity to aggress; 15 female anger-in's without the opportunity to aggress; 13 female anger-out's with the opportunity to aggress; 13 female anger-out's without the opportunity to aggress; 14 male anger-in's with the opportunity to aggress; 14 male anger-in's without the opportunity to aggress; 11 male anger-out's with the opportunity to aggress; and 10 male anger-out's without the opportunity to aggress. The experiment was conducted by a frustrator, who was introduced as the experimenter, under the guidance of a supervisor who was going to decide which subjects were to be given the opportunity to aggress, without the frustrator's prior knowledge. The frustrator was introduced as an undergraduate and the supervisor, as a graduate student. Subjects were led to believe that the goal of the study was to investigate the physiological correlates of intellectual performance. The procedure, which involved a mental arithmetic task followed by some written evaluation with the instructions provided only at that point, was explained to subjects. The participants indicated their willingness to be in the study by signing a consent form.

A cuff from an automated sphygmomanometer was then attached onto the non-dominant arm of the subject to measure heart rate, systolic and diastolic blood pressure. The subject was requested to relax, and maintain a comfortable position with as little movement as possible. A fifteen minute adaptation period was allowed for each subject during which time he/she completed the state part of the State and Trait Anger Scale (STAS) (Spielberger,

Jacobs, Russell, & Crane, 1983). In order to conceal the purpose of the study, questionnaires including Pennebaker's Inventory (Pennebaker, Burnam, Schaeffer & Harper (1977) and Pennebaker & Skelton, 1978) and the Cognitive part of the Schwartz's Cognitive and Somatic Anxiety Questionnaire (Schwartz, Davidson & Coleman, 1978) were also administered to the subject. Next, the subject was asked to execute the mental arithmatic task for the full twelve minutes. Harassment plus requests to start all over again were delivered on a fixed schedule by a same gender frustrator to the subject at the end of the second, sixth, and tenth minutes. At the end of the task, those subjects who were assigned to an-opportunity-to-aggress condition (N = 53) completed an evaluation of the frustrator for ten minutes. The subjects who were not assigned to the opportunity group (N = 52) were told to copy a neutral paragraph and then to circle some letters in another neutral paragraph for the same period of time. Next, he/she was to complete a post-experimental state part of the STAS. A thorough debriefing then followed with the objectives of the study and the performance of the physiological correlates explained by the supervisor. Both activities completed by respectively, the opportunity and the no opportunity groups had been shown to take about 10 minutes to complete in pilot subjects.

Experimental Task

Subjects were asked to serially subtract starting with 9000 in steps of 7 for 12 minutes, with the answers being given aloud. The importance of accuracy and speed was emphasized. Subjects were reminded that if they made a mistake or were lost, they had to start all over again. At the end of the second, sixth, and tenth minutes, interruptions plus harassment on the subjects' performance were made by a same gender confederate. Subjects were then asked to start all over again according to the fixed schedule. At the

end of the task, half of the randomly chosen Anger-in's and Anger-out's respectively, were given an opportunity to rate pairs of polar adjectives from 0 to 10 concerning their experimenters' competency and performance with 0 representing the worst and 10, the best (see appendix). The last part of the evaluation required subjects to use the supplied lists of positive and negative adjectives to describe their emotions as to how they felt about being participants in this experiment. In addition, they were asked to explain why they felt that way. Altogether, these two parts of written evaluation lasted for ten minutes. The rest of the subjects were asked to copy a neutral paragraph and then to circle some letters in another paragraph for the same period of time, acting as a control for the motor movement. The contents of these two paragraphs were taken from the advertising section of a newspaper. They were descriptions of positions in a corporation. Throughout the experiment, heart rate, systolic and diastolic readings were initiated and monitored every two minutes during the baseline and at minutes 3, 7, and 11 (i.e. one minute after each harassment) during the experimental phase as well as at minutes 1, 5, and 9 of the recovery phase.

INSTRUMENTATION

Measurement of heart rate and blood pressure

An electronic sphygmomanometer with pressure cuff, automatic electric pump, a microprocessor, and digital display (Dinamap 845 Vital Signs Monitor) was employed to monitor heart rate and blood pressure. This fully automated machine gives readings which are comparable to intra-arterial measurements (Borow & Newburger, 1982; Silas, Barker & Ramsay, 1980).

The State-Trait Anger Scale (STAS) (Spielberger et al., 1983) and the Anger Expression (AX) (Spielberger, Johnson, Russell, Crane, Jacobs & Worden 1985) were employed in the study. Only the state part of the State-Trait Anger Scale which consists of 15 items was used in the study to assess subjects' angry feelings before and after the end of the task, by putting an "X" on an unmarked line. The AX contains 24 items which assess a person's usual way of handling anger. These items tap two relatively independent dimensions: Anger-in vs Anger-out (Spielberger et al., 1985). Anger-in refers to how often angry feelings are experienced but not expressed. Typical anger-in items include: "I control my temper"; "I withdraw from people"; and "I tend to harbor grudges that I don't tell anyone about". Anger-out on the other hand refers to the extent that an individual engages in aggressive physical or verbal behaviors when angry. Typical items include: "I express my anger"; "I say nasty things"; and "I strike out at whatever infuriates me". The internal consistency for males and females ranged from .77 to .80, respectively.

STATISTICAL ANALYSIS

Two factorial (2x2) MANOVAs were executed to analyze the main and interaction effects of sex and anger expression preference on resting values of blood pressure and heart rate. Following that was another (2x2) MANOVA to investigate the physiological responses to the frustrating task as a function of sex and anger expression preference. Next was a series of (2x2x2) ANCOVAs to examine the physiological recovery as a function of sex, mode of anger expression, and opportunity/no opportunity to aggress; differences in autonomic level at the end of the arithmetic task were covaried out. A (2x2x2) ANCOVA was executed to investigate state anger as a function of sex, anger, and opportunity/no opportunity to aggress again, with the baseline differences being covaried out. Finally two (2X2) ANOVAs were employed to investigate the amount of expressed negative emotions and the subjects' perception of the competence and performance of the frustrator as a function of gender and anger direction preference.

RESULTS

Initial Baseline Differences in the Dependent Variables

Two 2x2 (Female/Male by Anger-in/Anger-out) MANOVAs were executed to investigate whether or not there were baseline differences on the dependent variables of heart rate, systolic and diastolic blood pressures, and pre-experimental subjective anger rating between experimental groups.

In the first MANOVA, the averages of the last two physiological readings from the adaptation period (i.e. heart rate, systolic and diastolic blood pressures) and the pre-experimental subjective anger rating were employed. The mean pre-provocation scores on heart rate, systolic and diastolic blood pressure, and subjective anger rating were 72.6 mm Hg; 108.6 mm Hg; 59.54 mm Hg; and 52.75, respectively for females, and were 68.86 mm Hg; 114.9 mm Hg; 57.56 mm Hg; and 48.65, respectively for males. When the samples were broken down by preference, the mean pre-provocation scores on heart rate, systolic and diastolic blood pressure, and subjective anger rating were 72.28 mm Hg; 110.7 mm Hg; 57.69 mm Hg; and 49.31, respectivley for anger-in's and were 69.10 mm Hg; 112.6 mm Hg; 59.77 mm Hg; and 52.72, respectivley for anger-out's. Males showed higher systolic resting blood pressure than females, $F(1, 101) = 12.97$, $p < 0.0005$. There were no gender differences on either heart rate, diastolic blood pressure, or subjective anger rating. In addition, there were no differences among anger preference

subgroups on any of the dependent resting values nor interaction effects between gender and preference.

In the second MANOVA with repeated measures, the last of the two resting physiological dependent variables, rather than their averages were executed to determine the stability of cardiovascular indices for possible baseline flutuations. Heart rate, systolic and diastolic blood pressures were all shown to be stable over the last two adaptation readings, all F's (1, 101) n.s., thus suggesting a stable baseline. There were neither main nor interaction effects as a function of sex and/or anger preference.

Generally speaking, resting values of heart rate, diastolic blood pressure, and subjective anger rating were not affected by gender or anger preference. Males exhibited higher systolic blood pressure than females.

Effectiveness of the Experimental Manipulations on Physiological Arousal

In order to assess the effectiveness of the harassment, a 2x2 (Female/Male by Anger-in/Anger-out) MANOVA with repeated measures was executed, with the major focus on whether or not there were any significant cardiovascular changes from the baseline to the experimental phase. In addition, the hypothesis of whether or not there were differential cardiovascular reactivities to harassment as a function of the anger preference was investigated. Since the stability of the cardiovascular indices was demonstrated, the averages of the last two readings (i.e. heart rate, systolic and diastolic blood pressure) were used as baseline and the averages of all three measures taken during the experimental phase were employed. Using the average of the three task measures appeared justified given the stable, high response level of subjects. See also Figure 1.

