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REAL-LIFE STRESS, LABORATORY STRESS, PERSONALITY, AND GENDER
AS FACTORS IN CARDIOVASCULAR REACTIVITY

by

L. VICTOR FICHERA

A dissertation submitted to the Graduate Faculty in
Psychology in partial fulfillment of the requirements for the
degree of Doctor of Philosophy, the City University of New
York

1997

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This manuscript has been read and accepted by the Graduate Faculty in Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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Abstract

REAL-LIFE STRESS, LABORATORY STRESS, PERSONALITY, AND GENDER
AS FACTORS IN CARDIOVASCULAR REACTIVITY

by

L. VICTOR FICHERA

Adviser: Professor John L. Andreassi

Two experiments were conducted to investigate the relationships between Type A behavior, hostility, and cardiovascular reactivity to various stressful tasks. Both laboratory and a real stressor were used. Changes in heart rate, blood pressure and skin conductance from baseline to task levels were used to assess reactivity. In experiment I, the physiological measures of 96 women were taken during a seated baseline period, a reaction time task and during a more socially stressful oral IQ quiz. Analyses indicated that Type A and hostile women were more reactive to the oral IQ quiz than the reaction time stressors. In experiment II, the heart rate and blood pressure of 86 men and women was measured during standing inactive (baseline) conditions and during a classroom oral presentation. The speech was real in that it was a graded part of their course requirement. Results indicated that all research participants, regardless of personality or gender, reacted strongly to the speech. It is suggested that measures of Type A and hostility are not only predictive of reactivity in men but in women also. In

addition, very intense, real stressors as opposed to artificial laboratory ones, may result in high levels of reactivity independent of variables which moderate reactivity at lower levels of stress.

Acknowledgements

I would like to take this opportunity to thank the many people who have helped to make this dissertation possible. I am grateful that Dr. Joel Lefkowitz accepted me into the Industrial Psychology program. He, and the other I/O faculty members advanced my education beyond my high expectations. Dr. Albright and Dr. Reichman have been involved in my research since it's early stages, from the initial research topic selection, to the final defense. Their constructive criticism, technical advice, and words of encouragement have made the lengthy process easier, and often exciting. I am grateful to Dr. Engle-Friedman and Dr. Cohen for serving as outside readers, especially upon such short notice. My fiancée, Liz, initiated my research through encouraging me to work in the psychophysiology laboratory. She has helped though acting within several roles: document editor, audience and critic of my practice presentations, technical advisor, and recruiter of research participants. Her confidence of my success, particularly when mine had faltered, was always appreciated. Dr. John Andreassi's role in the dissertation was central. The unaccountable amount of informational input, time, constructive and often "re-constructive" criticism, motivation, and encouragement were the foundation of this work. I could not have asked for a better mentor. Finally, my parents, who have gone the extra mile in their support of me, since day one, are an essential part of this dissertation, as all of my achievements in life are theirs'.

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INTRODUCTION

Stress has become an increasingly popular topic within organizations as administrators have become more aware of its deleterious effects upon the well being of the worker and the organization. The financial effects have become particularly noteworthy. In 1977, the estimated annual costs of cardiovascular disease and peptic ulcers within the U.S. was at \$45 billion (Schuler, 1980). By 1985, the cost estimate reached \$100 billion per year (The Economist, 1985) and in 1988, \$150 billion (Business Week, 1988). Workers have reported more stress-related illnesses in the 1980's than in previous decades, and health care reform will probably make businesses more responsible for such infirmities. Such illnesses are often thought to be the result of stress (McQuade and Aikman, 1974; Rosenman, 1990).

Stressors and stress are two different concepts. Generally, a stressor is some factor/situation which has the potential to generate stress, while stress can be defined as one's psychological and physical reaction to a stressor. Schuler conceptualized stress as an individual's "dynamic condition" when confronted with demands, constraints and/or opportunities, which impact personal desires (1980). So stress is a reaction to a stressor, which is perceived to carry a threat to something which an individual desires. There are multitudes of factors which can act as stressors. The Social Readjustment Scale (Holmes and Rahe, 1967) lists

many stressful life events (stressors) which have been associated with physical illnesses and psychological distress. Events such as the death of a spouse, changes in one's job, residence, and eating habits, having arguments with loved ones, and trouble at work are included in this scale. These are a few of the many factors which exemplify stressors. In general, the physical and mental reactions to stressors, thus the state of an individual who has confronted a stressor, describes stress. Physical responses such as changes in heart rate and blood pressure exemplify some of the physical reactions to stressors.

The work environment provides a plethora of real stressors which threaten a worker's health and sense of well-being. Consideration of negative consequences of job pressures leads workers to experience stress intermittently, and on a regular basis. Chronic stress negatively affects the worker by disrupting satisfaction and leading to ill health. Individual characteristics such as personality, and gender can magnify the negative impact of certain organizational characteristics (job stressors).

The workplace has been changing rapidly, with women comprising a greater proportion of the work force than ever before. Women at work face most of the same stressors that men encounter. They must also deal with stressors which are particular to women on the job. Job stress has been researched considerably over the last two decades, however

most studies used males exclusively. Now that the work force consists of a more significant number of women, future studies should attempt to utilize more representative samples by including more women or by studying women exclusively. Such research is needed, since job stress not only leads to anxiety and dissatisfaction, but may also be implicated in cardiovascular disease.

Throughout the 20th century, coronary heart disease has been the leading cause of death in the United States for both men and women. The primary risk factors such as serum cholesterol, cigarette smoking, dietary and exercise habits have gained much attention. As a potential mechanism in the development of coronary heart disease (CHD), cardiovascular reactivity has also drawn much attention. In a reactivity handbook by Clarksin, Manuck and Kaplan (1986), several of the primary measures of cardiovascular reactivity (CVR) such as systolic blood pressure, heart rate and diastolic blood pressure were linked to the development of atherosclerosis. Also, dysrhythmia, angina pectoris and myocardial infarction have been associated with cardiovascular reactivity. Personality variables such as hostility and Type A have also been associated with cardiovascular reactivity and coronary heart disease. So far, the majority of studies involving the reactivity-CHD relationship have looked at men only. Few have looked at women alone or at the differences between sexes. The few studies that investigated sex differences have found

some similarities and some differences in reactivity. More information is needed to better understand why these differences and similarities exist.

Since the 1970's, many experiments have been conducted to link various stressors, personality variables such as Type A, and gender differences to cardiovascular reactivity. A recent trend towards incorporating more women as participants is one way in which the literature is currently advancing. Another way that the stress literature seriously needs to be advanced is in terms of the meaningfulness and realism of stressors used. By the mid 1980's, the vast majority of stress studies used artificial laboratory tasks and "challenges" such as mental arithmetic and other cognitive and psychomotor tasks (Wright, Contrada & Glass, 1985). The use of such relatively meaningless and questionable "stressors" continues to be the norm rather than the exception in stress studies. What is currently needed are more studies which measure stress in real situations where the research participant experiences meaningful consequences rather than engaging in a task with no real effects. A reasonable ultimate goal of stress investigations should be to gain a better understanding of how the stressors in life affect a person's health and well-being. Approaching this goal requires the use of real life settings and stressors in research studies. Next presented is a review of the literature regarding coronary heart disease, cardiovascular reactivity, the Type A behavior pattern,

hostility and their association with women.

CARDIOVASCULAR REACTIVITY

a) **Definition and measurement**

Cardiovascular reactivity (CVR) can be defined as a change in cardiovascular activity between some resting condition and an active condition. The active condition typically involves some task requiring mental activity and or physical activity. To illustrate, if a person's heart rate was measured at 75 beats per minute (bpm) during a resting baseline phase and later exhibited a heart rate of 98 bpm during some task (such as mental arithmetic or the cold pressor), the difference in heart rate indicates cardiovascular reactivity. It can be thought of as a physiological adaptation or reaction to some stimulus, typically a stressful one. It is generally accepted that the activation of the cardiovascular system in times of stress has evolved as a psychophysiological reflex to danger (Sherwood & Turner, 1992). Sherwood and Turner have also maintained that reactivity can be thought of as a behavioral trait since it varies between people and it is relatively stable over time and across situations. It is also partly dependent on the situation, thus the nature of the task/situation needs to be accounted for in reactivity assessment.

The vast majority of studies of cardiovascular reactivity have measured systolic blood pressure, heart rate and diastolic blood pressure (Sherwood and Turner, 1992). A less

frequently used measure is mean-arterial pressure, a weighted composite of systolic and diastolic blood pressure. A few studies incorporate measures of stroke volume, pre-ejection period and pulse transit time. Some might question the use of cardiovascular measures as representative of cognitive/emotional reactivity since they are dependent on one's level of physical condition. The use of baseline data for comparison is the key to controlling for most of the effects of exercise.

Since the CVR research within the last 15 or so years has not always yielded positive results (Fredrikson & Matthews, 1990; Rosenman, 1990), several explanations have emerged. One is that there are problems with the measurement of cardiovascular reactivity (Pickering & Gerin, 1990; Pollak, 1991; Kamarck, Jennings, Debski, Glickman-Weiss, Johnson, Eddy & Manuck, 1992; Kamarck, 1992). Kamarck has focused upon the psychometric issues within CVR research for several years. Overall, he notes that the test re-test reliabilities within CVR studies have averaged from .37 to .63 and that such levels are generally low as compared to those found within studies of personality and cognition (Kamarck, 1992). He provided several possible explanations for such low reliabilities. One is that a learning effect can take place such that participants will be less stimulated by subsequent trials. Also, the less cognitive tasks, like the cold pressor, might lose their impact when the novelty wears off. He suggested

that task complexity be kept to a minimum (Kamarck, 1992). Also, in order to maximize discrimination among differing participants, tasks should be of a moderate, rather than high or low level of challenge/stress. Finally, he suggested that the effects of relevant (extraneous) variables should be considered and minimized if not controlled (1992).

There are many extraneous variables that temporarily affect a participant's state and thus contaminate cardiovascular measures. The use of caffeine, oral contraceptives, cigarettes and even body posture are some of the most common factors. Also, the location of sensors and the device used to measure CVR (stationary or ambulatory) can affect measurement outcomes. More will be said on some of these influences in the next section.

b) Brief overview of the literature

It might be best to borrow Sherwood and Turner's (1992) dichotomization of cardiovascular reactivity as an individual difference and as a function of situations, in order to provide a structure for discussion. The notion that reactivity is a stable characteristic that may be used to differentiate among people has its roots in early psychological research conducted by Lacey (1950) and Engel and Bickford (1961). Sherwood and Turner (1992) mentioned that the very first reports of cardiovascular reactivity date back to 1948 when Hickman, Cargill, & Golden measured cardiac output in a manner that "stressed" the subjects, resulting in

cardiovascular changes. However this was not meant to be a study of reactivity, and thus it lacked the proper controls, use of baseline measures and the investigative design needed for examining reactivity. Probably the "first" investigation of cardiovascular reactivity, that utilized a true baseline, was conducted by Obrist, Gaebeline, Teller, Langer, Grignolo, Light and McCubbin (1978). They claimed to be the first to report individual differences in reactivity (beta-adrenergic activation) when post-stressor measures were compared to basal measures. Since then, research on cardiovascular reactivity has become increasingly popular.

The general format used in investigating the notion that CV reactivity is a trait, involves the formation of two groups that are differentiated along some dimension which is related to reactivity, such as personality. The two groups are then subjected to the same stressful task. The reactivity (differences between baseline and task or post-task CV activity levels) measures are compared between groups. Also, large reactivity ranges above and below group means indicate that reactivity varies across individuals. For example, within 20 adult males, the systolic blood pressure reactivity ranged from 20 mmHg to 42 mmHg for a mental arithmetic task, 20 mmHg to 41 mmHg for reaction time, 32 mmHg to 60 mmHg for the speech stressor and 20 mmHg to 34 mmHg for a cold pressor (Sherwood & Turner, 1992). Such a wide range indicates individual differences in CVR. This CV reactivity "trait" is

apparently stable over time, starting at an early age.

Several fairly recent investigations have yielded results indicating that CV reactivity can be identified in children (Parker, et al., 1987; Mahoney, Schieken, Clarke & Lauer, 1988; Murphy, Alpert, Walker, & Willey, 1991). All of these studies used large samples and found resting measures to be related to reactivity. More importantly, Murphy et al. (1991) reported that 3rd graders who were more reactive to a video game stressor displayed higher cardiovascular measures one year later. The best predictor of high blood pressure was high reactivity in the previous year. Such results indicate that reactivity is a trait that develops at an early age. The reactivity profiles of adolescents were also investigated. High hostility scores and parental history of hypertension were predictive of hyper-reactivity in adolescents (McCann & Matthews, 1988). Overall, it appears that CV reactivity is a trait that begins in childhood and continues through adolescence and adulthood.

If individuals truly differ in cardiovascular reactivity, there should be some stability of reactivity over different situations. Various tasks have been used to assess CV reactivity. Mental arithmetic (MA) is a very popular task because it engages mental facilities, it is easy to implement and fine tune, and it does not place the subject at any risk of unreasonable physical or psychological harm. Typically, the subject must rapidly subtract numbers or make other

computations in his or her head. Overall, this task has repeatedly proven to be successful in generating a range of cardiovascular reactions in subjects, often according to some hypothesis regarding which individuals would react more. Houston, Smith and Cates successfully predicted that individuals characterized as highly hostile would be more reactive to a MA task than those who are less hostile (1989). Others have found the MA task to generate a cardiovascular response in other types of hypothetically hyperreactive individuals (Strickland, Myers, & Lahey, 1989; Williams, Riels, & Roper, 1990; Fredrikson, Tuomisto, & Bergman-Losman, 1991; France & Ditto, 1992).

The use of the mental arithmetic task is not without its difficulties. The general problem of "habituation" to stressors/tasks is applicable to the MA task. As subjects become familiar with the task, they may react less as the novelty wears off. Also, the requirement of spoken or written responses to the MA questions may have its own effect upon blood pressure independently of one's reactivity predisposition (Linden & Estrin, 1988); it was found that oral responses led to greater reactivity than written responses. Because of these possible confounding effects, it has been suggested (Linden, 1991) that the ordering of mental arithmetic questions and the type of responses should be standardized or at least reported.

Another popular task used in the assessment of

cardiovascular reactivity is the cold pressor test. It typically involves the immersion of a participant's hand or foot in ice water of about 4 Degrees centigrade for approximately a minute. Some researchers have used large ice packs on the forehead with success. Such a trial elicits physical discomfort, decreases in heart rate and increases in blood pressure (Anderson, Lane, Taguchi, Williams, & Houseworth, 1989). The reaction to the cold pressor is different from that of mental arithmetic and other tasks which elicit the classical defense pattern (mediated by the beta-adrenergic sympathetic nervous system). So this task/trial can demonstrate individual differences in reactivity due to somewhat different physiological mechanisms. Overall, this task has successfully elicited a wide range of CV reactions across individuals (Sherwood, Davis, Dolan and Light (1992), sometimes according to some related characteristic such as gender (Lash, Gillespie, Eisler, & Southard, 1991) and parental history (Anderson et al., 1989; Frederikson, Tuomisto, & Bergman-Losman, 1991). The cold pressor is not frequently used with studies of the reactivity of Type A/B individuals. This may be due to more logistical constraints and its frequent failure to elicit differential reactivity. The cold pressor failed to evoke differential reactivity across differing groups of subjects even though a reaction time task successfully differentiated these participants within the same study (Lovallo, Pincomb, & Wilson, 1986).

The cold pressor and mental arithmetic are two of the more popular tasks. CVR studies have incorporated other tasks which characterize the classical defense reaction such as various reaction time tasks, video games posing psychomotor challenges, anagram tasks, stressful interviews, and public speaking. So far, cardiovascular reactivity has been discussed as an individual difference. On the other hand, reactivity can be conceptualized as situationally specific, that is, an individual's reactivity is not only dependent upon a personal predisposition to react, but also according to factors independent of personal factors. Sherwood and Turner (p.21, 1992) supported the notion of CV reactivity as an individual difference by mentioning that "...the hemodynamic basis of reactivity is an individual characteristic only **partly modified** by coping demands of a situation.". "Partly modified" signifies that the situation and the **temporary** state of an individual has some effect upon CVR. More specifically, characteristics of the task such as the type of task, oral contraceptive use, caffeine, the degree of artificiality of the stressor/task, and even the posture of the participant during measurements affects reactivity, independent of individual predispositions to react.

Sometimes, an individual is predisposed to be more reactive than another, yet given a different stressor/task, the difference in reactivity disappears. Since the late 80's to early 90's, with recommendations from Pickering & Gerin

(1990), and Sherwood and Turner (1992), reactivity investigators have been using multiple stressors. More often than not, individuals who are reactive to a particular task, will react strongly to other tasks as well. However, the task sometimes has a uniquely strong or weak effect for a particular individual. Ambulatory measures of basal and task levels of CV activity were taken for three tasks; mental arithmetic, video games and reaction time (Pollak, 1991). Basal to task correlations of cardiovascular reactivity indicated individual reactivity predispositions for mental arithmetic and video games, yet not for the reaction time task (Pollak, 1991). Lawler and Schmeid (1986) found that Type A women were more reactive to the Stroop color/word task, yet they reacted similarly to Type Bs to an oral history quiz.

Fredrikson, Tuomisto & Bergman-Losman (1991) exposed research participants to two types of stress batteries; mental, including the Stroop test, mental arithmetic, and mirror tracing, and physical, the cold pressor and isometric exercise. They reported that those participants with a family history of hypertension were reactive to the mental or behavioral tasks yet were not differentiated according to the physical challenges. The above studies are but a sample of the many which indicate that the task itself has some differential effect upon CVR, independent of individual differences.

Recently, researchers have become increasingly concerned

with the ecological validity of reactivity investigations using laboratory stressors. The conclusions of most reactivity studies are based upon the assumption that results in the laboratory can be generalized to real-life situations. Few investigations have assessed the effects of real-life stressors posing real consequences to research participants. It is difficult to generalize the relationship between Type A personality and reactivity to real-life job stressors, such as task demands and role ambiguity, from laboratory stressors, such as the cold pressor and anagram puzzles. Compared to laboratory stressors, there are additional ethical and practical difficulties involved when a research participant is subjected to a stressor which has real consequences outside of the experiment. Such a potential for real and often threatening consequences is an important part of what constitutes a stressor.

In an attempt to assess the effects of real-life stressors, several studies have employed the use of ambulatory blood pressure monitoring devices. The usual procedure requires research participants to wear the monitor and go about their daily routine, facing whatever stressors emerge. With this typical measurement procedure, there is no control over the nature, levels and intensity of the stressors naturally encountered. Overall, difficulties regarding the ethical, practical and control related problems of real-life stress studies may have led many researchers to use more

convenient stressors. Many reactivity studies have failed to report "any clear rationale pertaining to the choice of specific stressors" (Sherwood and Turner, 1992). A few recent studies were designed to incorporate both real-life stressors and laboratory control.

The literature on real-life stress has been recently advanced through studies involving ambulatory blood pressure monitoring during routine daily activities and during stressful real-life moments. In particular, the use of ambulatory monitoring during a routine day, without the controlled introduction of a stressor, has two somewhat extreme characteristics. Such studies may be best at establishing ecological validity since they typically involve few intrusions into everyday life. However, there is little control over various aspects of the stressors encountered, if any. Comparisons of reactivity between research participants may be rendered impossible since one can not control the stressors encountered, that is, subject X may deal with many stressors or an intense one, while subject Y had an uneventful day. However, certain procedures can be used to improve the real-life stress research. The use of field diaries is probably one of the most important elements of a carefully run study. Participants typically write a description of daily experiences and activities with the corresponding time of occurrence in their event diaries. With the diary, it is possible to match daily experiences with measures of

cardiovascular activity. Also a research participant's evaluations and feelings regarding the intensity of the stressors can be documented.

Few have tested the assumption that an individual's responsiveness to laboratory stress represents his or her responsiveness to real-life stress. Several studies involving ambulatory monitoring have not clarified the validity of the assumption since results are mixed. In one investigation, the blood pressure and heart rates of 62 healthy men, aged 18-35, were assessed during mental arithmetic, reaction time, video game laboratory stressors, and during a 24 hour ambulatory monitoring period. Correlations within individuals, between laboratory task reactivity levels and ambulatory changes, led to the conclusion that individual differences in laboratory heart rate reactivity mirror those patterns obtained in the field (Pollak, 1991). That is, laboratory induced heart rate reactivity patterns are similar to those reactivity patterns measured in the field during one's daily activities. In a similar study, thirty two healthy male undergraduate students were measured at baseline and task levels during various laboratory stressors and during a 24 hour ambulatory monitoring period (Johnston, Anastasiades, and Wood, 1990). The students' heart rate was measured during cold pressor, video game, and mental arithmetic tasks in the laboratory. The video game and mental arithmetic tasks were designed to involve active coping. As opposed to passive coping, active

coping is an active response to some difficult task requirement(s). The cold pressor exemplifies a task which does not involve active coping since the participant does not actively respond. Stressors encountered in the field were whatever events occurred during a day at school (Oxford Polytechnic). Heart rate reactivity was calculated as the difference between sleeping heart rate and daily activity heart rate. Also, heart rate variability was designated as a representative measure of reactivity to stressors encountered during the day. Results indicated that participants were reactive to the various laboratory stressors and their heart rate changed significantly during the day, however more importantly, an individual's cardiovascular responses to the laboratory stressors were unrelated to field measures of heart rate. Reactivity patterns in the lab were not related to either heart rate variability during the day or comparisons between waking and sleeping heart rate. A-priori analyses indicated that there was some connection between field and lab peak heart rate responses during tasks requiring active coping. It was concluded that although ordinary measures of reactivity to field stressors were unrelated to reactivity in the laboratory, an index calculated with peak cardiovascular responses assessed across tasks involving active coping was related to field reactivity (Johnston et al., 1990).

It is difficult to make strong statements regarding lab to field reactivity consistency since the study by Johnston et

al., 1990) was not designed to test the moderating effect versus passive coping tasks, however other research endeavors actively investigated the idea. Van Doornen and van Blokland assessed the reactivity of 33 males in various conditions (1992). There were two stressful tasks requiring active coping; reaction time and a tracking task with noise blast punishment. A cold pressor stressor was used to represent a situation where passive coping was needed. To represent a real-life stressor, each participant was measured in a seated position at some time during the day of their public oral dissertation defense. The participants' responses to the cold pressors and the reaction time task were predictive of their reactivity during the anticipation of the oral defense. They concluded that reactivity to laboratory stressors which require either active or passive coping is predictive of reactivity to a real-life stressor (1992). Their findings show an association between laboratory reactivity and real-life reactivity, however the real stressor, "anticipation" of the dissertation defense is not a clearly defined or controlled stressor. Anticipation is a personal, internal and cognitive event which is difficult to operationalize. The stressor is not real in the sense that it is anticipated rather than presently occurring. The response rate was only 20% for this study which might lead one to believe that few PhD Candidates were willing to be measured on this stressful day. Given this response rate, it is understandable why the

researchers did not measure reactivity at a more clearly stressful time, that is, during the actual dissertation defense.

Although it is difficult to acquire an adequately sized sample of research participants for a task such as a real-life exam or speech, a few investigations were conducted. In one study, seven Type A and seven Type B women, as measured by the Jenkins Activity Survey, had their blood pressure and heart rate measured during a baseline rest period and during their statistics midterm examination (Lawler, Huck, and Smalley, 1989). Results indicated that Type A women had greater increases in systolic blood pressure and heart rate during the real-life exam as compared to Type Bs. Lawler et al. concluded that although "... results from this study must be considered preliminary, due to the small number of subjects" (p. 779), there were meaningful differences between the reactivity profiles of Type A and B women in a manner similar to Type A men (1989). In another study, adolescents' blood pressure reactivity to a mental arithmetic task in the laboratory was related to reactivity during a classroom speech given to their classmates (Matthews, Manuck and Saab, 1986). Results of a similar study were contrary in that blood pressure and heart rate changes during laboratory tasks were unrelated to real-life reactivity in adolescents (Southard et al., 1986).

A major problem with investigations employing ambulatory

monitors is that there is a lack of control over a participant's activity level and posture. Cardiovascular changes due to movement might be mistaken for changes due to reactivity to a psychological stressor. Also, blood pressure and heart rate are dependent upon one's posture. It is well established that blood pressure is greater while standing than while seated (Gellman et al., 1990, Shapiro et al., 1996) and that it is lowest when lying down. Even the elevation of one's legs while seated can effect blood pressure (Shapiro et al., 1996). In a study comparing laboratory to reactivity levels during a usual workday, leg movements were recorded along with ambulatory cardiovascular measures in order to control for movement artifacts (Pollak, 1991). However, records of leg movements are insufficient for determining postural effects since movement can be independent of body posture (standing or sitting). Before eliminating ambulatory measures taken during periods of leg movement (recorded by the monitor) there appeared to be no similarities between laboratory and field heart rate changes (Pollak, 1991). Also, participants were measured in a supine position during the laboratory testing and baseline phase, and field baseline (sleeping heart rate), yet posture during ambulatory measurement was free to vary. Since it is unlikely that the usual workday of the participants was spent in a supine position, it appears that comparisons of heart rate were made with different postures. Perhaps better control could have

been achieved if event diaries were used to obtain more precise measures of posture and body movements.

