Order Number 9325071

Influences of occupational stress, personality, and gender on cardiovascular responsivity

Brockwell, Albert Lee, Ph.D.

City University of New York, 1993

U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

INFLUENCES OF OCCUPATIONAL STRESS, PERSONALITY, AND GENDER ON CARDIOVASCULAR RESPONSIVITY

by

ALBERT LEE BROCKWELL

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

1993

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

April 20, 1993 — John L. Andreassi

Date — Chair of Examining Committee

April 20, 1993 — Herbert D. Saltzstein

Date — Executive Officer

John L. Andreassi, Ph.D.
Roger Millsap, Ph.D.
Harvey Barocas, Ph.D.
Glenn L. Albright, Ph.D.
Mindy Engle-Friedman, Ph.D.
Supervisory Committee

THE CITY UNIVERSITY OF NEW YORK

Abstract

INFLUENCES OF OCCUPATIONAL STRESS, PERSONALITY, AND GENDER ON CARDIOVASCULAR RESPONSIVITY

by

Albert Lee Brockwell

Advisor: Professor John L. Andreassi

Relationships among Type A behavior pattern, neuroticism, hostility, occupational stress, gender and cardiovascular responsivity to a cognitive stressor ("IQ Quiz") were examined. One hundred fourteen working college students (57 male and 57 female) at an urban university completed questionnaires to measure personality and stress, then participated in a psychophysiological assessment. Cardiovascular responses (systolic blood pressure, diastolic blood pressure, mean arterial pressure, heart rate, and peripheral skin temperature) to a cognitive stressor were recorded. Path analysis revealed direct relationships between Type A and greater mean arterial pressure reactivity, Neuroticism and decreased heart rate reactivity, and Hostility and greater Organizational Stress. Multivariate analysis of variance showed that men had greater systolic blood pressure reactivity to the cognitive stressor, as well as higher levels of systolic blood pressure and mean arterial pressure throughout the assessment. Hostility was significant in predicting occupational stress in dimensions involving interpersonal contact, Type A subscales were significant in predicting occupational stress in dimensions involving greater job demands, and Neuroticism was significant in stress involving subjective evaluation. Implications for occupational stress intervention and stress management training are discussed.

Acknowledgments

I would like to thank my dissertation advisory committee, Roger Millsap and Harvey Barocas, for their guidance and support during this project, and Glenn Albright and Mindy Engle-Friedman for their cooperation and support as outside readers. I wish to especially thank my chairman and advisor, John Andreassi, for his unyielding encouragement, patience, and inspiration not only during this dissertation, but throughout my graduate school tenure. His continual professional and personal guidance has been a tremendous influence in my own development. I would also like to thank Joel Lefkowitz for the opportunity to work with the scholars at CUNY, and Thomas Hall for helping me realize that I could succeed.

Without the support of my family, I would never have considered this undertaking. My deepest thanks to Ann, John, Alice, and Kirby for believing in me. I wish to thank my fiance, Mariangela, for her understanding and patience, as well as her encouragement and technical support.

This dissertation is dedicated to Daniel Lee Stanley.

Table of Contents

Page

List of Tables....................................ix

List of Figures...................................x

Introduction......................................1

Physiological Responsivity........................4

Occupational Stress...............................12

Occupational Stress Models........................12

Stress Management.................................19

Occupational Stress Research......................21

Occupational Stress Trends........................28

Type A Behavior Pattern...........................29

Construct Definition..............................29

Type A and Physiological Reactivity...............32

Type A and Work...................................41

Cognitive Aspects of Type A.......................45

Type A Trends.....................................49

Neuroticism.......................................52

Construct Definition..............................52

Studies of Neuroticism............................57

Neuroticism Trends................................61

Hostility...62

Construct Definition..............................62

Studies of Hostility..............................66

Hostility Trends..................................71

Gender..72

Table of Contents (continued)

Summary and Hypotheses........................80
Method..89
Subjects..89
Apparatus and Materials.........................89
Design and Procedure............................93
Results...96
Subjects..96
Psychological Measures..........................97
Physiological Measures.........................102
Hypothesis 1...................................110
Hypothesis 2...................................116
Hypothesis 3...................................120
Discussion.....................................124
General..124
Limitations....................................140
Conclusion.....................................144
Appendix A. Informed Consent Form..............148
Appendix B. Personal Data Sheet................150
Appendix C. Demographic Data Sheet.............152
Appendix D. Test Battery.......................154
Appendix E. Psychophysiological Assessment
Data Sheet. 168
References.....................................170

List of Tables

Page

Table 1. Means and Population Scores for Personality Scales........................98

Table 2. Intercorrelations among Personality Scales..................................99

Table 3. Rotated Factor Matrix and Scale Loadings for the Stress Diagnostic Survey........101

Table 4. Means and Standard Deviations for Physiological Measures and Reactivity Indices.................................109

Table 5. Means and Standard Deviations for Physiological Measures by Gender........118

Table 6. MANOVA Results of Physiological Measures by Gender......................119

Table 7. Correlations between Personality and SDS Scales.............................121

Table 8. SDS Multiple Regression Results.........122

List of Figures

Page

Figure 1. Hypothesized Path Model.................88

Figure 2. Revised Path Model.....................114

Introduction

American employers spent over $60 billion in premiums for employee hospitalization insurance in 1980 (Ainsworth, 1984). This cost escalates 16% per year to maintain the same benefits. In 1978, Greenwood estimated that job related stress for executives alone cost businesses between 10 and 19 billion dollars per year in sick days lost, hospitalization and outpatient care costs, and costs related to death of executives. Another study reported that between 1956 and 1981, health benefit costs to employers have increased more than 800% (cited in Jennings & Tager, 1981). The United States Clearing House for Mental Health Information reported that American industry suffers an annual $17 billion decrease in production capacity due to stress-related illnesses (Matteson & Ivancevich, 1987).

With alarming statistics such as these, it is no wonder that organizations have become concerned about the health of its workforce. Maintaining a vital workforce has a bottom-line financial benefit as well as concomitant psychological and physical benefits for workers. The implementation of stress reduction and fitness programs has run rampant in business and industry (Murphy, 1984). Clinicians have been called into the workplace to organize and run Employee Assistance Programs that are expected to handle employee problems ranging from alcoholism and divorce adjustment to stress and time management.

Although managers and corporations have the best intentions, these programs are often faddish and ill-conceived (Ganster et al., 1982; Murphy, 1984). Counterproductivity on the job in terms of theft and malingering is growing in the workplace (Jones & Boyce, 1990) and stress is often identified as the culprit. Stress researchers are still unsure about the complex relationships among personality and occupational stress. Personality factors implicated in vulnerability to stress have inspired legions of dedicated followers and practitioners. All too often, however, researchers produce evidence disconfirming the relevance or importance of the personality factor in the stress equation. The Type A behavior pattern is a prime example of a proposed risk factor that polarized scientists and practitioners. Recently, hostility has been touted as the active component in coronary heart disease (Williams et al., 1980), and Type A has been identified as a cognitive coping mechanism, rather than a risk factor (Rhodewalt et al., 1991). To complicate interpretation further, basic questions about individual physiological response to stressors and cardiovascular disease etiology have also been raised (Booth-Kewley & Friedman, 1987; Matthews, 1988).

A final threat to the stability of our knowledge concerning individual response to stress concerns the subjects used to develop much of our stress response database. Subjects in occupational research have, by and large, been men. With continuing gender diversity in the workforce, the basic assumptions concerning physiological responses to stress have been challenged as women consistently show different patterns of reactivity than men (Frankenhauser et al., 1989).

The importance of gender differences in response to stress impacts in two areas. First, in physiological assessments of workplace stress, measurement parameters must be selected that allow both women and men to demonstrate responsivity. Secondly, intervention or stress management programs should target parameters appropriate for their audience. For example, teaching systolic blood pressure reduction with biofeedback to women may not be found effective if they characteristically respond with heart rate or diastolic blood pressure increases to stress. Inconsistencies in psychophysiological response studies may be resulting from differential gender responses that are not accounted for in the statistical analyses.

This research was designed to address the issues of occupational stress, personality, gender, and cardiovascular response to stress within a multivariate multimethod framework. A basic overview of physiological responsivity to stress was presented, followed by a review of occupational stress issues. Personality factors that serve as individual difference variables in the stress response were discussed, followed by a discussion of gender differences in personality and responsivity. Finally, a research method was implemented to examine these factors utilizing personality and stress measurements and a psychophysiological assessment protocol, tested within a structural equation framework.

Physiological Responsivity

Individual variation in psychophysiological responsivity has been of interest to researchers ever since we have had the technology to reliably measure subtle changes in physiological processes. The historical development of psychophysiological concepts to explain individual variations in responsivity have been given detailed analysis by Andreassi (1989). Activation or arousal theory, autonomic balance, and individual response specificity are of particular importance in explaining the processes by which individuals differ in their response to external stimuli.

Activation theory proposes that variations in behavior on tasks are influenced by the degree of central nervous system (CNS) arousal. Stimulation from the environment causes concomitant decreases and increases in CNS activity. This variation comes primarily from the gatekeeping and channeling function of the reticular activation system. Malmo (1962) proposed that there are optimal levels of CNS arousability associated with optimal task performance. Too much or too little CNS arousal would result in suboptimal performance in tasks. If plotted on a Cartesian plane, this relationship could be depicted as an inverted U function. Andreassi (1989) enumerates several weaknesses with this concept, most notably the inability to define optimal levels of activation "a priori," and its lack of integration with other established models of psychophysiological functioning.

The concept of autonomic balance ($\bar{A}$) developed from the pioneering work of Wenger (1941, 1948; Wenger & Cullen, 1972). Essentially, autonomic balance proposes that individuals are dominated by either their sympathetic (SNS) or parasympathetic nervous systems (PNS). To assess whether one is SNS or PNS dominant, measurements are taken of several physiological indices, including respiration, skin conductance, heart rate period, pulse, salivation, blood pressure, and skin dermographia. Scores are weighted and a composite score ($\bar{A}$) is computed. High $\bar{A}$ individuals are PNS dominant, whereas low $\bar{A}$ individuals are SNS dominant. Theoretically, $\bar{A}$ is distributed normally in the population. While autonomic balance is an interesting theoretical metric, little empirical research has been conducted to establish its validity (Andreassi, 1989). The use of multivariate analyses to compute $\bar{A}$ provides the basis for a good assessment tool of individual differences, but its theoretical and applied utility must be further examined.

Individual response (IR) specificity maintains that individuals tend to exhibit a specific physiological response pattern to most external stimuli (Andreassi, 1989). Malmo and Shagass (1949) reported that psychiatric patients with a history of cardiovascular problems responded differently to pain stimuli than those with head and neck complaints. The cardiovascular group responded to pain stimuli with elevated heart rate, while others responded with elevated electromyographic activity. Lacey et al. (1953) applied IR specificity to normal populations and demonstrated that physiological reactivity within the individual was more consistent within subjects than between different types of stressors (cold pressor, mental arithmetic, letter association, and hyperventilation). In a follow-up study, Lacey and Lacey (1958) found similar characteristic response patterns within subjects and Schnore (1959) found that response patterns differed between tasks designed to elicit high or low arousal, as well as between people. While these studies highlight the relationship between the individual's physiology and the task they are performing, Sternbach (1966) cautioned that IR specificity is unstable over time and may be influenced by the experimental task used and the "implicit sets" of the subjects. Such implicit sets include preconceived ideas that subjects bring into the experimental situation, attitudes, and personality.

Health and physical well-being may be impacted by an individual's intensity of psychophysiological responsivity.

Manuck and Krantz (1986) reviewed theory and research related to the development of coronary heart disease and essential hypertension. Two models have been proposed to explain the relationship between cardiovascular responsivity in the laboratory and response patterns outside the lab. In the recurrent activation model, an individual goes through life responding acutely to stressful situations as they occur, with the same average intensity and recovery that is observed in the lab. The prototypic hyperreactor shows greater intensity in the lab and in life than the standard reactor. The model proposes that individuals recover and return to a resting baseline level in between periods of stress reactivity. Manuck and Krantz (1986) note that this is the most commonly held hypothesis concerning the generalization of individual differences in psychophysiological reactivity.

The prevailing state model proposes that laboratory measurements of reactivity are less life-like, but may be more predictive of eventual pathogenesis. In life, individuals do not recover to baseline or resting levels between periods of stress, but maintain a prevailing state of arousal. This continuous level of arousal may actually be less than the peak reactivity obtained in the laboratory, but shows greater assault to the individual's physiology over time.

While the specific mechanisms underlying the development of coronary artery disease and essential hypertension remain unclear, we have accumulated a great deal of evidence concerning the physiological responses of the body under stress. It was Cannon and de la Paz (1911) who led the way in characterizing the body's "fight or flight" response to stress. Specifically, they implicated adrenal medullary secretion and sympathetic nervous system (SNS) response. Sympathetic nervous system activation preparing the organism for action produces increased blood pressure, heart rate, and cardiac output, as well as neuroendocrine responses via sympathoadrenomedullary controlled secretions of epinephrine and norepinephrine. Metabolically, the body prepares to draw upon its energy stores by mobilization of lipids and glycogen and secretion of insulin and aldesterone (Herd, 1978). Thus, heat is produced and substrates are extracted from blood, which is taken from systemic vascular beds to support skeletal muscle function, the brain, and cardiovascular activities.

In discussing correlates of animal and human studies on cardiovascular pathogenesis, Schneiderman (1978) noted that studies in both areas point to the development of atheromatous plaque in arteries as a result of mechanical damage to the arterial wall from increased turbulence. The turbulence hypothesis essentially posits that initial hypertension results in increased heart rate and cardiac output with normal peripheral resistance. As hypertension becomes a fixed state in the organism, heart rate and cardiac output return to lower levels, but peripheral resistance increases due to vasoconstriction. High peripheral resistance creates turbulence as blood is pumped through the system, and the turbulence damages the sensitive linings of the endothelium. With catecholamines mobilizing blood lipids, the stage is set for development of atheromatic placque on the artery walls, resulting in atherosclerosis and clinical manifestation of embolism, thrombosis, or arrythmia (Schneiderman, 1978).

Epidemiological studies and advances in biotechnology have made it possible to identify specific "risk factors" for cardiovascular disease. Serum cholesterol and the roles of different lipoprotein types (high density lipoprotein and low density lipoprotein) have been identified, as well as dietary saturation of fatty acids, immune complexes, and cortisol, as influencing one's risk for developing cardiovascular disease (Clarkson, Manuck, & Kaplan, 1986).

Behavioral factors have also been found to influence the development of coronary artery disease and essential hypertension. The term "coronary-prone behavior" has been adopted to identify a characteristic pattern of behavior in individuals that is correlated with onset of coronary heart disease. The primary facet of this behavior pattern, now synonymous with coronary-prone behavior, is the Type A behavior pattern identified in a longitudinal study of 3,154 men over a 8.5 year period (Rosenman et al., 1976). While the Type A behavior pattern will be presented in detail elsewhere, it is appropriate to mention here that Zyzanski (1978) reviewed epidemiological evidence with respect to Type A behavior pattern. He concluded that Type A behavior was related to coronary heart disease in independent samples and that Type A was predictive of coronary heart disease in the Western Collaborative Group Study. Type A was found to be an even stronger predictor of reinfarction than single incidents and was further related to the severity of atherosclerosis. Additionally, Zyzanski (1978) defended Type A behavior as an independent risk factor, not related to other traditional risk factors such as smoking, triglycerides, or cholesterol. Components of Type A, however, were related to specific indices of risk, such as the correlation among job involvement, blood pressure, and cholesterol.

Williams (1986) presented a biopsychosocial model that illustrates how personality, the environment, and genetics interact to generate physiological responses. Based on the principle of patterned responses to environmental events experienced over time, the model proposes that incidents are sensed and perceived in the brain and that the brain then initiates a characteristic pattern of responses based upon its interpretation of the environmental stimuli. Genetic factors, history of environmental events, and personality factors (Type A for example) affect how the brain interprets the events, and specification of responses impacts on the targeted organs in the body. The model states that personality and cumulative effects of responses are chronic and develop over time. Thus, personality development involves an interaction between the individual's genetic predisposition and the environment to which they are exposed.

Williams (1986) identified two distinct patterns of physiological reactivity. Pattern 1 consists of an increased "fight/flight" motor response with increased muscular vasodilation, increased cardiac output, and increased epinephrine, cortisol, and prolactin. Pattern 2, however, is characterized by decreased yet vigilant motor response, muscular vasoconstriction, and increased testosterone. These patterns are controlled by different areas of the brain, with Pattern 1 response originating from the hypothalmus defense area and basal amygdala, and Pattern 2 response originating from the central amygdala, locus coerulus, and possibly lateral hypothalmus. Behaviorally, Pattern 1 is elicited in defensive or emergency situations, in fear or anxiety, during active, effortful coping, while performing mental work, and during uncontrolled aversive stimuli. Pattern 2 is elicited during vigilance or stalking tasks, during sensory intake (attending), during passive coping, and perhaps during controllable aversive stimuli.

As indicated in the Williams (1986) model, individuals perceive events in the environment. The interpretation of these events is influenced by genetics and personality. A response is determined by a complex of past history, genetics, and personality. The events may be any number of mechanical (temperature, pressure, etc.), psychological, or psychosocial phenomena that the individual is exposed to.

In this brief overview of physiological responsivity, the basic mechanics of response have been identified and general models have been presented. Individual responses to the environment depend upon the person's own genetic makeup as well as their past history of exposure to events. Thus, physiological responses to stress are a function of the person and the environment or incidents to which they are exposed. While many of the specific mechanisms are unknown, it has been demonstrated that cardiovascular pathogenesis may result from chronic exposure to stressors in the environment. The present research focused on one aspect of the environment: the workplace. Exposure to events in the workplace, both physical and psychosocial, have been found to elicit deleterious physiological and psychological responses in human subjects. Collectively, this is the field of occupational stress.

Occupational Stress

Occupational Stress Models

One of the earliest models of occupational stress emphasizes the congruence or fit between persons and organizations or environments (French, Rogers, & Cobb, 1974). The "P-E fit" model has been a driving force in stress research and is generally held as one of the dominant approaches in the job stress literature (Ganster & Schaubroeck, 1991). In its simplest terms, the model specifies that there is an optimal congruence or fit between people and the environments they work in. Environment is understood to be factors related to the job they are performing, such as work load and complexity. The environment makes demands that the workers are required to meet. Characteristics of the person include their abilities to meet the demands of the environment and their motivation to seek resources from the environment. For example, one's needs and values will drive one to seek out job environments that are congruent with one's needs and value structures. When there is a lack of subjective or objective fit between the elements of the person and the job, stress results. Chronic stress indicates a stable misfit, whereas acute stress is transitory. Strain refers to psychological (job dissatisfaction and anxiety) and physiological (blood pressure) deviations from the normal state of the person. The model maintains that continued strain can affect levels of morbidity and mortality.

In a comprehensive review of the P-E fit model and validation data, French, Caplan, and van Harrison (1982) found strong evidence of psychological strain in cases of misfit. Qualitative factors of the job, such as job complexity and responsibility for persons, showed strong relationships with job dissatisfaction, workload dissatisfaction, and boredom in cases of misfit. Similarly, participation in the workplace had a negative relationship to the experience of job dissatisfaction. Quantitative workload affected workload dissatisfaction, depression, and anxiety where there was poor fit. Social support was proposed to have bi-directional relationships with irritation, anxiety, and depression, in the sense that while those with low social support tend to display these signs of strain, these dynamics may hinder the development of positive interpersonal relationships. Interestingly, the relationship between fit factors and physiological strain was weak. Methodological considerations and the transitory nature of acute physiological reactivity were suggested as reasons why the relationships were poor. Those that did emerge, however, suggest that physiological strain indicators generally responded in the expected directions, but counterintuitive relationships were found with cardiovascular variables. For example, the higher the misfit in job complexity, the lower the heart rate. Similarly, the more people the subject supervised and the greater role ambiguity misfit, the lower the systolic blood pressure. On the other hand, the greater the social support from others, the higher the systolic blood pressure. Many of these findings have been shown to be related to expectations and cognitive appraisal of sources of support. It is also possible that unmeasured personality variables interact with the environment to affect indices of strain.