The mean provocation scores on heart rate, systolic and diastolic blood pressure were 94.24 mm Hg; 124.75 mm Hg; and 73.52 mm Hg, respectively for females and were 96.86 mm Hg; 134.34 mm Hg; and 76.83 mm Hg, respectively for males. The results indicated that there were significant changes from baseline to experimental provocation across the three dependent variables with a multivariate $F(1, 101) > 465.55$, $P < 0.0001$. In addition, there were time by gender differences for heart rate, systolic and diastolic blood pressure. These results suggested that males showed consistently greater cardiovascular changes than females across three dependent measures: $F(1, 101) > 7.28$, $P < 0.008$ for heart rate; $F(1, 101) > 4.96$, $P < 0.03$ for systolic; $F(1, 101) > 14.53$, $P < 0.0002$ for diastolic. Analyses of variance on anger expression preference or sex by preference were not

significant.

In summary, males showed greater cardiovascular changes (i.e. heart rate, systolic and diastolic blood pressure) than females from baseline to the experimental manipulation. Note the great cardiovascular reactivity to harassment, slow overall and incomplete recovery even after the minute 10 of recovery, as shown in Figure 1.

Overall Mean Change Scores On Heart Rate And Systolic And Diastolic Blood Pressure From Baseline To Provocation, And Then To Recovery

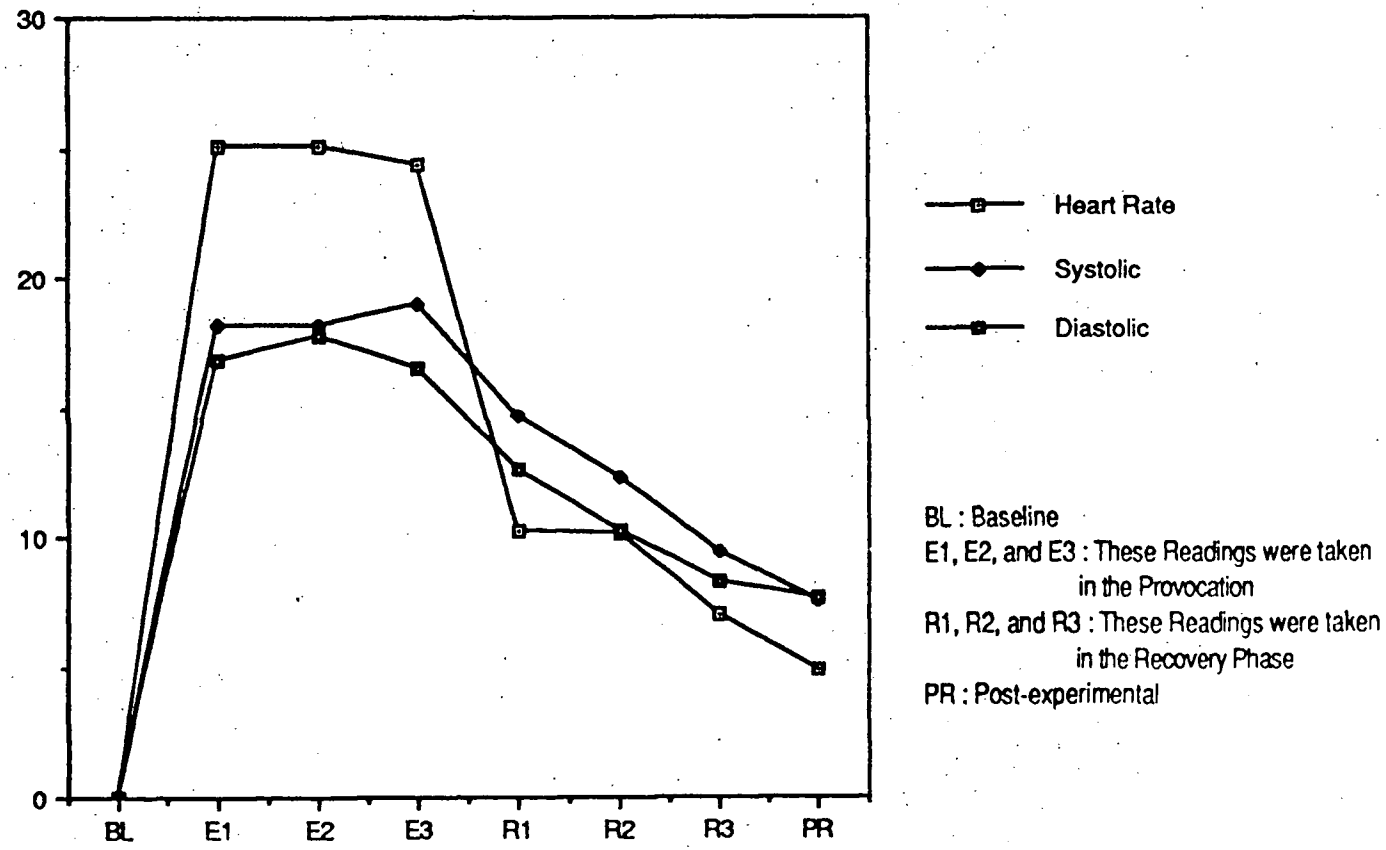

Figure 1

Effectiveness of the Experimental Manipulations on Subjective Anger Rating.

As shown in the above section, there were no main or interaction effects on the pre-experimental subjective anger ratings, as a function of sex and anger preference. The differences in pre and post scores would indicate changes in the subjective ratings of anger, presumably as a result of the experimental provocation. Adjusted mean change scores on subjective state anger ratings from pre- to post- experimental phases is displayed in Table 2. A 2x2x2 (Female/Male by Anger-in/Anger-out by Opportunity/No Opportunity) ANCOVA on the subjective ratings at post-test, with the pre-test subjective scores covaried out, revealed two 2-way interactions (i.e. sex by preference and sex by opportunity). In addition, there was a main effect for the opportunity condition.

In the Gender by Preference interaction, it was significant, $F(1, 96) = 6.85$, $p < 0.01$, as shown in Figure 2. Simple main effects revealed that at the end of the experiment anger-in males were significantly more angry than anger-out males at $p < 0.025$. The difference in subjective anger rating between anger-out females and anger-in females was not significant.

In the Gender by Opportunity interaction, it was significant, $F(1, 96) = 4.16$, $p < 0.04$, as shown in Figure 3. Simple main effects revealed that females who had an opportunity to aggress against their frustrator were significantly more angry than females who were not given such an opportunity at the end of the experiment. The difference between male/opportunity group

and male/no opportunity group was not significant.

The main effect of opportunity also showed that individuals who were given an opportunity to aggress against the frustrator were more angry by the end of the experiment than those who were not given such an opportunity, $F(1, 96) = 3.99$, $p < 0.049$, as shown in Table 2.

Cardiovascular Recovery Following the Experimental Phase

Trend analyses on heart rate and systolic and diastolic blood pressure during the recovery phase revealed overall linearity. Therefore, it was decided that analysis on these three dependent measures for this phase were to be carried out on the last data point during recovery while differences in autonomic arousal level at the final data point of the provocation phase were covaried out. This strategy isolated the recovery magnitudes adjusted for individual differences at the end of the harassment.