There are difficulties involved in manipulating a stressor in a real environment, and measuring or controlling the nature and intensity of stressors encountered during assessments of the effects of real-life stress. However, one can at least measure the relationship between perceptions of real-life stress and various indices of well-being. The associations between illness, absenteeism, and police stress were investigated using The Police Stress Survey (Spielberger et al., 1979) and The Seriousness of Illness Rating Scale (Wyler, Masuda and Holmes, 1968) in a correlational study by Tang and Hammontree (1992). The Illness rating questionnaire asks respondents to list commonly recognized disease syndromes which they experienced, and the police stress survey asks ratings of sixty job events compared to a disagreeable event standard. In one study, sixty police officers filled out both questionnaires and analyses indicated significant correlations between police stress, illness and absenteeism (Tang and Hammontree, 1992). These results indicated a connection between real-life job stress and illness. In order to distinguish global life stress from job stress, The Schedule of Recent Events (Holmes and Rahe, 1967) was used to measure general life stress. Results indicated that police stress (a specific type of job stress) and life stress, are separate constructs.

In a somewhat procedurally similar study, the relationships between a real-life job stressor, role ambiguity, Type A behavior and coronary risk factors such as blood pressure and triglycerides were assessed in a group of managers over a two year period (Howard, Cunningham and Rechnitzer, 1986). Although the design did not allow for an assessment of the direct link between stress experienced on the job and reactivity, correlational analyses revealed that self reports of role ambiguity were related to Type A behavior and higher systolic blood pressure (1986). The self-reports of role ambiguity may have been more of a function of personality than real job characteristics, so it is difficult to clearly determine if role ambiguity was a real-job stressor, or a perception held by the Type A managers participating in the study. At least an association between personality, perceived real-life stressful job characteristics, and coronary risk was established.

In summary, the real-life stress literature is still in an early stage of development. There are few investigations which assess real-life stressors and manage to control the frequency, intensity and nature of the stressor. Effects of postural changes can severely limit some of the conclusions which can be drawn from ambulatory studies. Several of the real-life and ambulatory studies show mixed results. Also, there are even fewer investigations involving women and real stress. In the study involving police stress, only 2 women

were included in the sample (Tang and Hammontree, 1992). With regard to women and real-stress, few firm conclusions can be made given the studies conducted so far.

The task, situated in the laboratory or the field, may have different meaning to different individuals. Several recent investigations of gender differences in reactivity have found results indicating that men and women may react differently according to the task's elicitation of challenge to particular gender stereotypes. Thus, a man who demonstrates the characteristic of high reactivity to various tasks such as the cold pressor, public speaking, and shock avoidance might show no reactivity when confronted with an interpersonal speech task. This was actually investigated by Girdler, Turner, Sherwood & Light (1990). Women demonstrated greater increases in cardiac output than men during an interpersonal speech task, designed to require "stereotypically feminine" skills (1990). In this task, research participants had to prepare a speech explaining how they were to deal with a hypothetical situation (their important flight to a conference was overbooked and they had to deal with the airline's personnel). Participants had to describe what they would do and what their emotions would be. Results indicated that women reacted differently than men and made more references to emotions than men in their speech (Girdler et al., 1990). Others have found similar results when using tasks with different gender relevancy (Lash,

Gillespie, Eisler, and Southard, 1991). More will be said on this topic in later sections. In sum, the task itself has its own effects upon reactivity independent of personal physiological predispositions to react.

Besides the nature of the task, temporary states of the individual which are independent of any stable traits regarding reactivity, can affect reactivity. Caffeine use has a clear effect not only upon resting cardiovascular activity but also upon reactivity. Many researchers have established that caffeine increases blood pressure per se, that is, without any other stressors or challenges, (Pincomb, Lovallo, Passey, Bracket, & Wilson, 1987; Lovallo et al., 1991; France and Ditto, 1992). It should be noted that such findings were obtained with men only. Other studies that used women only reported interaction effects for caffeine and some task, rather than a simple main effect (Strickland, Myers, & Lahey, 1989). Reactivity is not only due to main effects from individual propensities, extraneous situations, and temporary states but also from the interaction of these factors. It is important to recognize that these "extraneous" influences upon reactivity exist, in order to hold a more comprehensive conception of cardiovascular reactivity, to construct better stress/reactivity models, and to design properly controlled CVR studies.

The preceding information regarding cardiovascular reactivity is probably more meaningful in light of its

relationship to coronary heart disease. Before a discussion on cardiovascular reactivity and coronary heart disease (CHD), some background on CHD might prove worthwhile.

c) Cardiovascular disease

In the western and industrialized nations, coronary heart disease is currently the leading cause of death and disability (Diamond, 1982). This is true for both men and women (Verbrugge, 1983). Although men in their 40's are 4 times more likely to die from CHD than women, by age 70, men are only twice as vulnerable (NIH, 1993). In 1980, approximately 40% of the deaths in the U.S. were caused by some type of cardiovascular disease (Shapiro, 1983). By 1990, more than half of the deaths in the U.S. were caused by cardiovascular disease (Contrada, Leventhal, and O'Leary, 1992). Currently, CHD (coronary heart disease) is the most common form of cardiovascular disease. Atherosclerosis is the underlying condition which precipitates the various "forms" of CHD including angina pectoris, sudden death, and myocardial infarction. Atherosclerosis results in myocardial ischemia, which is an insufficient supply of oxygen to the heart due to a restricted supply of oxygenated blood. Angina pectoris is one possible result whereby one experiences severe pains in the chest and "suffocation" (McQuade & Aikman, 1974). Myocardial infarction is the more technical term for a heart attack which is the death of heart tissue. Sudden cardiac death is the unexpected death (no indications within an hour

or none at all) of heart tissue.

Atherosclerosis is the condition, or process, whereby the arteries that feed the heart become narrower, thereby reducing the flow of oxygenated blood to the heart. The atherosclerotic process may begin in childhood (Contrada, Leventhal, and O'Leary, 1992). This process initially involves mechanical injury to the inner walls of the coronary arteries. When injured, the inner-most lining of the artery develops small breaks or grooves. These grooves serve as convenient attachment sites for particular lipoproteins, lipids, vascular tissue and blood products which form atheromatous plaque, more commonly called a clot (Ross and Glomset, 1976; Contrada et al., 1992). Wounds (injuries) within an artery normally heal, and the artery returns to its original, pre-injured form. However, with a sufficient quantity of "debris", especially low density lipoproteins, an arterial wound will not heal properly but instead, it will become the site of a growing plaque. This plaque builds up along the inner walls of the coronary arteries and eventually restricts blood flow to the heart. The narrowing of the artery also heightens the probability that a thrombus would become lodged within a particularly narrow section of the artery resulting in a relatively sudden blockage.

The relative "cause" of CHD is atherosclerosis. Moving up the causal chain, there are several causes of atherosclerosis and moderators of the atherosclerotic process.

They comprise the primary risk factors of CHD such as high serum cholesterol, cigarette smoking, high blood pressure, dietary habits, age, obesity, sedentary lifestyle, diabetes mellitus and gender. Psychosocial factors have "... joined the biochemical and neurogenic factors as important influences of the disease process." (Diamond, 1982, pg. 76). Since several of the factors, like obesity and dietary habits, are really part of the serum cholesterol factor, more should be said about this risk factor.

Certain lipids and lipoproteins that course through the blood stream are the building blocks of atheromatous plaques (an atheroma is a subcutaneous cyst). Their presence in the bloodstream is a function of several variables. Not only the quantity of fat ingested, but also the type of fat is most relevant. In particular, the low density lipoproteins are notorious for forming plaques since they have an "affinity" to the arterial wall (Katch & McArdle, 1988). The metabolism of lipids is an important factor since it influences the amount of time the dangerous lipids have to travel throughout the blood stream. The pituitary-adrenocortico system, which can be affected by stressful stimuli (Contrada, Leventhal, & O'Leary, 1992) affects lipid metabolism through the secretion of cortisol and other glucocorticoids. Cortisol affects lipid metabolism in a way that increases the chances of developing CHD (Troxler, Sprague, Albanese, Fuchs, and Thompson, 1977). Overall, the presence of particular lipids in the bloodstream

and other metabolic mediating factors can increase the risk of forming atheromatous plaques. Psychosocial factors and reactivity to stressors interact with one's blood lipid profile to influence the development of atherosclerosis.

D) Cardiovascular Disease and Reactivity

Now that both coronary heart disease and cardiovascular reactivity have been discussed, possible relationships between the two can be addressed. Chronic reactivity probably hastens the development of coronary heart disease in several ways. First of all, since certain hormone levels are greatly elevated, the metabolism of plaque forming lipids is slowed. When metabolized slowly, the lipids are not removed from the bloodstream as quickly as when metabolized at a normal rate. Their time spent in the bloodstream, and thus their availability to settle into arterial walls is increased. Secondly, when reacting to stress, catecholamines (epinephrine and nor-epinephrine) are released (Barnett, Biener, & Baruch, 1987; Saab, Matthews, Stoney, and McDonald, 1989; van Doornen & van Blokland, 1992). They increase blood pressure to levels which may be high enough to provide the force necessary to injure the inner arterial walls (endothelium). Also, elevated blood pressure may become a chronic condition as a result of repeated reactivity involving the desensitization of beta-adrenergic (BA) receptors (Bertel, Buhler, Kiowski, & Lutold, 1980). When desensitized, these receptors are not able to regulate (homeostatically reduce) blood pressure normally.

The desensitized receptors lower blood pressure in response to levels of blood pressure which were higher than normal (before desensitization). In effect, the set point of blood pressure becomes raised. With such a progressive desensitization of BA receptors, vascular resistance would steadily increase. Overall, hyperreactivity or frequent physiological stress reactions can worsen the atherosclerotic process.

Blood lipids play a major role in atherosclerosis, and reactivity has effects upon lipids. Reactivity generally affects blood lipid quantities and dynamics. McCann (1992) noted three ways that stress affects blood lipids. First, stress directly increases the quantity of blood lipids. Second, stress increases production or decreases removal of lipoproteins. Third, stress can cause the first two effects become chronic (1992). Her investigation confirmed her hypothesis yet she admits that the three can occur simultaneously (1992). Contrada, Leventhal and O'Leary (1992) point towards the activation of the sympathetic nervous system during hypereactivity as the source for increased lipid quantities.

The preceding sections focused upon the process of reacting to "stressful" stimuli, and the **end-results** of chronic reaction. These are the latter two components of a general model of stress (see figure 1) proposed by the author. This basic model, of the **stress process** is made up of four stages. The first is the potential stressor stage. Here an

individual is presented with some stimulus, thought, challenge or task which have a potential for eliciting a stress response. The word "potential" is included since a response is dependent upon the second phase. The second stage is the filtering stage where personal and situational characteristics interact with the stressor to possibly initiate some physical reaction. A few examples of situational factors are job characteristics such as role ambiguity and social support from co-workers and physical discomfort from one's environment. Personal characteristics include personality, age, gender, and physical fitness. Such characteristics can serve to either magnify or attenuate the stressor. Individual differences and situational determinants are accounted for in this phase. The third stage is the adaptation or stress response stage where the individual's body **reacts** to the filtered stressor. The final stage is the outcome stage. Here the stressed individual experiences the effects of adaptation in the short, and or long run. In the near term, one may feel psychologically distressed, an increase in heart rate can be experienced and other emotions and physical changes may be felt. In the long run, effects such as a decreased immune response, chronic fatigue and disease outcomes such as CHD can be experienced. There are feedback loops in this model because an outcome can become a stressor, thus the fourth phase can feed back to the first. This model is generally consistent with several models existing in the health

psychology and psychophysiological literature (Selye, 1950; Cooper & Marshall, 1976; Cohen and Wills, 1985; Hendrix, Ovalle and Troxler, 1985). The mechanistic interactional model (Smith, & Anderson, 1986) is most relevant to this literature review since it includes the particular variables which have been focused upon (see figure 2).

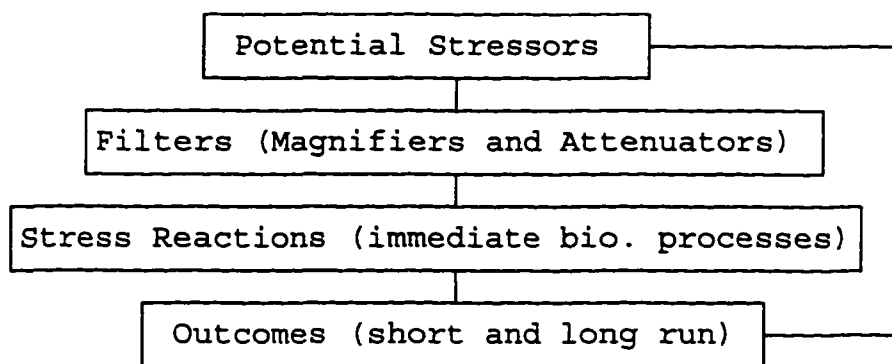


Figure 1. The General Stress Model

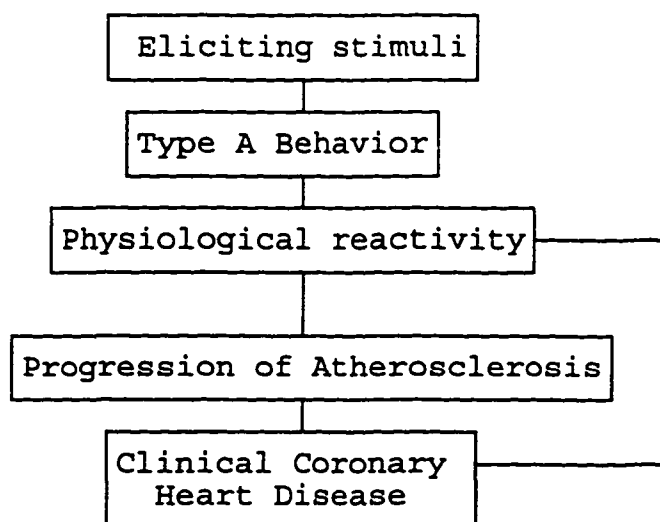


Figure 2. The mechanistic interactional model

The following sections of this review will focus on the second stage in particular, they will center upon the Type A/B behavior pattern, hostility, and gender as relevant factors operating within the second stage.

Type A Personality:

Definition and measures used:

In an effort to reduce CHD through public education, health professionals of the 1960's developed a list of the major risk factors of CHD. One factor stands out from the more tangible risk factors like smoking and cholesterol, and that is personality. In particular, the Type A behavior pattern (TABP), a concept developed by Friedman and Rosenman (1959), is a primary risk factor based upon a set of personal characteristics. McQuade & Aikman (1974) give an interesting account of the inception of the TABP concept: In the mid 1950's, two cardiologists, Friedman and Rosenman, were investigating the tangible risk factors of CHD, such as obesity and cigarette use. The chairs in their waiting room had to be re-upholstered, yet only the front edge of the seats were worn. The upholsterer noted that this is not typical of the chairs in most homes. Dr. Friedman noted that this might be a sign of "... struggle in their (the patients') lives." They surmised that their patients might be more anxious than the average person and thus a psychological variable (personality or disposition) might be related to coronary artery disease. They were intrigued by a study which reported

that men suffered from significantly more CHD than their wives although both basically had the same dietary habits. During an interview with one of these wives, Friedman and Rosenman were told that stress was the reason for this difference. With this information, the Type A behavior pattern was born (Friedman & Rosenman, 1974).

Friedman and Rosenman devoted much thought towards developing a life-philosophy which explains how particular behavior patterns might be associated with pronounced disease susceptibility. In an attempt to understand more about personality, stress and disease, Friedman and Rosenman collected and analyzed the work diaries and physiological measures of accountants, woman's club members, advertising men and engineers. They noted that times of tension and stress, as reported in the diaries, were correlated with elevated fatty acid levels in the blood (McQuade and Aikman, 1974). With this information, they started to conceptualize the Type A person. Such a person is described as aggressive, time urgent, ambitious, competitive and intensely driven. The Type B person was characterized as easy going, relatively unconcerned with time and achievements, and relaxed. Overall, they defined the Type B person as the opposite of a Type A person. It is interesting to note that Friedman and Rosenman described the Type A and B personality in much greater detail than is usually reported. They mentioned that Type A's go to sleep earlier, they are "dead creatively", they love

polyphasic thinking and behaving, they don't respect Bs, and a smart B uses (manipulates) an A. This has implications regarding TABP's construct validity since the main descriptors of this personality type (aggressiveness, time urgency, and competitiveness) are only "samples" of the much greater "population" of original descriptors of the two personality types. Do the current "samples" form a constellation that correctly represents the coronary prone individual? Such a question has become a main topic of investigation for decades after its inception. This issue will be addressed in a subsequent section.

Measurement of the Type A/B behavior pattern

Type A was originally measured through the Structured Interview which involves asking questions in a specified manner by a trained interviewer. Friedman and Rosenman utilized voice analysis (electronically recorded voice imprints) to more objectively distinguish between different styles of speech. They hypothesized that a sharply aggressive manner of speech is a primary indicator that someone possesses the Type A behavior pattern. In an experiment, they found that Type As who read a marine sergeant pep talk, put more "violence into the speech", while a Type B remained expressionless (Friedman and Rosenman, 1974). Speech patterns were measured electronically and they expressed confidence in this measurement technology. However, they subsequently decided that a less mechanically cumbersome although more

subjective measure might be needed. As a result, they created the Structured Interview.

The Structured Interview (SI) requires the interviewer to behave with varying degrees of aggressiveness towards the interviewee in order to elicit behaviors. Within this measurement procedure, the interviewer asks questions at a particular pace while noting verbal and non-verbal behaviors made by the interviewee in reaction to the questioning. The interviewer takes aggressive postures at times, such as leaning forward towards the interviewee, while asking increasingly demanding questions at a quick pace. The interviewee's posture and manner of speech are noted as the interviewer modulates his or her postural and spoken aggressiveness. In particular, the interview is intended to bring out impatience, hostility and competition in the interviewee by asking the questions in a confrontational manner (increased speech speed, inflected intonation, aggressive body posture). Overall, the interview seemed to distinguish coronary from non-coronary patients (Friedman and Rosenman, 1974). So far, the structured interview seems to predict CHD and correlate better with reactivity than other measurement methods (Rosenman, 1990; Eysenck, 1990). Yet it is not without problems since studies can be flawed if the interviewers are not properly trained (Rosenman, 1990). Although the SI seems to predict CHD and reactivity reasonably well, it is infrequently used for several reasons. To

properly conduct this interview requires special training which in turn involves travel, several days time, and a few hundred dollars. Because of the "costs" involved in becoming qualified to conduct the SI, other methods of Type A measurement have gained widespread popularity.

In an attempt to create a more easily administered and objective assessment procedure for the TABP, The Jenkins Activity Survey was developed (Jenkins, Zyzanski, & Rosenman, 1979). The Jenkins Activity Survey (JAS) is a paper and pencil, self-report questionnaire which measures personal behaviors and feelings in certain situations. It provides scores on several components of the Type A personality and a general Type A score. The components are job involvement, speed and impatience and hard-driving competitiveness. The constellation of these components forms an overall Type A score.

The Jenkins Activity Survey has come under criticism in recent years. Several researchers questioned its usefulness in assessing the key elements of Type A behavior patterns. Byrne, Rosenman, Schiller and Chesney (1985) pointed out that the JAS and other self-report questionnaires only assess attitudes rather than behaviors. In a review of prospective studies, Matthews (1988) concluded that the JAS does not identify more reactive individuals. Others have found that the Structured Interview (SI) is more strongly associated with physiological differences (reactivity) between Type A and Bs,

than the JAS. However, when used properly, the JAS can better identify Type As, strongly predict high reactivity, and correlate highly with the structured interview. Proper usage entails selecting the extreme Type As and Bs (top and bottom quartiles) rather than simply forming a median split. Houston (1983) demonstrated that this trifurcation leads to better correlations with the SI and eliminates the problems associated with the median split.

The TABP research history

Currently, there is still some controversy regarding the degree to which Type A behavior represents a coronary prone behavior pattern. Although numerous cross-sectional and prospective studies have demonstrated a connection between TABP and coronary heart disease (or at least CV reactivity) other investigations have yielded negative or mixed results. The Western Collaborative, Framingham, and Belgian-French Pooling Projects have all linked Type A behavior and CHD. Unfortunately, more recent prospective studies like the Multi-Risk Factor Intervention (MR FIT) and the Aspirin Myocardial Infarction Studies have not found an association between TABP and CHD. Since its inception in the 50's, the TABP (Type A Behavior Pattern) has gone through various stages of development. Overall, Type A/B was described in the 1950's, tested in the 60's, enthusiastically accepted in the 70's, questioned in the 80's, and re-analyzed in the 90's in light of its dimensionality and factors which interact with it

(Booth-Kewley, & Friedman, 1987). The following discussion will chronologically review the development of the Type A behavior pattern from its origin to the present.

The Type A behavior pattern was conceptualized by two cardiologists, Friedman and Rosenman. They sent out questionnaires to businessmen to see what types of feelings and behavior might be correlated with coronary heart disease. These questionnaires revealed that a sense of time urgency and competitive behaviors were correlated to higher incidences and severity of CHD. In order to follow up on these observational findings, Friedman and Rosenman set up a 12 year longitudinal study to assess the linkages between behavioral characteristics and health indices. Exercise patterns and diet were carefully controlled. Men described as more hostile, competitive, and time urgent, had higher serum cholesterol than those who were low on these three personality characteristics (Friedman and Rosenman, 1974). They replicated the study with a sample of women and obtained the same results, except that women with hostile, competitive and time urgent personalities actually had higher cholesterol than men. Between 1960 and 1961, Friedman and Rosenman gathered a sample of 3,500 men, measured them on personality characteristics and continued to observe them for 10 years. Those designated as Type A were three times more likely to suffer from CHD. They noted that diet and exercise did not predict disease profiles. In 1966, Jenkins, Friedman and

Rosenman identified specific personality characteristics which were associated with CHD, and grouped them into a construct called the Type A behavior pattern (TABP). This constellation of behaviors consists of impatience, hostility, a sense of time urgency, polyphasic activity, and a fervid, rapid and competitive attitude towards work and play.

In describing the Type A personality, Friedman and Rosenman (1974) developed a somewhat integrated series of "proverbs" with which one can live life to the fullest and avoid serious disease. Overall, they advocated a lifestyle which could be characterized as non-materialistic, aesthetically oriented, "laid-back", conscientious, and balanced. Type A's typically live the "wrong" life-style by possessing several "unhealthy" perspectives and bad habits. One problem of the Type A was called "hurry sickness" which is a non-rational preoccupation with struggling to get more and more done in less and less time. There is also the preoccupation with "getting something" rather than "becoming someone". Also there is "the quest for numbers" whereby an individual takes pleasure in accumulating tokens of success, and ruminating over lists of the **quantities** of one's possessions and quantitative achievements, be it the number of stock accounts, dollars in the bank or number of successful lawsuits. Overall, Friedman and Rosenman tried to combine these unhealthy behaviors and perspectives into a personality constellation called Type A.

Friedman and Rosenman generated a theory regarding the development of Type A behaviors. It is unfortunate that after 30 years worth of articles written on Type A behavior, their theory of the **development** of TABP has received little attention in the research literature. Briefly, Friedman and Rosenman hypothesized that the Type A individual suffers from severe "insecurity of status" (Friedman and Rosenman, 1974). Type As are not certain if they are "good enough" so they constantly struggle to collect a large quantity of materials or other more symbolic representations of success in order to at least temporarily satisfy their need for positive feedback. Friedman and Rosenman clearly noted "the key reason for the insecurity of the Type A person: he has staked his innermost security upon the pace of his status enhancement." (Friedman and Rosenman, 1974, p. 93). This explains the Type A's "hurry sickness" and "quest for numbers". Whenever others deter the Type A individual from achieving quantity, or by achieving more and thus creating higher standards, the Type A individual feels threatened and thus eventually develops hostility (a cynical way of thinking) towards others. They feel vaguely guilty if they relax and do absolutely nothing for several hours.

Friedman and Rosenman advocate a lifestyle which runs contrary to Type A living. In particular they advocate introspection to check oneself for thinking in an unreasonably hostile manner, taking time out to "smell the roses", never

rushing unless it is truly necessary, enjoying the classics and aesthetic aspects of life like architecture, literature, and the fine arts, carefully balancing time between work and play, and generally seeking to **become** someone rather than acquire something. They postulate that those with TABP live a lifestyle farthest from this ideal, and they suffer ill-health as a result of it.