In a conceptual review of occupational stress, Schuler (1980) concluded with several propositions. First, three distinct types of stress were identified as constraint stress, opportunity stress, and demand stress. An individual's total stress is seen as a sum of these, and the intensity of a stress condition is determined by the outcome valence and the probability of a particular outcome. There are organizational qualities attached to the individual's experience of stress which may be positive or negative, and reflect upon the individual's needs and values (e.g. promotion or demotion). Whereas there is a relationship between stress and physiological, psychological, and behavioral symptoms, all types of stress are positively related to the incidence of physiological symptoms and cognitive psychological outcomes. Opportunity stress is related to affective psychological outcomes (job satisfaction and attitudes) and behavioral symptoms (absence). Opportunity stress and constraint stress have an inverted U relationship with some behavioral symptoms (performance). Finally, individuals can use strategies and techniques to anticipate and confront stress conditions, reducing their deleterious effects. It may be argued that the outcomes of stress, in terms of coping or behavioral responses, are based upon the individual's past experiences, personality, and perception of the current situation they are responding to.

Holt (1982) provided an extensive review of occupational stress research to that date. Independent variables in stress research have included such objectively defined factors as the physical environment (noise, temperature, machine design), time (shiftwork and time pressure), social and organizational properties of work and it's setting (machine pacing and overload), and changes in one's job. Subjectively defined factors include role related issues (role ambiguity, conflict, and strain), person-job fit (responsibility for people and quantitative load), miscellaneous job aspects (task ambiguity, overload or underload, pay inequality, and underutilization), and off-job stress (disturbed life patterns, stressful life events, and family demands). Dependent variables, or outcome measures, in stress research have included physiological strain (pulse rate, cholesterol, catecholamines), psychological strain (job dissatisfaction, alienation, burnout), and behavioral and social strains (burnout, substance abuse, and absenteeism). Illness outcomes have also been studied, such as somatic-physiological responses (coronary heart disease, hypertension, headache, and ulcers), psychological disorders (depression, alcoholism, neurosis), and behavioral pathology (violence, impaired personal relations, accidents, and suicide). Holt (1982) identified variables that have been found to moderate stress relationships as well. These include physiological characteristics (use of drugs and exposure to environmental stressors), individual characteristics (Type A behavior pattern, neuroticism, attachment to the organization, and tolerance of ambiguity), the work situation (size of work unit, social support, job enrichment), and organizational characteristics (social support, interpersonal ties, and community involvement).

From Holt's review, several "basic truths" regarding organizational stress emerged. First, individuals' feelings about their work tend to be very complex and mixed. Simplistic questioning is not likely to be successful in accurately assessing how someone feels about their job. Second, the social and cultural context of work must not be overlooked. Values on the job are often dictated by norms carried in from the surrounding social milieu. The nonwork life of the individual also impacts how the person experiences stress at work. Families, religion, friends, and political views can all affect how they see their role at work, and how their work affects the rest of their lives. Finally, Holt (1982) concludes that health and illness are "extraordinarily complex states," and interpretation of these states requires an approach incorporating social, psychological, and biological considerations. Still, researchers were left with a laundry list of stressors and outcomes with no real organization or taxonomy of stress.

In a recent book on work and health, Karasek and Theorell (1990) provided a good synopsis of occupational stress influences and proposed a global model explaining interrelationships of environment and stress. Their model is based upon anxiety and learning interacting with job characteristics to produce feelings of job mastery or accumulated strain. Jobs are organized differently, and different jobs can affect an individual's experience of stress differently. Objective factors such as control and decision latitude can lead to strain in individual workers. Such strain can be manifested as physiological responses, such as cortisol secretion, or illnesses, such as coronary heart disease. They note that personality factors will affect the experience of strain and anxiety within the individual, and that in turn will impact learning and mastery of the job.

A main reason for studying stress in organizations is to identify ways of alleviating the stress, in order to provide a more healthy work environment for employees. As mentioned in the introduction, this can have significant financial benefits. Quick, Horn, and Quick (1987) presented a model to explain outcomes of job stress in a preventive medicine context. Organizational stressors (task, role, physical, and interpersonal demands) lead to individual and organizational stress responses. On the preventive medicine side of the model, health risk factors lead to asymptomatic disease. Finally, individual distress (behavioral, psychological, and medical) and organizational distress (direct and indirect costs) are related to symptomatic disease. Preventive stress management may be directed at the stressors, the responses, or the symptoms; however, intervention at an earlier stage is preferred.

Stress Management

The application of occupational stress literature is found primarily in attempts to reduce stress in employees through stress management training programs. Rather than reduce environmental stressors in a preventive fashion such as the model presented above, stress management training prepares individuals to cope with stressors that may impact them. While a complete review of stress management literature is beyond the scope of this paper, it should be noted that the utility of providing on-site stress management intervention has been questioned. Manuso (1983) reviewed a multimodal stress management program that provided training in biofeedback, guided imagery, diaphragmatic breathing, and muscle relaxation exercises. Subjects were 15 headache sufferers and 15 reporting symptoms of general anxiety. Manuso reports that psychological health measures, symptoms, and job satisfaction improved and visits to the health centers were reduced. The emphasis in this study was the dollar values attached to poor health. An individual with chronic anxiety or headaches costs the company $3,394.50 in pretraining expenses. That breaks down to $473.14 for health center visits, $56.61 in time off the job to go to the health center, $2,206.96 in interference due to symptoms, $72.80 in interference from bosses, $542.88 in interference from coworkers, and $42.12 in interference from subordinates. Subjects in this particular sample did not show excessive absenteeism, and these costs would be operating even if outside medical attention were obtained. After training cost was determined to be $532.68, representing a savings of $2,861.82 annually per participant. Manuso extended these figures to show an expected savings of $202,845.05 over three years for all participants. With training costs totaling $24,622.50, a three year net savings of $178,322.55 could be realized. This 1:3 cost-benefit ratio is quite optimistic and difficult to interpret without further data, but is used to demonstrate that organizations can benefit from addressing stress effects on an individual level.

Multimodal programs have been suggested as a way to provide a wide array of stress management technique options to a diverse workforce (Gibbs et al., 1985). Albright, Andreassi, and Brockwell (1991) used a multimodal stress management program consisting of progressive muscle relaxation, guided imagery, diaphragmatic breathing, and autogenic exercises to lower systolic blood pressure reactivity, diastolic blood pressure reactivity, and heart rate reactivity to cognitive stressors in both hypertensive and normotensive individuals. The basis of a multimodal program is that participants can select exercises that they are more comfortable with, and thus be more likely to practice the technique and become proficient with its use. Unfortunately, with the complexity of the programs come difficulty in their validation. Most of the stress management literature has focused on comparing specific techniques with specific subject populations with inconsistent findings (Murphy, 1984). Therefore, while research tends to support the efficacy of stress management training at the worksite, benefits are not reliably observed and its utility is still questioned.

Occupational Stress Research

While attempts to reduce the effects of work stress are questioned, deleterious effects of work stress are consistently being found. Hendrix (1989) found that physical stressors, external locus of control, quantitative workload, job boredom, and role conflict predicted the level of overall job stress on DoD civilian employees. Additionally, male gender, height-weight ratio, and cigarettes smoked per day predicted cholesterol ratio. It was concluded that while these data did not find a direct relationship between job stress and cholesterol, findings from other studies support the indirect relationship of job stress via other risk factors.

Basic assumptions concerning stressor-outcome relationships have been challenged. It is generally held that negative organizational outcomes result in increased withdrawal behaviors (absence and turnover) and reduced effectiveness in the workforce (Mowday, Porter, & Steers, 1982). While previous research has examined indices of ineffectiveness such as job satisfaction, absenteeism, and turnover (Ivancevich, Matteson, & Preston, 1982; Nicholson, Brown, & Chadwick-Jones, 1976), more recent work has implicated stress as an antecedent of such behavior (Bhagat, McQuaid, Lindholm, & Segovis, 1985; Hendrix, Ovalle, & Troxler, 1985). Ivancevich and Matteson (1981) argue that absenteeism can be beneficial to an organization, since employees can use absence to cope with stress. Many organizations provide paid "mental health days" for this purpose. Hendrix et al. (1985) conducted an extensive path analysis to test a causal model of absenteeism. They found that life stress influenced job stress, which in turn influenced job satisfaction. Job satisfaction then influenced the employee's intent to quit the organization. The relationship between stress and absence behavior was significant, but moderated by job satisfaction.

The association between stress and performance continues to be one of the most widely studied areas of occupational stress. The curvilinear, or inverted U relationship of job stress and performance became popular with the activation theory of motivation, as applied to organizations by Scott (1966). Basically, activation theory posits that there is an optimal level of stress required for maximum performance, and stress levels significantly higher or lower than this optimal level will result in decreased performance. In their facet analysis model of job stress, Beehr and Newman (1978) define "job stress" as referring to a "situation wherein job related factors interact with a worker to change (i.e., disrupt or enhance) his or her psychological and/or physiological condition such that the person is required to deviate from normal functioning." They argue that measures of job stress presented in their review have not adequately measured the construct because they failed to simultaneously assess employee health and job performance variables.

Beehr and Schuler (1982) challenged the traditional inverted U model of stress and performance. While many laboratory studies supported the curvilinear model (Jamal, 1985), Anderson (1976) provided the only applied research to support it, in a study of perceived performance and stress in owner-managers of small businesses damaged by hurricane floods. Meglino (1977) suggests that there is a positive linear relationship between stress and performance due to the "challenge," a notion which has been supported in a study of little league play (Lowe & McGrath, 1971). On the other hand, studies have found a negative linear relationship between stress and performance (Breaugh, 1981; Schuler, 1975), as well as no relationship (Dubin, Hedley, & Taveggia, 1976). Jamal (1985) applied these models to a work setting by measuring blue collar and managerial workers on job stress (role ambiguity, role conflict, role overload, and resource inadequacy), organizational commitment, and job performance (quality, quantity, and effort). The data supported a negative linear relationship between all measures of job stress and job performance across both groups. The inverted U function, therefore, is not so clearly distinct in applied work situations, and may be moderated by individual, work environment, and situational variables.

Motowildo, Packard, and Manning (1986) examined the complex stress-performance relationship by measuring self-reported perceptions of stressful events on the job (nursing), subjective stress, depression, Type A, and hostility, as well as supervisory reports of job performance (sensitivity, warmth, consideration, and tolerance) and cognitive/motivational aspects (concentration, composure, perseverance, and adaptability). Through path analysis, it was found that the frequency and intensity of stressful work events lead to the subjective experience of stress, which was related to depression and anxiety. These, in turn, affected indices of job performance, with the exception of tolerance of coworkers, which was directly related to the frequency of stressful events. Furthermore, individual difference variables, such as Type A and fear of negative evaluation, influenced the individual's perception of job stressors. The personality of the individual plays a significant part in the subjective assessment of stress and stressors, as well as indirectly affecting job performance in stressful conditions.

Schnall et al. (1990) performed a broad based study of men working in blue-collar and white-collar positions in the New York metropolitan area. Subjects underwent blood pressure recording with ambulatory monitors during one workday and evening and completed activity and mood logs at recording times. Job strain was defined as a high level of job demands (working fast and hard) and low levels of job control (low autonomy and little use of skill discretion) according to Karasek's (1979) Job-Decision-Control model. A variety of demographic, lifestyle (smoking and drinking) and personality (Type A, anxiety) information was obtained.

Exposure to job strain increased the likelihood of being hypertensive, and even after controlling for other risk factors, job strain successfully predicted diastolic blood pressure status as hypertensive or normotensive. In younger subjects, job strain was also found to be predictive of increased left ventricular mass index, a phenomenon associated with developing cardiovascular disease. Age, body mass index, and alcohol consumption were also found to be related to hypertension in this study. Interestingly, hypertensives and normotensives provided similar scores on questionnaires measuring Type A, anxiety, and medical symptoms.

Steffy and Jones (1988) reported that job stressors and job dissatisfaction were correlated with coronary risk as measured by the Framingham Index. Physiological indices of stress, however, were not correlated with self-reported measures. Women reported significantly higher high density lipoprotein counts and lower uric acid counts than men. Also, measures of psychosomatic distress correlated with job stress, job dissatisfaction, and stressful life events. Thus, the experience of distress, or at least its reporting, was not confined to the workplace but generalized to life issues and self-reported somatic complaints.

Siegrist and Klein (1990) measured workload, job conditions, and job security in blue collar men, then had them perform a Stroop task while heart rate, systolic blood pressure, and diastolic blood pressure were measured. The Stroop task involves presenting subjects with the name of a color written in a different color than the one named. Subjects are then required to name the color of the letters, usually under considerable time pressure. For example, the word "red" may be written with yellow letters and the subject would be required to respond "yellow." Individuals reporting higher levels of work stress tended to have less change in cardiovascular activity in the stressful task. Differences between high stress and low stress groups were significant, however, for certain stressors. For example, systolic blood pressure reactivity was higher for those reporting low cumulative workload, diastolic blood pressure reactivity was higher for those reporting low cumulative workload and stable job conditions (as opposed to worsening job conditions), and heart rate reactivity was higher for those reporting stable job conditions. The authors interpret these findings as evidence of a state of exhaustive coping after years of exposure to chronic stress. Baseline levels of heart rate and blood pressure were not correlated with reactivity, as measured by peak level of the parameter minus the baseline level.

While the results of this study may be interpreted as counterintuitive, they support the possible role of personality as a factor affecting physiological responses to stress. For example, since smoking affects heart rate reactivity, it was statistically controlled for in this study. As Eysenck (1985) pointed out, smoking is a behavior that can be related to personality, especially the dimension of extraversion. Personality, therefore, may play a significant role in the experience of stress, whether causally or as a coping mechanism.

Occupational Stress Trends

In sum, while a variety of models have attempted to explain work stress, no taxonomy of occupational stress exists. What researchers often end up producing is a laundry list of events, conditions, or psychosocial roles that may act as stressors. In effect, almost anything could be a stressor to an individual who, by virtue of their history, physiology, or personality, may be vulnerable to it. Research continues to establish relationships among work factors, personality, perceptions of the environment, and physiological responses to stressors. Without a taxonomy of occupational stress, however, attempts at reducing stress at work may be haphazard or ill-conceived. Stress management techniques are still questioned, and psychologists in business and industry are unable to address the issues with precision.

It is agreed, however, that stress is an individual phenomenon, and subject to interactions with individual difference variables. While Karasek and Theorell (1990) do not mention most personality factors by name, they note the importance of individual difference variables in affecting the development of strain. For example, they view the Type A behavior pattern as either a personality factor or as an environmental factor, depending upon where it is observed in their model. Other occupational stress theories have named factors such as the Type A behavior pattern and neuroticism as personality factors responsible for the experience of occupational stress.

Type A Behavior Pattern

Construct Definition

The link between personality and physiology has been underscored in the construct of the Type A behavior pattern. In an epidemiological study, cardiologists Jenkins, Rosenman, and Friedman (1966) proposed that a set of behaviors may be identified that are associated with the onset of coronary heart disease. The coronary-prone Type A behavior pattern consists of competitive striving, high achievement orientation, polyphasic activity under deadlines, impatience with others' slowness, rapid work pace, hostility, and aggression. The exact opposite of the Type A behavior pattern is called Type B, and is defined merely as a lack of the Type A behavioral components.

The concept of a coronary-prone behavior pattern grew from observations of over 3,000 working males in a period between 1960 and 1961. In this study, called the Western Collaborative Group Study (WCGS), participants were rated on their responses to a standardized stress interview (Structured Interview) designed to elicit the Type A behavior pattern (Friedman, 1969). The Structured Interview is a standardized face to face personal interview protocol that is designed to elicit expressions of Type A behavior. For example, the interviewer will feign stuttering and a loss for words to invoke the subject to fill in the words or complete the sentence, which are examples of Type A behavior. Items also encourage subjects to display hostility and explosive speech patterns. Follow-up and post mortem studies of WCGS participants confirmed that men possessing the Type A behavior pattern manifested higher incidences of coronary heart disease and atherosclerosis, which were coupled with eventual myocardial infarction or angina (Blumenthal et al., 1978; Friedman et al., 1973; Rosenman et al., 1976; Zyzanski et al., 1976).

Since the inception of the Type A construct, research has attempted to refine the components of coronary-prone behavior. Jenkins, Zyzanski, and Rosenman (1971) developed a self-report paper-pencil test to measure the Type A behavior pattern in a group administration format. The Jenkins Activity Survey (JAS) yields an overall score for Type A, as well as scores on subscales of Speed and Impatience, Hard-Driving and Competitiveness, and Job Involvement. The JAS Manual (Jenkins et al., 1979) reports several validation studies and states that the JAS is successful in identifying cases of CHD from controls, predicting new cases, predicting increased risk of reinfarction, and establishing a relationship between the Type A behavior pattern and coronary atherosclerosis. Most validation studies are of a concurrent design, however, and suffer threats to validity, particularly restriction of range in the sample.

In a factor analysis of a WCGS subsample, Matthews, Glass, Rosenman, and Bortner (1977) concluded that while the Structured Interview was comprised of five subscales, only two, Hard-Driving and Competitiveness and Impatience, were related to the eventual onset of CHD. Furthermore, within the Competitiveness factor, items concerning vigor, drive, and hostility accounted for most of the variance in the relationship with coronary heart disease. Control was identified as the Type A individual's resource for coping with stress and threatening situations. This study supports the subscale structure of the JAS as well, with the exception of items relating to Job Involvement as predictive of CHD.

Waldron and associates (1977) further examined the demographic variations among JAS scores. Over 5,000 working men and women completed the JAS as part of a risk detection program. Analyses comparing race, gender, and educational level found that the coronary-prone pattern is more prevalent among younger men than younger women and that sex differences diminish with age. Overall, however, men exhibit the Type A behavior pattern more than women. Among racial groups, the JAS showed differential relationships. In general, the predictive validity was less in non-white populations. Occupational status and education were positively related to Job Involvement scores, and Hard-Driving and Competitiveness was negatively related to education.

In sum, the Type A behavior pattern has been identified as an individual difference variable characterized by attempts to accomplish more in relatively less time than Type Bs. Competitive striving, job involvement, and hostility have been identified as components of the Type A behavior pattern. Type A is conceptualized as a coronary-prone behavior pattern, since it has been demonstrated to be predictive of eventual onset of myocardial infarction and angina. Concurrent with this predictive validity, Type A has been associated with physiological reactivity, especially those parameters involving the cardiovascular system.

Type A and Physiological Reactivity

While the Type A behavior pattern has been implicated in the more chronic physiologic process of CHD, research has also examined the Type A personality and physiological responsivity. Manuck, Craft, and Gold (1978) examined differential cardiovascular reactivity of Type As and Type Bs when faced with a cognitive task. Subjects were required to identify similarities among three stimulus designs presented on cards. The task contained stimulus sets that were difficult to solve within the allotted six seconds.

Systolic blood pressure was measured continuously before and during the task. Subjects were classified as Type A or Type B and completed an anger inventory prior to the task. Type A males showed significantly higher blood pressure during the task, but not at baseline. Males overall had higher blood pressure than females, but there were no Type A/B differences among females. There were no between group differences in anger for Type A/B or gender, but the task was shown to be sufficiently anxiety provoking.

To further investigate cardiovascular reactivity, Manuck, Craft, and Gold (1978) conducted a second study identical to the first, except for the inclusion of measurements of heart rate, diastolic blood pressure, and locus of control. Again, there were significant main effects for the task, and Type A males demonstrated higher systolic blood pressure in the task condition than Type Bs. There were no significant differences between Type As and Type Bs for heart rate or diastolic blood pressure. Internal locus of control subjects showed a tendency for greater systolic reactivity, but this failed to reach significance. The authors propose that the Type A construct contains elements of motivation to control the environment, whereas locus of control is primarily concerned with an expectation of control. In a stressful task, Type As don't necessarily expect to perform better, but may be more motivated to achieve control. This leads to the behavioral pattern of acting upon the environment to facilitate achievement.

Juszczak and Andreassi (1987) examined heart rate, skin conductance, and skin temperature of Type As and Bs involved in a dual task situation. The JAS Form C was used to measure overall Type A and subscale scores for Speed and Impatience (SI) and Hard-Driving and Competitiveness (HDC). The primary task was either a computer racing game or tonal memory task, while the secondary task required responding to light stimuli. Type As had higher physiological reactivity than Type Bs, especially with regard to heart rate and skin conductance during the cognitive task. Performance indices, however, were higher in the Type Bs. The JAS subscales act to moderate the relationship between personality and performance, as high Hard-Driving and Competitiveness scores were associated with lower performance on the primary tasks, and high Speed and Impatience scores were related to higher performance on the secondary task (reaction time). Again, components of the overall Type A construct tend to be more powerful factors in behavior, and the cardiovascular system tends to be the primary physiological system involved.