TABLE 2 :

Adjusted Mean Change Scores On Subjective State Anger Ratings From Pre- To Post- Experimental Phases

Sex	Female				Male			
Preference	In		Out		In		Out	
Opportunity	Yes	No	Yes	No	Yes	No	Yes	No
Adjusted Mean Change Scores	18.34	7.03	30.51	4.64	29.58	31.34	18.35	11.93

Two-Way Interactions Of Gender And Preference In The Post-Experimental Adjusted Mean Subjective State Anger Ratings

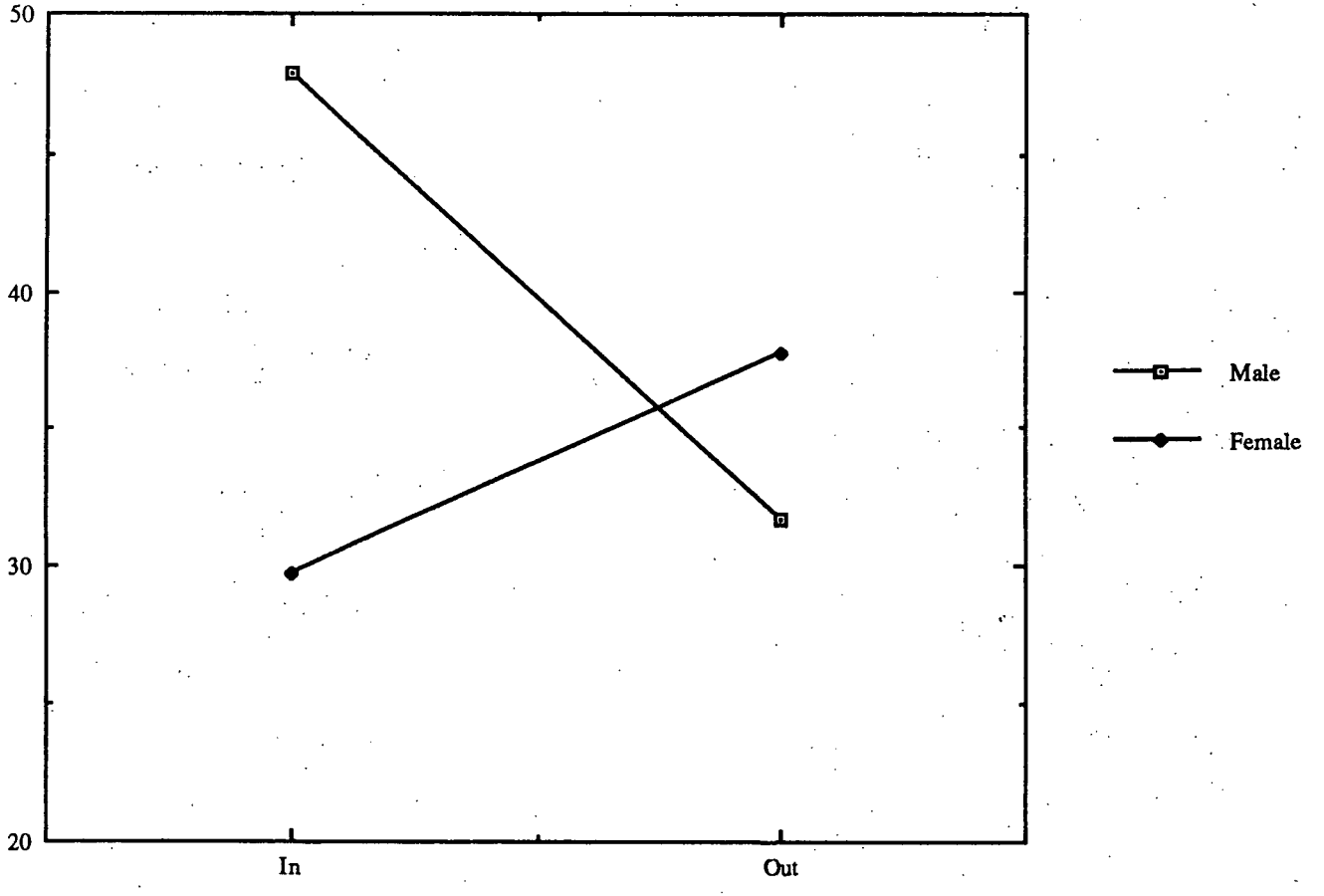

Figure 2

Two-Way Interactions Of Gender And Opportunity In The Post-Experimental Adjusted Mean Subjective State Anger Ratings

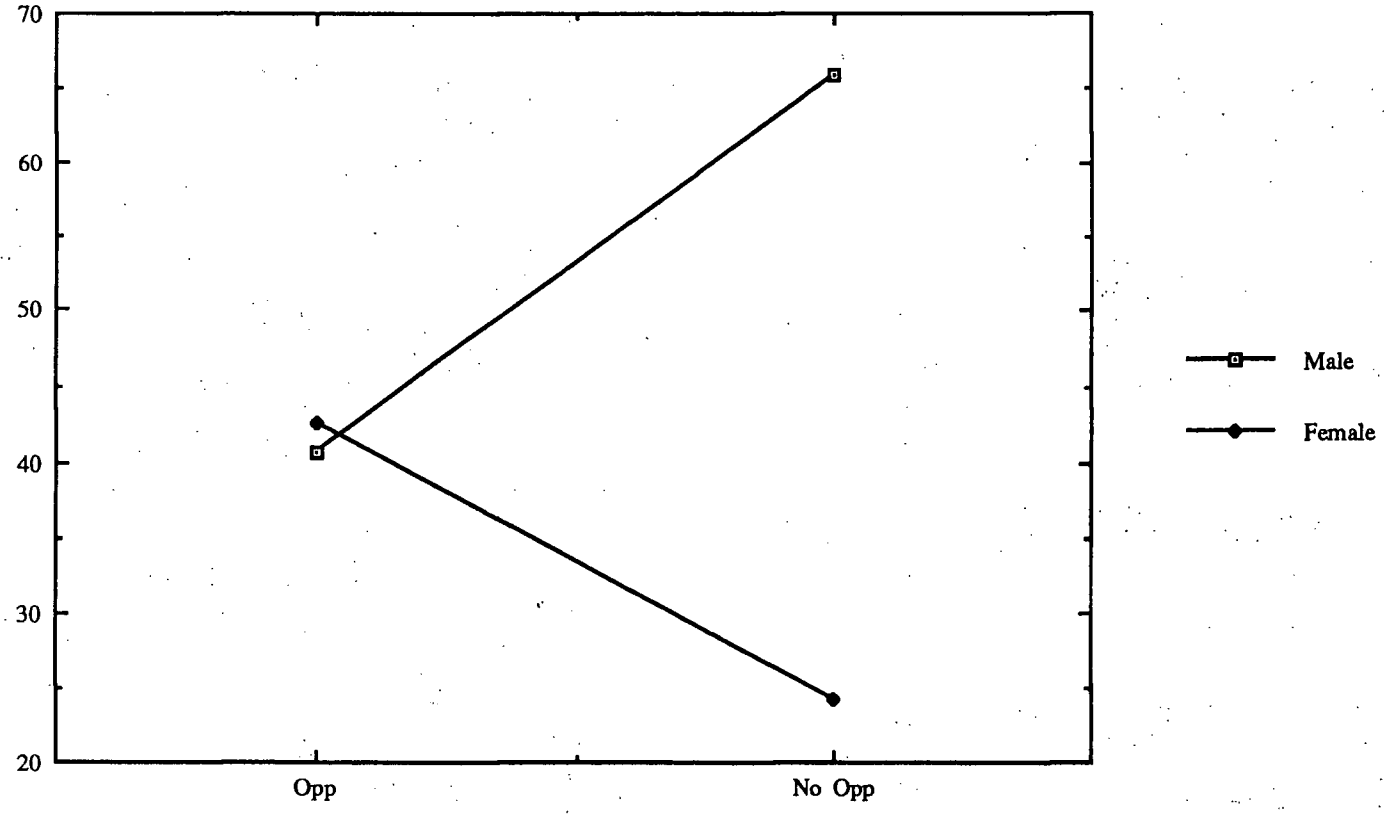

Figure 3

Due to the inadequacy of the BMDP program to accomodate individual covariates in a MANOVA program, a series of 2x2x2 ANCOVAs, rather than MANCOVA, were executed to investigate cardiovascular recovery as a function of sex, anger direction
preference, and opportunity/no opportunity to aggress. In addition, the hypothesis that groups of anger-in's given no opportunity to aggress and anger-out's given an opportunity to aggress would show a rapid recovery was tested.

Recovery of Heart Rate

On heart rate, there were no main or interaction effects, all F's (1, 96) < 3.01, P's > 0.086, suggesting that neither sex, anger preference nor the opportunity to aggress affected heart rate recovery. The overall pattern for females and males was similar and is displayed in Table 3.

Recovery of Systolic Blood Pressure

The adjusted mean recovery scores on systolic blood pressure for females and males were 117.66 mm Hg and 122.78 mm Hg, respectively. When the samples were broken down by preference, the adjusted mean recovery scores for anger-in's and anger-out's were 118.64 mm Hg and 121.78 mm Hg, respectively. Simple main effects for both sex and preference were noted. Females showed quicker systolic revovery than males, F (1, 96) > 10.78, $p < 0.0014$. Anger-in's showed quicker systolic recovery than Anger-

out's, F (1, 96) > 4.95, p < 0.0284. The overall pattern for females and males is displayed in Table 4.