With this background information, it is useful to distill the essentials to gain a sound understanding of the original theoretical conceptualization of TABP. In summary: Type As are insecure with regards to the adequacy of the quantity of their success. So, they strive to achieve more and more in less and less time because achieving quantity is the primary way to temporarily quell this sense of insecurity. As a result of this quest for quantity, Type A individuals develop impatience, hostility, competitiveness, high job involvement, and ultimately... heart disease.

By the 1960's, Friedman and Rosenman were settled with their conceptualization of the Type A individual and the theoretical relationships to heart disease. The next step was to test their ideas on a large scale. A longitudinal study with a large sample would allow them to more directly investigate the link between personality and cardiovascular disease. In 1964, a landmark prospective study of coronary heart disease was initiated. This study, called the Western Collaborative Group Study, utilized 2,750 healthy men as

subjects (Rosenman et al., 1964). Various measures of their health status and CHD risk behavior were recorded from 1965 to 1969. The primary finding was that those classified as Type A were more likely to suffer from angina pectoris and myocardial infarction (Jenkins, Zyzanski, & Rosenman, 1978). The Type A men were also more atherosclerotic (Rosenman, 1990). Such results helped to establish TABP as a coronary prone behavior pattern. The prospective nature of this investigation helped to give added weight to these findings.

In the early 1970's, some initial efforts were made to uncover the biological mechanisms which link TABP to coronary heart disease. Type A men were found to have greater noradrenergic reactivity to competitive and mental tasks than Type B men (Friedman, Byers, Diamant, & Rosenman, 1975). In response to adrenergic stimulation, catecholamides (epinephrine in particular) are secreted into the bloodstream and increase blood pressure. It was hypothesized that Type As exhibit an excessive sympathetic nervous system response to stressful stimuli (Friedman, et al., 1975). Such research involving noradrenergic reactivity was important for empirically establishing a biological mechanism or process linking (at least indirectly) Type A personality to cardiovascular disease. Research involving the SNS and TABP became more popular again in the early 1980's.

By 1974, there was a secondary, "follow up" completed on the participants within the Western Collaborative Group Study

(WCGS). Many articles refer to 1974 as the time when Friedman and Rosenman conducted their ground-breaking research. As a result of the follow up on the WCGS, (involving about 3,300 subjects analyzed over 4 to 8.5 years) the TABP was established as a risk factor in the development of angina, myocardial infarction, and sudden death (Jenkins, Zyzanski, & Rosenman, 1978; Lazarus, & Folkman, 1984; Contrada, Leventhal, & O'Leary, 1992)

In the mid to late 1970's, several studies included control and helplessness perceptions with the TABP variable. Glass (1977) found that the linkage between perceptions of helplessness and the helpless/hopeless response were related to disease outcomes and TABP. A research team at the Department of Psychiatry at the University of Rochester developed a multi-phasic model of stress and illness which states that when confronted with some loss, some individuals might become despondent (helpless/hopeless) resulting in a breaking of the weakest link in one's constitution (Schmale, 1972). Thus, someone with a damaged heart might suffer from angina as a result of feeling despondent over some loss. Glass hypothesized that the Type A person, being achievement-oriented, would strive in the face of difficulty. If this person fails, the helpless/hopeless complex sets in, and the individual eventually becomes ill (1977). Applied to the TABP person, a threat of loss of control might initiate cardiovascular activity, surges in catecholamides in the blood

and production of arithomatous lipids eventually leading to CHD (1977). The issue of control has not maintained its popularity beyond the 70's within the psychophysiological literature yet health psychology and social-psychological journals have continued to cover the topic.

A more enduring issue regarding TABP generated popularity in the late 70's. As previously mentioned, the Type A/B personality consists of a **constellation** of behavior patterns (components of Type A) such as manner of speech and perceptions of time and achievement, which form a "propensity to respond to stimuli in a characteristic manner" (Ganster, Schaubroek, & Mayes, 1991). There were originally a great number of descriptors of the Type A individual. Many were combined or selected from the whole to form the TABP. It is theoretically possible that some of the original essential components are missing from TABP. Also, some of the components existing within the current TABP definition may be more predictive of CHD than others. Many varied investigations of the TABP components first appeared in the late 70's. Issues regarding the relative predictive power of TABP components maintained its popularity throughout the 80's and into the 90's.

A major investigation of the "components issue" involved a re-examination of the data from the Western Collaborative Group Study. Forty variables were derived from the Structured Interview and assembled into seven categories;

four on anger and hostility, two on speech characteristics and one on competitiveness (Matthews, Glass, Rosenman, & Bortner, 1977). The analysis was relatively fine tuned, as compared to other analyses of TABP components. Speech characteristics were categorized as rapid, high in amplitude, and explosive. The investigators were able to differentially "predict" CHD outcomes according to the TABP subdivisions (Matthews et al., 1977). This may have been the first investigation which reported that the hostility component of the TABP was a relatively strong predictor of CHD.

In 1978, data from the WCGS was analyzed again. This time, an item analysis was performed on the responses and of the 61 item JAS filled out in 1965 (Jenkins, Zyzanski, & Rosenman, 1978). Discriminant analyses of the JAS items revealed that there are two or three dimensions of the TABP which differentially relate to different types of CHD. Those categorized in the first dimension are more prone to angina pectoris and are characterized by their intense competitiveness and impatience with others. Those in the second dimension are prone to silent myocardial infarction and are characterized by more internal behavior patterns such as being impatient and hard-driving with themselves yet not with others (Jenkins et al., 1978). This analysis of the TABP may be related to two types of Type As, one that is socially a Type A (and possibly related to the hostility dimension), and one that is only a Type A in regards to him or herself. Such

a dissection of Type A into an extroverted and introverted type has not been specifically addressed in the literature.

The components issue started to gain steam as the acceptance of TABP was peaking. Most of the studies up to the late 70's on TABP supported the notion that TABP is a coronary-prone behavior pattern, predictive of CHD (Eysenck, 1990). In a review by Booth-Kewley & Friedman (1987), the authors mentioned that in 1978, the National Heart, Lung and Blood Institute released a report accepting that TABP is associated with clinically apparent CHD. The TABP gained popularity in the literature at an increased rate at about 1979 (Booth-Kewley & Friedman, 1987). The investigations of the components of TABP were initially directed towards refining the concept and increasing the accuracy with which it predicts CHD (Jenkins, Zyzanski, & Rosenman, 1978). However, as an increasing number of investigations failed to demonstrate a relationship between TABP and CHD, the components issue was used as an explanation for the mixed results across studies, rather than as a means of refinement.

Various components of TABP were investigated to determine which were part of a truly coronary prone personality trait rather than a behavioral trait. The problem was that the TABP was originally conceptualized as a complex of behaviors which predict CHD. Reports involving the TABP complex were misleading since they labeled it as a coronary prone behavior type (Booth-Kewley, & Friedman, 1987). There is insufficient

evidence supporting **global** Type A behavior as the predictor of CHD rather than some of its components. Some of the Type A behaviors might prevent CHD while some may produce it. Booth-Kewley and Friedman (1987) mentioned that Type A people might have altered their CHD risk related habits (such as smoking and fat intake) in order to account for the negative results that ensued after 1978. Another explanation is that negative results became more publishable once TABP was established. The more popular explanation was that TABP is multidimensional and that only some of its components represent coronary prone behavior. Various components have been investigated since the late 70's.

Items from the Jenkins Activity Survey had been factor analyzed by several investigators (Lundberg, 1980; Svebak & Apter, 1984; Spence Helmreich, & Pred, 1987). A noteworthy analysis by Svebak and Apter (1984) resulted in two factors which split the JAS questions into two categories, those which tap into 1) irritability and impatience and those which relate to 2) hard-driving and competitive attitudes. The meaningfulness of this partitioning of the JAS rests upon the differential abilities of the individual partitions to predict CHD or reactivity. In other words, the two factors should differentially relate to physiological outcomes. So far there has been some support. The hard driving/competitive factor was not related to any health outcomes in contrast to the first factor (Spence, Helmreich, & Pred, 1987). Clinical

observations also supported the notion that the first factor, irritability and impatience, is related to health outcomes rather than the second (Wright, 1988). Measures of cardiovascular reactivity, skin conductance and JAS scores (with the two factors separated) were analyzed through regression analyses in order to ascertain if the two factors would differentially relate to reactivity outcomes following a video game task (Ohman, Nordby, & Svebak, 1989). Greater cardiovascular reactivity in those scoring high on factor one supported the notion that speed and impatience, and not the hard-driving/competitive component of the JAS, related to physiological responses (1989).

Several researchers reported findings which strongly differ from others investigating components of Type A. The issue of which component is more predictive or which one is not predictive at all is still very unsettled. In contrast to the findings of Spence, Helmreich and Pred (1987), Houston, Smith, & Zurawski (1986), reported that the hard-driving dimension was more predictive of physiological outcomes than speed and impatience. Also, the hostility component has gained much prominence as a predictor, particularly since it often outperforms other predictors of reactivity (Ganster, Schaubroeck, Sime, & Mayes, 1991). It is difficult for various researchers to find out which component or factor of TABP is most predictive. Issues of construct definitions, validity, and differential measurement procedures further

complicate TABP component research. As previously mentioned, hostility seems to be a major factor, thus it will be given a separate section in this literature review.

Besides the components issue, other enduring concerns regarding TABP research became prominent in the late 70's into the 80's due to an increase in results which only partly supported TABP as a coronary prone behavior pattern. A large prospective study, the Framingham, was undertaken in order to examine many variables with TABP such as gender, age, specific disease outcomes and CHD history (Haynes, Levine, Scotch, Feinleib, & Kannel, 1978). Although high Type A participants were more likely to suffer from myocardial infarctions, other disease outcomes like angina pectoris were not associated with TABP (Haynes et al., 1978). By 1982, there was much doubt regarding the usefulness of TABP. Type As appeared to be more likely to react to stressful stimuli, yet only under certain conditions, for **some** tasks, and in **some** physiological pathways. A review by Holmes (1983) concluded that there is only weak evidence for systolic blood pressure reactivity in Type A individuals and that the levels of reactivity are of questionable practical significance. Results from a large European study, the Belgian Heart Disease Prevention Project, added more confusion to the situation. High scores on various JAS scales were associated with angina pectoris and ECG abnormalities, yet not with other manifestations of CHD (Kornitzer, Kittel, De Backer, Dramaix, 1981). Also, the

speed and impatience factor seemed to be more predictive than other components of the JAS.

The Aspirin Myocardial Infarction Study looked at men who survived a myocardial infarction to see if those assessed as Type A were at greater risk of suffering from another infarction (Ruberman, Weinblatt, Goldberg, & Chaudhury, 1984). The results were clearly negative, indicating that TABP was not related to repeated infarctions (1984). Another major study which failed to find support for TABP as a predictor of CHD was the Multiple Risk Factor Intervention (MRFIT). This was the largest prospective study of its time, utilizing 12,700 healthy men. The TABP was measured by both the JAS and the Structured Interview and the subjects' health was monitored over a 7 year period. Results were quite negative in that both the JAS and the SI failed to predict CHD (Shekelle, Hully, Neaton, et al., 1985) Overall, with the large preponderance of mixed and negative results, the issues of TABP components and task relevancy emerged in order to provide possible explanations.

Besides the components issue, another important and enduring issue emerged from the problematic results reported during the late 70's and early 80's. This concern might be called the **task** issue, since it questions the relevancy and efficacy of different types of tasks used to elicit responses from Type As. Since Type A individuals theoretically respond to challenge and competition, a task that is not perceived as

challenging or does not engage other relevant traits of the Type A individual, such as impatience and hostility, should not meaningfully interact with the behavior pattern and thus it should not lead to greater reactivity. Therefore, the nature of the task should be relevant to the nature of the Type A individual, otherwise it is quite reasonable not to expect a TABP effect upon reactivity.

Type A/B differences are more often observed in situations that involve interpersonal challenge, competition or harassment. A cold pressor task is apparently not very relevant to Type A individuals, since it does not involve interpersonal impatience, hostility, competitiveness or aggressiveness. Because of their indifference to the task, there were no observable differences between Type As and Bs in Goldband's experiment involving the cold pressor (1980). Morell (1989) obtained very weak results that failed to support the connection between TABP and reactivity. She concluded that the task, reaction time, was probably not relevant to TABP individuals. In Harbin's relatively recent review of the TABP literature (1989), he noted that non-arithmetic and psychomotor tasks more effectively elicit cardiovascular responses than arithmetic tasks. In connection with this observation, it is important to note that many investigations of TABP utilized the mental arithmetic task and thus might have inappropriately contributed to the outgrowth of negative results regarding TABP and reactivity. Another

more recent task-related finding is that the "gender relevancy" of the task might also be a relevant factor in the association between TABP and reactivity. Lash, Gillespie, Eisler, and Southard, (1991) reported that men were more reactive than women to a cold pressor task described as requiring physical prowess and the ability to persevere over pain (requiring stereotypically masculine abilities).

Besides the task's relevancy to TABP, the intensity of the task might have an effect upon reactivity. It is possible that very difficult tasks might not be effective in eliciting CV responses (Houston, 1983) since at extreme levels of difficulty, most participants can become disengaged due to perceptions of hopelessness. Houston suggested that tasks be set at moderate difficulty levels in order to reveal TABP's relation to reactivity. Harbin (1989) hypothesized that the extreme task difficulty problem might be part of the mental arithmetic problem. If mental arithmetic problems are too difficult, the participants would mentally disengage from the task and thus fail to demonstrate any reactivity. Overall, the nature and difficulty of the task probably plays an important role in eliciting (or not eliciting) the TABP response to stressful stimuli. More positive results might be obtained if this important element of TABP research is considered in experimental designs.

By the late 1980's and early 90's, TABP and interactions with other variables became the main focus of research. Few

studies looked at TABP by itself for its effects upon reactivity. Some of the variables which were investigated with TABP were family history of hypertension, gender, hostility, age, and experimental setting. Overall, age does not seem to be an important variable in investigations of TABP and its relation to physiology. The relationship between TABP and physiological responses for children and adolescents has been demonstrated (Murphy, Alpert, Walker, and Willey, 1991). The results of a meta-analytic review by Harbin (1989) led him to conclude that the age of participants does not influence the TABP/reactivity association. With regard to family history of hypertension, some researchers have found that it interacts with TABP in determining physiological reactivity (Lane, White, & Williams, 1984).

As a result of the search for the more predictive components of TABP, hostility has emerged as a popular variable because of the many studies that have found it to be a strong predictor (Dembroski and Costa, 1987; Houston, Smith and Cates, 1989; Rosenman, 1990; Contrada, Leventhal and O'Leary, 1992) and the reviews which indicate that it is the **best** predictor of the various TABP components (Ganster, Schaubroeck, Sime, & Mayes, 1991). Since it appears to be a major variable in TABP research, it will be addressed in its own section in this review.

Another variable, gender, will also have its own section since it is a frequently neglected, yet relevant variable in

Type A and reactivity research. In general, the early studies and most of the large prospective studies of TABP such as the Western Collaborative Group Study, The Belgian Heart Disease Prevention Project, and the massive MRFIT, used samples consisting entirely of men. When women were investigated, many results demonstrated no association between TABP and cardiovascular reactivity in females, leading some to conclude that "Type A behavior, as it is currently assessed, is not a reliable predictor of increased CVR in women" (Harbin, 1989, pg. 114). Lawler and Schmeid, drew similar negative conclusions (1986). However, in light of other variables such as task meaningfulness, hostility, and hormone levels, positive results have recently emerged.

Another current issue within Type A research pertains to the generalizability of findings from the laboratory to the field. The main reason for such an interest is that the use of artificial lab tasks as representatives of real-life stressors has come under fire. Sherwood and Turner, pointed out that "real-world investigation is of fundamental importance" (1992, pg. 22). In their review of cardiovascular research, they demonstrated how the use of real stressors has led to better linkages between reactivity and actual disease, (1992). They mentioned Devereux's findings that damage to the heart was more strongly correlated with ambulatory measurements taken during real work as opposed to measurements taken during quieter periods (Devereux, et al., 1983). It is

also important to note that ambulatory measures have been used to validate the usefulness of laboratory measures. Participants' reactivity to video games and mental arithmetic was measured in a lab and their heart rate was continuously monitored throughout a work day (Pollak, 1991). Reactivity measures (changes in heart rate and blood pressure) taken in the laboratory, correlated highly with reactivity measures taken on the job, thus supporting the individual differences notion of CVR and the generalizability of lab results to the real world (1991). In their review of CVR, Sherwood and Turner (1992) concluded that ambulatory cardiovascular monitoring devices will be important tools for future studies.

Overall, the TABP has gone through an initial period of great acceptance followed by disenchantment. Many factors have contributed to the wave of negative results. Currently, researchers are investigating these factors to see how they moderate the relationship between TABP, cardiovascular reactivity and coronary heart disease. Hostility is one factor which deserves further attention.

Hostility and its relation to TABP, reactivity and CHD

A connection between hostility and illness had been suggested over 50 years ago. Medical writers from the 30's and 40's hypothesized that hostile people are more likely to develop coronary heart disease as well as other illnesses (Diamond, 1982). The basic principle is that emotions like anger precipitate physical changes which occur when the body

reacts to some threatening stimulus. Whether these changes can result in illness has been the focus of many recent investigations. One of the first studies involved a sample of 424 patients who were to undergo angiography (Williams et al., 1980). Hostility and Type A scores were strongly correlated with CHD, with hostility being more predictive of CHD than Type A. The study of hostility became popular in the 1980's and continues to be frequently investigated in the 90's. Before reviewing the hostility literature, the conceptual definition and measurement issues should first be mentioned.

Currently, the exact definition of hostility is not generally agreed upon. However, a review of the hostility research made it apparent that many studies since the mid 80's have conceptualized hostility as a cognition, or way of thinking rather than feeling or acting (Contrada, Leventhal and O'Leary, 1992). A main point regarding its definition focuses upon distinguishing hostility from anger and aggression. The concept of hostility can be more clearly understood in light of the distinction between cognition, affect/emotion and behavior (Smith, 1992). Aggressiveness describes a behavior more than a cognition or emotion. It can be defined as behaviors which involve physical and non-physical actions taken with a goal towards hurting someone. Anger refers more to an emotion or emotional state rather than a set of thoughts or actions. It is more of a negative emotional response to feelings of mistreatment or provocation

(Smith, 1992). It does not have to be carried out by an action, although it does contain some cognitive content. Hostility is more cognitive than emotional or behavioral. It has been defined as "... having a set of negative attitudes, beliefs and appraisals concerning others." (Smith, 1992, p. 139) leading one to think of others as sources of mistreatment and frustration. In a sense, a hostile individual has a cynical predisposition towards viewing others as untrustworthy enemies.

The cognitive conceptualization of hostility does not preclude overlap between anger or aggressiveness and hostility. Hostility does contain an emotional component. The point is that the **cognitive** component is **dominant** whereas in anger, **emotion** is the dominant defining aspect, and **actions** are dominant within aggressiveness. Hostility can be distinguished from anger and aggression by its cognitive orientation rather than emotional or behavioral. Several researchers argue that it is best to distinguish the constructs of hostility and anger (Barefoot, 1992; Smith, 1992) by maintaining hostility as a cognitive construct and anger as emotional. Subsequent investigations by other researchers, involving hostility and anger, have used the constructs according to these recommendations and found that hostility is significantly, yet not highly correlated with anger (Suarez, Harlan, Peoples and Williams, 1993; Shapiro, Goldstein, and Jamner, 1995),

Hostility has been predominantly measured by either the Cook-Medley Hostility Scale from the MMPI (1954), or from the Structured Interview component evaluating potential for hostility. Both measures have demonstrated good "re-test" reliability and high scores on them have been frequently associated with cardiovascular reactivity. They differ somewhat in their emphasis on the cognitive versus emotional aspects of hostility. In the interview-based measurement procedure, interviewers rate speech patterns according to intensity, style and content. Content includes expressions of anger and hostility. Style refers to uncooperative behavior exhibited as the interview progresses, and intensity refers to the level of displayed hostility in a response. The overall rating is called potential for hostility (PH) and it is defined as "the tendency to experience anger, irritability, and resentment in daily life and or the tendency to react to aggravating events with expressions of antagonism, rudeness, and uncooperativeness". (Dembroski and Costa, 1987, p. 140). In general, this measure of hostility tends to assess **expressed** hostility like verbal aggressiveness, rudeness, and disagreeableness, rather than hostile **experiences** such as cognitions of resentment, suspicion, anger and contempt (Smith, 1992). The test re-test reliability of the PH scale was found to be a modest, yet adequate .55 (Dembroski and Costa, 1987).

The other widely used means of measuring hostility is

through the Cook-Medley Hostility Scale (Ho) from the MMPI. This 50 item scale taps into more cognitive/experiential aspects of hostility like resentment and suspicion (Smith, 1992). So far it has demonstrated strong levels of internal consistency through Cronbach's alphas averaging around .80 (Smith, and Frohm, 1985). There is considerable evidence indicating that individuals with high Ho scores tend to possess a very negative schema regarding others (Smith, 1992). High Ho scores have been strongly correlated with overt hostile behavior reports (Smith, Sanders, & Alexander, 1990). They have also been strongly associated with reports of angry and suspicious daily thoughts (Pope, Smith, and Rhodewalt, 1990) and with anger proneness (Smith & Pope, 1990). Since the Ho scale tends to focus more upon the cognitive rather than expressive aspects of hostility, and the general conception of hostility centers upon cognitions rather than expressions, the Ho scale may be a more appropriate device for measuring hostility than the other measuring procedures (like interviewing) which focuses more upon expressions. This focus upon cognitions is important in order to maintain a distinction between measures of hostility and measures of aggressiveness and/or anger. Such a distinction is desirable since measures of hostility should not be contaminated by the presence of anger or aggression.

In order to see how hostility is related to cardiovascular reactivity and coronary heart disease, many

investigations were undertaken, mainly in the 1980's and continuing into the 90's. After the study linking CHD and hostility by Williams et al. (1980), others tried to replicate the study, using similar samples and measures. Unlike the original study, these replications did not find an association between CHD and hostility (Dembroski, MacDougall, & Musante, 1983; Seeman, & Syme, 1987). Such studies were criticized for poor methodology (Pickering, 1985). Researchers focused on studies with better designs, particularly prospective studies. Overall, there were six major prospective studies involving hostility and CHD or reactivity.

In general, the six prospective studies of CHD and hostility taken together, led to mixed results. Three showed no relationship between CHD and hostility and three resulted in positive associations between hostility and disease. One of the studies reporting negative results has been criticized on methodological grounds by several researchers (Williams, 1987; Smith, 1992). The criticism is based upon the finding that the research participants, who produced very low hostility scores, also scored very highly on a social desirability scale, thus implying that their reports on the hostility scale were inaccurate (Smith, & Pope, 1990). The other two prospective studies reporting no association between health and hostility (Leon, Finn, Murray, & Baily, 1988; Hearn, Murray, & Leupker, 1989) have not been dismissed. On the positive side, three prospective studies with results

supporting a connection between CHD and hostility, have encouraged investigators to continue working with hostility.

One of the three prospective studies which supported the association between CHD and hostility involved the monitoring of over 250 medical students 25 years after they filled out the Ho in 1954 (Barefoot, Williams, & Dahlstrom, 1983). In 1981, a questionnaire requesting information regarding the health status of these physicians was distributed in order to assess the association between hostility and future health status. Overall, the medical students who scored high on the Ho scale in the mid 50's were five times more likely to suffer from various forms of coronary heart disease 25 years later. In addition, morbidity and mortality caused by other diseases such as suicide, malignant neoplasms and accidents were more common in the hostile individuals. In the same year as the publication of these findings, another prospective study with positive results was reported. Hostility scores of over 1800 men were associated with their CHD profiles over a twenty year period (Shekelle, Gale, Ostfeld, & Oglesby, 1983). Many of the CHD risk factors such as cigarette use, serum cholesterol and age were controlled. The investigation resulted in significant associations between hostility scores and 10 and 20 year incidences of CHD and mortality from cancer. It is interesting to note that the mid to high scores on the Ho scale were most predictive of mortality rather than the extreme high scores.

The third prospective investigation followed 155 lawyers who had taken the MMPI 30 years earlier (Barefoot, Dodge, Peterson, Dahlstrom, & Williams, 1989). The results were basically identical to the other two successful prospective studies: hostility was positively associated with death due to cardiovascular disease, as well as other causes. Since this study, various researchers have incorporated hostility, often measured by the Cook-Medley Scale into their research on reactivity and CHD.