In another study of the JAS subscales and performance, Ohman, Nordby, and Svebak (1989) had 40 extreme scorers perform a car racing video game while electrocardiogram (ECG), heart rate, skin conductance, forearm electromyogram (EMG), and pulse transmit time were recorded. From their factor analysis of the JAS, two factors emerged and were labeled Irritation and Impatience, and Hard-Driving and Competitive. Ohman et al. (1989) found no relationship between Hard-Driving and Competitiveness and task-induced cardiovascular activation, and no differences in task performance on any scale. However, significant differences in heart rate and pulse transmit time were found between high and low scorers on the Irritation and Impatience factor. The authors conclude that it is this factor containing the primary components of aggression and hostility that is the underlying element of coronary-prone behavior.

Differential responses of the cardiovascular system in Type As and Bs were studied by Muranaka et al. (1988). It was hypothesized that Type A cardiovascular response was driven by heightened predisposition to beta-adrenergic responses (sympathetic activation) to stressors, whereas Type Bs were more sensitive to alpha-adrenergic responses (parasympathetic activation). To test this hypothesis, stressors known to elicit the beta response (mental arithmetic) and the alpha response (cold face stimulus; a bag of ice water applied to the forehead for two minutes) were administered to Type As and Bs, as determined by median splits on the Structured Interview and JAS. Systolic and diastolic blood pressure, mean arterial pressure, heart rate, and forearm blood flow were measured during the procedure, where each subject was administered both stressors. Each stressor elicited the expected response, with mental arithmetic resulting in forearm vasodilation and heart rate acceleration, and cold face stimulus resulting in vasoconstriction and heart rate deceleration. The Type A/B distinctions, however, were not as clear. Type As did not differ from Type Bs on the mental arithmetic task, though the beta-adrenergic "fight/flight" response was elicited. In the cold face stimulus condition, Bs maintained vasoconstriction longer than As, partially supporting differential alpha/vagal responsivity in Bs. Methodological concerns, such as the short duration of the stressor, are cited for the lack of statistical power to further confirm their hypotheses. This study provides empirical support, however, for Williams' (1986) two pattern theory of physiological response, noting differing activation mechanisms.

Using impedance cardiography, Albright, Andreassi, and Steiner (1988) examined the interactive effects of the Type A personality, physiological stress (exercise and cold pressor), and a cognitive task ("IQ Quiz") on cardiovascular activity. After completing the JAS, subjects were administered a series of conditions (e.g. baseline, self-relaxation, cognitive stressor, recovery, physical stressor, recovery) while repeated measurements of systolic and diastolic blood pressure, percent change in SBP and DBP from baseline, total systemic resistance, stroke volume, cardiac output, peripheral skin temperature, and myocardial contractility were taken. A series of multiple linear regression analyses revealed that stroke volume during the cognitive task accounted for over 40% of the variance on overall Type A and Job Involvement scales and over 20% of the variance on the Hard-Driving and Competitiveness factor, with Type As demonstrating significantly greater responsivity. The relationships among these more subtle indices of cardiovascular activity tend to be compensatory.

In attempts to delineate the relationships among Type A behavior pattern and physiological responses, several researchers have examined the literature using meta-analysis. Wright, Contrada, and Glass (1985) concluded that there is little difference in physiologic activity between Type As and Type Bs at a resting level, but that Type As have greater physiological reactivity in response to laboratory manipulations. In addition, the Structured Interview is more reliable than the JAS in classifying individuals with regard to physiological responsivity, and most population differences may be an artifact of the measurement device. Challenging tasks, competition, and individual differences in impatience and hostility may moderate the reactivity of Type As. Physiological responsivity is most apparent in systolic blood pressure and plasma epinephrine, and less so in heart rate and norepinephrine. Diastolic blood pressure, electrodermal activity, and pulse volume have provided inconclusive findings.

Another meta-analysis by Harbin (1989) employed statistical procedures to pool effect sizes across studies and test for differences in hyperresponsivity. Seventy-one studies yielded a total of 299 statistical tests that met the criteria for inclusion in the meta-analysis. Only studies using the Structured Interview assessment of Type A were used. Measures included heart rate, systolic blood pressure, diastolic blood pressure, norepinephrine, epinephrine, and cortisol. Type As were found to have demonstrated higher heart rate and systolic blood pressure reactivity, with diastolic blood pressure and norepinephrine being "less definitive." There were no effects for epinephrine or cortisol. Males and females differed in their responsivity, with Type A/B differences significant more often for males than for females. When the "power" of the statistical tests were examined, the effect sizes were larger for males than for females. Reasons for this differential include the contamination of the Type A construct with other variables (e.g. hostility), differential construct validity of the Type A assessment method, and differing physiological responsivity between males and females. It was also concluded that non-arithmetic problem solving tasks and psychomotor tasks were more effective at eliciting the responsivity than arithmetic tasks. Finally, age was not found to relate to differential responsivity.

In view of these and other meta-analyses (Booth-Kewley & Friedman, 1987; Friedman & Booth-Kewley, 1987; Matthews, 1988), Friedman and Booth-Kewley (1989) have directed the focus of the Type A construct back to its origin, as a vehicle for predicting the onset of coronary heart disease. They state that studies concerning Type A behavior (measured by the Structured Interview) and CHD continue to support the predictive power of the construct, but studies employing the JAS classifications do not generally possess the power of Structured Interview based predictions. They propose that the next step in Type A research should be refining the construct. Anxiety, depression, and hostility may act as moderators of coronary-proneness, and that research should further explore these relationships.

The construct of the Type A behavior pattern has undergone extensive evaluation and revision, often with disagreement among researchers with regard to its utility. After its initial identification as a coronary-prone behavior pattern, Type A, researchers sought to extend Type A relationships to a wide range of settings. The power of the construct, however, continues to be its relationships with a wide range of psychophysiological phenomena associated with cardiovascular pathogenesis. However, debate over appropriate assessment methods and statistical prediction still continues. Type As (as identified by the Structured Interview) show differences in heart rate and systolic blood pressure activity during stressful tasks, but not at rest. This is obscured when the Jenkins Activity Survey is used to make the Type A/B classification (Wright, Contrada, & Glass, 1985). But the results obtained with Structured Interview and Jenkins Activity Survey are closer if extreme scores are used to make JAS classifications. For example, Juszczak and Andreassi (1987) used high and low quartile splits and Ohman, Nordby, and Svebak (1989) used "extreme scores" on the JAS to find Type A reactivity consistent with Structured Interview findings. Also, Wright, Contrada, and Glass (1985) report that Structured Interview assessment of Type A can be unreliable and contaminated as well as JAS measures. Thus, there is no universally accepted method for evaluating Type A, but assessment and classification procedures should be driven by the resources available and research question at hand, realizing the possible threats to validity involved (e.g. sample characteristics and construct contamination).

As part of the exploration of the construct, Type A was examined in a wide range of settings. Naturally, a pattern of behavior specifying polyphasic activity under deadlines and job involvement would be invaluable in the area of occupational stress research, if the relationships were found to be valid. Most occupational stress models articulate Type A behavior as influential in the work stress experience. Therefore, a great deal of research has examined the Type A individual in the workplace.

Type A and Work

Occupational stress research has implicated personality factors, especially Type A, as influencing the strain one experiences in high stress situations. Matteson and Ivancevich (1982; Ivancevich & Matteson, 1984) brought the idea of Type A and Type B behavior to the organizational level and restated the Type A/B problem as one of person-environment congruence, like Karasek (1979). More specifically, just as individuals exhibit Type A/B behavior patterns, so do organizations. Problems arise when Type A individuals work in Type B organizations, or when Type B individuals work in Type A organizations. The Type A organization is characterized by a hard-driving competitive culture, whereas the Type B organization is just the opposite, "relaxed and easy-going."

To test their theory, indices of physical and mental health were collected for individuals and organizations representing all possible A/B combinations. It was found that Type B individuals in Type B organizations reported significantly fewer health complaints than any other group. Type A individuals in Type A organizations, however, reported more health problems than any other combination.

Additionally, the magnitude of the effects were such that mixed dyads (a Type A individual in a Type B organization or a Type B individual in a Type A organization) reported health problems more similar to the A/A group than the B/B group. This supports the contention that putting Type B people in Type A environments is destructive, but also that Type As, no matter what environment they are in, experience deleterious health effects. This study draws attention to the necessity of considering context in stress research and demonstrates that the human-environment interaction cannot be overlooked.

Howard, Cunningham, and Rechnitzer (1976) studied relationships among Type A behavior, traditional CHD risk factors, and organizational growth in 236 managers. They found that Type A managers were more prevalent in high growth companies. These managers also exhibited higher blood pressure, serum cholesterol, and triglyceride levels. Type A managers smoked more than their Type B counterparts and reported less exercise after age 55.

In a later study, Howard et al. (1986) obtained similar results with a sample of 217 workers. Job satisfaction and role ambiguity (a job stressor) were measured along with traditional risk factors. Increased role ambiguity was associated with higher systolic and diastolic blood pressures and triglycerides in Type As, with job satisfaction moderating the relationship. For Type Bs, increased role ambiguity was associated with lower systolic blood pressure, but higher intrinsic job satisfaction was associated with higher blood pressure. Thus, Type As may find more ambiguous work situations stressful, whereas Type Bs may find less ambiguous work situations stressful. The cardiovascular reactivity of Type Bs and Type As for a given situation differ.

The role of Type A behavior pattern in the workplace experience of stress under heavy job demands was examined in police radio dispatchers (Kirmeyer & Biggers, 1988). Subjects were administered the JAS and observed on the job. Measures of work demand describing who initiated the work (self, other, public, peer, superior) and productivity (work volume, nonwork volume, finished work, and simultaneity) were gleaned from the observations. It was found that Type As systematically interact with their work environment to make it more demanding. Additionally, different factors of the JAS operate to create the greater demand depending upon where the work is being initiated. Those who were involved in their jobs and competitive tended to create work for themselves and complete more, whereas those who were less competitive tended to receive their work from others. Type As tended to create more work demand, resulting in increased time urgency and impatient behavioral styles. This, in turn, affects the social networks of Type As. Those seen by supervisors as being more productive and driven tend to draw more assignments. Those who are highly competitive, but less job involved, may have solicited more work from supervisors in order to enhance their standing and acquire performance feedback opportunities. Because of this style in approaching work, Type As may place themselves in positions vulnerable to deleterious effects of work stress due to overload. At the same time, however, they continue acting upon the overload in a manner consistent with their Type A component factors. The directionality of Type A and the experience of work stress becomes blurred, since the relationship seems to be circular and self-fulfilling.

Kushnir and Melamed (1991) applied Karasek's (1979) Job-Demands-Control model to the experience of anxiety and stress of Type As in the workplace. The model essentially states that every job situation can be characterized in terms of external demands upon an individual's effort to complete the job, and their ability to moderate or control the decisions made about how to meet the demands. These dimensions have been found to be stressors, with the highest work strain occurring when there are high demands and low control. The resulting strain has been associated with adverse psychological and physiological outcomes, such as the onset of cardiovascular disease (Karasek et al., 1981; Karasek, Gardell, & Lindell, 1987). Kushnir and Melamed (1991) proposed that since Type A behavior has been associated with overload and control, Type A individuals should be especially sensitive to manipulations of demand and control, as proposed in the J-D-C model. While Type As reported higher workload and distress than Type Bs, they also reported higher perceived control. The authors speculated that Type Bs may find the workload to be positively challenging and stimulating. While there was a main effect for control influencing job satisfaction, it did not interact with Type A until workload was entered as a third variable. Thus, perceived control interacted with Type A to influence irritability and job satisfaction only when workload was taken into account. It was reported that high control may increase the threat to Type As, because it increases their accountability for the work. The J-D-C model was supported, with high stress in conditions of high demand and low control, but there were no clear cut trends for Type Bs, who reported job strain as irritability only, without a decrease in job satisfaction. Type As reported irritability as well as somatic complaints in high workload, low perceived control conditions.

Cognitive Aspects of Type A

With inconsistent findings concerning relationships between paper-pencil measures of Type A and the onset of coronary heart disease, Rhodewalt et al. (1991) proposed that the paper-pencil measures of Type A capture more of the cognitive appraisal aspects of the behavior pattern. Since Type A individuals tend to report higher levels of job stress, (Rhodewalt et al., 1984), there is a cognitive-perceptual event associated with Type A behavior pattern that may confound the relationship between Type A and coronary heart disease. Indeed, Type A individuals may generate stress for themselves through their cognitive appraisal of what is going on in the environment and their cognitive coping mechanisms. A model was proposed whereby Type A interacted with perceived job stress to influence physical symptoms and psychological distress.

To test the model, three hundred thirty-six school principals completed the Jenkins Activity Survey, job stress, and physical and psychological well-being instruments. The emergent path model indicated that while lack of situational control was stressful for all principals, it was particularly stressful for Type As. Situational control, job stress, physical symptoms, and psychological distress were correlated with Type A behavior pattern. Lower control over the situation leads to greater stress for Type As as compared to Type Bs. Stress, in turn, leads to greater psychological and physiological impairment. Job stress, therefore, mediated the relationship so that higher job stress yielded the symptoms, and situational control no longer affected it. Type A, however, had a more direct relationship to physical and psychological symptoms, even when job stress was controlled.

Type A was found to reflect a general, characteristic way of perceiving the environment and situations. The workplace is an environment that provides a number of factors that may be more or less stressful to Type A individuals, possibly exacerbating psychological and physical impairment. This study supports a cognitive-perceptual component of Type A behavior pattern, that while not directly correlated with coronary heart disease, may be interpreted as part of the milieu underlying a Type A individual's perception of appraisal of events in the environment. In turn, Type As respond to the environment with characteristic Type A behavior patterns. This perceptual response, in concert with cardiovascular lability, may then lead to onset of coronary heart disease, as well as other stress related outcomes.

Kirmeyer and Diamond (1985) examined the coping styles of Type A and Type B police officers. Subjects were interviewed regarding stressful situations they had encountered and completed a questionnaire to assess how they coped with stress. Type A police officers were found to appraise situations more aggressively than their Type B counterparts, who tended to exhibit more passive acceptance of situations. Type As were action-oriented with single-minded attention to the problem at hand. While the specific incidents and levels of experienced stress did not differ between As and Bs, their responses to the stressful situation differed significantly. Thus, the Type A behavior pattern emerged as an outcome of stress experienced on the job, not as a contributing factor.

To further delineate the cognitive aspects of Type A behavior, Watkins, Ward, and Southard (1987) developed the Type A Cognitive Questionnaire (TACQ) to tap into the cognitive belief systems of Type As, as proposed by Price (1982, 1986). It was proposed that Type As possess three core belief structures: you must constantly prove yourself through achievements, there is no universal moral principle, and all resources are scarce. Price (1986) wrote that a poor self-image is the "most important single cognitive factor underlying and promoting Type A behavior." Thus, they are striving to achieve and improve their perceived image in an environment of fierce competition for scarce resources.

The TACQ was designed to quantify these belief structures. Watkins et al. (1992) administered the TACQ to 67 female and 44 male college students, along with a battery to measure hostility, social support, and life stress. They found that TACQ correlated with hostility (MMPI Ho scale), and confirmed that cynicism was the active factor in Type A more than paranoid alienation. Also, the relationship tended to be stronger for men than for women. TACQ scores were not correlated with quantity of social support, but there was an inverse relationship with quality of social support in men only, with Type A persons reporting lower quality of social support. This relationship did not exist for women. The TACQ correlated positively with life stress.

These data provided evidence for the role of hostility as a debilitating component of the Type A behavior pattern, and supported the contention that Type A individuals tend to go through life exacerbating their own problems. Type A was measured as a belief system, or cognitive component, that affects how individuals perceive the environment. Also, this study found that these Type A relationships were much more pronounced in men. It was speculated that women place greater importance in their social support network and would be more vigilant in maintaining interpersonal support mechanisms.

Type A Trends

From this review, the role of Type A personality as a causal factor in occupational stress and cardiovascular responsivity to stressors has been called into question. Other personality factors such as hostility and neuroticism may interact with Type A to increase an individual's vulnerability to stressors. On the other hand, it has been proposed that Type A serves more as a cognitive appraisal mechanism. If this is the case, it is reasonable to infer that Type A moderates the experience of stressors in the workplace and provides for adaptive functioning of the individual. A path analysis performed with data examining anger and job stress revealed that trait anxiety influenced job pressure and dissatisfaction, and Type A behavior pattern influenced job pressure, dissatisfaction, and anxiety (Hodapp, Neuser, & Weyer, 1988). Thus, Type A behavior pattern may intervene in the relationship between occupational stress and the anxiety associated with it.

In a recent monograph concerning Type A, Ganster, Schaubroeck, Sime, and Mayes (1991) used the Structured Interview method of measuring Type A behavior pattern to define the nomological validity of the Type A construct. Subjects were administered a questionnaire battery to measure a variety of personality attributes, including Type A, extraversion, neuroticism, psychological and physiological strain. The Structured Interview produced scores for speech characteristics, hostility, and item content. Subjects participated in a Stroop task while systolic blood pressure, diastolic blood pressure, heart rate, electrodermal response, and skin temperature were measured. Consistently, the hostility component of the Structured Interview emerged as the most reliable Type A measure associated with all physiological parameters of reactivity to the Stroop task, with the single exception of heart rate. Other Structured Interview components, alone and in sets, were correlated with systolic and/or diastolic blood pressure. The authors conclude that while hostility is the most potent factor of Structured Interview Type A, in terms of sympathetic nervous system activation, other Type A factors should not be ruled out as contributing to the overall effect.

Personality variables in the study were examined in relation to Structured Interview factors. In general, the traditional Type A person as one who is outgoing, involved in their job, tolerant of ambiguity, exhibits male characteristics, and has high needs for achievement and power. Unexpected findings were that Type As had an internal locus of control and higher self esteem than Type Bs. Also, neuroticism and anxiety failed to correlate with either Structured Interview Type A or the hostility factor. From this lack of association, the authors concluded that hostility is nomologically distinct and that Type A measured by the Structured Interview is distinct from negative affectivity.

This study demonstrated that the Type A construct is varied and interpreted in many ways. The Structured Interview captures various elements of the Type A behavior pattern better than other assessment methods, as does the Jenkins Activity Survey. As a paper-pencil measure of Type A, the authors used the Thurstone Activity Scale rather than a more common metric such as the JAS, Bortner Scale, or Framingham Type A Scale. They report that because paper-pencil Type A measures do not assess hostility, they are poor predictors of eventual illness. They echo Friedman and Booth-Kewley (1988) by saying the Type A personality pattern and coronary-prone behavior cannot be equated, but that traditional Type A can be useful in studies of more cognitive aspects of performance and work functioning.

Even though the Type A behavior pattern has undergone extensive tests and scrutiny, there is still little consensus regarding its construction and utility. Originally proposed as an independent risk factor, attempts to use the construct as a predictor met with mixed results. Findings were further complicated with the advent of paper-pencil measures, which have been shown to assess distinctly different aspects of the construct than the Structured Interview. Occupational stress research found that Type A personality contributes to the experience of stress at work, but it also serves to influence how stress is perceived. Thus, the relationship between Type A and work stress is unclear.

It is clear, however, that Type A does not act alone in influencing experienced stress at work and physiological response to stress. Hostility has been identified as a component of the Type A behavior pattern. An independent personality factor, neuroticism, has also been proposed as strongly influencing deleterious psychological and physical effects of stress.

Neuroticism

Construct Definition

Another view of the relationship between personality and physiological responsivity is couched within a biologically based concept of personality and behavior. Eysenck (1967) implicates the physiology of the central nervous system in determining how an individual will respond to demands from the environment. The threshold for activating the reticular formation of the brain determines one's extraversion, and the conditionability of the autonomic nervous system determines one's neuroticism.

According to the model, individuals who are high in extraversion are characterized by a reticular formation with an activating part possessing a high threshold for arousal. Conversely, one low on extraversion possesses a reticular formation with a low threshold for arousal. Thus, individuals high on extraversion require greater stimulation from the environment to maintain a comfortable level of incoming sensory information to the brain. High extraversion individuals may be called "stimulus starved," since they seek out stimulation from the environment in order to satisfy sensory deprivation.