Recovery of Diastolic Blood Pressure

The adjusted mean diastolic recovery scores for female/in/opportunity, female/in/no opportunity, female/out/opportunity, female/out/no opportunity, male/in/opportunity, male/in/no opportunity, male/out/opportunity, male/out/no opportunity were 65.17 mm Hg; 68.24 mm Hg; 68.15 mm Hg; 66.26 mm Hg; 65.17 mm Hg; 65.6 mm Hg; 62.53 mm Hg; 69.58 mm Hg, respectively. There were neither main effects nor 2-way interactions. However, there was a significant 3-way interaction, F, (1, 96) > 4.88, P < 0.03. Simple interaction of gender and opportunity at anger-out level was significant at P < 0.05. Follow-up analysis with simple simple main effects at P < 0.05 revealed that for the male anger-out group, males with an opportunity to aggress exhibited the greatest recovery relative to any other male groups, whereas males without an opportunity to aggress showed the slowest recovery, again relative to any other male groups. For the male anger-in, female anger-in, as well as female anger-out groups, the opportunity/no opportunity factor did not impact on the cardiovascular recovery. The overall pattern for females and males is displayed in Table 5. The pattern of the adjusted mean changes in diastolic for males from provocation to recovery is displayed in Figure 4.

Table 4 :

Adjusted Mean Changes In Systolic From Provocation To Recovery

	F/IN/OPP	F/IN/NO OPP	F/OUT/OPP	F/OUT/NO OPP	M/IN/OPP	M/IN/NO OPP	M/OUT/OPP	M/OUT/NO OPP
Provocation cell means/covariate	124.87	123.87	127.46	124.23	133.93	133.00	136.82	137.50
Recovery cell	112.13	111.73	120.08	117.15	123.07	126.36	127.45	126.90

Table 3 :

Adjusted Mean Changes In Heart Rate From Provocation To Recovery

Table 5 :

Adjusted Mean Changes In Diastolic From Provocation To Recovery

	F/IN/OPP	F/IN/NO OPP	F/OUT/OPP	F/OUT/NO OPP	M/IN/OPP	M/IN/NO OPP	M/OUT/OPP	M/OUT/NO OPP
Provocation cell means/covariate	73.47	69.47	75.15	73.53	73.71	77.57	80.45	75.20
Recovery cell means	64.40	64.73	68.54	65.54	64.57	67.64	66.54	70.00
Change scores	9.07	4.74	6.61	7.99	9.14	9.93	13.91	5.20
Adjusted recovery cell means	65.17	68.24	68.15	66.26	65.17	65.60	62.53	69.58
Adjusted change scores	8.30	1.23	7.00	7.27	8.54	11.97	17.92	5.62

Adjusted Mean Changes In Diastolic For Males From Provocation To Recovery

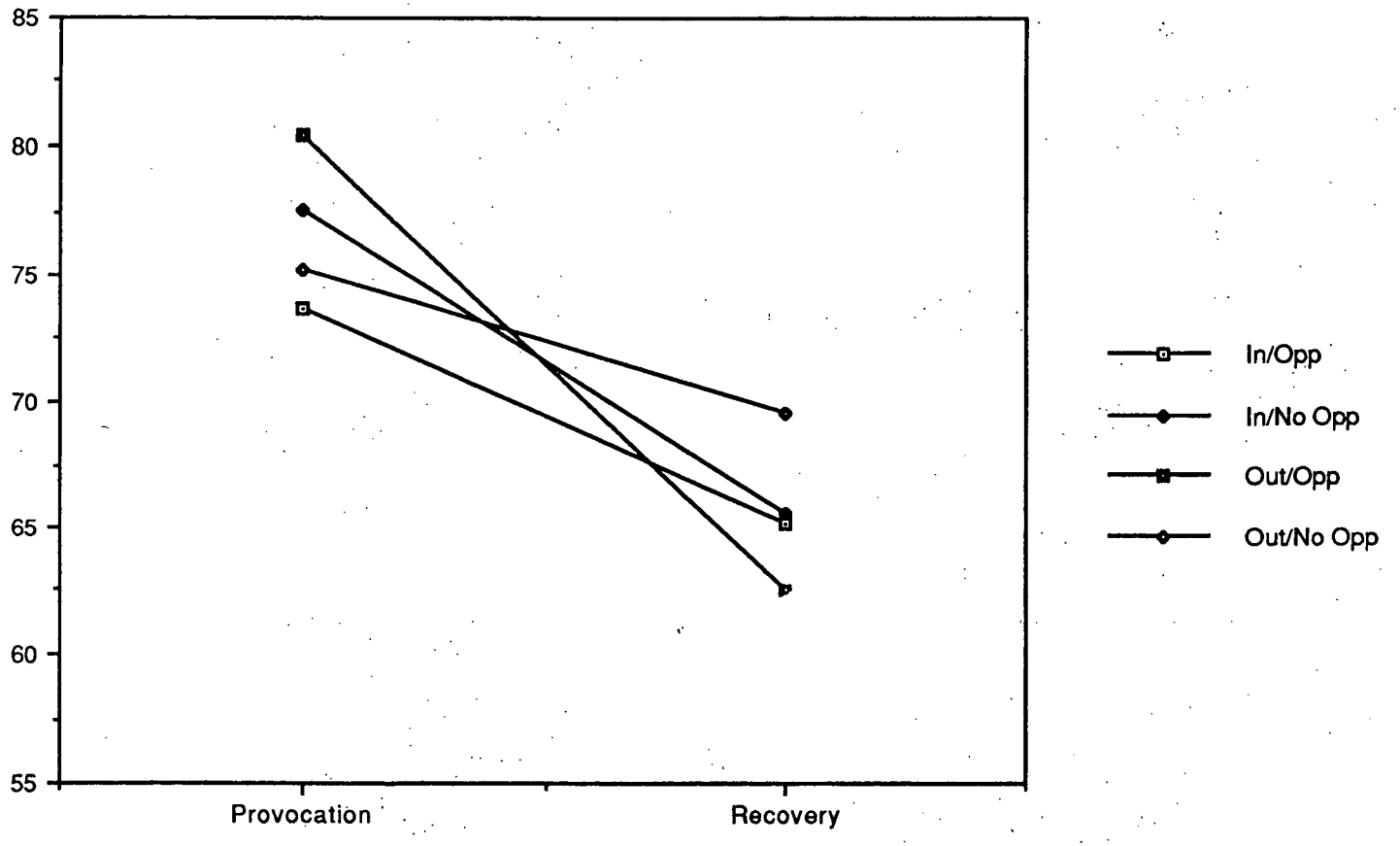

Figure 4

Effectiveness of the Written Evaluation as a Tool for Catharsis

Two separate 2X2 ANOVAs (Female/Male by Anger-in/Anger-out) were executed respectively, on the amount of expressed negative emotion and on the evaluation of the frustrator's performance and competence completed by those subjects assigned to an-opportunity-to-aggress condition (N = 53). The amount of negative emotion expressed was derived as a numerical number obtained by subtracting the number of positive adjectives from the number of negative adjectives. The subjects' perception of the frustrator's performance and competence was also expressed in a numerical figure obtained from the averages of all ratings, with 0 representing the worst, and 10, the best.

In the first analysis there were no main or interaction effect, all F's (1, 50) < 2.01, P's > 0.163, suggesting that all subjects, irrespective of their gender and/or anger direction preference, expressed the same amount of negative emotion when asked to criticize the experimenter. The mean number of negative adjectives expressed for female-in's, female-out's, male-in's, and male-out's were 3.7, 4.0, 3.3, and 1.9 respectively.

In the second analysis there was again no main or interaction effect, all F's (1, 50) < 1.76, P's > 0.19, indicating that all subjects, irrespective of their sex and/or anger direction preference, felt that the frustrator was unfriendly, demanding, critical, and aggressive. The mean ratings for female-in's, female-out's, male-in's, and male-out's were 3.7, 3.4, 3.0, and 4.0 respectively.

DISCUSSION

Special Features incorporated into the Study

Before going into the details of the findings, it is important to reiterate that this study is the first to include three major modifications and expansions of previous designs. Firstly, it examined the subjective and physiological arousal and recovery in an anger provocation situation for both males and females. Secondly, cross-validation on subjects' anger preference was executed to ensure that both subject themselves and their peers concurred to strengthen the assumption of true and consistent anger expression preference. Thirdly, subject gender, anger expression preference and opportunity to agress/not aggress was studied interactively.

Validity Checks

Having a cross validation through the addition of peer evaluation on subjects' anger direction preference precluded the 27 subjects who did not show a consistent anger direction preference. The obvious implication of this finding is that Engebretson et al (in press) tested the matching hypothesis with a somewhat different sample which likely ran a larger measurement error.

The repeated interruptions and harassment were effective in arousing subjective anger and cardiovascular reactivity in both males and females from baseline to the experimental phase. The magnitude of mean changes in heart

rate, and systolic and diastolic blood pressures were 24.6, 17.7, and 16.4 mm Hg, thus exceeding those in most previous studies. See Table 1 and Figure 1 for comparison.