Someone can be designated as Type A mainly because he or she is impatient with his or herself, and hard driving (seeks personal achievement), yet might not be Type A in relation to others. That is, he or she may not be hostile and competitive with other individuals. Thus sources of stress that are interpersonal, such as competitive tasks, or situations involving interpersonal tension and conflict, might not be as stressful to someone who is not Type A in a social sense. Unlike TABP, which includes personality aspects that are irrelevant to interactions with others, such as the hard driving personality aspect, hostility is a **purely** social construct. A hostile individual is defined as one who has particularly cynical and negative cognitions of others. In accordance with this notion, researchers have incorporated hostility measures in their studies using tasks involving social interactions, such as public speaking tasks. Suarez and Williams (1989) found that males assessed as highly

hostile by the Cook-Medley Scale, demonstrated greater blood pressure and heart rate reactivity to an anagram solving task **only** when they were harassed during the task. Christenson and Smith (1990) also found greater CV reactivity in more hostile participants who had undergone a social interaction task, only when high levels of self-disclosure were required. The authors hypothesized that hostile people, being mistrustful and suspicious, are more "stressed" when they must reveal personal information about themselves. Another investigation found hostile men to be more reactive to a marital interaction task which required the assertion of control over their wives (Brown & Smith, 1992). Overall, many of the investigations which were successful in finding positive associations between cardiovascular reactivity and hostility have utilized tasks which are **socially** stressful as opposed to tasks which do not include interpersonal sources of stress.

It is interesting to note that anger, which conceptually overlaps with hostility, and possibly serves as a link between hostility and reactivity, has been directly associated with reactivity. Matthews, Manuck and Saab (1986) measured adolescents on anger, anxiety and cardiovascular reactivity during a 5 minute class presentation (a real-life stressor). They found that participants who scored high on an anger scale demonstrated significant increases in diastolic blood pressure. Anxious subjects had significantly elevated systolic blood pressure and heart rate immediately before, and

during the classroom speech. If hostile individuals tend to view others as possessing malicious intents, then they might be prone to become angry at others in response to these hostile thoughts. It is possible that in a situation where one is being observed and evaluated by others, hostile cognitions may lead to anger, and anger may then lead to cardiovascular reactivity.

THE CARDIOVASCULAR REACTIVITY OF WOMEN

As previously mentioned, there has been a lack of research on the cardiovascular reactivity of women with respect to TABP, and high hostility scores. Reviewers like Harbin (1989) have even claimed that Type A does not apply to women in terms of differing reactivity predispositions. Later studies were more successful in demonstrating that Type A women react differently than Type Bs (Frankenhaeuser, 1991). Mixed results across different studies and over time are due to several factors, one such factor being the nature of the task. MacDougall, Dembroski and Krantz (1981) found that Type A women are more reactive to an oral history quiz and a structured interview, yet not to a cold pressor or reaction time task. Lane, White, and Williams (1984) found that Type A/B women reacted similarly to mental arithmetic tasks. Anderson, Lane, Taguchi, Williams, & Houseworth (1989) also found no reactivity differentials when their female participants were "stressed" with mental arithmetic. They

concluded that women are more motivated by interpersonal tasks. Current research has shown that Type A women do indeed react more to various stressors than Type B women. However, this relationship appears to be more complex than originally thought. Factors such as hostility, anger-in, neurotic anxiety, age, occupational status, desire for control, and the nature of the task effect the relationship between Type A personality and reactivity. Tasks such as the cold pressor and mental arithmetic can generate differing effects on women of different races. In a study by Anderson, Lane, Taguchi, Williams and Houseworth, (1989), black women had differing vascular responses from white women. In particular, black women demonstrated greater increases in systolic blood pressure in response to a cold face stimulus than white women. It is notable that in this study, all reactivity measures, systolic, diastolic blood pressure and heart rate, were increased by both tasks. In a reaction time task, women sometimes demonstrate reactivity in terms of accelerated heart rate yet not systolic blood pressure (Morell, 1989; Lawler, Huck and Smalley, 1989).

There is evidence that this lack of systolic blood pressure reactivity is due to the particular task rather than a "trait" of women. Systolic blood pressure reactivity in women has been demonstrated across several studies using various stressors/tasks such as mental arithmetic, anagrams, Ravens Matrices, and the cold pressor (Lawler, Schmeid,

Armstead, & Lacy, 1990). Besides the nature of the task and psychological factors, purely biological mechanisms such as the menstrual cycle, (Polefrone & Manuck, 1988) and various levels of estrogen, may affect reactivity in women. Overall, there are many factors resulting in a somewhat confusing picture of the reactivity patterns of women. Men and women differ in terms of sex (biology) and gender (the socialized behaviors and cognitions). Biological and psychological differences between the sexes may account for differences in reactivity. Some methodological factors might also apply to reactivity differences.

Biological bases of sex differences in CHD and reactivity

It is well established that women suffer significantly less from cardiovascular diseases before entering menopause (Kannel, 1982; NIH, 1993). Afterwards, their relative "protection" from CHD sharply declines. In the second report of the expert panel on detection, evaluation and treatment of blood cholesterol in adults (1993), the rapid rise in LDL cholesterol levels (low density lipoprotein) and loss of estrogen were depicted as primary reasons for the increase in CHD in post-menopausal women. The expert panel stated that "these higher levels (of LDL's) probably accelerate coronary atherosclerosis and contribute to relatively high rates of CHD in older women" (NIH, 1993). The increase in cardiovascular disease rates in these women cannot be accounted for solely in

terms of the classical risk factors (Kannel, Hjortland, McNamara, & Gordon, 1976). With this in mind, and the fact that pre and post menopausal women differ hormonally, it is reasonable to believe that there is some link between a woman's hormones and cardiovascular disease. This relationship has been investigated in various ways. In general, there are two types of studies that investigate the effects of hormones; those that compare the reactivity of men and women, and those that look at women who differ according to their hormone levels.

Before mentioning cardiovascular reactivity, it might be best to first briefly review the work on neuroendocrine reactivity and demonstrate several ways that neuroendocrine substances affect the body. Basically, cortisol (a corticoid) and the catecholamines are two hormones which have been indirectly associated with coronary heart disease. During stressful situations, the body tends to secrete corticoids in order to initiate inflammatory processes (Selye, 1950). Inflammation can be helpful in isolating foreign substances and redirecting blood flow to more appropriate locales. However, chronic inflammation in tissues in proximity to the heart or liver can hinder their operation, and possibly damage these organs (McQuade and Aikman, 1974). Also, cortisol alters lipid metabolism in a way which might lead to CHD (Herd, 1983). Researchers have looked at post-stress levels of cortisol, catecholamines and other substances like

epinephrine and nor-epinephrine in men and women. Overall, the research conducted through the 1970's and 80's has demonstrated that there are only a few differences in hormonal reactivity between the sexes. After males and females were subjected to various stressors, their norepinephrine levels were consistently found to be the same (Ward et al., 1983). The same can be said for cortisol since several studies have failed to find any sex-related differences in cortisol reactivity (Collins & Frankenhaeuser, 1978).

With regard to epinephrine, most studies have confirmed the notion that women react less to stressors than men in the laboratory. Various stressors were used, including reaction time tasks, venipuncture, cognitive tasks and school exams. However, there are several problems with the epinephrine reactivity research. First of all, most of the studies which found sex differences in epinephrine reactivity utilized a questionable index. The measurement of urinary excretion of epinephrine may not appropriately represent the plasma levels of epinephrine because much of the substance is metabolized before renal processing (Goldstein & Mc Donald, 1986). Across all ages, the basal metabolic rate (BMR) of women is 5% to 10% lower than the BMR of men (Katch and McArdle, 1988). If women and men differ in their metabolism of epinephrine, this sampling of convenience might result in inaccurate and underestimated levels of epinephrine in women.

Another problem with the research linking epinephrine

reactivity to gender involves the stressors used. Studies frequently utilized tasks which require skilled psychomotor performance and mental work which tap into achievement related motives. If men are socialized to respond more enthusiastically to challenging tasks where their efforts are proof of their "manhood", then such achievement oriented tasks will have differential meaning for men and women. It follows that women will at least psychologically, and possibly, physiologically, react less to the task. Thus, differing epinephrine levels may be due to social rather than physiological factors.

A final criticism of the research linking epinephrine reactivity to gender is that the vast majority of such studies were conducted in the laboratory. Studies utilizing real situations/stressors have not found greater reactivity among men. In one situation, parents' neuroendocrine levels were measured when they accompanied their child at a hospital for observation and testing (Barnett, Biener, & Baruch, 1987). The endocrine levels of both parents were the same, and even more interestingly, the norepinephrine reactivity of the mother was greater than that of the father (Lundberg, de Chateau, Winberg, and Frankenhaeuser, 1981). In another study, urinary catecholamide levels were measured after a psychological evaluation in a lab and after a normal day of work (Johansson & Post, 1974). Males secreted significantly more epinephrine than the women during the evaluation, yet did

not differ from women during their normal work activities. So it is important to note that although there are gender differences in epinephrine secretion, evidence supporting such differences are frequently less tenable due to the artificial settings that generate such results and the possibly inappropriate measurements used for neuroendocrine levels.

Another method used to investigate the possible effects of hormones upon reactivity involves comparisons **among** (or in some cases within) women, rather than between the sexes. Some researchers compared the reactivity of premenopausal women to post-menopausal women. Others have compared the reactivity of untreated postmenopausal women to that of postmenopausal women who had undergone hormone replacement therapies. Some have also made comparisons of reactivity of women at various stages of their menstrual cycles.

In general, there have been very few investigations of neuroendocrine reactivity among women. The results of the studies so far, provide little evidence supporting the notion that a women's reproductive hormones, particularly estrogen, estradiol, and progesterone, moderate the response to stressful situations (Barnett, Biener, & Baruch, 1987). For example, Collins, Eneroth, & Landgren (1985) subjected women at different points in their menstrual cycle to cognitive and psychomotor tasks. They found no reactivity differences across menstrual phases in urinary epinephrine, nor-epinephrine, and cortisol. Comparisons between postmenopausal

women treated with an estrogen-progestin compound and non-treated postmenopausal women, have demonstrated that there are no differences in neuroendocrine reactivity (Barnett, Biener, & Baruch, 1987). It may be concluded that the effects of female hormones upon neuroendocrine reactivity are not very significant.

Currently, there is indirect evidence supporting the hypothesis that female hormones play a part in women's reduced cardiovascular reactivity to stressful stimuli (Barnett, Biener & Baruch, 1987). An early study investigating female hormonal effects on CVR examined ovariectomized women in three experimental conditions; with estrogen injections, with a combination injection of estrogen and progestin, and a placebo control condition (von Eiff, Beck, & Czernik, 1971). The three groups of participants were given mental arithmetic and had their heart rate and blood-pressure monitored. There were few differences between groups except for a somewhat lower systolic blood pressure reading from the group that was given the combination therapy. Later investigation by Neus and von Eiff (1985) also revealed no differences besides a difference in systolic blood pressure reactivity. It was interesting to note that the use of oral contraceptives seemed to result in less systolic blood pressure reactivity.

Several studies reported positive results, yet sometimes these results were questionable due to methodological problems. Matthews and Saab (1986) examined the reactivity of

postmenopausal and normally cycling women, in response to various stressors including mental arithmetic, public speaking and a psychomotor challenge. They found that systolic blood pressure reactivity was markedly greater in the postmenopausal group than the normally cycling group, across all three tasks. Public speaking was the most "stressful" for the postmenopausal women, possibly indicating some psycho/social factor at work. This study seemed to be well conducted since the age factor was carefully controlled and baseline measures were taken. Other studies with positive outcomes were not so well designed. For example, Ladisich (1977), compared reactivity across women at different phases of their menstrual cycle and reported that phase does have an effect upon reactivity. These results are less tenable in light of the fact that the baseline measures were not reported.

Throughout the 1980's, many studies were conducted to investigate the effects of menstrual cycle phase upon cardiovascular reactivity. Polefrone & Manuck are frequently referred to in the literature regarding women and reactivity. In 1984, they reported significantly greater systolic blood pressure reactivity among women in the follicular phase with age and emotional levels (anxiety and anger) controlled. Since then, few studies have made clear progress towards supporting a consistent link between a particular phase and reactivity. Many researchers found that stages other than the follicular, were linked to greater reactivity, or that there

were no phase effects. In the same year that Polefrone and Manuck demonstrated a link, Plante and Denney (1984) found no menstrual phase effect. Hastrup and Light (1984) reported that women in the luteal phase demonstrated greater reactivity than women in the follicular phase. It was also noted that women in the luteal phase were more reactive than men (1984). Since then, many other studies failed to find a menstrual phase influence upon cardiovascular reactivity (Collins, Eneroth & Landgren, 1985; Stoney, Langer & Gelling, 1986; Weidner & Helmig, 1990).

One of the latest investigations involving the menstrual cycle and cardiovascular reactivity compared PMS with non-PMS women at various phases of the menstrual cycle (Girdler, Pedersen, Stern & Light, 1993). They found that menstrual phase has no influence on cardiovascular reactivity in both groups, across all phases. Overall, there is not sufficient evidence supporting the notion that female hormones play a direct role in CVR. The research to date has been mixed and difficult to interpret in light of other studies. Several methodological issues have been raised by reviewers of the literature (Barnett, Biener, & Baruch, 1987). Many studies failed to properly control for relevant confounding variables such as oral contraceptive use, age, and cigarette use. Tersman, Collins and Eneroth (1991) reported elevated systolic blood pressure reactivity in women within their luteal phase yet cigarette use was found to have interacted and confounded

the results. The common problem of insufficient sample size and the resulting loss in statistical power frequently led to inconclusive results (Barnett, Biener & Baruch, 1987). Finally, the nature of the stressors used might have skewed results. Most of the tasks used were mental arithmetic, the cold pressor and reaction time. Very few used more "meaningful" stressors such as public speaking which might impact the participants more effectively. This leads to the issue of socially driven factors which influence the reactivity of women.

Social/cognitive explanations for gender differences

Many stress researchers maintain that the appraisal of a situation is as important as the stressor in determining if a stimulus generates a "stress" response (Lazarus & Folkman, 1984; Smith & Anderson, 1986; Lash, Gillespie, Eisler & Southard, 1991). According to various models of stress (Smith and Anderson, 1986), a stressor's effect might be enhanced or attenuated through an individual's personality (a filter, in effect). Since women are socialized to sometimes apprehend situations in ways differently than men, they may magnify or attenuate a stressor/stimulus and thus produce a reaction/response that differs.

In a study by Lash, Gillespie, Eisler & Southard (1991), a cold pressor task was defined as masculine or gender neutral to separate groups of men and women. The experimental task was made to appear masculine by telling the participants that

traits such as perseverance, physical prowess and will-power, are associated with keeping one's hand in the ice water. The gender-neutral condition described the task in a more objective way, devoid of references to personal characteristics. Results indicated that the men were more reactive than women only when the task was presented as a "masculine" task. Otherwise, in the gender-neutral condition, both sexes reacted to the cold pressor in a similar manner. The results imply that gender differences in the perception of the task result in differing cardiovascular reactivity. In light of this, it is interesting to note that Type A women (indicated by the JAS) scored higher on the masculinity subscale of the Bem Sex Role Inventory (Nix & Lohr, 1981). Perhaps traditionally masculine traits are similar to some of the characteristics of the Type A personality.

It has already been mentioned that hostility plays an important role as a mediator of TABP and reactivity, and as a predictor of reactivity in its own right. Both men and women who score high on hostility scales tend to react more. In a study conducted by Weidner, Friend, Ficarrotto and Mendell (1989), both men and women demonstrated elevated blood pressure in response to unsolvable anagram tasks. **Both** men and women who scored higher on the Ho scale demonstrated higher reactivity. Also, those scoring high on Ho also reported more anger. So far, only three studies have looked at the relationship between hostility, anger and CHD in women

(Suarez, Harlan, Peoples, & Williams, 1993). A possible reason for some of the confusion in the TABP-CHD/reactivity literature and the differences in reactivity between genders, might center upon the way the two genders react to emotional anger and hostility. Measurement of these feelings may not be comparable for men and women.

Men are socialized to display anger while women are taught to be less overtly aggressive. The SI takes measures directly from overt behaviors. These overt behaviors are filtered through socialized roles of proper, "gender appropriate", behavior. Thus, the measurement of anger and hostility in women may be less accurate than for men. There is some evidence pointing in this direction. Matthews and Haynes (1986, pg. 115) noted that the questions within the SI are "oriented towards work or competitive behavior that may be socially acceptable to working men but not for women." In particular, they mentioned that men and women differ in their style of speech, for example, women use less vigorous language and sit in less confrontational positions (Thoreson & Low, 1990). Thus women could score lower on the SI as a function of their socialized style of speech rather than their propensity to develop CHD. It also implies that the SI is a measure with "differential validity" across genders, which results in confounds when attempts are made to compare men and women. The JAS does not measure behaviors directly, however many questions are based upon a respondent's recall of

previous behaviors. Morell (1989) did not find a link between TABP and reactivity in a sample of women. She concluded that the JAS might not properly measure TABP in women. Again, it would be socially undesirable for women to indicate that they are competitive or hard driving, even if they really are.

In the last 20 years, women have taken on many previously masculine roles. New attitudes and perceptions may be developed by adopting a new role. Frankenhaeuser (1991) noted that the male/female differences in catecholamine reactivity have decreased as women are encountering and meeting demands which were traditionally faced by men. It follows that as men and women become more alike in value judgements and attitudes, stress reactions might become more similar. Yet there are still striking differences that are difficult to account for due to the complex network of relevant factors at play. One area that offers much confusion to researchers is that regarding personal control.

Within the stress literature, a general perception of powerlessness or lack of control has been associated with negative outcomes (Siwolop, 1988; Wegert, 1990). However, having control may not always be beneficial. Strickland (1978) reported that high internals (those having a high internal locus of control) reported less anxiety in a situation where they believed that they had control over shock yet they exhibited greater reactivity. If there are gender differences regarding the use or "responsibility involved" in

control, there may be substantial differences in reactivity between men and women given the same amounts of control. Frankenhaeuser found that male and female managers differed in terms of blood pressure, heart rate and catecholamine levels when both were given more control over their work. The men demonstrated greater physiological arousal while there was a decrease for the women. Frankenhaeuser hypothesized that men and women use control differently, that is, men use extra control to work harder while women use it in a more relaxed manner (1991). It would be interesting to see how women with high scores on Bem's masculinity test would react to increased control, as compared to men.

A final factor that should be further investigated is age. While more men than women suffer from CHD in general, the number of women with CHD at older ages tends to approach the number of men. One possible reason for this might be that menopause involves hormonal changes that influence susceptibility to CHD. Another fact to take into account is that one's Type A score on the JAS tends to decrease as one enters his or her elderly years (Thoresen and Low, 1990). Putting all of this together, it seems that studies linking Type A to CHD, which use participants already suffering from CHD, will have a greater proportion of older women than younger women in the sample. If older people have scores that differ from when they were younger, their current scores would fail to properly reflect their current status. If the women

in a sample are older than the men, the women will have less accurate Type A scores and might demonstrate less of a relationship between their personality and CHD. If this reasoning and the underlying assumptions are correct, future investigations should control for age and/or refine measures of Type A in samples consisting of senior citizens.

Methodological factors explaining CVR differences

One possible reason for the differences between results involving men and women might center around methodological factors. In general, studies involving men had sufficient sample sizes, yet those involving women did not (Booth-Kewley & Friedman, 1987). The research involving women frequently fails to find the same positive results as those using men. Lawler, Huck, and Smalley (1989) did not find diastolic blood pressure reactivity in women during a midterm statistics examination. It was mentioned that the results were preliminary because of the small sample size (n=14). In a study involving public speaking and heart rate reactivity, responses to a lab stressor and a more naturalistic stressor were apparently associated, however, the strength of any conclusions were weakened because of a very small sample size (Turner, Carroll, Dean & Harris, 1987). Lawler, Schmeid, & Lacey (1990) reviewed the literature on Type A/B women and reactivity and found that small sample sizes may have accounted for many of the mixed findings. In the 18 studies

reviewed involving Type A women and reactivity, exactly half had sample sizes under 30. In summary, it appears that more studies with sufficient sample sizes are needed to better assess the reactivity of women.

JOB STRESS

Definition and Relevant Models

Organizational stress, or job stress, has been generally defined as "any characteristic of the work environment which poses a threat to the individual." (Caplan, Cobb, French, Van Harrison, & Pinneau, 1975, pg. 47). Job stress has become a growing concern of professionals working within industrial psychology, psychophysiology, occupational health and personnel management. The rising costs to the organization and the deleterious effects upon workers' health and well-being have prompted managers, researchers and health professionals to increase their attention towards learning more about this problem. To aid in the understanding of organizational stress, researchers have attempted to clarify its definition. Also, several models of organizational stress have been constructed to delineate its causes, effects, and the interrelationships among the variables within the model.

Schuler (1980) noted that a major problem with the job stress literature was the preponderance of competing and inconsistent definitions of organizational stress. Many definitions were insufficient since they failed to account for

several important aspects of job stress. For example, Cooper and Marshall (1976) defined occupational stress according to organizational characteristics (stressors), yet individual factors were not incorporated. They used the word stressor as if it were synonymous with stress. However, a stressor and stress are not the same. Schuler attempted to integrate various job stress models in order to improve the definition of stress and stressor. He clarified the notion of a stressor by indicating that various factors such as opportunities, demands and constraints can lead to a condition of stress. Stress is essentially a state, caused by a confrontation with these factors or stressors. His definition of stress as a "dynamic condition" appears to be both integrative and well suited for discussions of organizational stress. This condition involves **being** confronted with opportunities, constraints, or demands relating to some desired outcome. Also the element of uncertainty is involved in a stressful situation. Finally, the outcome of the situation must be **valued** in some way for stress to be experienced. Such a conceptualization has the desirable features of separating stressors from stress, and the inclusion of uncertainty and values within the definition.

Schuler's conceptualization of stress (1980), as well as many other researchers' views of organizational stress, seem to concur with the person-environment fit (P-E fit) model. The P-E fit was proposed by French, Rogers, & Cobb, to

illustrate how the mismatch of two factors (personal characteristics and environmental characteristics) can lead to job stress (1974). This model has been widely accepted by researchers investigating stress in organizations (Eulberg, Weekley, & Bhagat, 1988).

The P-E fit characterizes stress as a lack of fit between a person and his or her environment. If a person's abilities and or desires are not in line with the demands and supplies within the environment, adaptation becomes difficult and stress is experienced. Edwards and Cooper (1990) mentioned several reasons for this model's popularity. First of all, P-E fit goes one step beyond the overly simplistic stimulus response models since the "actor" within the environment (the O in the S-O-R paradigm) is considered. Thus the interactions between the person and the surroundings are accounted for. Also the model can explain why one person in a given environment may thrive while another feels stressed (because the model considers the person's particular attributes and values). Finally, it considers the environment, thus accounting for organizational characteristics which may generate or buffer stress.

One important criticism of the P-E fit model should be mentioned. Edwards and Cooper (1990) noticed that there are some theoretical problems with the model and its use. The model defines a "P" side which contains a person's values and abilities and an "E" side which defines the environment's

demands and supplies (meets the needs of the person). These perspectives of P and E have been grouped into two ways of looking at P-E fit: the first looks at a person's values and the environment's supplies (the SV orientation), the second focuses upon the abilities of the person and the environmental demands (the DA orientation). Edwards and Cooper (1990) maintained that these two orientations are very different conceptualizations of P-E fit since they strongly differ in terms of objectivity and subjectivity. The SV orientation takes into account the more subjective factors while the DA views the objective factors. The problem lies in the fact that many researchers have used these orientations interchangeably, ignoring the distinctions between them (Edwards and Cooper, 1990). Thus the literature on P-E fit is conceptually problematic.

Although the P-E fit model may not have a well defined body of literature clarifying its usefulness, its face validity offers hope because an interactionistic perspective which accounts for both the individual and the environment is one step ahead of other models which narrowly focus upon only one facet of job stress. Overall, the positive characteristics of the P-E fit model make it useful as a general guide towards understanding more about stress in the workplace.

A particularly positive characteristic of the P-E fit model is that it is consistent with the general stress model

(see figure 1). Both models account for stressors and filters such as personality variables, and outcomes. The job stress literature has addressed many variables encompassed by both models. For the remainder of this review, the general stress model will be used to organize and explain the pathways between job stress variables. Several of the most common stressor variables fitting into the first stage (potential stressor) of the model are role conflict, job ambiguity, role characteristics, aspects of the physical environment, interpersonal conflicts, and role conflicts. Variables which can enhance or attenuate the effects of stressors include social support and individual characteristics. Overall, gender and personality are the main characteristics associated with stressor attenuation or magnification. Personality constructs such as Type A, hostility, need for achievement, need for power, and locus of control have been empirically investigated in the job stress literature. Finally, outcome variables include absenteeism, turnover, job dissatisfaction, and physical illness.