On the other hand, the brain of low extraversion individuals is being constantly bombarded by sensory input due to the low threshold required for reticular activation. They are "stimulus satiated," and will behaviorally seek to minimize the amount of external environmental stimulation. Behaviorally, the low extraversion individual will attempt to avoid engaging in the kinds of exciting or stressful activities that the high extraversion individual craves. Low extraversion individuals are often referred to as introverts, since they characteristically will minimize their social contacts along with other stimulating activities.

A second dimension postulated by Eysenck is neuroticism, which refers to the conditionability of the nervous system. Individuals high in neuroticism react to environmental stimuli more quickly and with greater intensity than those low in neuroticism. Over the years, the term "neurotic" developed a clinical connotation referring to the manifestation of specific indices of nonpsychotic disorder. Neuroticism in the Eysenckian sense, however, exists as a fundamental personality dimension and does not refer to any clinical or abnormal manifestations. Everyone possesses some level of neuroticism, and extraversion for that matter, which may be measured and plotted on a normal distribution.

Jensen (1962) applied Eysenck's theory of neuroticism to performance on a high stress task. Subject's were required to master a serial learning task at rates of two or four seconds. The shortening of the stimulus presentation time acted as a stressor and Jensen measured neuroticism with the Maudsley Personality Inventory, an early version of the Eysenck Personality Inventory. He found that for those scoring low on neuroticism (also called "stable") there were an average of 63 errors on the long rate and 64 errors on the short rate, indicating no significant effect of stimulus presentation time. For those scoring high on neuroticism, however, the average errors for the short rate were 90, compared to an average of 46 errors on the long rate. It may be conceptualized that while all subjects in the same situation experience identical levels of external "stress," each individual may experience different levels of "strain" due to their own unique physiology. Jensen demonstrated that this may also translate into performance differences in high stress conditions.

In a factor analysis of the Eysenck Type A/B Questionnaire, Eysenck and Fulkner (1983) identified primary factors as tenseness, ambition, and activity. They found that extraversion was highly correlated with ambition and activity, whereas neuroticism was highly correlated with tenseness. Therefore, a total Type A score may be explained in terms of the more stable personality traits of extraversion and neuroticism, with the Type A individual falling within the high extraversion, high neuroticism quadrant, when the dimensions are plotted on a Cartesian plane. Eysenck and Fulkner (1983) further cite research to indicate that differential measures of extraversion and neuroticism may yield variations in cardiovascular disease. The development of angina pectoris, hypertension, and tachycardia have been associated with high neuroticism and low extraversion, whereas myocardial infarction and hyperlipidemia have been associated with high neuroticism and high extraversion.

In a review of studies relating personality, cancer, and cardiovascular disease, Eysenck (1985) found that individuals who develop cancer tend to express behaviors consistent with his conception of high extraversion and low neuroticism. On the other hand, those who develop cardiovascular problems overwhelmingly tend to exhibit low extraversion and high neuroticism. Personality assessment tools with low reliability and validity, such as many projective tests, will not be useful in delineating statistical relationships between personality and various outcomes. Also, Eysenck wrote that dichotomization of complex behavior, such as Type A and Type B, is not appropriate statistically or clinically. Current conceptions of hostility reflect Eysenck's third personality factor of psychoticism, characterized by aggression, impulsiveness and autonomy in the Type A research.

With regard to cardiovascular disease, the specific type of illness manifested may also be dependent upon other subtle personality factors interacting with the high neuroticism and low extraversion dimensions. Most notably are the factors associated with the Type A behavior pattern. As Eysenck (1983) indicated, the multifaceted conception of the Type A personality as posited by Jenkins et al. (1966)

may not be optimal from a statistically predictive point of view. Some factors associated with Type A may be more predictive of coronary artery disease than others, thus clouding statistical power of the overall Type A concept. Interactions with hostility, neuroticism, and extraversion also complicate the interpretation of the Type A concept.

Studies of Neuroticism

Furnham (1984) examined the relationships among several self-report measures of psychophysiological reactivity, including extraversion and neuroticism, sensation-seeking, arousal-seeking, and Type A. Extraversion was found to correlate highly with sensation-seeking and the Framingham A measure, and less with the Eysenck measure of Type A. Sensation-seeking was correlated with both the Framingham and Eysenck measures of Type A. Subscales and primary scales of these instruments were also highly intercorrelated, suggesting that the constructs being measured by this plethora of tests may share a great deal of common variance. In other words, different tests developed by different researchers with different theoretical emphases may all be "tapping into" a much smaller number of primary factors or constructs. Even the Type A construct, argued to be a behavior pattern, has correlated with personality measures based upon theoretically stable traits such as neuroticism.

Research by Bernardo, de Flores, Valdes, Mestre, and

Fernandez (1987) supports the contention that the coronary-prone (Type A) construct may be contaminated with other personality states or traits that may be related to coronary incidents, such as neuroticism or extraversion. Matched samples of coronary patients and normal controls were administered a battery of questionnaires designed to measure Type A behavior (JAS and Bortner scales), neuroticism, extraversion, psychoticism, dissimulation, hostility, and aggressivity. Between group analyses showed that male coronary patients tended to display a complex psychological pattern of Type A (all scales except Job Involvement), emotional hyperactivity (Neuroticism), and elements of hostility and aggression. For women, the results were less clear, with fractionation of the Type A elements between the two groups. Bernardo et al. suggest that there may be two psychological factors related to CHD: the Type A-Neurotic complex and a hostile-aggressive complex. This lends support to the concept of a physiologically based behavioral activation system posited by Eysenck and Fulkner (1983), in which psychological components can interact with an individual's physiology to lead to overt behavioral problems as well as physical malady (e.g. CHD, ulcers, hypertension, etc.).

In a similar study, Lichtenstein, Penderson, Plomin, de Faire, and McClearn (1989) examined Type A, extraversion, neuroticism, hostility, and a measure of inhibition of aggression. Over 1,000 older subjects completed the questionnaires and were rated on their coronary condition. The Type A construct was found to be multidimensional, composed of Pressure, Hard-Driving, and Ambitious factors, with Pressure representing the Eysenck and Fulkner (1983) concept of "tenseness." Type A and Pressure correlated with Neuroticism and Hostility, while Hard-Driving and Ambitious both correlated with Extraversion. Neuroticism was also correlated with Hostility, though the relationship was somewhat low. When all measures were pooled over age and gender, the risk factors for CHD were, in order, age, Pressure, Gender, Neuroticism, and Hostility. This study further supported the Type A-Neuroticism-Hostility complex as psychological factors in CHD, as well as a multivariate approach to the study of such a multifaceted issue.

Wistow, Wakefield, and Goldsmith (1990) devised a procedure to test Eysenck's (1985) proposal of the causal relationship between personality and disease. Neuroticism was found to correlate positively with symptoms of stress and negatively with symptoms of cancer. When a canonical analysis was performed with all measures, a bipolar factor emerged with stress and cardiovascular symptoms together, and neuroticism positively associated with it. Again, neuroticism was negatively associated with cancer. Thus, Eysenck's theory of the relationship between personality and disease was supported.

In examining personality at work, Sutherland and Cooper (1991) predicted that extraversion and neuroticism worked to mediate perceptions of the environment and behavior with regard to other personality components, specifically Type A. They tested males working on offshore oil rigs on their personality (Type A, extraversion, neuroticism), source of job stress, job satisfaction, and psychological well-being. They collected accident statistics on the subjects as well. Neuroticism was overwhelmingly the best single predictor of job satisfaction and poor mental well-being, followed by Type A. Type A workers were more dissatisfied with their jobs than Type Bs and reported significantly more accidents involving injury. Also, high neuroticism workers reported significantly more accidents and higher levels of job stress than their low neuroticism counterparts. Thus, the Type A behavior pattern and neuroticism were associated with greater job distress and poorer mental well-being, as well as higher accident rates. The mechanism of Type A behavior with regard to accidents remains unclear, but credence was given to the Type As achievement striving, and possible dissatisfaction from chronic failure and perception of poor performance on the job. Incidentally, the sample in this study tended to be Type B (73%). The fact that a smaller number of subjects were responsible for most of the variance in stress and mental health issues is alarming.

Of interesting note are the accident statistics collected in this study. Three hundred ten male workers reported a total of 91 accidents on the job (29%), and most of these were Type A and/or Neurotic. Of those, 53% resulted in lost time of two days or more, 88% required medical attention offshore, and 56% required evacuation to an onshore hospital (categories are nominal and do not sum to 100%). The utility of identifying a high risk personality becomes painfully evident when considering the personal injury and expense that may be prevented by appropriate screening, selection, and preventive protocols in the workplace, especially those characterized as high stress environments, as presented in this study.

Neuroticism Trends

In sum, neuroticism has been proposed as a biologically-based personality factor that has a direct impact on the experience of psychological and physiological distress. An individual high in neuroticism shows a great deal of behavioral and emotional lability and intensity. This can be heightened in times of stress. Eysenck has linked high or low neuroticism to the differential development of cancer or cardiovascular disease. Workplace studies have described the high neurotic worker as suffering from greater job dissatisfaction and distress, as well as being more accident prone on the job. Neuroticism, then, appears to be stable basic personality trait implicated in the stress response.

Neuroticism also works in concert with other personality factors. Traditional Type A indices as discussed above may be reconceptualized in terms of their relationships to primary personality factors. Neuroticism appears to go hand in hand with Type A in defining a high risk personality, but also enjoys a greater degree of consensus in the interpretation of the scale. Type A and neuroticism, however, are not the sole constructs implicated in the stress response. Indeed, hostility has been mentioned as part of the Type A construct and a contributing factor to the personality complex responsible for stress response.

Hostility

Construct Definition

Recent work has implicated hostility as a significant, if not primary component of CHD. Williams et al. (1980) administered a battery of physical and psychological tests to patients who underwent exploratory arteriography. Assessment instruments included the Structured Interview, JAS, and MMPI, as well as a number of additional stress and depression scales. From the sample of 424 patients, 319 were Type A, and there were more Type A men than women. The findings supported the Type A behavior pattern with regard to distribution and presence of coronary occlusion within the Type A group. Unexpectedly, however, the research team found that high scores on the Hostility scale (Ho) of the

MMPI were more significantly related to coronary occlusion than the Type A behavior pattern. When examined together, the degree of Type A and Hostility eliminated sex differentials. Low Type A and low Ho scoring individuals, whether male or female, were less likely to suffer from coronary occlusion than high scorers on these instruments.

Shekelle, Gayle, Ostfeld, and Oglesby (1983) examined the relationship between hostility, history of CHD, and risk factors in 1,653 working men. High scores on the MMPI Ho scale were found to be associated with a 10 year history of CHD, as evidenced by myocardial infarction and death in the pretest sample. At 20 years, the relationship was more tenuous, but significant when risk factors were statistically controlled. Also, high Ho scores were significantly related to risk of death from all causes, with higher risk associated with higher scores. The researchers conclude that hostility has some influence on factors that broadly affect human survival. Given that the high Ho scorer is described as "one who has little confidence in his fellow man" and "sees people as dishonest, unsocial, immoral, ugly, and mean, and believes that they should be made to suffer for their sins," it is possible that Ho taps into a lack of social support, since these people may not have many others to serve as a social support network in time of emotional need.

Barefoot, Dahlstrom, and Williams (1983) demonstrated further validity for the relationship between hostility and CHD by conducting a 25-year follow-up of physicians who completed the MMPI in medical school. The history of CHD (including angina and myocardial infarction) was determined for the sample of 255 physicians, 19 of whom had died. High Ho scorers, as determined by median splits on the sample, had significantly greater incidences of CHD than the low scorers. The authors report that the estimates of CHD in the sample are conservative, since in cases where subjects died, the autopsy may not have been performed or may not have detected subtle cardiovascular disease. The actual relationship between hostility and CHD, therefore, may be underestimated in this sample. Even with statistical control for risk factors and hypertension, the relationship between Ho and CHD over 25 years was significant. Furthermore, a significant relationship was found between high Ho scores and total mortality, which includes death from all causes, such as accidents and physical malady. This further supports the contention that the Ho scale taps into some psychosocial factors related to death from all causes. Relationships between Ho and major health problems, however, were not supported.

To further examine what factors the MMPI Ho scale measures, Costa, Zonderman, Mc Crae, and Williams (1986) conducted a factor analysis and construct validation study using over 1,000 MMPI cases. Two subscales emerged from the factor analysis of the Ho scale. The "Cynicism" subscale is interpreted to indicate a generally "low opinion of human nature," whereas the "Paranoid Alienation" subscale indicates feelings of persecution. The authors stress that neither subscale measures "anger, irritability, or aggression," but taps into "contempt for others and weak interpersonal bonds." Construct validation found strong relationships between the subscales and MMPI Neuroticism, Psychoticism/Infrequency, Somatic Complaints, Inadequacy, and Cynicism. These MMPI scales are general indices of psychopathology which have been associated with CHD.

A more extensive construct validation study of the Ho scale was conducted by Greenglass and Julkunen (1989). Sex differences were found on the expression of hostility. Male hostility was associated with greater open expression of anger, whereas female hostility tended to be more inward directed (Anger/In). Type A behavior in females, however, was associated with a greater tendency to express hostility outwardly. Cynicism was found to moderate hostile reactivity in both males and females. The authors conclude that while the MMPI Ho scale may be an overall barometer of hostility, the expression of behavioral manifestations of hostility are moderated by sex and other personality factors, such as cynicism and the direction of anger (in or out). The contention that the relationship between Ho and CHD is reflected in an interpersonal deficit is further supported by these data.

Studies of Hostility

The relationship between hostile aggression and Type A was examined in a laboratory study by Check and Dyck (1986). Subjects participated in an "ESP" task requiring them to "punish" or "reward" a confederate for their performance. Prior to the task, a detrimental evaluation of the subject by the confederate served to instigate aggression. The researchers found that actual aggression, measured as punishment delivered, was correlated with the desire to hurt the confederate, and that Type As had significantly greater desire to hurt the confederate than Type Bs. Overall, Type As demonstrated greater use of punishment than Type Bs, indicating a greater aggressive response when provoked.

Following up on Smith and Frome's (1985) finding that cynically hostile individuals have fewer and less satisfactory personal contacts and interpersonal support, Hardy and Smith (1988) sought to refine the hostility construct and examine the relationships among the Ho scale, social support, life stress, and physiological reactivity. Subjects participated in role playing exercises while systolic blood pressure, diastolic blood pressure, and heart rate were measured. The exercises were designed to simulate interpersonal interactions containing either low of high levels of interpersonal conflict. High conflict situations tended to be "disagreeable" in nature. Hostility was rated by independent evaluators in each exercise.

They found that the Ho scale measured cynical hostility, as high Ho individuals tended to view others disparagingly, be more anger prone, and behave with more hostility and less friendliness across all situations. High hostile individuals also showed greater diastolic blood pressure reactivity to high conflict situations in the role playing exercises. It was speculated that the hostility effect on diastolic blood pressure represented anger during interpersonal conflict; however, Ho was not related to state anger. The experimenters speculate that the experimental situation was not sufficiently provoking to elicit the emotional arousal associated with state anger. They also stated that high hostile people may respond to interpersonal conflict with heightened vigilance, which may have caused elevated diastolic blood pressure. Nevertheless, the authors cite Keys et al. (1971), who link elevated diastolic blood pressure with early onset of coronary heart disease. The reactivity of high hostile individuals to simulated conflict in this study should probably be interpreted as a lower bound indicator of what reactivity might be in a non-experimental situation.

This study found that high hostility was associated with less social support and increased life stress. More specifically, high hostile individuals reported obtaining less satisfaction from social support, rather than simply having a fewer number of supporters. Ruberman, Weinblatt, Goldberg, and Chaudhary (1984) have shown that high life stress and low social support is dangerous following heart attacks. The authors propose that cynical hostility aggravates a "biopsychosocial risk process," whereby the hostility and antagonism in high hostile individuals elicit hostility and antagonism in others. The stressful interpersonal environment surrounding these people then destroys the foundation needed for developing and maintaining positive social support mechanisms and relationships. Thus, the quality of interpersonal relationships deteriorate, and hostile individuals find it difficult to develop and maintain additional supportive relationships.

Durel et al. (1989) examined hostility, state anger, and cardiovascular variables in black and white men and women. The study included measurement of systolic blood pressure, diastolic blood pressure, and heart rate while subjects played a challenging video game, participated in the Structured Interview, worked a normal workday, and underwent a cold pressor test.

Results were quite varied across race and gender for the psychological and physiological variables. Baseline measures were different between groups, with anger positively correlated with resting diastolic blood pressure in black males and both systolic and diastolic blood pressure in black and white females. Hostility was correlated with systolic and diastolic blood pressure in black females, but negatively correlated with systolic blood pressure in white males. During the laboratory exercises, men were more reactive than women in diastolic blood pressure in the video game, whites were more reactive than blacks in the Structured Interview in both systolic and diastolic blood pressure, and blacks were more reactive than whites in both systolic and diastolic blood pressure in the cold pressor test. Anger was correlated with diastolic blood pressure in the cold pressor task for black women, whereas for white women, anger was correlated with systolic and diastolic blood pressure during the Structured Interview. Hostility was negatively correlated with systolic blood pressure during the video game for white men. During daily monitoring of blood pressure and heart rate, it was found that anger in black women was correlated with systolic and diastolic blood pressure at work. This relationship approached significance for all women, but was close to zero or negative for men.

From this potpourri of findings, one may conclude that cardiovascular function and reactivity does indeed vary among race and gender. While blacks were higher in hostility than whites, they were generally lower in state anger. It was reported that this was consistent with literature in the area, and served to complement each other with regard to the dynamics of anger in black society. Blacks and whites differed with respect to reactivity in specific tasks, with blacks responding with greater blood pressure reactivity in the cold pressor test, and whites showing greater blood pressure responses in the Structured Interview. It was suggested that there is a physiological basis for differential drug treatment of hypertension, with blacks responding better to diuretics and whites responding better to beta-blockers.

In many cases, gender differences were more pronounced than race differences in the study. Black and white women showed positive correlations with anger and blood pressure at rest, during a laboratory task, and at work, whereas men only produced more diastolic blood pressure reactivity during the video game and white men showed a negative correlation between systolic blood pressure and hostility.

The expression of hostility has also been examined in the context of the workplace. Cottington, Matthews, Talbott, and Kuller (1986) examined the relationships among suppressed anger, occupational stress, and hypertension in male plant workers. Simply, men who suppressed their feelings of anger and reported greater job stress demonstrated a higher probability of having blood pressure in the hypertensive range. Hodapp, Neuser, and Weyer (1988) looked at the anger component of job stress, and included measures of anxiety, work environment, and blood pressure.

Anger was found to be the product of perceived pressure and dissatisfaction, whereas anxiety resulted only from job pressure. Also, anger may be correlated with specific events, whereas anxiety arises from accumulated negative events.

Hostility Trends

It has been proposed that hostility is the active ingredient in risk for CHD, far and above the Type A behavior pattern. The construct of hostility is itself quite varied, but the primary component implicated in the stress response is cynical hostility, or harboring chronic negative, disparaging views of one's fellow man. This hostility is distinct from anger or anxiety, which are generally believed to be transitory states rather than enduring traits.

The data tend to indicate that hostility accounts for greater variance in eventual CHD onset than paper-pencil measures of Type A. However, since Structured Interview measures of Type A include assessments of hostility, statistical conclusions become more tenuous. Indeed, when it comes to outright aggression, one study (Check & Dyck, 1986) found that Type As demonstrated greater aggressive responses when provoked. High hostile individuals, like Type As, tend to create their own psychosocial milieu which can perpetuate their behavioral response contingencies. The quality of their interpersonal relationships is diminished and their physiological responses to stress are exaggerated.

Reactivity in diastolic blood pressure seems to be the mechanism involved in physiological activation among high hostile individuals (Hardy & Smith, 1988). As reported by Durel et al. (1989), the physiological responsivity question becomes complicated when mixed gender samples are used. In that study, women showed heightened physiological activation and differential response patterns then men. Weidner et al. (1989) found that while women scored lower on a measure of hostility, they also differed in their cardiovascular response patterns to a cognitive stressor. Specifically, hostile males responded with greater systolic blood pressure reactivity, whereas hostile women responded with greater diastolic blood pressure reactivity.