In addition both female and male anger-in's given an opportunity to aggress expressed the same amount of negative emotion and dissatisfaction with the frustrator as their anger-out counterparts did, thus suggesting that they indeed acted against their natural tendency. This was important for three reasons. Firstly, it demonstrated that anger-in's, who usually withhold their anger, expressed it overtly at request, presumably because there were no adverse consequence to it. Secondly, it strengthed the argument that the catharsis effects could be solely attributed to the equal opportunity for counter aggression on the part of anger-in and anger-out subjects. Thirdly, it gave further support to the effectiveness of the harassment for both anger-in's and anger-out's.

Were the Hypotheses Supported ?

The first hypothesis: Cardiovascular reactivity to harassment as a function of subject's sex and anger direction preference.

It was hypothesized that male subjects would not display significant differences in reactivity to harassment as a function of their anger direction preference. For female subjects, it was unknown how anger-in's versus anger-out's would react. Results supported the hypothesis that male anger-in's and male anger-out's did not display significant differences in reactivity to harassment. The same pattern of reactivity was also true for both anger-in

and anger-out females. In other words, anger direction preference alone had no discriminable impact on physiological reactivity to harassment for either males or females. The findings concerning the reactivity of females, given special consideration to their anger direction preference, are novel to the literature because not much about this group has been investigated previously.

Gender, on the other hand, discriminated resting blood pressure, with males showing higher resting systolic blood pressure. In addition, when harassed, males showed higher reactivity from baseline to provocation on heart rate, systolic and diastolic blood pressure than females. In other words, gender serves as a better predictor than anger direction preference for both resting values and reactivity to harassment.

The second hypothesis: Cardiovascular reactivity at the post-harassment phase as a function of sex, anger direction preference, and opportunity/no opportunity to aggress. It was postulated that groups of anger-in's given no opportunity to aggress and anger-out's given an opportunity to aggress (i.e. matched samples) would show more rapid recovery of autonomic activity than mismatched samples

Results supported the foregoing hypothesis for anger-out males on diastolic recovery. Anger-out males, given an opportunity to aggress, showed the largest recovery among all male groups, whereas anger-out males not given an opportunity to aggress exhibited the slowest recovery, again among all male groups. The match/mismatch hypothesis did not hold true for anger-in males.

Although the so-called matching hypothesis was not supported with females, they showed a very interesting pattern in systolic blood pressure recovery. Females showed a significantly larger recovery than males and female anger-in's showed a significantly faster recovery than female anger-out's. In other words, anger-in females, exhibited faster systolic recovery, irrespective of whether or not they had an opportunity to aggress against the frustrator.

The third hypothesis: the subjective feelings of anger after harassment and recovery as a function of sex, anger, opportunity/no opportunity to aggress. It was hypothesized that the groups that showed the least amount of subjective anger at the end of recovery were the anger-out's who had the opportunity to give negative evaluations on the frustrator.

Results indicated that the foregoing was not supported. In fact, those who had the opportunity to aggress were significantly more angry than those who were denied this opportunity. When samples were broken down by their gender and opportunity, females who were given an opportunity to aggress were more angry than females not given such an opportunity, suggesting that the former group might be sensitized to the harassment when they completed the negative evaluation and therefore were more subjectively angry. Feedback obtained from some subjects during the debriefing confirmed that the written evaluation could well serve as a reminder of the harassment. This phenomenon could also be explained with the experimenter's demand to be critical by being asked to complete an evaluation. However, opportunity to aggress had a cathartic effect on the subjective anger experience of males.

Males who had an opportunity to aggress showed less frustration than males who were not given such an opportunity. When subjects were broken down by their sex and preference, anger-out females were more angry than their anger-in female counterparts. Anger-in males, on the other hand, were more angry than their anger-out counterparts.

The last hypothesis: the evaluation of experimenter's competence and performance as a function of anger preference. It was unclear how the anger-in group vs the anger-out group would react to an aggression opportunity, given that there were no negative consequences to be anticipated.

Results indicated that there were no differences in the amount of expressed negative emotion or in the amount of unfavourable ratings on the frustrator's performance and competence as a function of gender and anger direction preference. In other words, the findings revealed that given no adverse consequences to it, even anger-in's were willing to express their negative emotions overtly, just as much as anger-out's did.

How do the Current Findings Tie in with the Literature ?

The present findings that repeated interruptions and harassment superimposed on a math task produced significant cardiovascular reactivity and subjective anger were entirely consistent with the literature (Baker & Schaie, 1969; Engebretson et al, 1989; & Hokanson & Burgess, 1962). It is worthy noting that the autonomic response magnitude here was much higher than in an equivalent study using math alone as shown in the study by

Linden, (1987); this was especially true for diastolic blood pressure and heart rate responses.

As mentioned earlier, Engebretson et al, (1989) conducted the first study to examine the reactivity concerning anger direction preference in an anger provocation situation in males. Their matching hypothesis was partially supported for systolic blood pressure. In the present study, both males and females were included. It was found that the matching hypothesis, as suggested in the study by Engebretson et al (in press), was confirmed with our male anger-out population for diastolic blood pressure. The discrepancy in the type of blood pressure for which the matching hypothesis was supported could possibly be explained by the use of different procedures. The harassment task of tracing an irregular pattern using a metal pointer with interruptions and degrading remarks in the study by Engebretson et al (in press) triggered higher differential systolic reactivity in anger-in versus anger-out males than the current study (i.e. a mean difference of 5.25 vs .1 mmHg) and therefore it was easier for them to study differential cathartic effects on systolic recovery. However, in the present study, the experimental task of serial subtraction together with interruptions and harassment produced presumably higher diastolic reactivity (since Engebretson et al did not report reactivity in diastolic, no direct comparison could be made) and therefore it was more likely to obtain differential diastolic recovery rates in the current study.

Not much has been known about cardiovascular reactivity of female anger-in's and anger-out's. Why did the matching hypothesis fail to hold for females? The few studies with this group found that, unlike males, females with an opportunity to launch counter-aggression did not accelerate their recovery (Williams (1972) & Hokanson and Edelman, (1966)). In addition, Hokanson et al (1968) showed that the "natural" response for females

that enabled them to achieve fast recovery was through ignoring rather than returning the shocks to the frustrator. The authors attributed the sex difference in counter aggression responses to social learning and comformity to social expectancy. The same explanation likely accounts for the failure of supporting a matching hypothesis of females in this study. The present data, which suggested that female anger-in's made faster recovery than female anger-out's, irrespective of whether they had an opportunity to aggress, is in line with the traditional teaching that women are not supposed to show their anger and may actually benefit autonomically from doing so (Hokanson & Edelman, (1966), Hokanson et al (1968) & Lerner (1977)). If holding anger in has always been their "habitual" response and produces no conflict, it makes sense that anger-in's recovered faster. According to this, the matching hypothesis for females also holds in the sense that by living up to the social learning and social expectancy, their subjectively experienced conflict and autonomic arousal may be reduced. This finding is further strengthened by the parallel finding on subjective anger which was also less in the anger-in females.

It is puzzling that the catharsis obtained through the opportunity to aggress did not produce a significant effect on post-experimental subjective ratings for male anger-out's. Empirical evidence suggests that subjective emotions and physiological arousal are often asynchronous but why this would apply to one subgroup only (i.e., male/opportunity group) needs to be addressed in future research. Given the fact that females were expected to behave differently than males in an aggressive situation, it was understandable that having an opportunity to aggress would only serve as a reminder of previous harassment, thus maintaining their subjective anger experience. Therefore, females who were given such an opportunity were more angry than females who were denied such an opportunity. It was also

understandable that anger-out females were more angry at the end of the experiment than anger-in females probably because they were verbally more expressive.

Summary of Important Findings

In the present study, it was found that anger direction preference did not discriminate resting heart rate, systolic and diastolic blood pressure. In addition, it did not discriminate cardiovascular reactivity as a result of harassment. Gender, on the other hand, was significant in predicting cardiovascular reactivity during harassment and males exhibited greater autonomic arousal when harassed.

Male anger-out's given an opportunity to aggress showed quicker recovery of diastolic blood pressure than their no-opportunity anger-out peers.

No catharsis effect for counter-aggression was obtained with females.

Given no adverse consequence, anger-in's could overtly express their anger and dissatisfaction at request.

Therapeutic Implications and Directions for future Research

For borderline hypertensives and essential hypertensives, as well as individuals who are prone to heart attacks, it is essential to maintain low blood pressure. It has been well documented that subjective anger increases heart rate and systolic and diastolic blood pressure (Engebretson, (in press)).