Potential Stressors

What is more clear than the definition of stress itself is an understanding of the causes of stress, namely stressors. These are the spontaneous events or daily threatening situations which interact with personal and environmental characteristics (filters) and have the potential to arouse the stress response which can produce immediate and sometimes

long-lasting outcomes. A primary source of stress on the job comes from roles. Role stressors include role conflict, role ambiguity, and role demand (requirements of an occupational position). Role conflict and role ambiguity are the classic sources of organizational stress. House and Rizzo (1972) conducted one of the first comprehensive field studies involving these variables. Their overall conclusion was that both role ambiguity and role conflict had relatively strong relationships to experiences of stress/anxiety, with ambiguity often showing stronger relationships to experiences of stress (1972). Certain roles or positions within an organization are particularly stressful. The role of leader has been frequently found to carry many sources of stress (McQuade and Aikman, 1974; Schuler, 1980).

One reason why the role of leader is more stressful is because it requires relatively more decision making which is often severely restrained by forces beyond the manager's power. Material resources, the capacities of subordinates, time, money, political, and bureaucratic snags, and communication problems can all limit a manager's ability to implement decisions. Accounting for this conflict, Karasek (1979) proposed that one's job demands should be compared to job decision latitude in order to better understand the source of job stress. He maintained that only looking at one side, either demands or decision latitude, paints an incomplete picture of the work environment's effects (1979). With this

perspective, job strain (the outcome of job stress) is said to occur when demands are high and decision latitude is low (Karasek, 1979). Karasek's perspective is supported through his own empirical investigations and the work of others. Ganster and Fusilier (1989) found workers with high job demands and low decision latitude to be more likely to develop cardiovascular disease.

The element of uncertainty (ambiguity) seems to be an important ingredient for stress (Schuler, 1980). Spector, Dwyer and Jex critically sought to invalidate many previously "established" job stressors in order to refine the list (1988). They reported that many of the variables which were once thought to be potent job stressors were not significantly related to job stress. However, low autonomy was found to be strongly associated with job stress (1984). Overall, theoretical and empirical evidence exists supporting the notion that role conflict and ambiguity are salient stressors.

Women face role related stressors in organizations particular to their gender. They can experience stress due to conflict between their role as a worker and as a woman, particularly if the tasks required in the position contain elements which are inconsistent with socialization experiences. The socialization process and early childhood experiences ingrain notions of what a woman should be. We are socialized to interact with others in particular ways. Maccoby demonstrated how interactions within early play groups

can partly account for differences in sex-role perceptions (1988). At early ages, boys and girls segregate into two independent play groups, each with different rules for interaction and influence (Maccoby, 1988). Such early social experiences leave women with the impression that they should be pleasant, flexible, and socially sensitive (Eagly and Johnson, 1990). Furthermore, Eagly and Johnson noted that gender based expectations of behavior may "spillover" into the workplace (1990). Thus women may feel that their early socialized role characteristics should be applied in the workplace. However, the characteristics of passivity, dependence, and flexibility are not always congruent with the behaviors required for successful job performance. Such incongruity is particularly salient where women hold positions of authority.

Role conflict and ambiguity are particularly relevant to women in managerial positions. Women as managers may experience conflict since the role of "being a woman" and being a leader may conflict with their self-image, and their co-workers' perception of them. According to the sex-role congruency hypothesis (Nieva and Glutek, 1981) there is a degree of match or goodness of fit between sex-role stereotypes and leader behaviors and perceptions. Subordinates of female managers may feel less comfortable since the sex role stereotype of a woman is inconsistent with implicit ideas of what constitutes a manager (Rice, Instone,

& Adams, 1984). If others perceive the women manager as existing in conflict with her managerial role, such information can be directly or indirectly fed-back to her, thus engendering within her a personal feeling of conflict. According to Eagly and Carli (1981), women are more easily persuaded and subject to peer pressures. A subordinate's or co-manager's perceptions of conflict can be communicated from subordinates and other managers through alienation, harassment, and differential treatment. Substantial evidence exists indicating that women as managers are more alienated, harassed and treated differently than male managers (Caplan and Caplan, 1994). Besides these external forces generating conflict within the female manager, more internal forces are probably at play.

An additional aspect of role conflict particular to women is based upon competing demands of the roles that women fulfill. Currently, women are still responsible for a large proportion of domestic chores, especially childcare, even though many work full time (Frankenhaeuser, 1991). Thus women are in conflict with their responsibilities in the home and on the job. This can have serious health related effects if conflict leads to stress and stress leads to illness. Barnett, Biener and Baruch (1987) pointed out that women were once less coronary prone than men, yet since the 1970's their "CHD protection" has been declining. Frankenhaeuser reported that women are suffering more from cardiovascular illnesses

and that they are reacting to achievement demands as much as men (1991). Overall, she mentioned that women are taking on the male profile of being more stressed and more coronary prone, and that such a shift for the worse is partly due to conflicts and burdens related to the maintenance of the responsibilities of two roles (1991).

A relatively new stressor is the presence of electronic performance monitoring devices (Miller et al., 1988). As of 1990, approximately 10 million U.S. workers were monitored by electronic surveillance devices (Halpern, 1992). Such devices include computer software which monitors and records typing speed, telephone hook-ups which allow supervisors to listen to subordinates' conversations with clients, cameras which monitor the location of employees, and computer driven devices which account for an employee's performance. There are several ways in which electronic performance monitoring (EPM) can lead to increased job stress. Loss of control, decreased privacy, weakened social support, and job ambiguity are frequently mentioned in the EPM literature.

Outcomes of job stress

One of the major reasons why stress has become such a widely researched topic in organizational psychology is because of its negative and costly effects upon workers and the organization as a whole. For the workers as individuals, there are many negative effects upon their health such as cardiovascular disease, stomach ulcers, colitis, suppression

of the immune system, and migraine headaches. Psychologically, stressed workers may feel anxious, helpless, or even depressed if the stress is chronic. For the organization, several undesirable effects of job stress have been found: absenteeism, turnover, lower job performance, and rising costs of workers' insurance.

REVIEW SUMMARY, FOR RESEARCH PROPOSAL

The preceding literature review can be summarized as follows: Coronary disease risk profiles have been investigated in attempts to predict (and thus hopefully prevent) heart disease. The TABP is an important indicator of coronary prone behavior as indicated by correlations with cardiovascular reactivity and CHD outcomes. However, the TABP seems to be an imperfect indicator either due to its own flaws, or problems with the research designs which utilized it. Studies using TABP have not consistently predicted CHD and/or reactivity across different tasks. The TABP does not seem to predict for women as well as it does for men. However, this weaker relationship needs to be further investigated due to the dearth of investigations utilizing appropriate samples of women. The components of TABP, particularly hard driving/competitiveness, impatience, and hostility, may have different amounts of influence upon reactivity. Many recent studies have indicated that hostility may be a significant component of the TABP. Finally, the situations and tasks used in most reactivity and "stress"

experiments generally tend to be artificial and carry no real consequences or significance to research participants. Theoretically, a stimulus (potential stressor) which does not carry a potential threat or meaningful consequence, will not result in stress to an individual (Schuler, 1980). Overall, there is a need for research; involving women, using varied tasks (especially real-life) with adequate sample sizes, using multiple measures of reactivity particularly blood pressure, heart rate and skin conductance, using measures of TABP that can be separated into individual components for comparisons of the effects of these components, and that compare the effects of different tasks.

There is a current need for more investigations involving the cardiovascular reactivity of women since the literature thus far paints a very incomplete picture. There are notable differences in reactivity between men and women, due to many possible factors. What needs to be clarified is the extent to which these differences are due to biological or social factors or methodological problems. The Type A Behavior Pattern shows much promise as a predictor of CHD, yet there is a need to look at its components in greater detail. Methodological problems such as small sample size, pose a threat, yet there is evidence that women are truly reactive. A meta-analysis by Booth-Kewley & Friedman (1987), partitioned out the sample size problems and found that women can be just as reactive, and sometimes more reactive than men. With this

meta-analysis in mind, researchers should be assured that women can demonstrate significant levels of reactivity, and should accordingly strive to explicate under which conditions women respond differently than men.

In light of the literature review, several hypotheses can be made and tested in this dissertation:

H1: Type A women will demonstrate higher cardiovascular reactivity in terms of higher blood pressure (systolic and diastolic), heart rates, and mean arterial pressure, than Type B women for reaction time and the oral quiz tasks.

H2: The oral quiz (interpersonal task) will lead to greater physiological reactivity, than reaction time (independent task).

H3: Type A women will demonstrate greater increases in skin conductance than Type B women for the reaction time and oral quiz tasks.

H4: Women with higher scores on the Cook-Medley Hostility Scale (Ho) will demonstrate greater increases in skin conductance for the reaction time and oral quiz tasks.

H5: Women with higher scores on the Cook-Medley Hostility Scale (Ho) will demonstrate greater cardiovascular reactivity in terms of higher blood pressure (systolic and diastolic), heart rates, and mean arterial pressure, than women scoring low on the hostility scale, for both the reaction time and oral IQ quiz tasks.

H6: Type A men and women will demonstrate higher cardiovascular reactivity in terms of higher blood pressure (systolic and diastolic), heart rates, and mean arterial pressure, than Type Bs for the classroom speech task.

H7: Women and men scoring high on the Cook-Medley Hostility Scale (Ho) will demonstrate higher cardiovascular reactivity in terms of higher blood pressure (systolic and diastolic), heart rates, and mean arterial pressure, than Type Bs for the classroom speech task than those scoring low on the scale.

Method (Experiment 1)

Participants:

Research participants were drawn from the subject pool at Baruch College of CUNY. Only women were selected. They were given classroom credit for their participation in the various stages of the experiment. The mean age was 24.6 (SD 6.22) with a range of 17 to 48. Research participants came from a diverse array of ethnic backgrounds: 31% White, 29% Hispanic,

28% Black, 12% Asian. A total of 116 were selected initially. Approximately 20 individuals were not included in the analysis for various reasons such as extensive missing data in Jenkins Surveys, failure to abstain from the use of vasoactive substances before cardiovascular measures, having difficulties with spoken English, extreme obesity making it impossible to use the upper arm pressure cuff, and having the flu or a cold. The total number of women fully participating was 96. Participants were screened for Type A/B behavior and hostility in a classroom setting (Jenkins Activity Survey (JAS) and The Cook-Medley Hostility Scale). As recommended (Houston, 1983; Rosenman, 1990) a quartile split was used to trifurcate the data so that only those who scored in the top and bottom 25th percentiles on the JAS were analyzed in most of the statistical tests. Thus, most analyses had a sample size of 64 (32 Type A and 32 Type B). The 25th and 75th percentiles were based upon the JAS scores obtained from the research participants involved in the Western Collaborative Group Study (Jenkins, Zyzanski, & Rosenman, 1979). The WCGS sample consisted of 2,588 males, employed in ten large corporations in California. Their ages ranged from 48-65 in 1969, when they were administered the JAS. The participants' raw JAS scores were approximately normal.

Apparatus/materials:

A Lafayette reaction timer which measures reaction time to visual stimuli to the nearest hundredth of a second

(digital readout) was used. A stationary Critikon Dinamap Vital Signs Monitor Model 1846, was used to measure heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP). The Dinamap monitor automatically estimates and displays mean arterial pressure, which is defined as the average pressure during the cardiac cycle ($MAP = 1/3 (SBP - DBP) + DBP$). The Dinamap incorporates an adult size pressure cuff that can be fitted to the participant's upper left arm. This monitor displays its information through digital LED readouts. Skin conductance, another index of autonomic activity, was measured by a J & J skin conductance monitor (digital readout).

A taped "IQ quiz" (Schiffer et al., 1976) was used for the interpersonal stressor task. The quiz consists of 35 questions covering topics such as geography, math, history and vocabulary. Some items require a participant to solve word problems and recall a list of digits. The IQ quiz is designed to generate anxiety by requiring the participant to think quickly and answer the questions in a short period of time. Also, the difficulty of the questions progressively increases to a point where the last 4-6 questions are almost impossible to answer. The taped questions are asked by a woman with a terse and demanding tone of voice and the respondent must answer the question out loud to the experimenter. In previous studies utilizing the IQ quiz, research participants have demonstrated increases in heart rate and blood pressure

(Schiffer et al., 1976; Albright, Andreassi, & Brockwell, 1991).

The Jenkins Activity Survey, consisting of 52 questions, and the Cook-Medley Scale, with 50 items, was administered in group situations (see Appendix 1). A questionnaire covering various background information including parental history of hypertension, heart disease and respiratory illness, use of caffeine, drugs and cigarettes, and other relevant factors was administered before any physiological measures were taken (see Appendix 1).

Design:

The experimental design was mixed with a within-subjects factor in which all individuals were tested under both conditions of the experiment (reaction time and IQ quiz). Counterbalancing was accomplished within each group of thirty two participants, such that one half began with the reaction time task and the other with the IQ quiz. In addition, between-group comparisons were made to test the cardiovascular reactivity of Type As versus Type Bs. This involved comparing baseline to task changes in heart rate, blood pressure and skin conductance for Type As and Bs. This design allowed for comparisons across tasks and across individuals differing in their measured hostility and TABP scores.

Procedure:

Subsequent to completing the psychological tests, participants were selected for participation in the

experiment. The criterion for selection depended on JAS scores; i.e., those scoring in the 75th percentile and above were selected as Type A, and those scoring in the 25th percentile and below constituted the Type B sample. Those selected were next instructed to complete a physiological assessment form (see appendix 1) and an informed consent document approved by the Internal Review Board of Baruch College.

Participants were tested in a 9' by 5' room maintained at a temperature of 72 degrees F. After filling out the consent form and physiological assessment form, participants were seated in the experimental room and the procedures for the two tasks were explained. After being fitted with the blood pressure cuff, participants were informed that they would receive a \$50.00 cash prize for having the highest quiz score and the fastest reaction times. The sequence of the experiment was: 6 minute baseline, followed by task 1 for six minutes, rest for 6 minutes, task 2, then finally a recovery period of 6 minutes. Physiological samples were taken at one and a half minute intervals during all phases of the experiment. At these times the experimenter recorded heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and skin conductance level. All of these measures were displayed digitally at each sampling period.

Immediately before administering the RT task, the experimenter explained the RT procedure to the participant.

Then the participant was given a few practice trials in order to verify that the instructions were understood. After practice, the RT task commenced and physiological measures were taken. The subject was not given any feedback from the experimenter regarding performance on the RT task until the debriefing session.

For the IQ Quiz, the participant was told to answer all questions out loud. The IQ Quiz tape was started and the participant heard a brief explanation of the procedure. Physiological measures were taken as soon as the first question was asked. After each question, there was a 5-7 second pause during which time the subject was to answer the question out loud to the experimenter who was recording the answers. After the pause, the tape recording revealed the correct answer to the research participant.

After all conditions were completed (baseline, tasks and recovery measures), the participant was debriefed and then dismissed. The debriefing involved the communication of the research constructs, their relevance to the participant, the experimental hypotheses and expected results. The experimenter presented the participant's physiological measures, their scores on the various personality questionnaires, and scores on the RT and IQ quiz. The debriefing process also provided an opportunity for research participants to ask questions and express their opinions regarding the experiment.

Method (Experiment 2)

Participants:

A total of 98 men and women participated in Experiment 2. They were recruited from various psychology courses which had a graded classroom presentation as part of the course requirement. Data from 12 of the 98 participants had to be excluded from analysis. Reasons for an individual's exclusion from analysis included use of vasoactive substances before blood pressure measurements (3), failure to attend a second baseline measurement session (2), having a serious illness (1), having a notable difficulty with spoken English (1) and failure of the Critikon monitor to record sufficient readings during the speech task (5). Of the 86 participants who remained in the analysis, 56 were women and 30 were men. Since many of the subjects were part-time and evening students, their ages were not the typical 18-22 years seen in many colleges. Many participants were older students who were re-attending college. Ages ranged from 17 - 45, with an average of 26. Subjects came from diverse ethnic backgrounds: 28% White, 26% Asian, 24% Black, and 22% Hispanic.

Research participants were required to give a presentation in class in order to fulfill a course requirement (worth about 10% of their final grade). Their participation entailed giving a 6 minute speech in class presenting material germane to their course. Twenty-seven Type A and 20 Type B research participants were identified by selecting those who

scored in the upper and lower quartiles on the Jenkins activity survey. Thirty-nine men and women scored between the 25th and 75th percentile and were not designated as Type A or B. In addition to the JAS, research participants completed the Cook-Medley Hostility Scale.

Apparatus/Materials:

Heart rate and blood pressure were monitored with a portable monitor (Critikon Dinamap 8100). This portable monitor provides a digital readout of mean arterial pressure, heart rate, and systolic and diastolic blood pressure. Appropriate cuff sizes allowed proper fitting on the participant's upper arm.

Two forms were provided to the subjects before they participated. One was a questionnaire covering demographics and factors related to cardiovascular reactivity such as parental history of hypertension and use of caffeine. The other was an informed consent form which described the procedures of the study and the rights of the participants.

Design and Procedure:

This experiment had both between and within-subject factors in order to allow comparisons between Type A and Type B participants and comparisons within subjects between baseline and task conditions. The within-subject comparison was used to determine the degree of cardiovascular reactivity. The between subject comparison between Type As and Type Bs was used to help determine whether Type As react differently than

Type Bs. Participants were grouped (for the purpose of comparisons) according to their scores on the Jenkins Activity Survey into Type As and Type Bs. Both Type A and Bs had their baseline heart rate, mean arterial pressure and blood pressure assessed a week before they were measured during the oral presentation. The order in which Type A and B individuals were called to present their speech was counterbalanced. Individuals from both groups had their physiological responses measured during the speech. Comparisons between Type A and Type B individuals were made. Their cardiovascular reactivity (difference between baseline and task cardiovascular levels) were compared to determine if Type As differ from Type Bs. Scores on the Hostility Scale were also correlated with reactivity measures. In addition, individual baseline cardiovascular measures were compared to task levels to determine the effects of a real life stressor on responsivity.

Procedure:

Several psychology classes were visited by the experimenter to describe the general variables and procedures involved in the study, and to hand out several forms. These forms included a consent form, The Jenkins Activity Survey and The Hostility scales from the MMPI (labeled "affect inventories"). After receiving the completed forms, they were scored in order to designate the participants into one of three groups; Type A, Type B, and mid-range (scoring within

the 26th to 74th percentile on the JAS). About 2 weeks after the initial meeting with the class, the experimenter returned and scheduled research participants for baseline measures for those who wished to participate.

Baselines were measured in a room in the Baruch psychophysiology lab. This room isolates the participant from changes in temperature, lighting and sound levels. The Critikon Dinamap 8100 (the same device used in the classroom) was used to obtain baseline measures of heart rate, mean arterial pressure, systolic and diastolic blood pressure, for 8 minutes. Measures were taken every 1.5 minutes, with participants in a standing position. The first measure was eliminated from all data analyses since the first measure is typically affected by participants' reactions while orienting to the situation and setting. After baselines were taken, the participant was notified of the procedure to be used in the following week during the class presentation. Instructions to keep one's arm straight and the requirement to stay standing during the speech were made clear, so the participants knew what to expect on the day of presentation. The subject had the opportunity to ask questions. Each baseline and pre-task briefing took about 15 minutes per participant. They were scheduled to have their baselines taken again during the next week. Only the data from the second set of baselines was used since the first set are influenced by the novel setting, the equipment and the process of having measures taken (see

Andreassi, 1995).

On the day of the presentation, physiological variables were measured with participants in a standing position in front of the room. Research participants were reminded not to bend their arm with the cuff since it would disrupt the measurement process and make the cuff feel uncomfortable. The experimenter, controlling the bloodpressure monitor, was situated about 20 feet away from the participant. The monitor faced away from the participant and the class. The monitor made three short, high frequency tones whenever a reading was finished. From 20 feet away, the tones are audible, yet low in amplitude (volume). Readings were taken for 6 minutes at 1.5 minute intervals. Although the last measure was taken at the 6th minute, participants sometimes continued their speech uninterrupted in order to finish their class requirement. When finished, the next participant was fitted with the cuff and the same procedure was followed. A general debriefing was presented to the class at the end of the experiment, and individuals were given the opportunity to schedule a private debriefing regarding their personality and reactivity profiles.

Results

Experiment 1

For both experiments, all data were processed through the use of computer software. In particular, Lotus 123, version

3.1 and SPSS for Windows, version 6.01 were used for computing all descriptive and inferential statistics. Participants' results on the Jenkins Activity Survey were scored using a program created in the Baruch Psychophysiology Laboratory. Raw scores, percentiles and other descriptives were computed for global Type A, speed and impatience (SPIM), job involvement (JI) and hard-driving competitive (HDC) personality characteristics, see table 1. Raw scores were used for computations in inferential statistics involving these variables. The designation of Type A was based upon a raw global A score above the 75th percentile while the criterion for Type B was the 25th percentile or lower on the global A variable. The Cook-Medley Hostility test was scored by hand using a scoring key from Cook and Medley (1954). Raw scores, T scores and various descriptives were computed, see table 1. Hostility T scores have a mean of 50 and a standard deviation of 10.

Table 1

Means and Standard Deviations of Personality Measures (N=64).

Personality	Mean	SD
Global A	229.3	100.5
Speed and Impatience	178.1	78.1
Job Involvement	196.5	40.9
Hard Driving & Competitive	127.3	30.6
Hostility (raw)	23.98	8.22
Hostility (T score)	58.67	11.83

Correlational analyses were conducted to determine the degree to which various personality measures were related to each other, table 2. Typically, scores on the global Type A scale are strongly correlated with other measures of the Type A behavior pattern constellation. Table 2 shows that, indeed, many of the components of Type A and hostility were related to each other. In particular, the global Type A score correlated significantly with two out of its three components. The exception was Job involvement which seemed to be atypically represented in this sample. Many of the participants were students whose jobs are a means of paying for college rather than as a part of a meaningful career. This was indicated by a median raw score of 196, which would be at the 39th percentile if scaled to the standard scores. Scores on the Cook-Medley Hostility scale were significantly

correlated with the global Type A score, $r = .46$, and with speed and impatience, $r = .71$.

Table 2

Intercorrelations Between Scores on Global Type A, its Components and Hostility (N=64).

	Global A	SPIM	JI	HDC	Ho
Global A	1.00				
SPIM	.711 ***	1.00			
JI	.239	.015	1.00		
HDC	.501 ***	.091	.346 **	1.00	
Ho	.467 ***	.340 **	-.174	.192	1.00

Note. Global A is the overall Type A score, SPIM is speed and impatience, JI is job involvement, HDC is hard driving and competitive, and Ho is hostility. The p values are 2-tailed. * indicates significance at .05 level, ** at the .01 level and *** at the .001 level.

Five different physiological measures were taken from all participants in Experiment 1: mean arterial pressure, heart rate, skin conductance, systolic blood pressure, and diastolic blood pressure. Readings were taken during baseline, reaction time task and the oral IQ quiz. Table 3 shows mean physiological measures during the three conditions for Type A and B women.

Table 3

Mean Cardiovascular Measures During Baseline, Reaction Time and Oral IQ Quiz Tasks for Type A (N=32) and B (N=32) Women.

Physiological Measure	Condition and Type A or B					
	Baseline		Reaction Time		IQ Quiz	
	A	B	A	B	A	B
Mean Arterial pressure	77.7	80.2	84.0	84.4	87.3	86.1
Heart Rate	80.2	78.2	85.3	81.4	85.9	83.3
Systolic Blood pressure	104.5	110.7	111.5	113.7	115.1	115.2
Diastolic Blood pressure	61.8	62.4	65.8	64.7	67.8	66.7
Skin Conductance	9.0	9.2	13.5	12.2	15.1	14.0

Note. Heart rate is expressed in beats per minute (bpm), Blood pressure measures in mmHg, and skin conductance in micromhos.

Reactivity scores were computed as the difference between physiological readings from baseline to task for each of the five physiological dependent variables. This was done for both the reaction time task and the oral IQ quiz. Thus for each condition there are five reactivity scores (differences) or dependent variables. Table 4 shows reactivity measures during RT and the IQ quiz, for three groups of participants; Type A (those scoring in the top 75th percentile on the JAS), Type B (those scoring in the bottom 25th percentile) and mid-range scorers (26-74th percentiles). Figures 1 and 2 illustrate that for both tasks in general, Type As had the highest reactivity measures, Type Bs had the lowest and those

in the mid-range generally reacted between As and Bs.

Table 4

Mean Reactivity to RT and Oral IQ Quiz in Type A, Type B and Mid-Range Scorers (N=96).