The Durel et al. (1989) work articulates the importance of addressing gender as an influence in differential physiological response to stress. Variations in responses by gender may contaminate statistical conclusions in stress research, as well as preclude valid interpretations of the data. Thus, the relationship of gender to these variables should be explicitly examined in such research.

Gender

The majority of studies reviewed thus far in this paper have used male subjects, primarily because males were typically found in the environments where occupational research was conducted. The sheer percentages of women entering the workforce and assuming nontraditional roles (Catalyst, 1990; Jackson & Alvarez, 1992) demands that research incorporate gender concerns, especially in substantive areas where gender differences may exist. As evidenced in preceding studies, personality and physiological responsivity to stress are areas where such differences may be found.

In her study of the WCGS participants, Waldron et al. (1977) concluded that younger women scored somewhat lower on Type A than younger men, but that gender differences tended to disappear over time. Using two different measures of Type A (JAS and Framingham Type A scale), Kelly and Houston (1985) found convergence on the construct as it relates to employed women. Type A employed women reported more stressful work experiences and more daily stress and tension than their Type B counterparts. Not different, however, were their marital satisfaction or leisure activities. Kelly and Houston (1985) reported that Type A women tended to feel greater stress when more social support was present. It was proposed that social support from supervisors or husbands may be perceived as an intrusion or burden. Also, it may drive motivation to perform, since an expectation of achievement is created. In looking at specific job stressors, quantitative work load, overtime, occupational level, and role conflict were not solely responsible for mediating the relationship between Type A and stress. It was proposed that these variables were not sufficient in capturing the full extent of workplace experiences that were occurring to influence stress. Type As, however, did report working more overtime hours, more quantitative workload, and working more hours per week than Type Bs.

Houston and Kelly (1989) readdressed gender issues in the workplace by adding hostility to the analysis. High scores on hostility (MMPI Ho scale) were correlated with several measures of job stress, including role conflict, job tension, and underutilization of skills. Hostility was also correlated with stress, tension, and anger-out, and negatively correlated with social support from supervisor and husband. Interestingly, hostility was not correlated with marital satisfaction or social support from friends and relatives. The authors, again, propose that there are other sources of stress unmeasured in their study, and discuss the self-perpetuating nature of hostility and negative interpersonal experiences.

In a series of studies, Frankenhauser et al. (1989) examined relationships among occupational stress, social support, and cardiovascular variables in managerial and clerical men and women. Managers reported greater autonomy of work, which is to be expected. Female clericals reported greater social support and female managers reported higher conflict between work and non-work roles, but no other job stress variables were different, with the single exception of personal control being higher for men. Interestingly, Frankenhauser et al. (1989) found that women were higher on Type A (Structured Interview) than men, especially in the area of competitiveness. Managers complained about heavy workload, time pressure, and responsibility for others as work stressors, and women in general complained about lack of communication. The most dissatisfied group in the study were male clericals.

With regard to physiological measures, men had higher systolic blood pressure and women had higher heart rate. Managers, as a group, had significantly higher heart rate than clericals, but this was due to the extremely high heart rate of women managers. Males had higher low density lipoprotein and triglyceride counts, and women had higher high density lipoprotein counts. When examined as total cholesterol, there were no significant differences between males and females.

In a second study, Frankenhauser et al. (1989) fitted subjects with ambulatory blood pressure monitors for repeated measurements of blood pressure throughout the day. They also examined urinary catecholamines and self-reported measures of stress. In general, blood pressure tended to be higher in the morning, but systolic blood pressure was highest in the evening when the researchers visited to collect data. Male manager's blood pressure, both systolic and diastolic, dropped at the end of the workday, but female manager's blood pressure and clerical's blood pressure remained high into the evening. Men had significantly higher systolic blood pressure than women, but women had significantly higher heart rate than men. Diastolic blood pressure did not differ between genders. In all subjects, systolic and diastolic blood pressures were elevated while on the job. Higher levels of epinephrine were also found in the job environment. Norepinephrine and cortisol decreased after work in men, but norepinephrine increased after work in females. Males, however, reported more work overload than females, and managers reported more overload than clericals.

The authors conclude that women managers are highly competitive, with high job involvement and a love for their work. They are androgynous in terms of their sex role profile, and hence experience a great deal of conflict between work and nonwork demands. Women are unable to "unwind" after work, like their male counterparts, and exhibit higher perceived total workload. Physiologically, women had a serum cholesterol count as high as men, but great differences in physiologically meeting demands of the day.

In examining the relationship between hostility and other lifestyle and risk factors for coronary artery disease, Musante et al. (1992) measured hostility, physical activity, smoking, diet, systolic blood pressure, and diastolic blood pressure in eighty-one women and fifty-seven men. While Ho scores were correlated with cholesterol intake for females and males, lower fiber intake and higher animal fat intake were associated with high Ho scores in females. In males, high Ho scores were correlated with smoking, high sugar intake, and low calcium intake. While hostility was correlated with poor eating habits, it was positively correlated with physical activity. The authors propose that individuals engage in displacing activities, such as physical activity, to buffer the negative effects of unhealthy lifestyle behaviors.

With regard to cardiovascular activity, Ho scores were positively associated with systolic blood pressure in women, but negatively associated with systolic blood pressure in men. This finding was consistent with Durel et al. (1989). The inclusion of lifestyle behaviors in this study permitted the authors to concluded that while physical activity was correlated with hostility in both women and men, the dietary habits of high hostility women are counterproductive to cardiovascular health, and thus may have deleterious effects on their blood pressure. This relationship did not hold up for men, whose poor dietary habits may have differential effects on their physiology.

Russo and Zuckerman (1991) examined risk for essential hypertension in female and male college students by measuring family history of hypertension, personality variables, and blood pressure in a mental arithmetic task. Men with a family history of hypertension showed greater diastolic blood pressure reactivity to the task, and also possessed greater body mass, whereas women with a family history showed greater depression, greater dysphoria, greater neuroticism, and less expressed anger than those with no family history. In a discriminant function analysis, neuroticism, Type A and extraversion were useful in differentiating those women with and without family history of hypertension, but body mass and blood pressure change was useful in differentiating men. It was proposed that women develop essential hypertension through personality risk factors, such as neuroticism, inward anger, and depression. Men, however, exhibit physiological responsivity under stress. Thus, women may have a "built-in" biological control over excessive blood pressure reactivity to stress, but can develop essential hypertension over the long run given their psychological risk profile. The authors use this notion to explain why the onset of hypertension is much later in women than men. Additionally, they implicate socialization to explain why women may turn anger inward, and develop depression under stress rather than express distress outwardly as men do.

In a biopsychosocial model of cardiovascular stress responsivity, differential effects between men and women may be due to socialization. In this sense, when women express the physiological manifestation of stress through sympathetic nervous system response, resulting, for example, in increased systolic blood pressure, they may be socially sanctioned by parents and others to not express themselves that way. Instead, the response may be directed through different parameters. This is a cognitive feedback mechanism, so deleterious cognitive effects of this socialization, in terms of depression, dysphoria, and inward anger, would be expected. According to the previous study, the physiology does, eventually, catch up.

In our society, women are entering the workforce in ever-increasing numbers (Catalyst, 1990; Jackson & Alvarez, 1992). Social roles and responsibilities, while not yet equal, are approaching equivalence. The learned mechanisms that kept women and men behaviorally distinct are dissolving. Previously reported research addressed female stress, hostility, and physiology in the workplace as different from male experiences, but approaching parity. Nevertheless, the extent to which prior learning, physiology, and psychophysiological mechanisms dominate gender differential responses to stress at home or in the workplace will dictate differential strengths and weaknesses in assessment of stress and development of stress management approaches. This research was designed to address these differences in a diverse sample of working men and women.

Summary and Hypotheses

In the preceding chapters models of occupational stress have been discussed and the roles of personality factors in the stress response have been presented. Factors such as the Type A behavior pattern, neuroticism, and hostility have been implicated as variables that influence an individual's physiological response to stress. Additionally, these factors have been proposed as influencing one's way of perceiving and interacting with the environment and others.

Of specific concern in the present research is the working environment. While occupational stress continues to be a problem for business and industry, researchers are still having difficulty in defining the nature of individual strain and stress responses. Personality is included as a variable or set of variables in nearly every occupational stress model, but their relative contributions remain speculative. The Type A behavior pattern is illustrative of this point. Personality and early occupational stress models view stable personality traits as brought to the workplace by the individual. In this context, Type A individuals would be Type A independent of the work environment, and as Ivancevich and Matteson (1984) posit, the work environment itself could be Type A or Type B. In this model, being Type A or Type B, or neurotic or hostile for that matter, would precipitate the experience of occupational stress. More recently, however, Type A has been viewed not as a personality trait per se, but as a cognitive coping mechanism that is elicited following the experience of occupational stress. The issue becomes more confused when considering the relationships among the personality variables involved. Hostility is a component of some Type A measures, and neuroticism is correlated with Type A. Theoretically, neuroticism is a predisposing factor to experiencing deleterious effects of stress, meaning that individuals who are high in neuroticism experience psychological and physiological problems when exposed to high stress. This position is fundamentally different than saying that some people when under stress develop high neuroticism. Thus, the relationships among personality factors in the occupational stress arena continues to be under debate.

Previous research is also confounded by the issue of gender differentiation in the stress response. Evidence presented here indicates that women respond to stressors differently than men. This has several implications for occupational stress practitioners. The accumulated knowledge base of work design, occupational stress, and applied work physiology must be viewed more critically because most of this empirical wisdom is based upon research with male subjects in traditionally male occupations. In the absence of data, the practical differences in female and male firefighters in performing their tasks cannot be known.

This impacts on the practice of assessing and managing stress at the worksite. If women and men view stressors differentially, then those differences may be misrepresented in summary data that do not take gender into account. In the case of stress management, protocols that work for men may not be effective for women. Most physiological activation data indicate that men respond to stress with increased systolic blood pressure, whereas women respond with increased heart rate. Stress management training courses that emphasize blood pressure reduction may not be as effective for women, since their primary parameter of responsivity may not be measured or focused upon. This also complicates evaluation of the programs, since research should analyze gender differences in multiple physiological parameters in order to make meaningful conclusions about the program.

Many studies reported in this review have used multiple variables, demonstrating the complexity of this type of research. A recent study by Helin and Hanninen (1988) found that while males responded to a stressful situation with greater systolic blood pressure responsivity than females, Type A subjects responded with greater diastolic blood pressure responsivity. The sample sizes in this study, however, were too small (seven female Type As, nine female Type Bs, eight male Type As, and five male Type Bs) to draw any meaningful conclusions.

While Type A, neuroticism, and hostility each have proponents that posit their importance in the stress response, the most promising theoretical position is that of a personality complex of these factors (Bernardo et al., 1987; Eysenck & Fulkner, 1983; Llorente, 1986) that presents a dynamic relationship to the psychological experience of stress as well as physiological responsivity to stressors (Eysenck, 1985). Chess, Thomas, and colleagues have written extensively about how temperament crystallizes early in life (Chess & Thomas, 1978; Thomas & Chess, 1985; Thomas, Chess, & Korn, 1982). Their New York Longitudinal Study followed 133 subjects from infancy. Data were collected at strategic points in the subjects' development, starting in infancy. Parents were interviewed, school records were examined, and the children themselves were evaluated.

Chess and Thomas (1978) identified basic dimensions that distinguish children very early in life. Most notable was the child's interaction with their environment. Parents, intellectual development, and relationships with peers or siblings were found to interact with the child's temperament to affect behavior. Thus, they posit an interactionist model of development. Thomas and Chess (1985) identified categories of temperament, such as activity level, adaptability, intensity of reaction, and attention span and persistence, that develop early in childhood. Subjects were coded in each category and a factor analysis was performed on the data. Three "temperamental constellations" emerged. The first is characterized by categories that include biological regularity, positive approach or exploration of new stimuli, and a mildly or moderately intense positive mood. They called this temperament the "easy child." The second group was totally opposite of the first and characterized by negative withdrawal from new stimuli, slow adaptation to changing circumstances, and intense negative mood. The third group was characterized by mild negative reactions to novel stimuli and slow adaptability to change over repeated exposure to events.

Thomas and Chess (1985) found that there was a great deal of consistency between childhood temperament and adult development, especially in the areas of later onset of psychological disturbances. Rather than disorder being based upon notions of anxiety or neurosis, the manifestation of problem behavior could be parsimoniously traced to overt characteristics of the child, interactions with parents and peers, and other environmental influences. Goodness of fit between an individual and their environment was important for optimal development, with dissonance leading to distorted development and maladaptive functioning.

The temperamental characteristics reported by Thomas and Chess (1985) are not unlike personality factors such as Type A, neuroticism, and hostility. For example, the temperamental category of activity level, described as "the motor component in a child's functioning," fits nicely with the concept of adult Type A behavior. Speed and Impatience is a subscale of the Jenkins Activity Survey that directly involves motor responses, and polyphasic behavior (doing many things at once) is a hallmark of the Type A. Intensity of reaction is, by definition, the basis for Eysenck's neuroticism. The temperamental category quality of mood concerns the amount of "pleasant, joyful, and friendly behavior, as contrasted with unpleasant, crying, and unfriendly behavior." Cynical hostility is characterized by contempt for others and a disparaging view of humankind. Quality of mood temperament seems to tap into personality elements we recognize as adult hostility. Therefore, the work of Thomas and Chess (1985; Chess & Thomas, 1978; Thomas, Chess, & Korn, 1982) supports these personality constructs as individual factors, or temperamental categories, that interact with the environment to result in optimal, maladaptive or counterproductive behavior.

In a study of personality, occupational stress, and physiological responsivity, Andreassi, Albright, and Brockwell (1989) reported that females exhibited greater peripheral skin temperature, more heart rate variability, and greater heart muscle contractility in response to a cognitive stressor. Additionally, Type Bs showed higher peripheral skin temperatures with less reactivity than Type

As (indicating relaxation), as well as higher resting heart rates and heart rate responsivity than Type As. Interestingly, occupational stress measures, Type A scales, hostility, and neuroticism were predictive of baseline classification of hypertension. Evaluation of zero order correlations among the scales revealed that nearly every measure of occupational stress correlated with neuroticism and hostility. Unfortunately, the small sample size in this study precluded further statistical tests of these relationships. Nevertheless, this study supported the idea of a complex of personality factors that combine to influence psychological and physiological manifestations of strain due to stress.

The present research examined the influences of occupational stress and personality on physiological responses to stress within a multivariate multimethod framework utilizing structural equation modeling. Since gender has been demonstrated to affect the experience of stress as well as physiological responses to stressors, the role of gender in influencing various personality and physiological response parameters was addressed.

The following relationships were hypothesized for this research:

1. In a structural equation model, Type A, neuroticism, and hostility would be directly related to occupational stress, and occupational stress and gender would be directly

related to cardiovascular response to psychological stress (Figure 1).

2. Gender would be related differentially to physiological parameters, with women showing greater heart rate and skin temperature responsivity and men showing greater systolic blood pressure responsivity.

3. Analyses would reveal that high Type A, high hostile, and high neuroticism individuals would report greater occupational stress across all job and organizational stress areas.

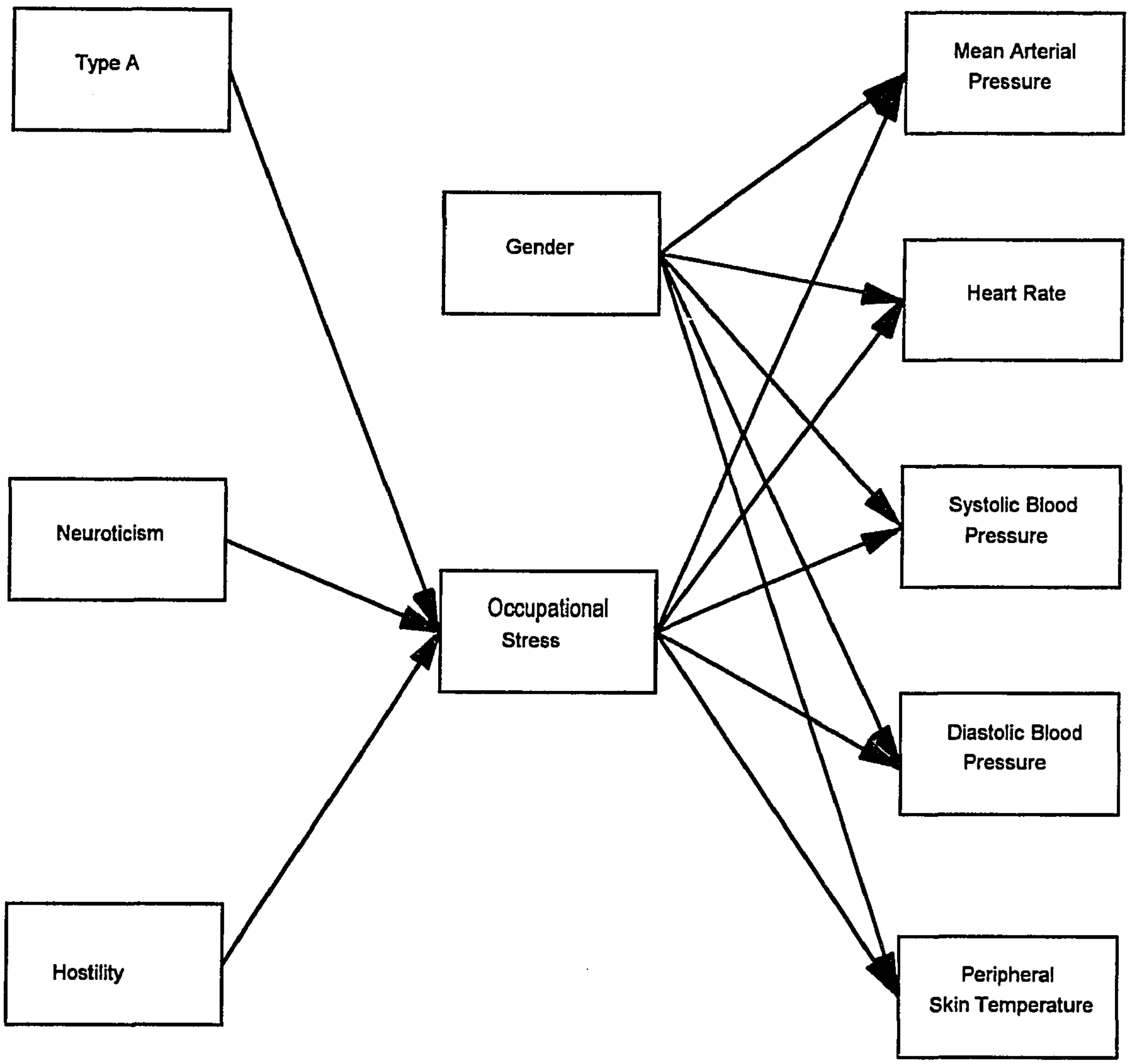

Figure 1. Hypothesized Path Model

Method

Subjects

Participants for this study were recruited from the subject pool of psychology students at Baruch College, CUNY. Subjects received 2 hours of credit towards their three hour research requirement or extra credit from their instructor.

Since this study assessed occupational stress variables, the only qualification to participate in the research was outside employment for at least 8 hours per week. Individuals under treatment for hypertension were precluded from participating in the study, due to the moderating effects of hypertension medication on cardiovascular responsivity to stress.

A total of 114 subjects participated in this research. A major thrust of the present study was the difference between males and females in cardiovascular responsivity to stress. Since previous research has found differences in response parameters by gender, this effect is best handled experimentally by providing for equivalent sample sizes. Thus, the total subject pool was evenly divided between males and females, yielding subsample sizes of 57 female and 57 male participants.

Apparatus and Materials

The psychophysiological assessment was conducted at the Psychophysiology Laboratory, Baruch College, CUNY. The Lab provided a controlled environment to protect from extraneous influences during testing. Additionally, the Lab was configured to support psychophysiological research and has been used successfully in many past studies.

Systolic blood pressure, diastolic blood pressure, heart rate, and mean arterial pressure were measured by a Dinamap Vital Signs Monitor Model 1846. The Dinamap monitor was fitted with an adult size blood pressure cuff that was applied to the subject's left upper arm. The instrument permitted a programmed repeated measures protocol that was set for two minute intervals. Values were displayed to the experimenter by LED readouts.

Peripheral skin temperature was measured using a Bodylog skin temperature instrument. A thermistor was affixed with tape to the dorsal surface of the second phalanx on the subject's right third (middle) finger. Values were continuously displayed to the experimenter by a CRT.