The present finding, that anger-out males who employed their "natural" anger direction preference after an upsetting situation obtained the fastest diastolic blood pressure recovery, has clear therapeutic implications.

Anger control and assertive trainings should pay special attention to individuals' anger direction preference and consider the at times opposing phsiological responses for male/female patients/subjects.

Since the present study is the first to include both female and male college students, replication with a community sample is needed for maximal generalization. Also, the operational definition of an anger-in response has not been thoroughly researched and can benefit from future investigation. Lastly, the roles of social learning and social expectation for men versus women on anger direction preference and associated autonomic activity deserve further investigation. Given the present findings, there is little doubt that situational factors, such as opportunity/no opportunity to aggress, sex differences, and habitual anger expression preferences will have to be studied together.

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Appendix I

A set of screening questionnaires concerning mainly about demographic information and self-evaluated anger direction preference

INTELLECTUAL PERFORMANCE AND CARDIOVASCULAR REACTIVITY

By completing this package you will have given your consent to participate in the first part of the study with Dr. Linden from the Psychology Department as the Principal Investigator. It will take you 10 minutes to complete all the questions.

All information is strictly confidential. While findings may be used in future studies, there will be no identification of you personally on any permanent records. All information will be recorded in group form and will remain strictly anonymous. Some of you will be contacted again for participation in the second part of the study with your permission and is therefore essential for you to fill in your name and telephone number. If you do not want to participate, simply return the uncompleted package to the researcher. Refusal to participate will in no way prejudice class standing. If you have questions concerning about this study, you can contact Josanna Lai, the graduate student in charge of this project,

....
Signature Date

Demographic Information

1) Sex: A) Female B) Male

2) Do you have a history of high blood pressure?
A) Yes B) NO C) Unsure

3) Please print your name: .....

4) Phone number we can contact you for possible participation in the second part of the study: .....

5) Preferred time during the day for us to contact you
.....
.....
.....

Listed below are 24 reactions people may experience when angry. For each one, please indicate on the scale provided (1 to 4) how frequently, on average, you experience these reactions when angry. There are no right or wrong answers and do not spend too much time on any one statement.

WHEN ANGRY OR FURIOUS	Almost Never	Some-times	Often	Almost Always
1. I control my temper	1	2	3	4
2. I express my anger	1	2	3	4
3. I keep things in	1	2	3	4
4. I am patient with others	1	2	3	4
5. I pout or sulk	1	2	3	4
6. I withdraw from people	1	2	3	4
7. I make sarcastic remarks to others	1	2	3	4
8. I keep my cool	1	2	3	4
9. I do things like slam doors	1	2	3	4
10. I boil inside, but I don't show it	1	2	3	4
11. I control my behavior	1	2	3	4
12. I argue with others	1	2	3	4
13. I tend to harbor grudges that I don't tell anyone about	1	2	3	4
14. I strike out at whatever infuriates me	1	2	3	4
15. I can stop myself from losing my temper	1	2	3	4
16. I am secretly quite critical of others	1	2	3	4
17. I am angrier than I am willing to admit	1	2	3	4
18. I calm down faster than most other people	1	2	3	4
19. I say nasty things	1	2	3	4
20. I try to be tolerant and understanding	1	2	3	4
21. I'm irritated a great deal more than people are aware of	1	2	3	4
22. I lose my temper	1	2	3	4
23. If someone annoys me, I'm apt to tell him or her how I feel	1	2	3	4
24. I control my angry feelings	1	2	3	4

For each of the 13 statements listed below, please circle the number (-4 to +4) which best describes how you generally deal with your feelings.

		Not At All True				Neither True nor False				Very Much True
1)	When I hear good dance music, I can hardly keep still.	-4	-3	-2	-1	0	+1	+2	+3	+4
2)	My laugh is soft and subdued.	-4	-3	-2	-1	0	+1	+2	+3	+4
3)	I can easily express emotion over the telephone.	-4	-3	-2	-1	0	+1	+2	+3	+4
4)	I often touch friends during conversations.	-4	-3	-2	-1	0	+1	+2	+3	+4
5)	I dislike being watched by a large group of people.	-4	-3	-2	-1	0	+1	+2	+3	+4
6)	I usually have a neutral facial expression.	-4	-3	-2	-1	0	+1	+2	+3	+4
7)	People tell me that I would make a good actor or actress.	-4	-3	-2	-1	0	+1	+2	+3	+4
8)	I like to remain unnoticed in a crowd.	-4	-3	-2	-1	0	+1	+2	+3	+4
9)	I am shy among strangers.	-4	-3	-2	-1	0	+1	+2	+3	+4
10)	I am able to give a seductive glance if I want to.	-4	-3	-2	-1	0	+1	+2	+3	+4
11)	I am terrible at pantomine as in games like charades.	-4	-3	-2	-1	0	+1	+2	+3	+4
12)	At small parties I am the center of attention.	-4	-3	-2	-1	0	+1	+2	+3	+4
13)	I show that I like someone by hugging or touching that person.m	-4	-3	-2	-1	0	+1	+2	+3	+4

Rate these traits and qualities according to how well they describe you, using the following scale:

1	2	3	4
Very Well	Fairly Well	Somewhat Well	Not At All

Circle a rating for each trait or quality

1) Being hard-driving and competitive.	1	2	3	4
2) Usually pressed for time.	1	2	3	4
3) Being bossy or dominating.	1	2	3	4
4) Having a strong need to excel in most things.	1	2	3	4
5) Eating too quickly.	1	2	3	4

Rate your feelings at the end of an average day at school, using yes (Y) or no (N) answers.

1) Often felt very pressed for time.	Y	N
2) Work stayed with you so you were thinking about it after working hours.	Y	N
3) Work often stretched you to the very limits of your energy and capacity.	Y	N
4) Often felt uncertain, uncomfortable, or dissatisfied with how well you were doing.	Y	N

In general do you get upset when you have to wait for anything?	Y	N

Appendix II

A set of screening questionnaires concerning mainly about peer-evaluated anger direction preference

Listed below are 24 reactions people may experience when angry. For each one, please indicate on the scale provided (1 to 4) how frequently, on average, your peer/ family member (the one who have asked you to do the evaluation for) experiences these reactions when angry. There are no right or wrong answers and do not spend too much time on any one statement.

WHEN ANGRY OR FURIOUS	Almost Never	Some- times	Often	Almost Always
1. He/She controls his/her temper.....	1	2	3	4
2. He/She expresses his/her anger.....	1	2	3	4
3. He/She keeps things in.....	1	2	3	4
4. He/She is patient with others.....	1	2	3	4
5. He/She pouts or sulks.....	1	2	3	4
6. He/She withdraws from people.	1	2	3	4
7. He/She makes sarcastic remarks to others.....	1	2	3	4
8. He/She keeps his/her cool.....	1	2	3	4
9. He/She does things like slam doors.	1	2	3	4
10. He/She boils inside, but he/she doesn't show it.....	1	2	3	4
11. He/She controls his/her behavior .	1	2	3	4
12. He/She argues with others..... .	1	2	3	4
13. He/She tends to harbor grudges that he/she doesn't tell anyone about.	1	2	3	4
14. He/She strikes out at whatever infuriates him/her.....	1	2	3	4
15. He/She can stop himself/herself from losng his/her temper.....	1	2	3	4
16. He/She is secretly quite critical of others..	1	2	3	4
17. He/She is angrier than he/she is willing to admit.....	1	2	3	4
18. He/She calms down faster than most other people	1	2	3	4
19. He/She says nasty things.....	1	2	3	4
20. He/She tries to be tolerant and understanding	1	2	3	4
21. He/She is irritated a great deal more than people are aware of	1	2	3	4
22. He/She loses his/her temper.....	1	2	3	4
23. If someone annoys him/her, he or she's apt to tell him or her how he/she feels	1	2	3	4
24. He/She controls his/her angry feelings.....	1	2	3	4

For each of the 13 statements listed below, please circle the number (-4 to +4) which best describes how your peer/family member (the one who have asked you to do the evaluations for) generally deals with his/her feelings.