Physiological Measure	Mean Reactivity		
	Type A	Mid-Range	Type B
Reaction Time			
MAP	6.25	3.59	4.10
Heart Rate	5.06	4.00	3.15
Systolic BP	7.01	5.24	3.01
Diastolic BP	3.91	1.94	2.23
Conductance	4.54	2.97	3.01

Oral IQ Quiz			
MAP	9.60	7.48	5.88
Heart Rate	5.68	6.06	5.09
Systolic BP	10.59	6.44	4.41
Diastolic BP	5.91	3.92	4.17
Conductance	6.07	3.43	4.83

Note. MAP = mean arterial pressure, BP = blood pressure, Conductance = skin conductance. Mean Reactivity is the mean difference between baseline levels and task (RT or quiz) levels.

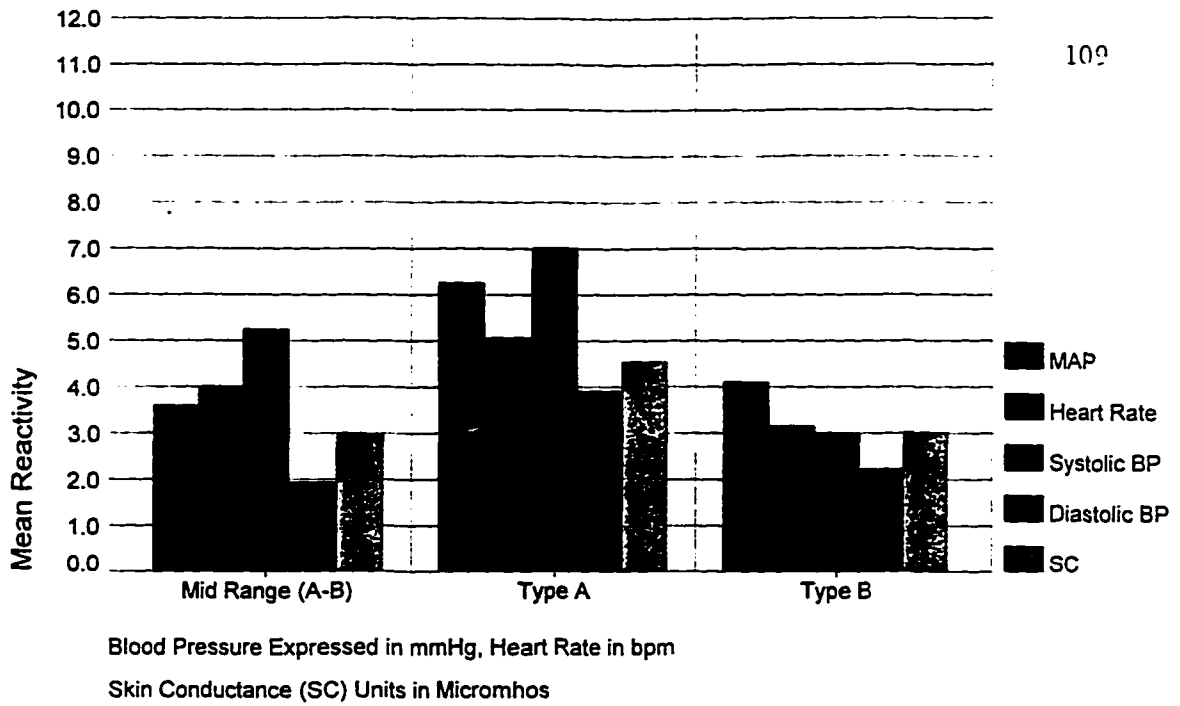


Figure 1. Reactivity of Type A, B and Mid Scorers During Reaction Time Task. Type A individuals were determined by scores at or above the 75th percentile on the JAS, Type B were at or below the 25th percentile and Mid-range scorers were from the 26th to the 74th percentile on the JAS.

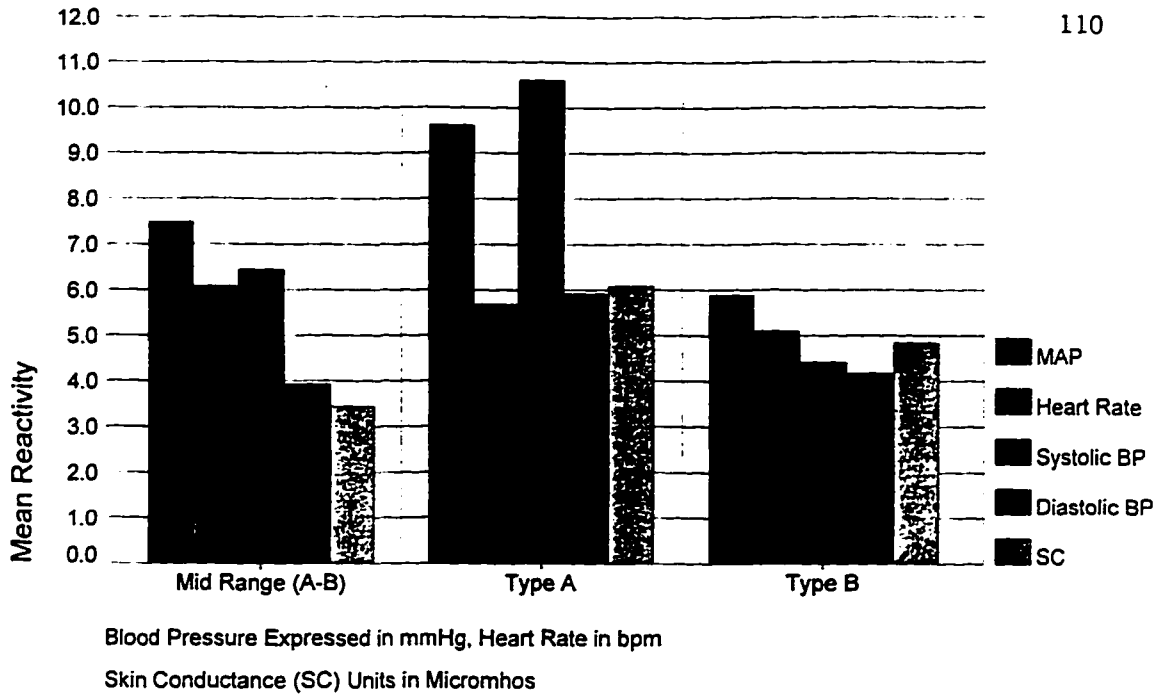


Figure 2. Reactivity of Type A, B and Mid Scorers During Oral IQ Quiz. Type A individuals were determined by scores at or above the 75th percentile on the JAS, Type B were at or below the 25th percentile and Mid-range scorers were from the 26th to the 74th percentile on the JAS.

There were several hypotheses positing relationships between personality and reactivity. Correlations were run for Type A and Bs, in order to get a general picture of these relationships, see table 5. For the reaction time condition, global Type A, its components speed and impatience, job involvement and hard driving competitiveness, and hostility were correlated with the five physiological reactivity measures. The same correlation matrix was formed for the oral IQ quiz condition (table 5). For reaction time, 22 out of 25 of the correlations were positive, indicating the anticipated directionality of the relationship between reactivity to a stressor and a personality type which is more likely to overreact. Although the directionality of the correlations were mainly consistent across personality variables, the strength of the correlations were not as consistent. Only global Type A, speed and impatience, and hostility were significantly correlated to the reactivity outcome variables. Hostility was related only to change in systolic blood pressure, $r = .209$, $p < .05$. For diastolic blood pressure, significance was marginal; $r = .207$, $p = .05$

Most correlations between reactivity measures and personality measures were positive for the oral IQ quiz condition, see table 5. Similar to the reaction time condition, global Type A and speed and impatience were significantly correlated to most of the reactivity measures. Also, hard driving competitiveness was significantly related

to greater reactivity in several physiological indices.

Table 5

Intercorrelations Between Personality Measures and Reactivity for Reaction Time and Oral IQ Quiz conditions (N=64).

	Reaction Time Condition				
	Global A	SPIM	JI	HDC	Ho
MAP	.192	.240 *	.001	.013	.149
Heart rate	.182	.264 *	.052	-.029	.061
Systolic BP	.242 *	.226 *	.020	.001	.209 *
Diastol.BP	.211 *	.305 **	-.031	-.156	.207
Conductance	.227 *	.217 *	.081	.009	.050
	Oral IQ Quiz				
	Global A	SPIM	JI	HDC	Ho
MAP	.352 **	.248 *	.075	.234 *	.169
Heart rate	.031	.138	-.059	-.057	.021
Systolic BP	.385 ***	.151	.027	.259 *	.200
Diastol. BP	.277 *	.253 *	-.155	.014	.205
Conductance	.173	.248 *	.031	-.225 *	.083

Note. The five physiological variables above are change scores between task and baseline. MAP = mean arterial pressure. Conductance = skin conductance. BP = blood pressure. All significance tests were 1-tailed.

* indicates significance at .05 level, ** at the .01 level and *** at the .001 level. Correlations were run for Type A and B research participants (N=64).

Subsequent to the correlational analyses, several of the personality variables were looked at more specifically.

Across both tasks, and for most reactivity scores, global Type A was moderately correlated with reactivity. A series of independent samples t tests were used to assess differences in reactivity between Type A and Bs. Table 6 presents mean differences in reactivity for Type A and B women. Overall, Type A participants were more reactive to the oral IQ quiz and the reaction time task than Type B subjects (figures 3 and 4).

Table 6

Mean Reactivity and Mean Differences Between Type A (N=32) and Type B (N=32) Individuals and Independent Groups t Tests.

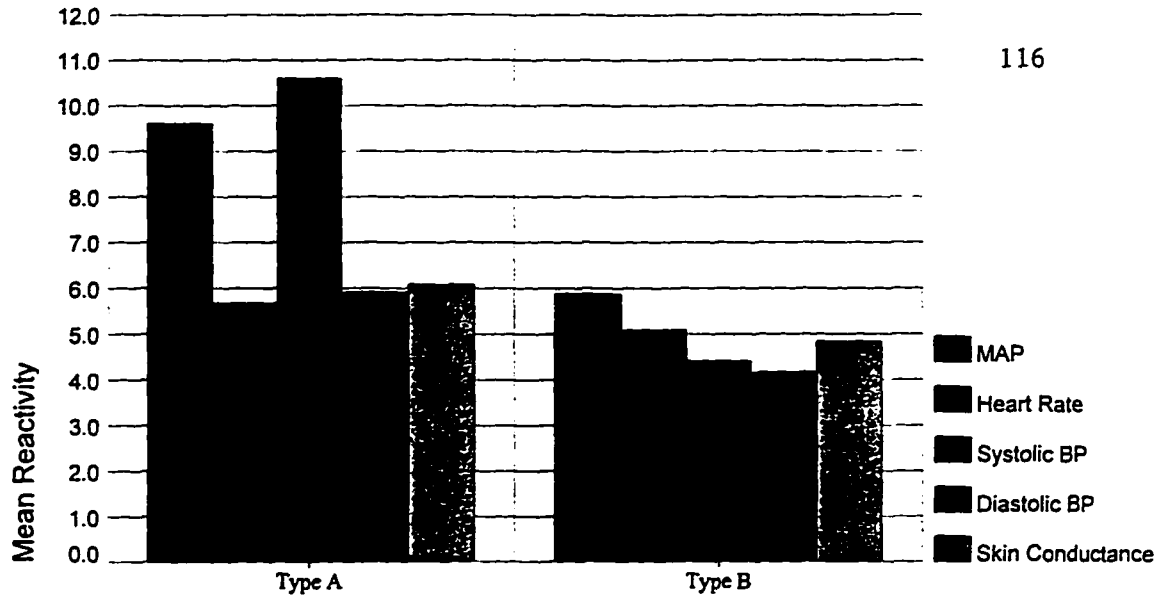
Physiological Measure	Mean Reactivity (Baseline-Task)		Difference in Reactivity	Independent Group t	
	A	B		t (62)	p
Reaction Time Task					
MAP	6.25	4.10	2.15	1.56	.062
Heart Rate	5.06	3.15	1.91	1.47	.146
Systolic BP	7.03	3.01	4.02	2.46	.008 **
Diastolic BP	3.91	2.23	1.67	1.73	.044
Conductance	4.54	3.01	1.53	2.23	.014
Oral IQ Quiz Task					
MAP	9.60	5.88	3.72	2.75	.004 **
Heart Rate	5.68	5.09	0.58	0.42	.337
Systolic BP	10.59	4.41	6.18	3.65	.001 ***
Diastolic BP	5.91	4.17	1.74	1.54	.064
Conductance	6.07	4.83	1.23	1.44	.078

Note. MAP = mean arterial pressure. Conductance = skin conductance. BP = blood pressure. Blood pressure is expressed in mmHg, conductance in micromhos and heart rate in beats per minute. All tests are one-tailed. ** indicates significance at the .01 level, *** at the .001 level. Results with p values > .01 were deemed insignificant by the Bonferroni adjustment.



Blood Pressure Expressed in mmHg, Heart Rate in bpm
Skin Conductance Units in Micromhos

Figure 3. Reactivity of Type A & B During Reaction Time Task.



Blood Pressure Expressed in mmHg, Heart Rate in bpm

Skin Conductance Units in Micromhos

Figure 4. Reactivity of Type A & B During Oral IQ Quiz.

In analyzing the effect of personality type upon reactivity, multiple t tests were performed. To control for experiment-wise alpha error, the Bonferroni correction was applied. Only results with a p value of .01 or lower were considered significant. For reaction time, Type A women were more reactive than Type Bs, in terms of systolic blood, $t(62) = 2.46$, $p < .01$. For the oral IQ quiz, Type As were more reactive than Bs in MAP and systolic BP, see table 6.

Since the correlational analysis indicated that Speed and Impatience (SPIM) was related to reactivity in several physiological variables, further analyses were performed. Data were grouped into low and high SPIM by quartile split. This resulted in a small sample size of 16 per group. The t tests revealed that those who were in the upper 75th percentile were more reactive in diastolic blood pressure for both tasks, $t(30) = 1.86$, $p < .05$, and $t(30) = 2.63$, $p < .01$. Also, those with a high speed and impatience score had higher mean arterial pressure in the Oral IQ Quiz task, $t(30) = 2.68$, $p < .01$. A median split was performed to see if the sample size was a factor. With the median split, the sample size was 32 per group, yet the only significant difference was found for diastolic blood pressure in the oral quiz condition, $t(64) = 1.81$, $p < .05$.

Correlational analyses weakly indicated some relationship between reactivity and raw scores on the Ho hostility scale. In particular raw scores on the Ho scale were correlated with

systolic BP reactivity during reaction time, $r = .21$, $p < .05$. Hostility was also weakly related to changes in systolic and diastolic BP during the oral IQ quiz, $r = .20$ and $r = .21$, $p < .05$ respectively. Multiple t tests with the Bonferroni adjustment were performed involving Hostility and reactivity for the RT and Quiz conditions. A median split was used to bifurcate participants into high ($N=48$) and low ($N=48$) hostility groups. Participants who scored high in hostility demonstrated greater increases in systolic blood pressure and diastolic blood pressure in the RT task and greater increases in MAP and diastolic BP in the Oral IQ Quiz, see figures 5 and 6. There were no significant differences in skin conductance and heart rate between low and high hostility participants for either task, see table 7.

Table 7

Mean Difference in Reactivity Between High (N=48) and Low (N=48) Hostility and Independent Groups t Tests.

Physiological Measure	Reactivity (Diff) High Ho - Low Ho	Independent group t	
		t (62)	p
Reaction Time Task			
MAP	2.15	1.56	.062
Heart Rate	2.19	1.70	.047
Systolic BP	4.05	2.53	.007 **
Diastolic BP	2.14	2.24	.010 **
Conductance	.35	.250	.309
Oral IQ Quiz Task			
MAP	3.20	2.39	.009 **
Heart Rate	.35	.26	.399
Systolic BP	3.45	1.91	.030
Diastolic BP	2.73	2.48	.008 **
Conductance	.15	.17	.439

Note. MAP = mean arterial pressure. Conductance = skin conductance. BP = blood pressure. Blood pressure is expressed in mmHg, conductance in micromhos and heart rate in beats per minute. All tests are one-tailed. ** indicates significance at the .01 level, *** at the .001 level. Results with p values > .01 were deemed insignificant by the Bonferroni adjustment.

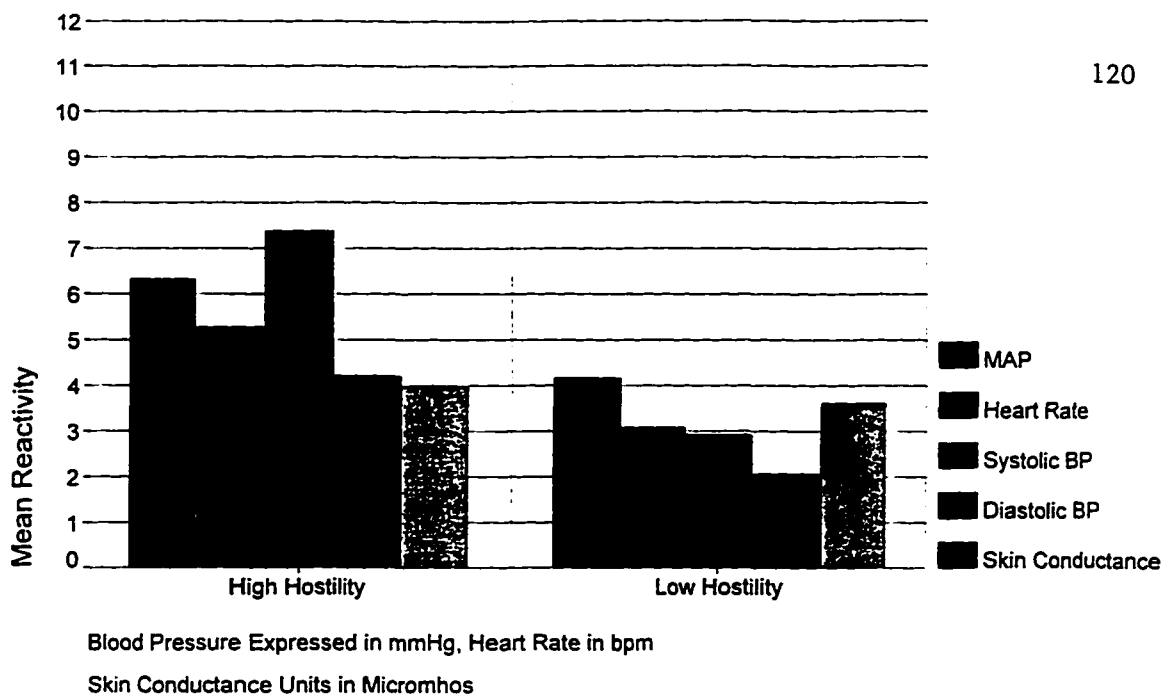


Figure 5. Reactivity of High and Low Hostility Scorers During Reaction Time. High Scorers include those scoring at the 50th percentile or higher on the Cook-Medley Ho scale. Low Scorers scored below the 50th percentile.



Blood Pressure Expressed in mmHg, Heart Rate in bpm

Skin Conductance Units in Micromhos

Figure 6. Reactivity of High and Low Hostility Scorers During the Oral IQ Quiz. High Scorers include those scoring at the 50th percentile or higher on the Cook-Medley Ho scale. Low Scorers scored below the 50th percentile.

Analyses indicated that for four of the physiological measures, reactivity was greater for the oral IQ quiz than the Reaction time task, table 8. There were no differences in heart rate between tasks. Significance remained after re-testing with the Bonferroni correction.

Table 8

Mean Differences in Reactivity Between Oral IQ Quiz and Reaction Time Tasks (N=64).

Physiological Measure	Mean Difference	SD	df	t
MAP	2.56	5.62	63	3.65 ***
Heart Rate	1.27	6.08	63	1.68
Systolic BP	2.57	7.08	63	2.92 **
Diastolic BP	1.82	4.20	63	3.25 **
Conductance	1.67	2.57	63	5.23 ***

Note. ** = .01, *** = .001

Analyses were conducted to determine if Type A individuals were more reactive to the oral IQ quiz or the Reaction time task. Within Type As, and for each physiological variable, the mean reactivity was computed for each task. The difference between these means for the IQ quiz and RT task was not significant for any of the physiological variables.

Physiological recovery scores for MAP, heart rate,

systolic BP, diastolic BP and skin conductance were calculated by subtracting the last task measure from the last recovery phase measure (taken 4.5 minutes after the task finished). Measures of recovery from the RT and IQ quiz tasks were compared within and across Type A and B women. Within Type As and Type Bs, recovery measures were significant for all physiological measures in both tasks. For the RT task, there were no recovery differences between Type A and Bs. For the oral IQ quiz, Type As demonstrated greater recovery in mean arterial pressure, $t(62) = 3.51$, $p < .001$ and systolic blood pressure, $t(62) = 2.87$, $p < .01$, than Type Bs, see table 9.

Table 9

Mean Differences in Recovery Between Type A and B for Reaction Time and Oral IQ Quiz Tasks, and Independent Groups t Tests.

Physiological Measure	Mean Recovery Score		Difference in Recovery	Independent Group t	
	A	B		t (62)	p
Reaction Time Task					
MAP	5.41	4.71	.70	.34	.72
Heart Rate	5.73	3.40	2.33	1.31	.194
Systolic BP	5.86	3.56	2.30	1.05	.296
Diastolic BP	3.83	3.11	.72	.44	.654
Conductance	.27	-.03	.30	.72	.469
Oral IQ Quiz Task					
MAP	9.06	2.20	6.86	3.51	.001 ***
Heart Rate	5.66	4.16	1.50	.86	.390
Systolic BP	10.10	2.63	7.46	2.87	.006 **
Diastolic BP	3.83	1.26	2.56	.95	.341
Conductance	.60	.33	.27	.75	.451

Note. MAP = mean arterial pressure. Conductance = skin conductance. BP = blood pressure. Blood pressure is expressed in mmHg, conductance in micromhos and heart rate in beats per minute. Mean recovery scores computed as difference between last recovery measure taken 4.5 minutes after task and last task measure. ** indicates significance at the .01 level, *** at the .001 level.

Experiment 2

Research Participants' results on the Jenkins Activity Survey were scored as in Experiment 1. Raw scores, percentiles and other descriptives were computed for global Type A, speed and impatience (SPIM), job involvement (JI) and hard-driving competitive (HDC) personality characteristics, see table 10. Raw scores were used for computations in inferential statistics involving these variables. The designation of Type A was based upon a raw global A score at, or above, the 75th percentile while the criteria for designation as Type B was the 25th percentile or lower on the global A variable. Mid range scorers were those whose global Type A scores ranged from the 26th percentile to the 74th. The Cook-Medley Hostility scale was scored by hand using a scoring key (Cook and Medley, 1954). The reference group norms for percentiles were the same as those used in Experiment 1. Raw scores, T scores and various descriptives of personality measures were computed, see table 10. T hostility scores have a mean of 50 and a standard deviation of 10.

Table 10

Means and Standard Deviations of Personality Measures, Experiment 2 (N=86).

Personality	Mean	SD
Global A	233.2	69.7
Speed and Impatience	179.2	65.3
Job Involvement	189.8	37.9
Hard Driving & Competitive	124.2	31.3
Hostility (raw)	22.09	8.3
Hostility (T score)	55.13	11.71

Baseline physiological measures were computed by finding the mean of the last four of five measures taken during the second baseline session. Mean baseline measures of heart rate, mean arterial pressure, systolic BP and diastolic BP were calculated separately for Type A/B and gender, see table 11. None of the differences in baselines between Type As and Bs were significant. Differences in baselines between men and women were significant for MAP, $t(64) = 4.98$, $p < .001$, systolic BP, $t(64) = 6.59$, $p < .001$, and diastolic BP, $t(64) = 3.32$, $P < .01$. These tests were two-tailed and still significant after applying the Bonferroni correction. None of the baseline measures included the first baseline measure. It was eliminated from analysis because it is often contaminated by reactions to the experimental situation. Physiological measures taken during the classroom speech (task) were

averaged for each participant. Reactivity was computed by finding the difference in heart rate and BP measures between baseline (resting) and classroom speech (stressed) conditions. There were four resulting reactivity indices: mean arterial pressure, heart rate, systolic and diastolic blood pressure.

Table 11

Cardiovascular Measures During Baseline for Type A and B and for Men (N=30) and Women (N=56).

Physiological Measure	Baseline			
	Type A	Type B	Men	Women
MAP	92.4	96.5	99.9	90.27
Heart Rate	83.7	83.8	77.8	83.2
Systolic BP	122.7	126.8	132.4	117.8
Diastolic BP	70.7	75.6	77.4	70.4

Note. MAP = mean arterial pressure, BP = blood pressure. Blood pressure is expressed in mmHg, conductance in micromhos and heart rate in beats per minute.

Figure 7 shows mean blood pressure and heart rate reactivity scores (baseline to speech levels) for Type A, B and Mid-range scorers (between the 26th and 74th percentile on the JAS). Only physiological responses from the second baseline measurement session were used because first session readings are usually affected by the novelty of being tested and meeting the experimenter (see Andreassi, 1995). Readings taken at a second session yield more accurate physiological baseline measures.