The cognitive stressor was a version of the Schiffer et al. (1976) "IQ Quiz" presented on audiotape. Subjects were required to attend to the instructions and answer the verbally presented questions aloud. The Quiz instructions stressed the importance of performing well on the test. Items varied in difficulty and included mathematical word problems, geography, verbal reasoning, vocabulary, and a digit span task.

An informed consent form explained the subject's rights and procedures of the study (Appendix A). A Personal Data Sheet was used to obtain identification, gender, and work information from the subject (Appendix B) and a Demographic Data Sheet was used to obtain information concerning the subject's ethnic affiliation, current living situation, children, and credit hours (Appendix C). The psychological instruments were presented as a test battery (Appendix D).

Type A behavior pattern was assessed with the Jenkins Activity Survey Form C (JAS; Jenkins, Zyzanski, & Rosenman, 1979). The JAS is a 52 item paper-pencil self-report questionnaire designed to evaluate coronary-prone behavior. Each item typically has three or four response options to which the individual will respond. Responses on the JAS yield scores for Overall Type A (TA), and subscales Speed and Impatience (SI), Hard-Driving and Competitiveness (HDC), and Job Involvement (JI). Internal consistency reliability coefficients have been found to range from .73 for HDC to .85 for TA, and four year test-retest reliabilities have been reported to range from .57 for HDC to .68 for JI (Jenkins, Zyzanski, & Rosenman, 1979).

Neuroticism was measured by the Eysenck Personality Inventory (N). The EPI is a 57 item paper-pencil self-report questionnaire that is designed to measure central nervous system conditionability as defined by Eysenck. Test-retest reliability after nine months has been reported to be .88 for this scale (Eysenck & Eysenck, 1968).

Hostility was measured by the Ho scale of the Minnesota Multiphasic Personality Inventory. Derived by Cook and Medley (1954), the Ho scale consists of 50 items presented in a paper-pencil self-report format. Respondents mark either "True" or "False" to items on the test, indicating whether or not they agree with the content of the item. Test-retest reliability for the Ho scale has been reported to be .85 after one year (Barefoot et al., 1983) and .84 after four years (Shekelle et al., 1983).

Occupational stress was measured by the Stress Diagnostic Survey (SDS; Ivancevich & Matteson, 1981). The SDS is a 60 item instrument designed to measure occupational stress across a wide variety of work factors. Each item describes a source of stress to which the respondent indicates whether it is "Never" to "Always" a source of stress for them. Two primary occupational stress domains are measured by fifteen subscales. Macro dimensions or organizational stress is assessed by subscales for Politics, Human Resource Development, Rewards, Participation, Underutilization, Supervisory Style, and Organizational Structure. Micro dimensions or job stress is assessed by subscales for Role Ambiguity, Role Conflict, Quantitative Overload, Qualitative Overload, Career Progress, Responsibility for People, Time Pressure, and Job Scope. Internal consistency for SDS scales range from .59 for Role Conflict to .79 for Human Resource Development, Role

Ambiguity, and Time Pressure. Test-retest reliability after one year ranges from .48 for Role Conflict to .64 for Underutilization and Time Pressure (Ivancevich & Matteson, 1981).

Design and Procedure

Participants were briefed in mass testing sessions. The purpose of the study and procedures were presented and the experimenter answered any questions. After all questions were addressed, the consent form was read aloud and explained by the experimenter and informed consent was obtained from each subject. Subjects were assured that their responses on all questionnaires and in the psychophysiological assessment would be held in the strictest confidence. All data would be reported in aggregate and no individual responses would be identified. Data sheets would be coded and kept secure. Subjects were allotted one and one half hours to complete the questionnaire battery consisting of the Personal Data Sheet, JAS, EPI, Ho, and SDS. Upon turning in the questionnaire battery to the experimenter, subjects were scheduled for the psychophysiological assessment. Following a question and answer session, participants were released from the questionnaire portion of the research.

Subjects reported to the Psychophysiology Laboratory at Baruch College, CUNY, and were greeted by the experimenter. The pretest briefing consisted of the experimenter explaining the procedures to the subject, ensuring them that there was no risk to their physical or psychological health, and answered any questions that they may have had. When there were no further questions, the subject was led to a room within the Psychophysiology Laboratory that was set up for this testing. The subject was seated facing a neutral wall and was not able to see the experimenter or equipment. The Demographic Data Sheet was then be completed. The blood pressure cuff was attached to the left upper arm, and the skin temperature thermistor was attached to the dorsal surface of the second phalanx on the subject's right third (middle) finger. The instruments were be brought into operation and calibrated for the subject. A pretest interview was conducted to ascertain the subject's history of heart or respiratory problems, current medications, and use of vasoactive substances within the last two hours.

The protocol for the psychophysiological assessment consisted of a series of repeated measurements taken for each condition during the assessment. Data were recorded on a psychophysiological assessment data sheet (Appendix E). At each measurement time, systolic blood pressure, diastolic blood pressure, heart rate, and mean arterial pressure were recorded from the Dinamap Vital Signs Monitor, and peripheral skin temperature was recorded from the Bodylog instrument. The conditions in the psychophysiological assessment were:

1. Baseline at 2 minutes
2. Baseline at 4 minutes
3. Baseline at 6 minutes
4. Quiz (with instructions) at 2 minutes
5. Quiz at 4 minutes
6. Quiz at 6 minutes
7. Recovery at 2 minutes
8. Recovery at 4 minutes
9. Recovery at 6 minutes

At the completion of the psychophysiological assessment, the experimenter debriefed the subject by discussing the research hypotheses, questionnaires, and psychophysiological assessment protocol. The experimenter answered any questions the subject may have had and offered to provide the subject with an abstract of the research at the completion of the project. Subjects were given a summary of the independent and dependent variables for the course requirements.

Results

Data analyses were performed with an IBM 3270 PC/AT equipped with a math coprocessor. Software packages utilized were SPSS/PC+ version 4.0 (Norušis, 1990) and PC-LISREL version 6.13 (Jöreskog & Sörbom, 1984). Raw data were coded and hand entered into a flat ASCII file via Microsoft Word version 3.11 (Microsoft, 1986).

Subjects

Subjects' jobs ranged from those typically found in student populations such as waiter and delivery driver to rather unconventional jobs such as freelance model and night club security officer. The mean hours worked per week was 24.13, with a standard deviation of 9.44 hours. In addition to working, subjects were taking a mean semester courseload of 13.31 credit hours, with a standard deviation of 2.92. The participants represented the racial and ethnic diversity found at a large urban college. Twenty-seven percent were black, eighteen percent were Hispanic, seventeen percent were Asian, and thirty-one percent were white. Most subjects reported living with their parents (73%), followed by living with roommates (15%) and married or living with a mate (8%). Only four percent reported being single and living alone. Only nine subjects (8%) reported having children (eight had one child and one had two), but six of those reported that they were single parents. Unfortunately, these numbers were too small for meaningful analysis.

Psychological Measures

All psychological instruments were hand scored according to their established protocols with the exception of the Jenkins Activity Survey, which was scored with an in-house computerized scoring program. Scores were obtained for the Jenkins Activity Survey Type A scale (TA), JAS subscales of Speed and Impatience (SI), Hard-Driving and Competitiveness (HDC), and Job Involvement (JI), the Eysenck Personality Inventory Neuroticism scale (N), and the Cook-Medley Hostility scale from the MMPI (Ho). Means, standard deviations, and standard scores on these scales for the sample are reported in Table 1. Intercorrelations for these scales are reported in Table 2.

The Stress Diagnostic Survey was designed primarily as a clinical tool to aid psychologists in identifying sources of work-related stress with individual clients. While its fifteen dimension scores are useful in a clinical context, the number of factors was not practical for this research. Test literature states that while SDS dimensions are highly intercorrelated, they may be broken down into two major factors. Macro occupational stress is comprised of seven SDS dimensions measuring organizational level stressors (Politics, Human Resource Development, Rewards, Participation, Underutilization, Supervisory Style, Organizational Structure) and micro occupational stress is comprised of eight dimensions measuring job level stressors

Table 1

Sample Means and Population Scores for Personality Scales

Scale	Mean	Percentile Score
TA	230.40 (66.51)	51.34 (26.28)
SI	181.61 (59.69)	52.82 (27.21)
HDC	122.77 (29.81)	48.43 (27.89)
JI	188.20 (43.68)	34.66 (22.75)
N	12.82 (4.98)	69.40 (27.77)
		T Score
Ho	26.89 (6.35)	61.61 (8.83)

Note. Standard deviations are in parentheses.
Key: TA = Jenkins Activity Survey Overall Type A; SI = Jenkins Activity Survey Speed and Impatience; HDC = Jenkins Activity Survey Hard Driving and Competitive; JI = Jenkins Activity Survey Job Involvement; N = Eysenck Personality Inventory Neuroticism; Ho = Cook & Medley Hostility Scale.

Table 2

Intercorrelations among Personality Scales

Scale	TA	SI	HDC	JI	N	Ho
TA	1.00					
SI	.63***	1.00				
HDC	.54***	.23*	1.00			
JI	.25**	.09	.28**	1.00		
N	.26**	.33***	.02	.09	1.00	
Ho	.25**	.34***	.03	.11	.56***	1.00

*$p < .05$. **$p < .01$. ***$p < .001$.

(Role Ambiguity Role Conflict, Quantitative Overload, Qualitative Overload, Career Progress, Responsibility for People, Time Pressure, Job Scope).

The FACTOR procedure in SPSS/PC+ (Norušis, 1990) specifying principal components extraction was performed with the fifteen SDS dimensions in order to derive more parsimonious indices of occupational stress for this study. The SPSS/PC+ program (Norušis, 1990) routinely performs two tests of the data designed to examine the relationships among the variables and their propriety for a factor analysis. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO = 0.91013) and the Bartlett sphericity test (Bartlett = 1130.0443, $p < .001$) both indicated that the SDS dimensions were adequate for the analysis. The program derived a two factor solution, which was rotated by the varimax method in order to minimize the number of variables loading on one factor and aid in the interpretability of the solution.

The rotated factor matrix with factor loadings for each scale are presented in Table 3. SDS dimensions were found to correspond to their respective macro and micro levels with the exception of Job Scope and Career Progress, two micro stress dimensions that loaded more highly on the macro factor. One may argue, however, that while Job Scope and Career Progress refer to task specific activities as measured by the micro level dimensions, they ultimately

Table 3

Rotated Factor Matrix and Scale Loadings for the Stress Diagnostic Survey

	Factors	
Scale	Organizational Stress	Job Stress
Politics	.543	.441
Human Resource Development	.730	.283
Rewards	.747	.315
Participation	.830	.206
Underutilization	.843	-.024
Supervisory Style	.819	.197
Organizational Structure	.670	.440
Role Ambiguity	.461	.572
Role Conflict	.263	.800
Quantitative Overload	.169	.893
Qualitative Overload	.257	.793
Career Progress	.566	.367
Responsibility for People	.333	.704
Time Pressure	.089	.852
Job Scope	.546	.490

involve the individual's fit in the larger organizational scheme. Including these dimensions with the macro scales thus seems appropriate. On the basis of the factor analysis, an Organizational Stress variable was created and defined as the mean of dimensions loading on factor 1 (Politics, Human Resource Development, Rewards, Participation, Underutilization, Supervisory Style, Organization Structure, Career Progress, and Job Scope). Similarly, a Job Stress variable was created and defined as SDS dimensions loading on factor 2 (Role Ambiguity, Role Conflict, Quantitative Overload, Qualitative Overload, Responsibility for People, and Time Pressure).

Physiological Measures

The psychophysiological assessment protocol yielded measurements of systolic blood pressure, diastolic blood pressure, heart rate, mean arterial pressure, and peripheral skin temperature taken at two minute intervals during a six minute baseline condition (three measurements), a six minute quiz condition (three measurements), and a six minute recovery condition (three measurements). As a manipulation check, a multivariate analysis of variance (MANOVA) for a repeated measures design was performed for the determinations in each physiological parameter. Condition (baseline, quiz, and recovery) and Time (two minutes, four minutes, six minutes) were identified as within-subjects factors. A separate MANOVA was performed for each physiological parameter (e.g. systolic blood pressure, diastolic blood pressure, mean arterial pressure, heart rate, and peripheral skin temperature). A main effect for Condition was found in each analysis (approximate *F* values derived from multivariate tests of the Condition effect were all $p < .001$ in each analysis), indicating that the IQ Quiz was successful in eliciting psychophysiological responsivity in each parameter.

For this research, a measure of physiological responsivity to the stressor was required. Raw score differences in physiological measures would need to be standardized in order to make meaningful comparisons among parameters. Two issues were considered in developing an index of reactivity: the appropriate observed measurement in each condition and the appropriate points in the assessment epoch from which to calculate responsivity. Since three readings were taken during each condition, observed measurements could be either the mean of all three determinations or the singular peak measurement during the condition. The changes from quiz to recovery were explored as possible indices of responsivity because it was noticed during the psychophysiological assessment that subjects appeared more anxious prior to the quiz than after, and case by case observation of the data indicated that subjects may have recovered lower than baseline. If this was so, reactivity from baseline to quiz may be attenuated by the effect of the law of initial values. Very simply, the law of initial values states that the higher the level of any particular measurement, the less responsivity there will be to a stimulus (Andreassi, 1989). Andreassi (1989) provides a detailed description of the principle. In this case, the application is to baseline levels in the psychophysiological assessment. High initial values at baseline may attenuate levels reached in the quiz, reducing the reactivity index. If this is so, changes from quiz back to recovery may be a better index of responsivity than the traditional conceptualization of baseline to quiz reaction.

The utility of analyzing peak to peak changes between conditions rather than mean to mean changes was considered. Peak to peak measurements are often used in psychophysiological research where continuous readings are taken. Low reliability in blood pressure measurement utilizing the standard auscultatory technique may underdetermine systolic blood pressure and overdetermine diastolic blood pressure. This technique relies on a cuff physically shutting off blood flow to the extremity, in this case an arm, slowly releasing the pressure, and observing the reading in millimeters of mercury. Systolic blood pressure is determined when blood can first go through the cuff (Korotkoff sounds heard through a stethoscope) and diastolic blood pressure is determined when the cuff no longer constricts blood flow (Korotkoff sounds no longer heard). It is possible that true systolic or diastolic pressure may not be accurately determined because the true reading is in between ventricular systole, or heart beats, hence no Korotkoff sounds are heard. Although the Dinamap blood pressure device is automated, an internal microphone works on the same principle as a manual sphygmomanometer and stethoscope. While the average of multiple determinations over time serve as a basis for inferring true blood pressure, it is possible that a peak measurement in a set of determinations may be more accurate. Therefore, peak to peak changes between baseline and quiz and between quiz and recovery were examined as well.

Mean measurements for each condition (baseline, quiz, and recovery) were determined by summing the readings from each two minute measurement period and dividing by three. Peak measurements for each condition were determined by taking the single lowest value (out of three) for baseline and recovery conditions and the highest value for the quiz condition. Since peripheral skin temperature drops under stress, peak scores for this parameter were the highest measurement in baseline and recovery and the lowest measurement in the quiz condition. Reactivity was defined as the absolute value of the percent change from the baseline condition measurement to the quiz condition measurement, and recovery was defined as the absolute value of the percent change from quiz condition measurement to the recovery condition measurement.

A series of paired t-test comparisons examined the various indices of reactivity. Peak measurements were significantly more extreme than means in all physiological parameters and across all conditions ($p < .01$ for each comparison). With the exception of heart rate, physiological parameters in the recovery condition were more relaxed than in baseline, which is to be expected. Reactivity and recovery indices (percent change from baseline to quiz and quiz to recovery, respectively) provided mixed results in the mean comparisons, with baseline to quiz reactivity more pronounced for heart rate ($p < .01$) and recovery more pronounced for peripheral skin temperature ($p < .05$). Mean reactivity and recovery indices for systolic blood pressure, diastolic blood pressure, and mean arterial pressure were not significantly different. Peak changes, however, were significantly different in each parameter, with baseline to quiz reactivity being more pronounced in all parameters except peripheral skin temperature, where quiz to recovery was stronger (for each, $p < .01$).

The magnitude of the effects using peak measurements begs caution in their use. It was determined that using peak measurements capitalizes on chance and single determinations that may be spuriously extreme. The MANOVAs found significant main effects for Time in each physiological parameter (all approximate *F*s were $p < .001$), as well as significant interaction effects for Condition and Time (approximate *F*s were $p < .001$ for all parameters except heart rate, where $p < .05$). This indicates a large degree of variance among the determinations within conditions. Spuriously high or low determinations may contribute significantly to the error in subsequent analyses. Taking the mean of multiple determinations eases the error variance associated with single measurements and provides greater reliability. Therefore, it was decided that measures incorporating reactivity and recovery from means would be used in subsequent analyses.

It is appropriate to mention the statistical risks inherent in post hoc analyses of this sort. Serial univariate tests contribute to the Type I familywise error rate, which is basically a summation of all alpha levels for each comparison (Keppel, 1982). Such error typically accumulates when comparisons are made among cells in a factorial design. The inflation of alpha in this way increases the probability of making a Type I error, or rejecting the null hypothesis when it is indeed true. The t-tests performed here were unplanned and an informal "decision to suspend judgment" (Keppel, 1982) was made when it was determined that use of peak measurements would capitalize on chance.

The decision to use mean scores generally obviated the need for further consideration of the appropriate change index. Only heart rate and peripheral skin temperature had significantly different changes from quiz to recovery than reactivity from baseline to quiz ($p < .01$ for heart rate; $p < .05$ for peripheral skin temperature). Heart rate increased 14% from baseline to quiz, and decreased 12% from quiz to recovery. Thus, the difference is in the expected direction. Peripheral skin temperature decreased 1.42% from baseline to quiz, and increased 1.86% from quiz to recovery. While statistically significant, the .44% difference in skin temperature represents a 1.12 degree Fahrenheit difference. An examination of peripheral skin temperature means in each condition shows that, on the average, skin temperature actually went up .18 degrees from baseline to quiz, then went up an additional 1.27 degrees from quiz to recovery. The counterintuitive direction from baseline to quiz may be indicative of the anxiety experienced by the subject in the baseline condition. In light of these data, it was determined that reactivity from baseline to quiz constituted the best index of responsivity on theoretical as well as empirical grounds. Means and standard deviations for the physiological parameters and reactivity indices are reported in Table 4.

Table 4

Means and Standard Deviations for Physiological Measures and Reactivity Indices

Parameter	Mean	Reactivity (%deltaB)[a]
Systolic Blood Pressure		
Baseline	115.31 (14.61)	
Quiz	125.05 (16.17)	8.74 (5.92)
Recovery	113.40 (12.71)	
Diastolic Blood Pressure		
Baseline	64.86 (7.10)	
Quiz	70.42 (8.05)	9.23 (6.40)
Recovery	64.10 (7.12)	
Heart Rate		
Baseline	76.56 (11.82)	
Quiz	86.89 (14.21)	14.11 (9.63)
Recovery	76.30 (11.00)	
Mean Arterial Pressure		
Baseline	83.72 (8.35)	
Quiz	91.58 (9.45)	9.57 (6.29)
Recovery	82.62 (8.09)	
Peripheral Skin Temperature		
Baseline	85.70 (5.68)	
Quiz	85.88 (5.09)	1.42 (1.45)
Recovery	87.15 (5.09)	

Note. Standard deviations are in parentheses.

[a] %deltaB refers to the percent change from Baseline to Quiz.

Hypothesis 1

Hypothesis 1 was tested with structural equation modeling techniques using PC-LISREL version 6.13 (Jöreskog & Sörbom, 1984). LISREL is an analysis package designed for delineating directional or path relationships among a set of variables or constructs. The complete LISREL model is comprised of a measurement model articulating the relationships among observed variables and latent variables, and a structural model specifying causal relationships among the latent variables, describing direct and indirect effects, and explaining variance in the model. Latent variables are unobserved constructs hypothesized to underlie observed or measured variables (Loehlin, 1987). The program is quite versatile and can analyze very complex structural models.

Scores on Type A, Neuroticism, Hostility, Organizational Stress, and Job Stress were entered into a raw data matrix along with the psychophysiological reactivity indices (percent change from baseline to quiz) for systolic blood pressure, diastolic blood pressure, heart rate, mean arterial pressure, and peripheral skin temperature. Gender was entered as a dummy coded variable (1 = male, 2 = female). LISREL read the raw data matrix and created covariance matrices for the analysis. The question of whether to base the LISREL analysis on the correlation matrix or the covariance matrix depends largely on the data being analyzed and the model being tested (Hayduk, 1987).