		Not At All True				Neither True nor False				Very Much True
1)	When he/she hears good dance music, he/she can hardly keeps still.	-4	-3	-2	-1	0	+1	+2	+3	+4
2)	His/Her laugh is soft and subdued.	-4	-3	-2	-1	0	+1	+2	+3	+4
3)	He/She can easily express emotion over the telephone.	-4	-3	-2	-1	0	+1	+2	+3	+4
4)	He/She often touchs friends during conversations.	-4	-3	-2	-1	0	+1	+2	+3	+4
5)	He/She dislikes being watched by a large group of people.	-4	-3	-2	-1	0	+1	+2	+3	+4
6)	He/She usually has a neutral facial expression.	-4	-3	-2	-1	0	+1	+2	+3	+4
7)	People tell him/her that he/she would make a good actor or actress.	-4	-3	-2	-1	0	+1	+2	+3	+4
8)	He/She likes to remain unnoticed in a crowd.	-4	-3	-2	-1	0	+1	+2	+3	+4
9)	He/she is shy among strangers.	-4	-3	-2	-1	0	+1	+2	+3	+4
10)	He/She is able to give a seductive glance if he/she wants to.	-4	-3	-2	-1	0	+1	+2	+3	+4
11)	He/She is terrible at pantomine as in games like charades.	-4	-3	-2	-1	0	+1	+2	+3	+4
12)	At small parties he/she is the center of attention.	-4	-3	-2	-1	0	+1	+2	+3	+4
13)	He/She shows that he/she likes someone by hugging or touching that person.	-4	-3	-2	-1	0	+1	+2	+3	+4

Rate these traits and qualities according to how well they describe your peer/family member (the one who have asked you to do the evaluations for), using the following scale:

1	2	3	4
Very Well	Fairly Well	Somewhat Well	Not At All

Circle a rating for each trait or quality

1)	Being hard-driving and competitive.	1	2	3	4
2)	Usually pressed for time.	1	2	3	4
3)	Being bossy or dominating.	1	2	3	4
4)	Having a strong need to excel in most things.	1	2	3	4
5)	Eating too quickly.	1	2	3	4

Rate his/her feelings at the end of an average day at school, using yes (Y) or no (N) answers.

1)	Often felt very pressed for time.	Y	N
2)	Work stayed with him/her so he/she was thinking about it after working hours.	Y	N
3)	Work often stretched him/her to the very limits of his/her energy and capacity.	Y	N
4)	Often felt uncertain, uncomfortable, or dissatisfied with how well he/she were doing.	Y	N

In general does he/she get upset when he/she has to wait for anything? Y N

Appendix.III

Consent Form

Consent form

I agree to participate in a study entitled "Intellectual performance and cardiovascular reactivity" conducted by Dr. Wolfgang Linden, Psychology, University of British Columbia. The purpose of the study is to measure blood presure and heart rate while performing arithmetic challenges in which speed and accuracy will be stressed. The procedures to be used are not painful or harmful, and have been used with hundreds of subjects before you. This study has been approved by the university's ethics committee.

Study participation will require about 50 minutes of my time and will consist of a rest phase during which I will receive feedback on my current level of blood pressure and heart rate, as well as a 10 minute arithmetic task and a relaxation phase after the task. After the taskI will be asked to evaluate the experiment.

Whether or not I agree to participate in this study in no way affects my acedemic progress in this university. I may also withdraw at any time I desire. Any information resulting from the study is treated with strict confidentiality. I will have the opportunity to ask questions and receive explanations about this study. I have been given a copy of this consent form. Also, if I have any questions, I can contact Josanna Lai, the graduate student in charge of this project,

Signature of Participant Witness

Date:

Appendix IV

Pre-experimental State and Trait Anger Scale; Pennebaker's Inventory; and the cognitive part of the Schwartz's Cognitive and Somatic Anxiety Questionnaire

Please put a cross on the scale (from Not at all to Very much so) to indicate how you feel right now. There are no right or wrong answers but check the choice which seems to describe your present feelings best at this moment.

		Not at all	Very much so
1.	I am furious	.....	
2.	I am annoyed	.....	
3.	I feel like banging on the table	.....	
4.	I feel angry	.....	
5.	I feel aggravated	.....	
6.	I feel irritated	.....	
7.	I feel like yelling at somebody	.....	
8.	I feel like breaking things	.....	
9.	I am resentful	.....	
10.	I am mad	.....	
11.	I feel like I'm about to explode	.....	
12.	I feel frustrated	.....	
13.	I feel like hitting someone	.....	
14.	I am burned up	.....	
15.	I feel like swearing	.....	

B On the following pages several common symptoms or bodily sensations are listed. Most people have experienced most of them at one time or another. We are currently interested in finding out how prevalent each symptom is among college students. All data will be confidential.

For each sensation, mark the letter which indicates how frequently you experience that symptom. For all items, use the following scale:

A	B	C	D	E
Have never or almost never experienced the symptoms	Less than 3 or 4 times per year	Every month or so	Every week or so	More than once every week

For example, if your eyes tend to water once every week or two, you would write a D in the corresponding space.

1. Eyes water .....
2. Itching or painful eyes .....
3. Temporary deafness or hard of hearing .....
4. Lump in throat .....
5. Choking sensations .....
6. Sneezing spells .....
7. Running nose .....
8. Congested nose .....
9. Ringing in ears .....
10. Bleeding nose .....
11. Asthma or wheezing .....
12. Coughing .....
13. Out of breath .....
14. Swollen ankles .....
15. Chest pains .....
16. Racing heart .....
17. Cold hands or feet even in hot water .....
18. Leg cramps .....
19. Insomnia .....
20. Toothache .....
21. Upset stomach .....
22. Indigestion .....
23. Heartburn .....
24. Severe pains or cramps in stomach .....
25. Diarrhea .....
26. Constipation .....
27. Hemorroids .....
28. Swollen joints .....
29. Stiff muscles .....
30. Back pains .....

For each statement below please rate the degree to which you typically experience this feeling when you are feeling anxious. Put a number to the left of each symptom using the scale below as a guide.

Not at all Very much so

1 2 3 4 5

____ 1. I find it difficult to concentrate because of uncontrollable thoughts.

____ 2. My heart beats faster.

____ 3. I worry too much over something that doesn't really matter.

____ 4. I feel jittery in my body.

____ 5. I imagine terrifying scenes.

____ 6. I get diarrhea.

____ 7. I can't keep anxiety-provoking pictures out of my mind.

____ 8. I feel tense in my stomach.

____ 9. Some unimportant thought runs through my mind and bothers me.

____ 10. I nervously pace.

____ 11. I feel like I am losing out on things because I can't make up my mind soon enough.

____ 12. I become immobilized.

____ 13. I can't keep anxiety provoking thoughts out of my mind.

____ 14. I perspire.

Appendix V

Harassment Script

1) READ IT AT MIN 2

LOOK ( ), YOU ARE SUBTRACTING WAY TOO SLOW. YOU'VE GOT TO DO IT MUCH FASTER. CONTINUE WHERE YOU STOPPED.

2) READ IT AT MIN 6

( ), YOU'RE STILL TOO... SLOW... AND ALSO INACCURATE. THIS CAN'T BE YOUR BEST. K, TRY IT AGAIN FROM WHERE YOU LEFT OFF.

3) READ IT AT MIN 10

YOU'RE OBVIOUSLY NOT GOOD ENOUGH AT DOING THIS, NOW TRY HARDER. KEEP GOING.

4) READ IT AT MIN 12 AFTER I TAKE THE MEASURE

STOP SUBTRACTING

Appendix VI

Instructions together with the paragraphs to be copied by the no opportunity group

Your task now is to copy the passage on the first page onto the blank space right below it and if you need additional space, there are some extra sheets clipped at the end. When you finish it, turn to the next page and circle all the "p" and "d" in that passage. You have nine minutes to finish working on these two passages. If you finish before the time is up, which we will let you know through the intercomm, continue to sit back and relax.

Thank you for your co-operation.

SALES REPRESENTATIVES:

Due to internal promotions and increased business opportunities, Alfa-Laval Limited, a world wide leader in food processing technology, requires two sales representatives.

One person is required for the Maritime provinces to cover Food, Dairy, Fish and Brewery industries. We also require a person for Ontario to cover Food and Dairy industries. The successful candidates must have experience in the Food and Dairy industries combined with an Engineering background.

We offer a competitive salary, comprehensive benefits package and advancement opportunity. Please send your resume, in confidence to: Mr. G. Begley, Vice-President, Corporate Relations.

The Transportation Department of the Regional Municipality of Hamilton-Wentworth requires a Director of Operations for the Transportation Department (HSR/CCL).

Under the general direction of the Commissioner of Transportation, the principle assignment will be to manage the Operations Division in the Regional Transportation Department which provides bus services on both the urban and inter-urban routes and involves approximately 600 employees in two major locations.