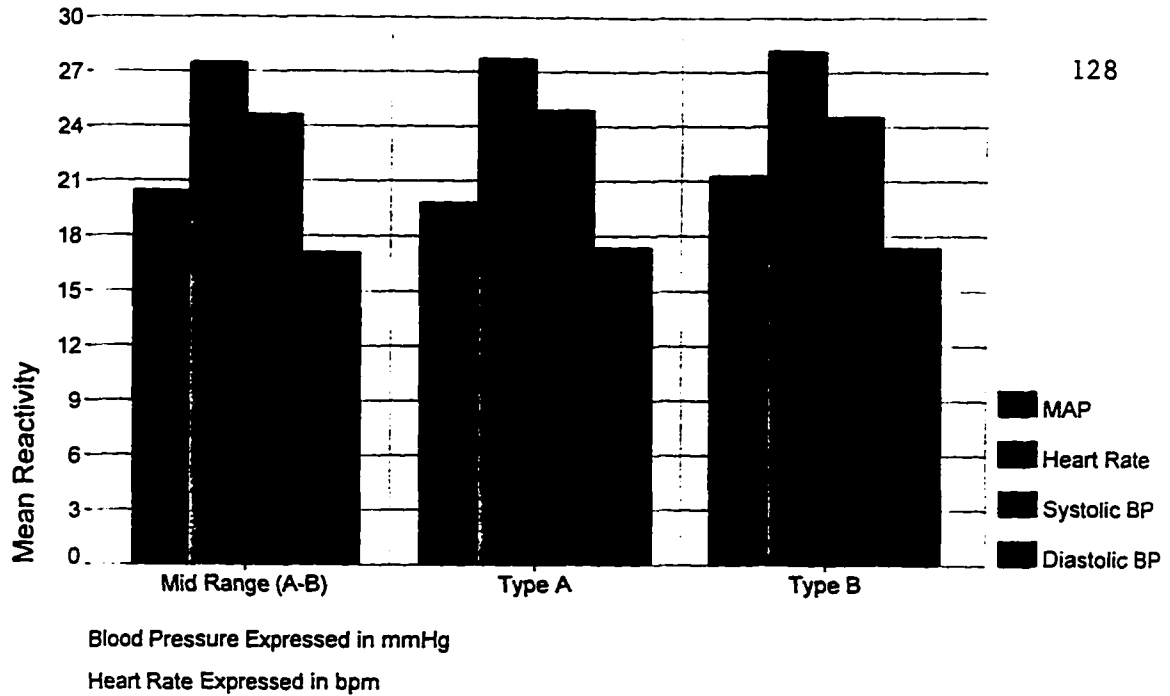


Figure 7. Reactivity to Class Presentation for Type A, B, and Mid-Range Scorers. Type A was determined by a score above the 74th percentile on the JAS, Type Bs scored below the 26th percentile and mid-range scorers were between the 26th and 74th percentiles on the JAS.

A MANOVA was performed to determine if the reactivity scores were significant, i.e., whether they differed significantly from zero. A resulting equivalent of Hotellings T square, $F(4,81) = 17.2$, $p < .001$, indicated significance. All univariate F tests for each of the four reactivity variables were also significant.

Correlational analyses were conducted to determine the degree to which various personality measures were related, see table 12. Since the global measure of Type A incorporates its components (speed and impatience, job involvement and hard driving/competitiveness) it was expected that these Type A subscales would be correlated with the global measure. Table 12 shows that global Type A was strongly correlated with speed and impatience, $r = .65$ and hard driving/competitiveness, $r = .42$. Hostility was not significantly correlated with the global type A measure, $r = .12$, however it was significantly correlated with all three of the Type A subscales. Job involvement was negatively correlated with hostility, $r = -.35$.

Table 12

Intercorrelations Between Scores on Global Type A, its Components and Hostility (N=86).

	Global A	SPIM	JI	HDC	Ho
Global A	1.00				
SPIM	.652 ***	1.00			
JI	.103	.015	1.00		
HDC	.420 ***	.100	.260 **	1.00	
Ho	.120	.271 **	-.351 ***	.212 *	1.00

Note. Global A is the overall type A score, SPIM is speed and impatience, JI is job involvement, HDC is hard driving and competitive, and Ho is hostility. P values are 2-tailed. * indicates significance at .05 level, ** at the .01 level and *** at the .001 level.

It was expected that certain personality measures, especially the global A measure and hostility, would be more predictive of reactivity than other personality characteristics. Correlations were run in order to analyze the relationships between personality variables and physiological changes in heart rate and blood pressure, table 13. None of the personality measures were significantly correlated with any of the reactivity scores.

Table 13

Intercorrelations Between Personality Measures and Reactivity During the Classroom Speech. N=86.

	Classroom Speech				
	Global A	SPIM	JI	HDC	Ho
MAP	-.092	.029	.031	.001	-.040
Heart rate	-.053	-.097	-.023	.001	-.087
Systolic BP	.058	.071	.078	.054	.104
Diastolic BP	.012	.072	.161	.061	-.028

Note. The four physiological variables above are change scores between task and baseline. MAP = mean arterial pressure.

Mean reactivity scores were computed for Type A, Type B, and mid-range scoring participants, table 14. A MANOVA was performed upon the three groups to determine if Type As mean reactivity scores were different than Type Bs. Also, it allowed for a comparison between Type A, B and Mid-range scorers. A Wilk's lambda, $F(4,81) = .961, p > .05$ indicated non-significance. All univariate tests were also clearly insignificant, see table 14. Differences in reactivity of those scoring high and low in hostility were analyzed to see if they reacted differently to the real-life stressor. A MANOVA was performed resulting in a Wilk's Lambda, $F(4,81) = .574, p > .05$, indicating non-significance. All univariate F statistics were also non-significant.

Table 14

Mean Cardiovascular Reactivity Scores for Type A (N= 27), B (N= 20) and Mid-Range Scorers (N=39) on the JAS and Univariate ANOVA for Differences Between Personality Types.

Physiological Measure	Mean Reactivity	Univariate F	ANOVA p
Mean Arterial pressure		.498	.609
A	19.8		
Mid	20.5		
B	21.3		
Heart Rate		.025	.974
A	27.7		
Mid	27.5		
B	28.1		
Systolic Blood pressure		.029	.971
A	24.9		
Mid	24.6		
B	24.5		
Diastolic Blood pressure		.028	.972
A	17.3		
Mid	17.1		
B	17.3		

Note. Units of measurement for Blood pressure are in mmHg. Heart rate is measured in beats per minute.

To determine if reactivity and personality differed between male and female participants, the data were partitioned by sex. The only reactivity difference that was noteworthy was for heart rate. Type A men had a 27.41 increase in heart rate, while Type B men increased 20.16 bpm. The relationship was the reverse for women; Type B women had greater increases in heart rate, 33.50 bpm compared to Type A women who had a 27.8 bpm increase. A MANOVA was performed for

each sex with reactivity measures as the dependent variable and Type A/B as the independent variable. For both sexes, the overall F and all univariate Fs were not significant. Thus within each sex, the change in heart rate, between Type A and Bs, was not significant.

Separate analyses for hostility and reactivity were conducted for men and women. For men scoring high in hostility, their MAP reactivity ($M = 23.78$) was greater than those scoring low ($M = 19.42$, $F(1,22) = 7.618$, $p < .01$). The same pattern was observed for diastolic blood pressure. The more hostile men had a mean increase of 20.86 mmHg for diastolic blood pressure, while low hostility men had mean increases of 17.17 mmHg, $F(1,22) = 3.49$, $p < .05$. For women, there were no significant differences in reactivity between those scoring low and high on the hostility scale.

Scores on various personality measures were compared between the sexes to determine if there were any differences. Means were strikingly similar between the sexes, and all univariate Fs were not significant for all measures: global Type A, speed and impatience, hard driving competitive, and hostility. The only differences between the sexes were in the intercorrelations of personality measures. Global Type A and hostility were not correlated in women, $r = -.02$ while for men they were significantly related, $r = .338$, $p < .05$. Overall, for men, hostility was moderately or marginally correlated with most of the Type A components: speed and impatience $r =$

.372, $p < .05$, job involvement, $r = -.39$, $p < .05$, hard driving competitive, $r = .279$, $p < .08$. For women the only correlation between hostility and Type A measures was for Job involvement, $r = -.337$, $p < .01$. For both men and women, hostility was negatively related to job involvement.

There were several apparent physiological differences between men and women, independent of personality, see figure 8. A MANOVA was conducted to test for differences in reactivity between the sexes. The differences between baseline and task levels of the four cardiovascular variables, heart rate, mean arterial pressure and blood pressure were entered as dependent variables. A Wilk's Lambda, $F(4, 81) = 3.88$, $p < .006$, indicated that the sexes differed in one or more of the reactivity indices. In particular, univariate F statistics showed that men and women differed in three out of the four reactivity indices, see table 15.

Table 15

Mean Reactivity and Differences Between Men (N=30) and Women (N=56) and Univariate Analysis of Variance.

Physiological Measure	Mean Reactivity			Univariate ANOVA	
	Men	Women	df	F	p
MAP	22.22	19.51	(1,84)	6.17	.015 *
Heart Rate	23.94	29.71	(1,84)	5.54	.021 *
Systolic BP	25.87	24.08	(1,84)	2.31	.132
Diastolic BP	19.36	16.14	(1,84)	9.49	.003 **

Note. Mean difference is difference between baseline and task levels. MAP = mean arterial pressure, BP = blood pressure. Significance tests are two-tailed. * = significance at the .05 alpha level, ** at the .01 level.

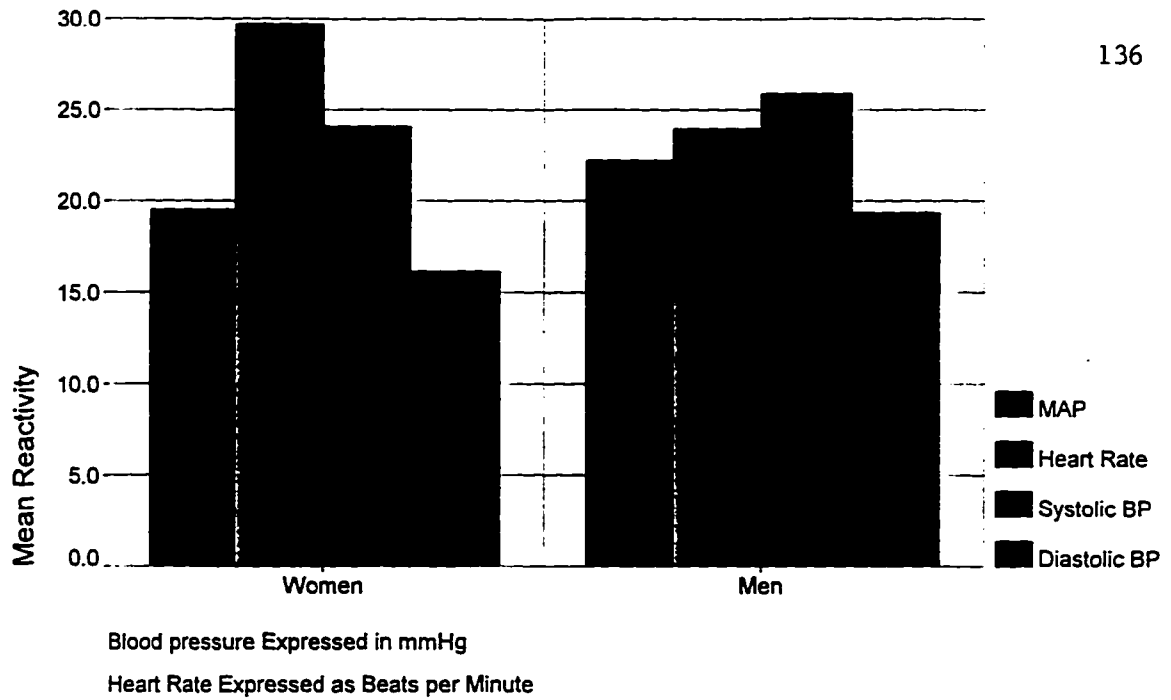


Figure 8. Reactivity to Class Presentation for Women (N=56) and Men (N=30).

Three other factors related to reactivity were analyzed: parental history (PH) of heart disease, smoking habits, and exercise. For men and women combined, 67% had no parental history of heart disease, 28% had one parent with heart disease and 5% had both parents. Parental history of heart disease was not related to any reactivity measures. Of the 86 participants in Experiment 2 12% stated that they smoked more than three cigarettes per day. Correlations between cigarette use and personality measures were all negative and non significant. The only significant correlation with reactivity was for heart rate, $r = .236$, $p < .01$. Exercise data were collected from all participants. A scale of 0-4 was used to code for exercise patterns within the last year. A zero indicated no exercise at all, a 1= occasionally walking out of one's way for exercise or occasional calisthenics (very light infrequent exercise), a 2 signified more regular light exercise, a 3 = regimented moderate exercise such as aerobics for 30 min 3 time a week, and a 4 = heavy, intense, exercise. Table 16 shows frequencies of exercise for the total sample and men and women separately.

Table 16

Exercise Frequencies for the Total Sample and Men and Women Separately.

Exercise Pattern	Frequency %		Frequency %		Frequency %	
	Total		Men		Women	
(0) None	39	45%	9	30%	30	54%
(1) V. Infrequent	15	17%	5	17%	10	18%
(2) Light	15	17%	6	20%	9	16%
(3) Moderate	8	9%	4	13%	4	7%
(4) Heavy	9	10%	6	20%	3	5%
	-----		-----		-----	
	N= 86		N= 30		N= 56	

Spearman correlations for non-parametric data were computed for men and women. For men, exercise did not correlate significantly with any reactivity outcomes, however, for all four reactivity measures, correlations were negative. The only sizable correlation to a reactivity measure was for heart rate, $r(S) = -.288$, $p < .062$. For women, exercise was correlated with global Type A, $r(S) = .238$, $p < .05$. For hostility, the correlation of $-.13$ was not significant. The only reactivity measure which was correlated with exercise in women was systolic BP, $r(S) = -.265$, $p < .05$. For both sexes, all reactivity measures were negatively correlated with exercise, although only systolic BP was significant, for women.

Discussion

The results of Experiments 1 and 2 have many implications not only relevant to the hypotheses presented in the introduction, but to several of the issues regarding personality, gender and stress. The most basic model involving these variables states that certain personality types are more physiologically reactive to various stressful situations. Currently, this model has not been satisfactorily tested with women because most studies have only included men in their samples, or the sample sizes of women have been small. Experiments 1 and 2 were designed to address several hypotheses derived from the basic model.

Experiment 1

Hypothesis one stated that Type A women would demonstrate greater cardiovascular reactivity than Type B women for both RT and the oral IQ quiz. Results were supportive of this hypothesis for both stressors/tasks. During reaction time, systolic blood pressure changes were greater for Type A women. During the oral IQ quiz, mean arterial pressure and systolic blood pressure were greater for Type As. Although Type A and B women did not react significantly differently in some of the physiological variables, such as heart rate, Type A women had higher reactivity scores for all five reactivity measures for both reaction time and the quiz.

An important aspect of the results for Type A women was

that they were more reactive to both tasks, rather than only one. In several previous studies, failures to find greater reactivity in Type A women were sometimes attributed to task irrelevancy. That is, that the task was not stressful to the women because it was not important to them as women or as Type As, and thus Type As did not have greater reactivity. In Experiment 1, the nature of the two conditions/tasks were quite different. The reaction time (RT) task required speed, vigilance and motor skill while the oral IQ quiz required broad knowledge and the ability to respond verbally in a quick fashion. Additionally, the RT task involved a minimum of interaction with the experimenter while the oral IQ quiz required a participant to tell the experimenter the often incorrect answer to a difficult question. The IQ quiz provided more opportunities for interpersonal tension and embarrassment since it involved far more social interaction than the RT task. Overall, the oral IQ quiz provided more possible stressors than RT, and many of the sources of stress were interpersonal.

An important characteristic of both tasks in Experiment 1 was that they included a monetary incentive for high performance, i.e., a \$50. prize for the best combined quiz and RT score. Many other investigations using RT did not use an incentive. Previous research has indicated that the incentive factor weighs heavily in determining if a task will result in reactivity (Fowles, 1983). Differences in results between

this study and previous ones without incentives, which failed to show reactivity to RT, may be reconciled by the fact that there was an incentive in the present study that may have influenced reactivity.

Although hypothesis one predicted that Type A women would demonstrate greater reactivity for both heart rate and blood pressure, most empirical studies have found that women show reactivity for only heart rate and not blood pressure (e.g., Lawler and Schmeid, 1986). The results of Experiment 1 were not in accord with this finding since for both the oral IQ quiz and reaction time, there were no heart rate differences between Type A and B women. In addition, Type A women demonstrated heightened reactivity for systolic blood pressure and mean arterial pressure. Although few studies have shown greater systolic blood pressure reactivity in Type A women (Lawler et al., 1990), Experiment 1 and an experiment involving a real-life statistics midterm stressor (Lawler, et al., 1989) demonstrated greater systolic reactivity in Type A women. It has been suggested that researchers select women with resting systolic blood pressure at 116-117 mmHg or greater in order to equate men and women in this resting level (Lawler et al., 1990). In Experiment 1, the resting level of systolic blood pressure for women was 104.5 (Type A) and 110.8 (Type B), yet for both tasks, Type A women were more reactive. These results with women at such levels of resting systolic blood pressure indicates that a selection of women with 116-

117 mmHg or greater systolic blood pressure may be unnecessary.

Hypothesis two stated that research participants would demonstrate greater reactivity to the oral quiz, than the reaction time task. This was supported by the results indicating that for mean arterial pressure, systolic blood pressure (BP), diastolic BP and skin conductance, the women were indeed more reactive to the oral IQ quiz than the RT task. Significance remained after re-testing with the Bonferroni correction.

It was expected that Type A women would be more reactive to the Oral IQ quiz than the reaction time task because it contains more stressful elements, particularly sources of interpersonal tension, which are more relevant to Type As and possibly more relevant to women. The literature on Type A women indicates that the RT task does not consistently elicit greater reactivity in Type A women (MacDougall, Dembroski and Krantz, 1981; Lawler, Huck and Smalley, 1989). One pattern observed across the literature is that Type A women rarely demonstrate greater reactivity to psychomotor and mental arithmetic tasks (Harbin, 1989), yet they have shown reactivity more consistently to the interpersonally challenging situations such as the Structured Interview. It is possible that some tasks may not be meaningful and thus truly challenging to women (Thoresen and Low, 1990). More specifically, tasks which include some interpersonal element

of challenge may be more salient to women (Girdler, Turner, Sherwood and Light, 1990). Thus the Oral IQ quiz may have been more challenging and correspondingly stressful to the women because it entailed more sources of interpersonal stress than the RT task.

Women have been found to appraise certain interpersonal situations and challenges as more stressful than men do. Such situations involve the possibility of victimization, a challenge to their nurturing ability, behaving too assertively, or an evaluation of their physical appearance (Gillespie and Eisler, 1992). These are all interpersonal challenges as opposed to many of the "personal performance" challenges such as cognitive achievement, psychomotor skill and physical endurance, which are more salient to men (Lash et al., 1991). Blood pressure differences were found between men and women in response to a cold pressor task only when the instructions for the task were worded to invoke stereotypical male challenges to physical fitness (Lash, et al., 1991). In a study involving an interpersonal speech task, women displayed greater cardiac output than men (Girdler, Turner, Sherwood and Light, 1990). These findings led the authors to conclude that reactivity differences between the sexes "... may be indicative of a greater degree of stress induced by the interpersonal speech task..." (Girdler et al., p.588, 1990). In another study, men and women expressed their belief that an interpersonal speech task required "feminine" attributes, such

as emotionality, submissiveness and empathy, for good performance (Stoney, Matthews, McDonald, and Johnson, 1988). In contrast to the oral IQ quiz, RT is less interpersonal and it challenges physical abilities, which may be more relevant to the stereotypical male (Eisler and Skidmore, 1987).

Although the IQ quiz includes more interpersonal challenges and there is some evidence in the literature that women are more reactive to interpersonal challenges, the design of Experiment 1 does not allow for a conclusion that the IQ quiz was more salient to women due to its greater gender relevancy. There were no male research participants in Experiment 1 who could have served as a basis of comparison of reactivity between the sexes. It is possible that men would have also been more reactive to the oral IQ quiz than the RT task. Also, it has not been clearly established that the IQ quiz is truly more relevant to women, it has only been indirectly inferred. The literature points out that the element of interpersonal challenge is relevant to Type A individuals, particularly their more hostile and competitive aspects. So the greater reactivity demonstrated by women to the IQ task may have been due to the task being "Type A relevant" rather than gender relevant. The design of Experiment 1 does allow for this possible explanation of the results.

The two tasks differed in ways beyond the interpersonal dimensions. The tasks posed threats to different personal

abilities. The oral IQ task strongly threatened a research participant's sense of mental competency or intelligence, while the RT task posed a "threat" to one's sense of psychomotor speed. It is possible that college students would more strongly value their intelligence rather than their reaction time on some esoteric task. Thus the IQ quiz may have threatened a more relevant personal attribute than the RT task, and thus greater reactivity may have been due to a more relevant threat rather than Type A or gender relevance.

To conclude, the IQ quiz is different from the RT task on several important dimensions; possible gender relevance, Type A relevance and the personal ability which it threatens. Given the design of the experiment, the most warranted explanation for the greater reactivity to the IQ quiz was that it includes more stressful elements, particularly interpersonal challenges, which are more relevant to Type A individuals.

Hypothesis three stated that Type A women would demonstrate greater changes in skin conductance than Type Bs for both the reaction time and oral IQ quiz tasks. Results were not supportive for either task. Examination of the skin conductance effect sizes and the greater reactivity of Type As indicates that SC may have been affected by the oral IQ Quiz (table 6). Given the relatively small sample size and the overly conservative nature of the Bonferroni correction used, it is possible that truly significant reactivity differences

between As and Bs were masked. So far, there are extremely few studies involving women's skin conductance reactivity to stress. In a review, (Lawler et al., 1990) one investigation reported that Type A women had greater skin conductance reactivity than Type Bs (Ketterer et al., 1982). Results for Experiment 1 support the notion that women can demonstrate skin conductance (SC) reactivity for various tasks, however differences in SC reactivity between As and Bs have not been firmly established.

Overall, the results with Type A women can help to establish a literature base covering personality and reactivity to challenge in women. It has been suggested that studies include a more broad range of ages, particularly beyond the typical 18-22 range. The sample of women who participated in Experiment 1 ranged in age from 17 to 48. The average participant was 25 years old, and 54% were older than 22. Lawler et al. (1990), observed that few studies have found a clear relationship between Type A college aged women and greater reactivity, especially with blood pressure. This lack has led some (e.g., Matthews and Woodall, 1988; Harbin, 1989) to conclude that Type A women do not show enhanced cardiovascular reactivity to stressors (1990). Experiment 1 demonstrated that in a sample of 64 women, over half of whom were older than 22, Type A women were more reactive to stressors, and, in particular, that blood pressure reactivity was higher in Type A women.

The literature on personality and reactivity to stress has recently supported the notion that hostility may be a better predictor of reactivity to stress than the global Type A measure or any of its individual components. So far, there are very few empirical studies involving the relationship between women scoring high in hostility, and coronary heart disease (Suarez, Harlan, Peoples and Williams, 1993). Several failed to find an association between hostility and reactivity for either sex (e.g. Sallis et al., 1987; Hardy and Smith, 1988; Suarez and Williams, 1989). Often the negative results were attributed to the inappropriateness of the stressor because it did not include a meaningful element of "interpersonal struggle" or tension between people. Both tasks in Experiment 1 had an element of competition since participants were informed that their scores were being compared to those of the other subjects and that they could win a \$50.00 cash prize for having the best combined RT and quiz scores.

Hypothesis five predicted that women who scored high on the Hostility scale would demonstrate greater reactivity to both RT and the Quiz, than those who scored low. Results supported this hypothesis in terms of greater systolic BP, and diastolic BP reactivity for the RT task, and greater MAP and diastolic BP reactivity for the IQ quiz for women who scored above the 50th percentile in hostility. These results are consistent with those reported in an investigation involving

blood pressure reactivity to an anagram task, in women and men varying in hostility (Weidner et al., 1989). For both sexes, those scoring high in hostility showed greater increases in systolic and diastolic BP, than those scoring low in hostility. It was noted that the 'anagram task was probably relevant to hostile individuals since participants were told that they were easy to solve, yet they were actually unsolvable. The misleading information "... may have aroused suspiciousness and mistrust, especially among those subjects scoring high on the Ho scale." (Weidner et al., 1989). Hypothesis four stated that women scoring high in hostility would show greater skin conductance reactivity for both tasks. Results from RT and the oral quiz were not supportive.