While using a correlation matrix standardizes the data and puts all variables on the same metric, statistical constraints are introduced that may affect the interpretation of the model (Loehlin, 1987). Unstandardized coefficients are generally accepted to be more statistically robust, unless some factor in the analysis precludes their use. Therefore, the primary model fitting analyses utilized the covariance matrix developed from raw scores. However, the correlation matrix was employed after the final modification to the model to test for any possible variations in fit.

The proposed model (Figure 1) specifies relationships among observed variables only. No latent variables or hypothetical constructs were hypothesized for this research. Therefore, LISREL submodel 2, path analysis for observed variables was used for this model. Path analysis in LISREL involves specifying relationships, or paths, between variables in the model. LISREL considers the overall model as a "system of equations" (Jöreskog & Sörbom, 1989). Coefficients are then computed for each direct path as well as all indirect paths, and the overall fit of the model is assessed with several indices.

Hypothesis 1 was tested by specifying the direct paths between the variables as articulated in Figure 1, then modifying the model to obtain optimum fit among the variables. Personality variables (Type A, Neuroticism, and

Hostility) and Gender were specified as exogenous variables or predictors. Job Stress, Occupational Stress, and the physiological reactivity indices were specified as endogenous variables. In structural equation modeling, exogenous variables do not receive effects from other variables in the model. Thus, it was not hypothesized that one personality factor could influence another. Similarly, path relationships were not specified among the physiological reactivity measures, since inferences about one physiological reaction influencing another would be tenuous given this research design.

The model as proposed in Figure 1 yielded a poor fit with the data. Chi square tests are typically employed to test goodness of fit with models. In this case, χ^2 (18, N = 114) = 73.49, $p < .000$. (In model fitting analyses, a good fitting model has a high probability value.) The model fitting process was driven theoretically, with parameters fixed or freed in accordance with hypotheses derived from the literature. Three modifications were made. Job Stress and Organizational Stress were highly correlated (r = .645, $p < .001$). Since there was little a priori reason to hypothesize a directional path between the variables, the parameter in the psi matrix corresponding to the covariance between Job Stress and Organizational Stress was freed to account for the variance. Secondly, paths were freed between the personality variables and the physiological response variables, hypothesizing that personality would have a direct association with the physiological responses. Finally, since no paths between Job Stress or Organizational Stress and the physiological response variables were significant, all of those paths were fixed as a block.

The revised path model is depicted in Figure 2. Arrows show direct relationships between variables and the path coefficients are from the gamma matrix of the standardized solution. All coefficients reported in Figure 2 are significant on a t-distribution ($p < .05$). The revised model yielded a satisfactory fit, χ^2 (24, N = 114) = 17.07, $p > .846$. The goodness of fit index (GFI) is a more sophisticated comparison of the observed covariance and implied matrices. Expressed as a ratio, the closer the index is to one, the better the model fits. The goodness of fit index for this model is .974. LISREL also reports an adjustment to this index (AGFI) that incorporates degrees of freedom to indicate a more parsimonious fit. In this case, the AGFI is .928, which is not a dramatic difference. The squared multiple correlations found for the endogenous variables in the final model were .118 for Organizational Stress, .103 for Job Stress, .019 for Systolic Blood Pressure Reactivity, .039 for Heart Rate Reactivity, .041 for Mean Arterial Pressure Reactivity, and .017 for Peripheral Skin Temperature Reactivity.

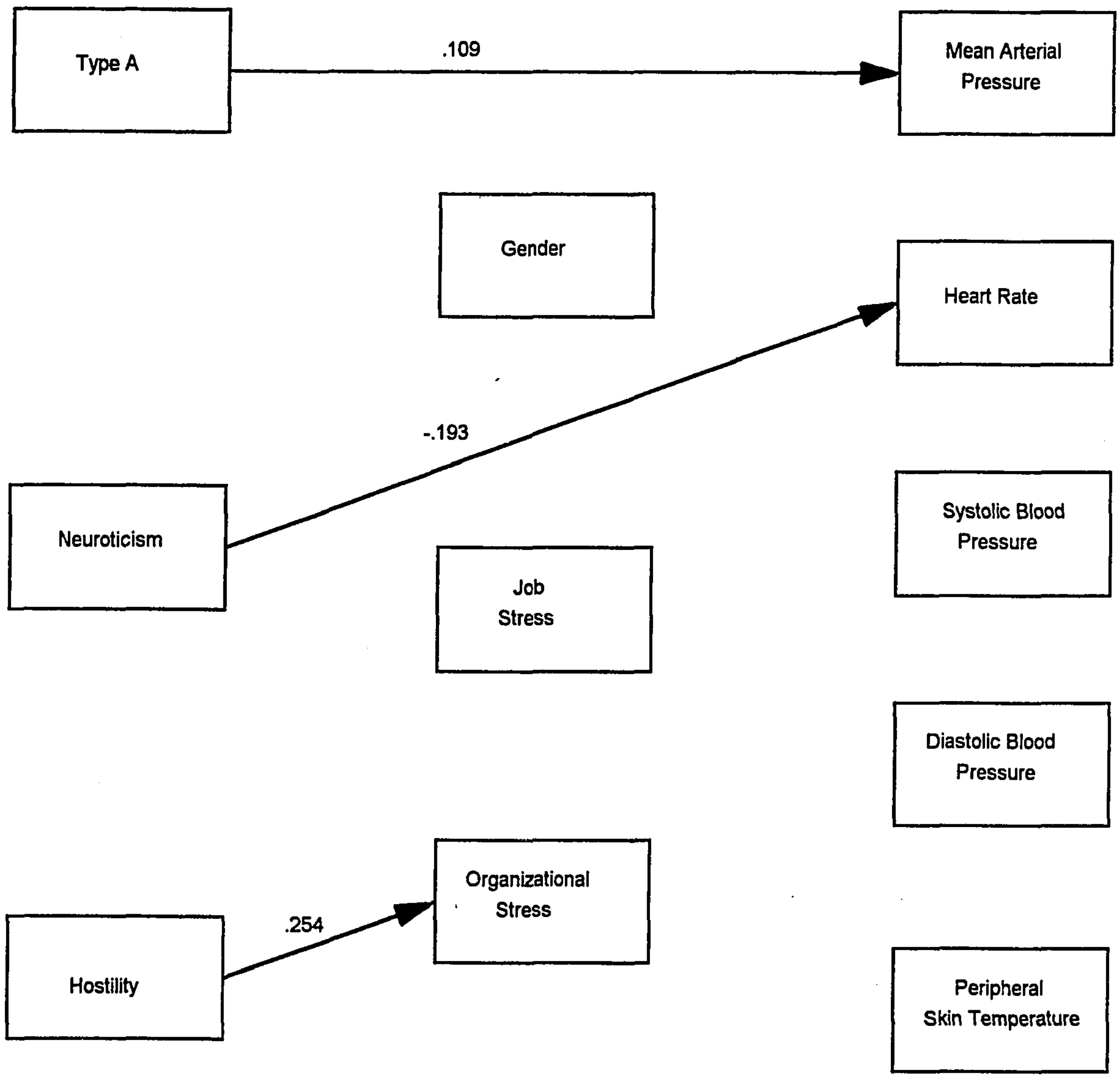

Figure 2. Revised Path Model

Note. Coefficients are from the gamma matrix of the standardized solution.

A test of the "null model" was performed to determine if the derived path model fits better than no model at all (Bentler & Bonett, 1980). The null model says that exogenous variables are unrelated to endogenous variables, and that endogenous variables are mutually uncorrelated. A model was created with beta and gamma parameters set to zero, and the psi matrix fixed as diagonal. Hence, no effects were hypothesized. Indices for the null model were χ^2 (49, N = 114) = 298.23, $p < .001$, GFI = .695, AGFI =.590. The null model index is calculated by taking the difference of the final model chi square from the null model chi square (298.23 - 17.07 = 281.16) and dividing it by the null model chi square (281.16 / 298.23 = .943). The high value (.943) indicates that the final model fits significantly better than no model at all.

The negative relationship of Neuroticism to heart rate reactivity was not expected. It was questioned whether high Neuroticism subjects possessed higher resting heart rate levels that would attenuate the reactivity indices. This question was pursued in post hoc analyses. In Pearson product-moment correlational analyses, Neuroticism was negatively correlated with heart rate reactivity (r = -0.21, $p < .05$, two tailed).

In a second set of post hoc analyses, z-scores were computed for Neuroticism, and the sample was divided into Neurotics (N $z > 0$) and Stables (N $z < 0$). This analysis is analogous to employing median splits on personality scores to obtain rough sample estimates. Another split was performed using the 75th and 25th percentile scores, to provide more extreme samples of those scoring above the 75th percentile and below the 25th percentile. One-way analyses of variance revealed no significant differences between Neurotics and Stables in either sample for heart rate differences.

A similar analysis was performed for Type As and Bs with regard to mean arterial pressure. Pearson product-moment correlations revealed significant correlations between Job Involvement, a JAS subscale, and mean arterial pressure at baseline ($r = -.19$, $p < .05$, two-tailed), during the Quiz ($r = -.20$, $p < .05$, two-tailed), and during recovery ($r = -.19$, $p < .05$, two-tailed). The Speed and Impatience subscale was correlated with mean arterial pressure reactivity ($r = .21$, $p < .05$, two-tailed). A similar series of sample splits on the Type A score, at $z <> 0$ and at 25th and 75th percentiles, found that only in the extreme sample did Type Bs show significantly higher mean arterial pressure ($M = 86.94$ mmHg) than Type As ($M = 82.53$ mmHg) at baseline ($F(1, 60) = 4.42$, $p < .05$).

<u>Hypothesis 2</u>

Multivariate analysis of variance (MANOVA) for a repeated measures design was used to test Hypothesis 2. A separate MANOVA was run for each physiological parameter.

Gender was entered as a between-subjects factor and the mean determinations at baseline, quiz, and recovery constituted the three levels of within-subject factor condition. Means and standard deviations for the physiological variables are reported in Table 5. Results from the MANOVAs are reported in Table 6.

For systolic blood pressure, there was a main effect for gender ($F(1, 112) = 47.75$, $p < .001$), as well as an interaction between gender and condition, corresponding to reactivity (approx. $F(2, 111) = 5.88$, $p < .01$). Thus, men not only showed higher systolic blood pressure, but they showed greater reactivity and recovery before and after the cognitive stressor. Men and women also differed in peripheral skin temperature reactivity as shown by a significant interaction effect (approx. $F(2, 111) = 3.83$, $p < .05$), but the main effect for gender was not significant ($F(1, 112) = 1.29$, n. s.) indicating that while there was differential reactivity, there was no difference in mean temperature during the psychophysiological assessment. Mean arterial pressure showed the opposite, with women significantly lower than men throughout the psychophysiological assessment ($F(1, 112) = 18.84$, $p < .001$), but no significant difference in reactivity and recovery (approx. $F(2, 111) = 1.69$, n. s.). There were no significant differences in levels or reactivity for diastolic blood pressure or heart rate.

Table 5

Means and Standard Deviations for Physiological Measures by Gender

Parameter	Female	Male
Systolic Blood Pressure		
Baseline	107.18 (8.57)	123.44 (14.93)
Quiz	116.87 (10.92)	133.23 (16.50)
Recovery	106.67 (7.32)	120.13 (13.43)
Diastolic Blood Pressure		
Baseline	64.19 (6.46)	65.53 (7.70)
Quiz	69.51 (6.90)	71.33 (9.03)
Recovery	63.68 (6.15)	64.51 (8.00)
Heart Rate		
Baseline	76.85 (11.99)	76.26 (11.75)
Quiz	86.83 (14.50)	86.96 (14.05)
Recovery	76.35 (10.33)	76.25 (11.73)
Mean Arterial Pressure		
Baseline	80.23 (6.72)	87.21 (8.41)
Quiz	88.59 (7.57)	94.57 (10.23)
Recovery	79.80 (6.25)	85.44 (8.77)
Peripheral Skin Temperature		
Baseline	86.59 (5.05)	84.81 (6.16)
Quiz	86.42 (4.52)	85.33 (5.59)
Recovery	87.36 (4.83)	86.94 (5.37)

Note. Standard deviations are in parentheses.

Table 6

MANOVA Results of Physiological Measurements by Gender

	Gender Effect	
	Main	by Cond.
Parameter	F(1, 112)	Appx. F(2, 111)
Systolic Blood Pressure	47.75***	5.88**
Diastolic Blood Pressure	1.00	1.07
Heart Rate	.01	.27
Mean Arterial Pressure	18.84***	1.69
Peripheral Skin Temperature	1.29	3.83*

*$p < .05$. **$p < .01$. ***$p < .001$.

Hypothesis 3

The ability of personality measures to predict occupational stress in each dimension was tested in Hypothesis 3. Speed and Impatience (SI), Job Involvement (JI), and Hard-Driving and Competitiveness (HDC) from the Jenkins Activity Survey, Hostility (Ho), and Neuroticism (N) were entered into stepwise multiple regression equations for each dimension of occupational stress measured by the Stress Diagnostic Survey. Overall Type A was not used since it is a composite of its subscales and may introduce problems with multicollinearity. Correlations for all scales are presented in Table 7 and results of the analyses are reported in Table 8.

Of the fifteen occupational stress dimensions measured by the Stress Diagnostic Survey, Hostility was found to be the sole predictor in five of them (Politics, Human Resource Development, Participation, Supervisory Style, and Role Conflict), Speed and Impatience the sole predictor in two (Underutilization and Job Scope), Job Involvement and Speed and Impatience in two (Quantitative Overload and Time Pressure), and Neuroticism the sole predictor in three (Rewards, Role Ambiguity, and Qualitative Overload). Hard-Driving and Competitiveness with Hostility predicted Responsibility for People. All relationships were in the

Table 7

Correlations between Personality and SDS Scales

SDS Scale	JAS SI	JAS JI	JAS HDC	Eysenck N	MMPI Ho
Politics	.11	.16	-.01	.13	.25*
Hu.Res.Dev.	.11	.15	.10	.16	.34**
Rewards	.15	.08	.14	.22	.20
Particip.	.20	-.02	-.02	.15	.29*
Underutil.	.25*	-.04	.01	.18	.23
Supv.Style	.23	.03	-.02	.18	.31**
Org.Struc.	.09	.03	.08	.12	.18
Role Amb.	.20	-.08	.10	.22	.15
Role Con.	.20	.07	.05	.20	.23
Quant. OL.	.22	.26*	.21	.19	.23
Qual. OL.	.11	.00	.10	.22	.22
Career Prog.	.16	-.11	.01	.10	.16
Resp.People	.16	.14	.22	.11	.32**
Time Press.	.26*	.29*	.18	.18	.18
Job Scope	.26*	-.04	.13	.15	.18

*$p < .01$. **$p < .001$.

Table 8

SDS Multiple Regression Results

SDS Scale	Solution	F(1, 112)	Mult. R	$AdjR^2$
Politics	Ho	7.32**	.25	.05
Hu.Res.Dev.	Ho	14.82***	.34	.11
Rewards	N	5.85*	.22	.04
Particip.	Ho	10.42**	.29	.08
Underutil.	SI	7.57**	.25	.05
Supv.Style	Ho	11.65***	.31	.09
Org.Struc.	-	n. s.	-	-
Role Amb.	N	5.51*	.22	.04
Role Con.	Ho	6.04*	.23	.04
Quant. OL.	JI, SI	6.91**[a]	.33	.09
Qual. OL.	N	5.94*	.22	.04
Career Prog.	-	n. s.	-	-
Resp.People	Ho, HDC	9.42***[a]	.38	.13
Time Press.	JI, SI	9.27***[a]	.38	.13
Job Scope	SI	8.16**	.26	.06

[a]d. f. = 2, 111

*$p < .05$. **$p < .01$. ***$p < .001$.

hypothesized direction, with greater personality scores (e.g. high Hostility, high Type A, or high Neuroticism) associated with higher reported occupational stress. Solutions were not found for Organizational Structure and Career Progress.

Discussion

General

From the literature reviewed in the preceding sections of this paper, a rather straightforward model of personality, experience of occupational stress, and physiological responsivity to stress was presented. The basic hypothesis of the model was that personality would be related to the experience of occupational stress, which in turn would be related to physiological responsivity to a cognitive stressor. Type A behavior, Neuroticism, and Hostility were identified as the personality factors involved in a complex that would be associated with occupational stress. In addition, gender was hypothesized to have direct relationships with the physiological responsivity to stress.

The revised path model that emerged from the data clarifies some relationships, but obscures others. Occupational stress, as Organizational Stress and Job Stress, was not found to be related to any physiological index of reactivity as hypothesized. Personality, however, was found to be related to both the experience of occupational stress and physiological reactivity to stress. Specifically, Type A was found to be associated with mean arterial pressure reactivity, Neuroticism was associated with heart rate reactivity (negatively), and Hostility was associated with Organizational Stress. These distinctions emerged even though Type A, Hostility, and Neuroticism were all significantly intercorrelated, demonstrating the power of multivariate analysis over univariate methods in complex designs.

The recoding of Stress Diagnostic Survey dimensions created Organizational Stress as an index combining the macro level occupational stress dimensions in the survey. All of these dimensions (Politics, Human Resource Development, Rewards, Participation, Underutilization, Supervisory Style, Organizational Structure, Career Progress, and Job Scope) affect how the individual perceives stress from their respective place in the organization. It is interesting that the only direct relationship received by this variable was from Hostility, which by definition expresses a cynical outlook on the world, especially "a low opinion of human nature," and measures "contempt for others and weak interpersonal bonds" (Costa et al., 1986).

The workplace is an environment where social interaction is forced, at least to some extent. Type A individuals, in their zealousness to achieve more, be more competitive across situations, and perform multiple activities simultaneously, may view others as interfering with their goals or striving and develop cynical Hostility as a mechanism to reduce interference from social interaction. This position is consistent with those who posit that Hostility is the active component in Type A behavior (Friedman, 1969; Matthews et al., 1977) and is supported by research indicating that Type As seek to control their environment (Karasek et al., 1981; Kushnir & Melamed, 1991). Rhodewalt et al. (1984) demonstrated that Type As respond to challenging work environments with characteristic Type A behavioral patterns and that Type As generate their own stress through manifest Hostility. These findings also support Watkins, Ward, and Southard (1987) and Watkins et al. (1992), who found that Type As experienced a lower quality of social support and that Type As possess core beliefs concerning no universal moral principle and scarcity of resources. They also found that Hostile cynicism was correlated with Type A. Hardy and Smith (1988) and Smith and Frome (1985) used mock interpersonal conflict scenarios to find that hostile individuals had fewer and less satisfactory social contacts, supporting the role of Hostility as a way of psychosocial disengagement. Additional research should focus on the Hostility - organizational stress relationship. As stated previously, no clear taxonomy of work stress exists, and this may be an advantageous point to start.

The third personality construct addressed in this research was Neuroticism, as defined by Eysenck (1967). Contrary to the hypothesis, Neuroticism failed to show a direct relationship to either Job or Organizational stress in the path model. The scale used to measure neuroticism in this research has been identified as one of the many personality scales laden with "negative affectivity." This construct is defined by Watson and Clark (1984) as a "mood-dispositional dimension" manifested as distress, being upset, possessing a negative view of oneself, and anxiety. Negative affectivity is a general, pervasive mood that manifests itself in the absence of any overt stressor and may include "anger, scorn, revulsion, guilt, self-dissatisfaction, a sense of rejection, and, to some extent, sadness." Individuals high in negative affectivity are more likely to report distress, discomfort, and general dissatisfaction over time and across all situations. Watson and Clark (1984) further identify 18 psychological scales purportedly measuring negative affectivity, with the Eysenck Personality Inventory Neuroticism scale included.

Brief et al. (1988) found that stress and dissatisfaction measures were inflated by negative affectivity as operationalized by the Taylor Manifest Anxiety Scale. They proposed that negative affectivity should be measured and controlled for in stress research. In an attempt to replicate and extend Brief et al.'s (1988) study, Chen and Spector (1991) had workers complete a battery of scales to measure various stressors and strains, as well as multiple measures of negative affectivity. While correlations were found among negative affectivity, job stress, and job strain measures, using Burke et al.'s statistical partialing method they found little support for the effect of negative affectivity on the relationship between stressors and strains. Schaubroeck, Ganster, and Fox (1992) found that while negative affectivity did not affect physiological indices of stress, it did attenuate the effects of work stress when estimated in a structural equation.