Responsibilities will involve directing and managing the functions of the Operations Divisions to ensure a safe and efficient operation, including deployment of staff; schedule monitoring; performance management; public relations; active participation in labour negotiations, arbitrations, recruitment, grievances, health and safety, and staff training and development. The incumbent will also be a member of the Transportation Department's senior management team, involved in overall strategic planning and direction of the HSR/CCL.

The ideal applicant will have several years experience in a Sr. management/administrative position, involving the deployment of staff on a multi-shift basis in a unionized environment. A university education or equivalent managerial experience at a senior level is required, along with strong interpersonal skills. Preference will be given to candidates possessing transit experience.

Salary will be within the range of $54,000 to $63,000 and will be commensurate with experience and qualifications.

Applications are invited from persons possessing the above qualifications which should be submitted in the form of a complete resume by October 24, 1988.

Appendix VII

Instructions together with the evaluation to be completed by the opportunity group

The questions in the following pages are concerned about the experimenter, and not the supervisor. It is important for the study that you answer them in an open and frank manner to improve the design of the study. Neither will the experimenter find out what you put down nor will she have any undesirable consequences as a result of your evaluation. Thank you for your co-operation.

The questions in the following pages are concerned about the experimenter, and not the supervisor. It is important for the study that you answer them in an open and frank manner to improve the design of the study. Neither will the experimenter find out what you put down nor will he have any undesirable consequences as a result of your evaluation. Thank you for your co-operation.

In the following questions you are asked to rate pairs of adjectives concerning how you feel about the experimenter from 0 to +10. Assign a number to each rating and please justify your ratings with explanations.

1) Fair Unfair
+10 9 8 7 6 5 4 3 2 1 0
.....

My rating is .....
The reason I give this rating is:

2) Competent Not competent
+10 9 8 7 6 5 4 3 2 1 0
.....

My rating is .....
The reason for my rating is:

3) Friendly Unfriendly
+10 9 8 7 6 5 4 3 2 1 0
.....

My rating is .....
The reason for my rating is:

4) Understanding Demanding
+10 9 8 7 6 5 4 3 2 1 0
.....

My rating is .....
The reason for my rating is:

5) Easy going Critical
+10 9 8 7 6 5 4 3 2 1 0
.....

My rating is .....
The reason for my rating is:

6) Passive Aggressive
+10 9 8 7 6 5 4 3 2 1 0
.....

My rating is .....
The reason for my rating is:

Please describe your emotions as to how you felt being a subject in this experiment, incorporating some of the adjectives listed below that you think are appropriate. Also explain why you feel the way you do.

List of adjectives:

Happy	Sad	Frustrated
Joyful	Depressed	Annoyed
Elated	In despair	Irritated
Positive	Resentful	Belittled
Pleasant	Unpleasant	Aggravated
Relieved	Negative	Offended
Triumphant	Unhappy	Insulted
Euphoric	Disappointed	Angry

Good	Bad	Furious

The way I feel about myself as a subject in this experiment is:

Appendix VIII

Post-experimental State and Trait Anger Scale; Pennebaker's Inventory; and the cognitive part of the Schwartz's Cognitive and Somatic Anxiety Questionnaire

B On the following pages several common symptoms or bodily sensations are listed. Most people have experienced most of them at one time or another. We are currently interested in finding out how prevalent each symptom is among college students. All data will be confidential.

For each sensation, mark the letter which indicates how frequently you experience that symptom. For all items, use the following scale:

A	B	C	D	E
Have never or almost never experienced the symptoms	Less than 3 or 4 times per year	Every month or so	Every week or so	More than once every week

For example, if your eyes tend to water once every week or two, you would write a D in the corresponding space.

1. Eyes water .....
2. Itching or painful eyes .....
3. Temporary deafness or hard of hearing .....
4. Lump in throat .....
5. Choking sensations .....
6. Sneezing spells .....
7. Running nose .....
8. Congested nose .....
9. Ringing in ears .....
10. Bleeding nose .....
11. Asthma or wheezing .....
12. Coughing .....
13. Out of breath .....
14. Swollen ankles .....
15. Chest pains .....
16. Racing heart .....
17. Cold hands or feet even in hot water .....
18. Leg cramps .....
19. Insomnia .....
20. Toothache .....
21. Upset stomach .....
22. Indigestion .....
23. Heartburn .....
24. Severe pains or cramps in stomach .....
25. Diarrhea .....
26. Constipation .....
27. Hemorroids .....
28. Swollen joints .....
29. Stiff muscles .....
30. Back pains .....

Please put a cross on the scale (from Not at all to Very much so) to indicate how you feel right now. There are no right or wrong answers but check the choice which seems to describe your present feelings best at this moment.

		Not at all	Very much so
1.	I am furious	.....	
2.	I am annoyed	.....	
3.	I feel like banging on the table	.....	
4.	I feel angry	.....	
5.	I feel aggravated	.....	
6.	I feel irritated	.....	
7.	I feel like yelling at somebody	.....	
8.	I feel like breaking things	.....	
9.	I am resentful	.....	
10.	I am mad	.....	
11.	I feel like I'm about to explode	.....	
12.	I feel frustrated	.....	
13.	I feel like hitting someone	.....	
14.	I am burned up	.....	
15.	I feel like swearing	.....	

For each statement below please rate the degree to which you typically experience this feeling when you are feeling anxious. Put a number to the left of each symptom using the scale below as a guide.

Not at all Very much so

1 2 3 4 5

____ 1. I find it difficult to concentrate because of uncontrollable thoughts.

____ 2. My heart beats faster.

____ 3. I worry too much over something that doesn't really matter.

____ 4. I feel jittery in my body.

____ 5. I imagine terrifying scenes.

____ 6. I get diarrhea.

____ 7. I can't keep anxiety-provoking pictures out of my mind.

____ 8. I feel tense in my stomach.

____ 9. Some unimportant thought runs through my mind and bothers me.

____ 10. I nervously pace.

____ 11. I feel like I am losing out on things because I can't make up my mind soon enough.

____ 12. I become immobilized.

____ 13. I can't keep anxiety provoking thoughts out of my mind.

____ 14. I perspire.

Appendix IX

Debriefing

Debriefing

We are not surprised if you found part of the study unpleasant. We are now going to explain why we harassed you somewhat and why we frustrated you with our negative comments on your performance.

Research shows that anger coping skills (keeping in anger vs letting out anger) are associated with specific cardiovascular responses, namely diastolic blood pressure, systolic blood pressure, and heart rate. Extreme cardiovascular responses are believed to be involved in the development of heart disease. The findings obtained in this study may shed lights on the hypothesis of cardiovascular responses under stress and tell us about the relationships between gender, anger direction preference, and cardiovascular indices. In addition, we also wanted to find out if negative evaluation of the frustrator helps to let off the steam you may have built up and therefore facilitate a rapid return of cardiovasculalr indices to baselines. Some subjects could let off the steam; others were not able to let it out. That is the way the study was designed.

Thus the goals of the study were
1) To examine whether there are gender differences in reactivity to harassment between anger-in's and anger-out's.
2) To determine whether the anger-out's group given an opportunity to aggress against the frustrator will show what we predict, that is, the most rapid recovery of automatic reactivity as opposed to other groups.

Since the subject matter we are studying is anger and anger-coping skills, we view it essential to provoke subjects and to make them feel annoyed and frustrated, in order to mimic a realistic situation.

So once again we apologise for the harassment and the negative feeling you have as a result of your participation in this study. The negative comments on your performance are from a standard script and by no means reflect your actual performance on the serial subtraction task. It is important that you do nooot share this information with others otherwise our study will be contaminated. Also, we welcome your input so that we can improve our design. Finally, we really appreciate your participation in this study to further our knowledge in the field of cardiovascular reactivity. This will help to shed lights on coronary heart disease, a number one killer in the western world.

I would like to know how you feel now about the experiment after I explained the design and purpose to you. Please share your fellings with us and feel free to make suggestions you may have about the design of the study. Thanks again for participating.

If you would like to know the results of this study, a copy of the report will be available in approximately five months time from the following address:

Josanna Lai
Psychology Department
University of British Columbia

If you are interested in this area of research and would like to read more about it , you could start with:

Gentry, W., Chesney, A., Gray, H., Hall, R., & Harburg, E. (1982) Habitual anger-coping styles: I. Effect on mean blood pressure and risk for essential hypertension. Psychosomatic Medicine, 44, 195-202.

Hokanson, J., & Burgess, M. (1962) The effects of three types of aggression on vascular processes. Journal of Abnormal and Social Psychology, 64, 446-449.

Van Egeren, L., Abelson, J. & Thornton, D. (1977) Cardiovascular consequences of expressing anger in a mutually dependent relationship. Journal of Psychosomatic Research, 22, 537-548.