Overall, it appeared that the oral IQ quiz was an appropriate task for eliciting greater cardiovascular reactivity in those scoring high in hostility, perhaps due to the interpersonal tension inherent in the task. Interpersonal tension was generated by emphasizing the fact that the participant's score (and in a sense her IQ) was being compared to all the other participants'. The participant's apparent knowledge was tested and often shown to be "lacking" in front of the experimenter. The questions were of sufficient difficulty to result in an average correct score of only 7 out of 35 (15 was the high score). Thus, the participants gave the wrong answer most of the time. Upon hearing the correct answer within 2-5 second after their answer, they frequently

expressed frustration or embarrassment upon hearing that they were wrong. This was indicated by nervous laughter, sighing, exclamations (sometimes self-deprecating), occasional swearing, foot tapping or stomping and complaints about the difficulty of the items. After the quiz, participants often expressed that they performed poorly, or worse than the others. They often stated that they "must have looked stupid" to the experimenter. Given the reactions of the participants, it appears likely that the IQ quiz can be characterized as an interpersonal stressor because of the embarrassment and frustration experienced during poor performance in the presence of the experimenter.

Currently, the efficacy of various components of the Type A personality in predicting reactivity and coronary heart disease (CHD) is uncertain in the stress literature. It seems as if the global Type A measure and hostility are those most frequently correlated with heightened reactivity to stress. However, a few researchers have emphasized irritability and impatience (Ohman, Nordby, and Svebak, 1989) or competitiveness as being more strongly associated with enhanced reactivity. Results from Experiment 1 can add more to the literature on this so called "components issue." Correlations between the Type A components and reactivity outcomes indicated that for the reaction time task, speed and impatience was most strongly related, with global Type A coming in a close second and hostility being correlated to

only one reactivity outcome. For the oral IQ quiz, the Global Type A measure was most highly correlated with reactivity. Hard driving competitiveness and speed and impatience more or less tied as second most predictive. Hostility was not significantly correlated with the quiz. However, comparisons of reactivity between low and high hostility women indicated that this component of Type A is a useful predictor of blood pressure reactivity.

Judging from the correlations, Global A and Speed and Impatience were the best predictors of reactivity across both tasks and hard driving and competitiveness was fairly predictive for the oral IQ quiz. Job involvement was unrelated and hostility was weakly related to reactivity. As mentioned in the results, scores for job involvement were atypically low compared to the standards designated in the Jenkins Activity Survey scoring form. Also the standard deviation was small. In terms of range, very few participants scored high on job involvement. It is difficult to determine if a restriction in range and low variance contributed to the failure of job involvement to be associated with reactivity, although it is a possibility.

Other inferential analyses with the components of Type A showed that participants who differed in speed and impatience (SPIM) only reacted in terms of diastolic blood pressure for both tasks and in mean arterial pressure for the IQ quiz. A problem with this analysis was that it was impossible to

divide the participants into high and low quartiles of speed and impatience and retain a sample size of 32 per group (as was possible with the Type A analysis). It is suspected that a small sample size attenuated the power of the analyses and thus reduced the chance of attaining statistical significance. The small sample size might explain why significance tests resulted in weaker relationships between reactivity and SPIM than the correlations hinted at.

Overall, the results for the components of Type A were fairly consistent with a meta-analysis of the Type A coronary heart disease empirical literature (Booth-Kewley and Friedman, 1987). What is interesting is that the results in Experiment 1 are between personality and reactivity while the meta-analysis is between personality and disease outcomes. Also, the meta-analysis included studies mostly based on male participants. The fact that the results of the meta-analysis corresponded well with the results of study one which had tested only women, supports the idea that Type A personality characterizes reactivity in both men and women. The meta-analysis found job involvement to be entirely unrelated to coronary heart disease and speed and impatience weakly yet consistently related. Also hostility and Type A as classified by the Structured Interview, were most associated with disease outcomes. As a result of the meta-analysis, it was concluded that the hostility component was one of the best predictors of heart disease, and that speed and impatience and job

involvement are less important aspects of the Type A personality.

Experiment 2

The primary goal of Experiment 2 was to investigate the relationship between personality and cardiovascular reactivity to a real-life stressor in men and women. The results of Experiment 2 have many implications for the association between personality, reactivity and gender.

Hypothesis six predicted that Type A men and women would demonstrate greater cardiovascular reactivity to the classroom presentation than Type Bs. Hypothesis seven predicted greater CVR in men and women scoring high in hostility. The results did not support either hypothesis. An unexpected finding was that the magnitude of the reactivity observed for all physiological measures was very large: for men and women; Type As and Bs; and hostile and non-hostile participants. For some individuals, observed physiological changes were extraordinarily high; systolic blood pressure increased by as much as 42.0 mmHg, MAP by 34.2 mmHg, diastolic pressure by 30.6 mmHg, and heart rate increased by 60.3 bpm. The average increases were 24.7 for systolic, 20.5 for MAP, 17.2 for diastolic and 27.7 bpm for heart rate. Such increases are notably high in comparison to mean increases of 11.8 mmHg systolic, 7.7 mmHg diastolic pressure, and 9.65 bpm for heart rate culled by the writer from 21 published studies (between

1978 and 1991) in order to generate a general standard for comparison.

Clearly, the magnitude of cardiovascular reactivity and the absolute levels of heart rate and blood pressure were atypically large as compared to other reactivity outcomes to psychological stress in previous studies. This great magnitude of reactivity might have attenuated the personality/reactivity effect. The classroom speech, having real consequences such as the possibility of embarrassment in front of one's peers and a graded evaluation of the speech by the professor, may have been intense enough to overpower more subtle contributions to reactivity such as personality type. In effect, it seems that most personality differences, except hostility in men, were masked or overcome by the overall very high reactivity to the stressor.

Although research has shown that Type A and hostile individuals often react relatively more than Type Bs and low hostile individuals, it does not mean that Type As and more hostile individuals will react to a situation a Type B and low hostile person will not react to at all. The personality effect is often relative, not absolute. Given an extremely stressful situation, Type As and Bs may demonstrate equally high cardiovascular reactivity. If they have reacted to a level where their physiological limits have been met, then there will be little or no room for personality factors to operate. Given the great magnitude of reactivity measures

from the classroom presentation, it is suspected that this situation may have indeed resulted in physiological limits being reached (a ceiling effect) and thus no differences between personality types could be observed.

Hypothesis seven stated that higher scores on the Cook-Medley hostility scale (Ho) would be associated (correlated) with higher cardiovascular reactivity for both genders on the speech task. Separate analyses for hostility's effect upon reactivity were conducted for men and women. The results of Experiment 2 were partly supportive. For women, there were no reactivity differences between high and low hostility participants, yet for men there were some effects. Both mean arterial pressure and diastolic blood pressure reactivity were significantly greater for more hostile men. Thus, the hostility measure seemed to have survived the effect of extreme reactivity that may have affected other personality measures, at least for the men.

There are few investigations which involve extremely stressful situations and address the issue of stressor intensity. However, it is generally acknowledged that the type of stressor which is best at demonstrating Type A/B differences in reactivity is one with a moderate degree of difficulty/intensity, and a moderate incentive to do well (Houston, 1983). In the case of the classroom speech, the grade on the speech was a real incentive, which probably carried considerable weight, especially compared to many

laboratory studies with incentives having little meaning outside of the laboratory. The real pressure of being scrutinized by the class and the professor was also probably more salient to the participants than most laboratory tasks/trials.

Differences in reactivity were observed between men and women. For example, women's heart rate increased more than for men by a mean difference of 5.7 bpm (29.7 bpm versus 23.9 bpm). Also, men demonstrated greater increases in mean arterial pressure (22.2 mmHg) and diastolic blood pressure (19.3 mmHg) compared to women (19.5 mmHg, diastolic 16.1 mmHg). Such differences tend to be consistent with sex differences found in the cardiovascular reactivity literature. In response to a modified version of the Stroop color word test, women demonstrated greater heart rate reactivity (12 bpm) compared to men (6 bpm) (Collins and Frankenhaeuser, 1978). Rather consistently, women demonstrate greater changes in heart rate than men in response to various stressors (Hastrup and Light, 1984; Stoney, Davis, and Matthews, 1987; Weidner, Friend, Ficarrotto and Mendell, 1989; Girdler, Turner, Sherwood and Light, 1990). Contrary to typical findings, men were not more reactive than women in terms of systolic blood pressure. However, men were more reactive in terms of mean arterial pressure, which includes systolic blood pressure as a component. Since both men and women had very high increases in systolic BP (25.8 mmHg and 24.0 mmHg), it is

possible that there was a ceiling effect such that both sexes had reached a maximal limit and differences could not be observed. There is evidence that differences in the hormonal levels between men and women can partly account for differences in cardiac versus vascular reactivity. Before explaining the effects of hormonal differences, a description of the biochemical physiology of the stress response may be helpful.

There are several pathways describing the biochemical response to stress. One such pathway follows this causal route: a stressor is cognitively realized-- the hypothalamus is stimulated-- it then stimulates the pituitary gland-- which then affects the adrenal medulla-- the medulla then secretes the catecholamines epinephrine and norepinephrine into the blood stream-- these catecholamines affect peripheral (vascular) resistance and cardiac performance. Blood pressure is affected by vascular resistance. Epinephrine excretion results from reactivity to psychological (as opposed to physical) stressors. In response to laboratory stressors, results have consistently indicated that men show greater levels of urinary excretion of epinephrine than women (Barnett, Biener and Baruch, 1987). Also, women have higher levels of estrogen which reduces the rate of catecholamine excretion and lowers vascular resistance (Saab, Matthews, Stoney, and McDonald, 1989). Finally, differences in peripheral alpha- and beta-adrenergic receptors may account

for differences in blood pressure reactivity, since women may have a lesser concentration and/or less sensitivity of both receptors (Freedman, Sabharwal and Desai, 1987 in Girdler et al., 1990). These beta and alpha adrenergic receptors ultimately regulate the magnitude of cardiovascular reactivity through stimulating vasodilation and vasoconstriction of blood vessels. In sum, men and women differ hormonally in their levels of estrogen, and estrogen can, at least indirectly, lower blood pressure reactivity. Thus, greater increases in mean arterial pressure and diastolic BP in men during the classroom speech may have been due to hormonal differences between the sexes.

Besides differences in blood pressure, men and women differed in terms of heart rate to the classroom speech. Again, the finding that women had greater heart rate increases than men was consistent with the findings of previous studies. Such differences may be explained by biochemical differences. It has been proposed that women show greater heart rate reactivity due to decreased vagal activity, i.e., decreased parasympathetic dampening of heart rate (Collins and Frankenhaeuser, 1978). Also the use of oral contraceptives may affect cardiovascular reactivity (Barnett, Biener and Baruch, 1987; Girdler, Turner, Sherwood and Light, 1990). However, in Experiment 2, only eight women of 56, reported that they were currently using oral contraceptives. Additionally, estrogen may lead to increased stroke volume and

cardiac output. This is related to heart rate because stroke volume \times heart rate = cardiac output. Thus, if HR increases, so does cardiac output, as long as stroke volume remains the same. Overall, it appears as if biochemical differences between the sexes may have resulted in differences in reactivity. The results of previous investigations involving biochemical differences are supportive of the possibility that such factors influenced the observed gender differences in the current study. However, these factors, namely estrogen and catecholamine levels, were not measured in Experiment 2, so their effects here are uncertain.

For the men in Experiment 2, there were no significant correlations between exercise levels and reactivity. However, all reactivity measures for men were negatively correlated with exercise levels. Previous investigations indicated that men who exercised, either recently or regularly, were less reactive to a mental arithmetic task (Houston, Smith and Cates, 1989; Roy and Steptoe, 1991). Regular exercise may help buffer an individual psychologically against stress through a generalization of "exercise-related self-efficacy to other situations, leading to elevations in self-control and coping ability" (Roy and Steptoe, p. 689, 1991). Given the relatively small sample size, and small number of men who regularly exercised in the sample, it may be best to withhold any judgment regarding the exercise/reactivity relationship for men.

For the women in Experiment 2, significantly negative correlations were observed between exercise and systolic blood pressure. As with men, exercise was negatively correlated to all four reactivity outcomes for women. There is some consistency with the negative correlations between exercise and reactivity in women (in Experiment 2) and the negative correlations between exercise and reactivity for men in the literature. This points to a somewhat emerging theme, that women are very similar to men in terms of reactivity to stress and the factors that moderate it. A good proportion of the participants in Experiment 2 did not exercise regularly at all (72% of the women and 47% of the men). This may have restricted the range of scores in varying exercise levels and thus reduced the power in any analyses involving exercise and other variables.

Possible Limitations

The law of initial values (LIV) sometimes affects results in reactivity research. If one group has higher baseline levels in some cardiovascular measure, such as blood pressure, then that group's blood pressure reactivity might be attenuated because it was already elevated at baseline. Significance tests were performed to determine if Type A and B women had different baseline levels in the physiological measures. The only significant difference was for systolic blood pressure (Type A $M=104.5$, Type B $M=110.7$) $t(64) = 2.32$, $p < .05$. The possibility of an effect due to the LIV was

tested by running correlations between baseline and reactivity for the participants as a whole, and separately for As and Bs. Significant negative correlations, particularly within the subgroups would indicate that the LIV had some effect. Although several correlations were negative, none were significant, thus it is concluded that the LIV did not have an effect upon reactivity outcomes. Correlations between baselines and reactivity were run for Experiment 2. There were no significant negative correlations between baseline and reactivity for men and women as separate groups and for the sample as a whole. The LIV did not seem to affect results in Experiments 1 or 2.

Both experiments were designed to specifically analyze extremes in Type A. Analyses involving components other than Type A could not take advantage of the use of upper and lower quartile groups with 32 participants in a group. This may have led to otherwise significant results being weakened by reduced power stemming from either an inadequate sample size or a median splitting of the data rather than a quartile split. Such was the case for the analysis of speed and impatience differences. Other analyses were probably limited in power due to small sample sizes. Several of the analyses involving men, in Experiment 2, were possibly not as robust as desired because there were only 30 men in the sample. Also, few participants had parents with a history of heart disease (PH), thus analyses of PH were limited. Likewise,

supplementary analyses were limited by the fact that few participants smoked or exercised frequently.

Typically those who score high on the JAS Type A scale have high scores on the Ho hostility scale. This is usually demonstrated in moderately positive correlations. For Experiment 1 with women, this relationship between hostility and TABP was apparent, however it was not for the women in Experiment 2. The reasons for this discrepancy are unclear. For men, as expected, high hostility scores were associated with higher Type A scores. It is notable that hostility was related to greater reactivity for women in Experiment 1 and for men in Experiment 2, yet not for women in Experiment 2. These women did not have the typical positive correlations between Ho and TABP. Maybe there is some connection.

Although all physiological changes were greater for the classroom presentation than the oral IQ quiz and reaction time tasks, definitive conclusions regarding the factors responsible for reactivity differences between Experiments 1 and 2 can not be made. These experiments used different samples of research participants. However, given the extreme differences in reactivity between studies, it seems justifiable to pose some possible reasons for such differences. Arguably, the primary difference between Experiments 1 and 2 was that the stressors in Experiment 1 were laboratory based, and relatively artificial, whereas the classroom presentation in Experiment 2 was a real-life

stressor. Greater reactivity in Experiment 2 may have been due to greater stressfulness of the task, which unlike the tasks in Experiment 1, carried real consequences for the participants. Meaningful real-life tasks may be more stressful, and thus lead to greater reactivity, especially for women (Frankenhaeuser et al., 1978; Lawler, Huck and Smalley, 1989; Girdler, Turner, Sherwood and Light, 1990). It would be interesting to compare reactivity measures between laboratory and real-life tasks within the same subjects, in order to test the notion that real-life tasks are more stressful, and thus induce greater physiological changes.

Conclusions

Generalizations beyond typical samples

Given the results of Experiments 1 and 2, several conclusions can be drawn regarding personality, physiological reactivity to stress and gender. A general conclusion that women are more similar, than different, to men in their reactions to stress can be made. Although many previous studies concluded that women are different from men in their reactions to stressors and in the relevance of Type A and hostile personalities to their reactivity, the results of Experiments 1 and 2 indicate otherwise. Previous research has shown that Type A men are more reactive to various stressors than Type B men. Furthermore, previous reviews have asserted

that Type A women are not characterized by greater reactivity to stressors (Harbin, 1989). Results from two different tasks (RT and an Oral IQ Quiz) in Experiment 1, demonstrated that Type A women are indeed more reactive to stressors in terms of MAP, systolic BP and diastolic BP. The same can be said for hostility in that more hostile women were more reactive to both tasks in Experiment 1. Previous research has frequently concluded that women react in terms of heart rate yet often not in terms of blood pressure, as men often do. Experiment 1 demonstrated that women react in terms of both systolic and diastolic blood pressure. In Experiment 2, women showed highly elevated levels of systolic and diastolic BP during the real-life stressor. Thus it appears that at least for these three tasks, one more independent and solitary, one more interpersonal, and one interpersonal and real in its consequences, women react as men: blood pressure increases during exposure to a stressful situation and Type A and hostility are also related to reactivity.

Other similarities between men and women were demonstrated. In Experiment 2, both exhibited high magnitudes of reactivity to the real-life stressor and they both had nearly identical scores on all personality measures; global Type A, speed and impatience, hard-driving competitiveness, job involvement, and hostility. Although both men and women demonstrated unusually high magnitudes of cardiac and vascular reactivity, they differed in that men were more reactive in

mean arterial pressure and diastolic blood pressure while women were more reactive in heart rate. This finding, consistent with most previous studies, indicates that men were greater vascular reactors while women were cardiac reactors. However, unlike many previous findings, these differences were relative, not absolute, since men and women demonstrated high degrees of both vascular and cardiac reactivity.

Several previous studies have questioned the generalizability of the Type A construct and hostility to various ethnic groups, women, and people older than 24. The sample used in Experiment 1 consisted of an atypically wide range of ethnicities (31% White, 29% Hispanic, 28% Black, 12% Asian) and ages (17-48, $M=24.6$) in women. The sample for Experiment 2 was equally diverse. The results supporting the notion that Type As and more hostile women are physiologically reactive, can be more easily generalized to the diverse population at large.

Task relevance and gender

Across reactivity investigations, the types of stressors or tasks used have varied considerably. Some tasks are solitary, imposing only motor or cognitive challenges. Other solitary tasks require speed, vigilance, or the ability to resist physical discomfort. There are also non-solitary stressors/tasks which include elements of interpersonal competition, tension and challenge. Current theory and

empirical evidence suggests that certain tasks and stressors are more salient to certain personality types. In addition, certain tasks may be more challenging/stressful for men or women. In the stress literature, a failure to find reactivity in women or differences in the reactivity between Type A and B women has been attributed to the idea that the task was not relevant to women. For example, a relatively consistent finding is that women are not reactive to the cold pressor test, which demands a more "masculine" ability to tolerate discomfort. The degree to which a task contains interpersonal stressors may be an important factor in the task's salience to women.

Results of both Experiments 1 and 2 demonstrated that women were reactive to three different stressors, widely varying in degrees of interpersonal contact. A review of the stress literature for women concluded that the "interpersonal vs. task distinction so frequently drawn" is not supported by the many studies with varying tasks which have all shown Type A/B differences (Lawler, Schmeid, Armstead and Lacy, p. 140, 1990). Results of Experiments 1 and 2, demonstrating reactivity in women for all three tasks, with a differentiation of reactivity between Type A and Bs in Experiment 1, are consistent with the observation by Lawler et al. (1990). In conclusion, it appears that the interpersonal nature of a task is not a necessary factor in eliciting reactivity in women. However, given the result that women

were more reactive to the oral IQ task than the less interpersonal RT task, perhaps interpersonal tasks are more salient to women.

The components issue

With regard to the importance of various components of the Type A personality, several conclusions can be made. It appears that the global Type A measure was the best predictor of reactivity and hostility was second best. Job involvement seems to be an unimportant factor and hard driving competitiveness may only be weakly related. Speed and impatience has potential as a good predictor of reactivity, particularly for RT, yet the design of the experiments and the limited results preclude any firm conclusions regarding this component. In conclusion, the global Type A score and the hostility measure were better predictors of reactivity than the other Type A components.

It is possible that the global Type A measure is a better predictor because it accounts for several characteristics rather than only one. A single component might not be relevant to the situation/stressor at hand. For example, a non-competitive, solitary, RT task would probably not evoke greater reactivity in an individual high in competitiveness, yet for someone with a high global A score, other, more relevant characteristics, such as hard driving and speed and impatience may be accounted for. Overall, the global Type A

measure contains more personality factors, so it is more likely to tap a task relevant factor than a more limited instrument. On the other hand, an individual component, such as speed and impatience, might be a better predictor than the global measure for a task which is particularly relevant to impatient individuals. Since many tasks/stressors have characteristics which are relevant to more than one component, the global Type A, which is a composite of components, is a more appropriate predictor. The oral IQ quiz in Experiment 1 was such a task. It included elements of interpersonal tension, speed, mental challenge, competition and achievement evaluation. Given that stressors of everyday life, particularly those on the job, are complex, that is, having characteristics which are relevant to several components, the global Type A measure may be a good predictor of reactivity. Given the results of Experiment 1, and the fact that many laboratory and real-life stressors are at least in part interpersonal, hostility may also be a predictor of hyper-reactivity. It is important to note that these conclusions are based upon samples of Jenkins Activity Survey that fall in at least the upper and lower quartiles. Many previous investigations of the Type A behavior pattern did not partition the participants in this manner.

Real-life Stress on the Job

Another topic that can be addressed, given the results of

Experiments 1 and 2, is that of possible effects of job stress. A frequently stated criticism of the application of reactivity findings from the laboratory to the workplace is that results might not generalize to real-life situations. Workplace stressors involve real-life consequences which can affect the worker in the long term, whereas laboratory stressors rarely have any significant consequences after the experiment is over. Experiment 2 demonstrated that not only can a real-life stressor generate physiological reactivity, but that such changes may be of a greater magnitude than those found in most laboratory studies. The cardiovascular reactivity (CVR) literature posits that the increased intensity of CVR, particularly among those who hyperreact, causes greater damage to the cardiovascular system, and thus increases the risk of developing coronary heart disease (CHD). Measures of CVR such as systolic blood pressure, heart rate and diastolic blood pressure were associated with the development of atherosclerosis (Clarksin, Manuck and Kaplan (1986). Also, symptoms of coronary artery disease, such as dysrhythmia, angina pectoris and myocardial infarction have been associated with cardiovascular reactivity. As a result of CVR, atherosclerotic plaque forming lipids are elevated (Contrada, Leventhal and O'Leary, 1992) and increased catecholamines raise blood pressure, which, when chronic, can desensitize blood pressure regulating receptors (Bertel, Buhler, Kiowski, & Lutold, 1980). These results of CVR;

increased BP, lipid level increases, and desensitizing of BP regulating receptors, are associated with atherosclerosis and CHD. Experiment 2 showed an extraordinarily high increase in CVR to real-life stress. Such results should lend support towards emphasizing the importance of dealing with stress in the workplace. The evaluations and implementation of stress management programs should be of greater concern to managers who value the health and well-being of their employees, given the extent of physiological changes which can arise from a real stressor and the suggestive connection between these changes and CHD.

With regard to women and reactivity in the workplace, Experiments 1 and 2 demonstrated that women react very similarly to men. As more women enter the workforce and adopt roles which were once male-dominated, they will probably face stressors which women did not traditionally have to encounter. Also stressors more salient to some women such as role conflict (Frankenhaeuser, 1991) may become more important within the "feminizing" workforce. There is evidence that women who adopt traditionally male work roles will physiologically react to stress in a manner similar to men (Collins and Frankenhaeuser, 1978). Later research led Frankenhaeuser to note that "... sex differences have decreased markedly-an increasing proportion of women are reacting to achievement demands as strongly as men." (p. 197, 1991).

Results of both Experiments 1 and 2 demonstrate that women react similarly to men, and results from Experiment 2 indicate that they react with the same, or even greater, potentially health-threatening intensity as men. The findings in the literature and within these two experiments underscore an increasing need to monitor and manage stress in women, as well as men, within organizations.

APPENDIX 1)

Psychophysiology Laboratory
Department of Psychology
Baruch College, CUNY

Physiological Assessment Data

Research Participant's name _____

Assessment date _____ Time _____

Age _____

History of heart disease, respiratory problems, or high blood pressure

Mother: _____

Father: _____

Self: _____

Any current medications (including headache treatments):

Vasoactive substances (colas, cigarettes, coffee, chocolate) within the last two hours: _____

If you exercise, which activity(ies), how many times per week and for how long (please specify the type of activity:

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