The present study contributes to this ongoing debate by finding no direct relationship between Neuroticism, as measured by a high negative affectivity laden instrument, and self-report measures of Job or Organizational Stress. Cynical Hostility, as measured here by the MMPI Ho scale, has not yet been included in the list of instruments that supposedly measure negative affectivity. In addition, the present research found a negative relationship between Neuroticism and heart rate reactivity to cognitive stress. While antithetical to the negative affectivity proposition, this finding supports the extensive research validating Neuroticism as a valid construct with a significant physiological component. The findings by Bernardo et al. (1987) implicating complex interactions among personality, reactivity, and disease are supported, thus maintaining the integrity of these measures. Additional research on the Stress Diagnostic Survey would have been helpful in explaining why it was not related to Neuroticism in the present study.

While the hypothesized relationships between occupational stress and physiological reactivity to stress were not found, other personality factors did show direct relationships. Type A was found to have a positive relationship with mean arterial pressure, and Neuroticism a negative relationship with heart rate reactivity. Thus, those higher in Type A responded to cognitive stress with greater mean arterial pressure reactivity than those low in Type A. Mean arterial pressure has been identified as the single most appropriate index for the effective movement of blood through the circulatory system (Papillo & Shapiro, 1990). Thus, it is reasonable to view mean arterial pressure as an index of stable, working activation. This finding supports the Jenkins Activity Survey Type A measure as an indicator of physiological activation under challenge.

Post hoc analyses aided in the interpretation of this relationship. The zero order correlations revealed that the Job Involvement subscale was negatively correlated with mean arterial pressure in all conditions, suggesting that those high in Job Involvement characteristically possess low mean arterial pressures. This, in itself, is counterintuitive and does not correspond with the path model. Speed and Impatience, however, was correlated with mean arterial pressure reactivity, suggesting that those high in this Type A facet tend to show greater reactivity under challenge, ostensibly because they address challenges or tasks quickly or impatiently. Therefore, this more dynamic aspect of Type

A behavior was found to coincide with the physiological dynamics of activation.

Group comparisons were made by making group splits at zero z, and at 25th and 75th percentiles. Only in the extreme cases were Type A and Type B differences found. The lower mean arterial pressure for Type As found at baseline disappeared after the task began. Thus, Type As showed a lower resting mean arterial pressure before the task, but then had greater reactivity to the stressor. This supports the work of Manuck, Craft, and Gold (1978) who found Type As to respond with greater systolic blood pressure reactivity in a laboratory task, and Wright, Contrada, and Glass (1985), who also found patterns of differential physiological reactivity between Type As and Type Bs in response to laboratory stressors. These findings are also consistent with Siegrist and Klein's (1990) evidence of "exhaustive coping" affecting lability under stress. Type A physiology may be such that over a period of time, resting levels sink lower to compensate for the times of hyperactivation.

The correlational pattern of the JAS subscales also indicate that different components of Type A personality are differentially related to physiological responses in different parameters. This supports Juszczak and Andreassi (1987), who showed how subscale differences can affect task performance. In their study, the Hard-Driving and

Competitive subscale of the JAS was related to lower performance on a primary task in a dual task paradigm, but Speed and Impatience was related to faster reaction time. Similarly, Ohman et al. (1989) found no differences in cardiovascular activity between Type As and Type Bs defined by the Hard Driving and Competitive subscale, but did observe differences in activation between high and low scorers on the Irritation and Impatience subscale. JAS subscales possess complex relationships to outcome variables in cardiovascular research.

In the path model, those high in Neuroticism showed less heart rate reactivity to the cognitive stressor than those lower in Neuroticism. The exhaustive coping paradigm applies equally well here, but additional research is necessary to examine this phenomenon.

The discussed relationships between the personality and physiological response indices with regard to exhaustive coping or insufficient experimental stimulation are speculative. This study was not designed to infer causal relationships or examine the effects over time. In that respect, one may not infer from these data that individuals who have exhibited high Neuroticism for most of their life, or several years, may be in state of exhaustive coping under stress and thus show attenuated physiological reactivity to a laboratory stressor. Inferring such relationships outside of the laboratory would be even more tenuous; however, the possibility of an exhaustive coping mechanism is quite salient in view of these data. Its plausibility is supported by the finding that these subjects are college students who attend school full-time, and work outside of school in a half-time job. An average college student in this scenario may well be expected to be physically exhausted, let alone show exhaustive coping mechanisms. Thus, there seems to be reasonable evidence that some exhaustion or coping mechanism affected participants in the study.

Though the revised model provided only partial support to Hypothesis 1, it was encouraging to find direct relationships between personality variables and reactivity indices in physiological parameters associated with sympathetic activation. The relationships between personality and occupational stress dimensions further support the role of personality in perceiving and responding stressors. These relationships reinforce the Williams (1986) biopsychosocial model whereby individuals interpret events from the environment and react to those events through their genetics, history, and personality. His model also specified that cumulative effects over time could influence responsivity. The relationships among personality and physiological response remain obscure, but data obtained in this research support the existence of such relationships. Relationships among personality factors involved in activation or arousal, Type A and Neuroticism, and physiological indices of reactivity, mean arterial pressure and heart rate, respectively, are supported by the path model, and complex relationships between personality and occupational stress dimensions are supported by multiple regression analyses.

The third hypothesis of this research also involved personality variables, but specifically examined their relationships with occupational stress dimensions. Past research has identified Type A, Neuroticism, and Hostility as personality factors that may individually be related to the experience of occupational stress. Each dimension of the Stress Diagnostic Survey was entered as a dependent variable in a multiple regression equation, with the Jenkins Activity Survey subscales, Neuroticism, and Hostility entered as independent variables. Unlike the path analysis where variance was distributed throughout the model, personality variables here were specifically "tasked" to predict occupational stress dimensions.

While personality measures were able to predict all but two SDS scales in the analyses, the percent of variance accounted for in the equations tended to be rather small. Estimates ranged from four percent in Rewards, Role Conflict, Role Ambiguity, and Qualitative Overload to thirteen percent in Responsibility for People and Time Pressure. Three solutions had multiple predictors

(Qualitative Overload, Responsibility for People, and Time Pressure).

In examining the relative contributions of the personality scales to the SDS solutions, Hostility was found to figure prominently in those SDS scales involving some interaction with people. Politics, Human Resource Development, Participation, Supervisory Style, Underutilization, Role Conflict, and Responsibility for People almost all involve interpersonal conflict as a source of stress. Role Conflict refers to stress in completing their duties at work in the face of conflicting role demands. This conflict is usually psychosocial in nature, typically between competing demands from supervisors. Therefore, the dynamic of Hostility contributing to work stress by manifesting itself as cynical, interpersonally directed Hostility is supported. In areas where work requires interpersonal interactions, high levels of Hostility are not adaptive. Apparently, the cynical, disparaging view of humankind associated with Hostility carries over easily into social work situations. Cottington, Matthews, Talbott, and Kuller (1986) found that male plant workers who suppressed their anger and reported job stress were more likely to be hypertensive. Hodapp, Neuser, and Weyer (1988) found anger arising from job pressure and dissatisfaction and anxiety resulting from job pressure. Hostility at work, therefore, seems to be a viable factor in the experience of work stress. Results from the present study underscore the psychosocial connection of Hostility and work stress.

Jenkins Activity Survey subscales enhanced prediction in several SDS dimensions. Speed and Impatience predicted Underutilization and Job Scope stress, and Speed and Impatience along with Job Involvement predicted Quantitative Overload and Time Pressure. All of these dimensions are concerned with meeting demands at work. It was intuitively gratifying to find that Type A Speed and Impatience was influential in predicting occupational stress arising from Time Pressure and Quantitative Overload, a numerically based construct. This is consistent with the characterization of the Type A as an individual striving to not only meet demands from the environment, but actually generating more demands. Eventually, the Type A is faced with an inability to meet all of the demands that have accrued, hence problems with Time Pressure and Quantitative Overload. That, in turn, may impact their Job Scope, or range of duties. The JAS Hard-Driving and Competitiveness subscale worked with Hostility to predict stress from Responsibility for People, which fits neatly into the Hostility theory. One may easily expect a hard-driving Type A to experience stress when their competitiveness may be subverted due to responsibility for the well being of others. Kirmeyer and Biggers (1988) reported the competitive striving and demand engendering behavior of police dispatchers, and Kushnir and Melamed (1991) demonstrated the motivation of Type As to maintain control of the work environment, especially in the face of higher workload and distress. These data also support findings by Motowildo, Packard, and Manning (1986), who found that Type A and fear of negative evaluation can affect the subjective perception of work stressors. Rhodewalt et al. (1984), Watkins et al. (1982), and Watkins et al. (1987) demonstrated the cognitive appraisal aspects of Type A, which involves environmental perceptions influenced by belief structures concerning no universal moral principle and competition for scarce resources.

Finally, Neuroticism was the sole predictor of stress arising from Rewards, Role Ambiguity, and Qualitative Overload. These relationships make intuitive sense when one considers the high Neuroticism individual as one who responds quickly and intensely to environmental events, especially those involving perception and judgment. In their study of oil rig workers, Sutherland and Cooper (1991) found that Neuroticism and Extraversion mediated perception of the environment and behavior, that Neuroticism was the best predictor of job dissatisfaction, and that workers high in Neuroticism reported more accidents. The SDS scales reinforce the perceptual component of Neuroticism leading to distress. Ambiguity in one's roles, quality demands, and unfairness in rewards are all characterized by perceptual events. Ambiguity, quality, and equity are subjective evaluations that occur in relation to one's perceived status. These results indicate that high Neuroticism individuals tend to infuse more emotionality and lability into the perceptual process, increasing the probability that stress may develop. In a study of undercover agents, Girodo (1991) found that high Neuroticism and Introversion was correlated with poor mental health, as measured by the SCL-90 and Health Opinion Survey. This was in a stressful occupation where evaluations in the face of ambiguity and subjective perceptions can make the difference between life and death.

Gender was hypothesized to have a direct influence on physiological reactivity, especially systolic blood pressure and heart rate. The path analysis failed to support this contention. While the path analysis found no direct relationships between gender and physiological reactivity indices, the MANOVAs conducted for Hypothesis 2 did uncover significant differences in responsivity. As predicted, men responded to the cognitive stressor with greater systolic blood pressure reactivity than women. Men also had significantly higher systolic blood pressure levels throughout the psychophysiological assessment. Frankenhauser et al. (1989) found higher systolic blood pressure in male workers, as well as reduced recovery in women at the end of the workday. Durel et al. (1989) also found complex cardiovascular activity patterns for working women, and Weidner et al. (1989) found that hostile men responded to a laboratory stressor with systolic blood pressure increases and hostile women responded with diastolic blood pressure increases. Andreassi (1989) provides an excellent review of blood pressure response differences between men and women. Of note is Gentry's study (cited in Andreassi, 1989), which found men to respond with greater systolic blood pressure than women when faced with frustration or attack.

The second hypothesized difference in reactivity, for heart rate, was not supported. However, men and women did differ in peripheral skin temperature reactivity, even though their resting levels were not significantly different. This supports the findings of Andreassi, Albright, and Brockwell (1989), who observed greater peripheral skin temperature reactivity among women in response to the same cognitive stressor used in the present research. An examination of the means, however, shows that reactivity was actually small for women and men did not respond in the expected direction. Thus, peripheral skin temperature was not a good index of reactivity in the present research.

Finally, women had significantly lower mean arterial pressure during the psychophysiological assessment, though there was no significant difference in reactivity to the cognitive stressor. Since mean arterial pressure readings are derived mathematically from systolic and diastolic blood pressure, this finding would be expected since women had significantly lower systolic blood pressure readings throughout the assessment.

The nonsignificant relationships of gender to physiological reactivity measures in the path analysis are not discouraging. The path analysis incorporates all variance in the model to test the relationships. In this case, gender did not contribute a substantial amount of unique variance to the solution. Also, Hayduk (1987) discusses the difficulties in using dummy coded or dichotomous variables in LISREL models. Gender, coded as one or two, may not be appropriate for full exploitation in a path analysis. The MANOVA used gender as a between subjects or grouping variable and compared the psychophysiological assessment scores specifically as varying between the groups. The LISREL analysis, however, examined gender as providing a unique contribution to the model, and found that it did not provide a unique contribution over and above personality variables. In that sense, personality was stronger than gender in predicting cardiovascular reactivity when all factors are considered together.

These data support the concept of differential psychophysiological responsivity to cognitive stress between men and women. The notion of a "built in" mechanism to protect women from excessive blood pressure responses, as articulated by Russo and Zuckerman (1991), is supported here. The ramifications of this, with regard to later onset of female hypertension, follows logically. Such discussion, however, is highly speculative in the absence of data. Extreme caution must be exercised in debating the origin of this phenomenon.

While gender differences in physiological reactivity to cognitive stress have been successfully documented here and elsewhere, the origin of these variations remain speculative. The temperament work of Thomas and Chess (1985) has contributed greatly to the position of an interactionist model with regard to the origins of these events. Their work with the New York Longitudinal Study has yielded fascinating insights into the development of individual differences in behavior and the manifestation of pathology. Their work supports the position of complex personality and environmental interactions to influence perception and behavior. The present research sought to examine these relationships within the restricted context of the workplace and found them to be no less complex.

Limitations

Limitations of this study are extensive, as are threats to the validity of the findings. Subjects were inner city college students working part-time. Thus, their perceptions of the workplace with regard to stressors may not be the same as full-time workers. However, students were typically attending college on a full-time basis and working outside half-time. A working student's attention is easily diverted and their job does not express the same kind of valence that one would see in a career position. Also involved is the sheer amount of time spent at work. A full-time worker will have fuller appreciation on the stressors on the job simply by spending more time there. Additionally, since these were part-time jobs and subjects were students, their motivation for filling out questionnaires honestly and accurately was questioned. Past research conducted with college subject pools have yielded highly questionable results. Aside from occasional blank responses due to language problems, there was no evidence to suggest that the data obtained here suffer from a threat to validity from invalid responses or deception by the subjects. Also, it is interesting to note that in a sample of 114 college students working an average of 24 hours a week in addition to taking 13 hours in course credits, five percent would identify themselves as single parents solely responsible for raising their children.

Another issue concerning the subjects, which may be a "mixed blessing," was their ethnic diversity. While it was good in the sense that the sample came from a broad range of cultures and perceptions, serious practical problems were faced in the administration of the study. Some subjects had a great deal of difficulty with the questionnaires because English was not their native language, and in some cases was very new to them. One subject arrived for the psychophysiological assessment with her friend, who explained that the subject recently arrived from Russia and did not speak English. Apparently, her friend (who was also a subject) helped her fill out the questionnaire during the mass testing session. Unable to speak English, the subject could not understand the audiotaped IQ Quiz presented in the psychophysiological assessment. (In order to allow the student to obtain credit for participating in research, a psychophysiological assessment was devised using problems presented visually, to which the subject responded physiologically in the appropriate direction.)

Limitations in the psychophysiological assessment include the selection of the cognitive stressor, the instruments used, and the test setting. The Schiffer IQ Quiz has been used in the past and was successful here in eliciting a psychophysiological reaction. Subjects are told during the briefing that they would be given an "IQ Quiz" as a stressor. This reportedly makes subjects anxious and may have led to the high baseline levels observed in some parameters. Some subjects even asked what some of the questions were like prior to the assessment. If Type As and Type Bs respond differentially to different types of stressors, as proposed by Williams (1986) and Muranaka et al. (1988), then perhaps the IQ Quiz should itself be examined more closely. It is possible that other types of stressors may be more appropriate for this line of research, such as the interpersonal scenarios played out by Hardy and Smith (1988) or the interactive video game used by Juszczak and Andreassi (1987). Finally, the psychophysiological assessments were conducted during winter months, so subjects generally came into the test situation cold. This may have affected baseline readings and contributed to poor peripheral skin temperature during the quiz reactivity. It is not likely that the test setting exerted a deleterious effect on the results.

All psychological instruments were published, standardized tests with extensive validation histories, with the exception of the Stress Diagnostic Survey. More information on the SDS and the properties of it scales would have been helpful. The instrument performed well, however, and results from it are consistent with the body of occupational stress literature.

The statistical analyses performed in support of this research were fairly straightforward multivariate analyses. The limitations of the path analysis in this research provides the greatest limitation and challenge to the results presented in this paper. Structural equation modeling is a powerful multivariate tool that can used to make causal inferences from correlational data. This research, however, is not afforded that luxury. The research design specified for this study was, essentially, a pre-experimental one-shot case study design (Campbell & Stanley, 1963). Even though the psychophysiological assessment and Hypothesis 3 treated the data as a time series design (lending greater statistical conclusion validity to Hypothesis 3), the data reduction and path analysis was, indeed, limited to one observation. This design, therefore, precludes any causal inferences from the data.

Conclusion

This research sought to clarify relationships among personality, gender, occupational stress, and cardiovascular response to stress. Complex interactions among the personality and stress variables were found, as well as unexpected relationships between personality and psychophysiological reactivity to cognitive stress. Type A personality was directly associated with mean arterial pressure reactivity, and Neuroticism was associated with reduced heart rate reactivity to a cognitive stressor. Hostility was directly related to Organizational Stress. Relationships between personality and occupational stress were found to be multifaceted, with Hostility related to stress in areas where interpersonal interaction is high, Type A facets related to stress in areas where demands and control are at stake, and Neuroticism related to occupational stress in areas where perceptual evaluations are involved. The relationships of these three variables to occupational stress were quite parsimonious, but the low estimates of variance accounted for indicate that there are other sources of variance at work.

The direct relationships between Type A and mean arterial pressure reactivity and between Neuroticism and heart rate reactivity were not hypothesized, and the Neuroticism - heart rate finding was counterintuitive. It was speculated that theories of exhaustive coping could account for these findings. The Type A-Hostile-Neurotic complex was mentioned as a possible constellation of personality factors that, in association, possesses direct relationships to psychological and physiological stress. Such a constellation was not supported in this research, rather stress responses were found to be quite complex and varied according to the individual personality factors and stress indices. Similarly, support was not found for negative affectivity saturating the self-report indices of occupational stress. Indeed, the scales used here appeared to maintain their integrity and generally displayed relationships consistent with their theoretical and empirical bases.

The most profound finding from this research addresses gender differences in response to a cognitive stressor. Greater systolic blood pressure reactivity in men reported in past research was confirmed. Also, this study replicated findings from an earlier study that found greater peripheral skin temperature reactivity in women. This phenomenon is not well established in the literature and requires further exploration. Men and women also differed in mean arterial pressure throughout the psychophysiological assessment.

Even given the limitations discussed above, the findings lend support to the role of personality and gender in the experience of occupational stress and psychophysiological reactivity to cognitive stress. Future research should continue to delineate the specific antecedents and consequences of workplace stress. This research supports the importance of individual personality in the work - stress relationship. Only when we have a better understanding of the complex relationships as discussed in this paper will we be able to develop a true taxonomy of stress. This will then allow psychologists in the workplace to address organizational, job, and personnel stress issues with precision.

Finally, the differences between men and women in reacting to cognitive stress has been supported and expanded by this research. Stress management practitioners should be aware of differences in female physiology that may affect their reactivity to stressors. In the present research, women were shown to have lower systolic blood pressure and mean arterial pressure than men. On the other hand, peripheral skin temperature may be an appropriate modality to pursue psychophysiological stress management training in women. Future research should explore differences in cardiovascular performance under stress, perhaps using impedance cardiography.

Industrial and organizational psychologists, employee assistance programs, and clinicians involved with working women must take these issues into account when dealing with this ever growing population of the workforce. The present research demonstrated that personality is related to the experience of occupational stress, and that gender issues must be addressed. Future research should focus on the efficacy of stress management training programs and delivery of psychological services tailored for the psychological and physiological needs of working women.

Appendix A

Informed Consent Agreement

Psychophysiology Laboratory
Baruch College
The City University of New York

I hereby acknowledge that on ________________, 19__, I was informed by Albert L. Brockwell or his designee of a research project being conducted at the Psychophysiology Laboratory of Baruch College, CUNY, under the auspices of Professor John L. Andreassi, concerning occupational stress, personality, gender, and cardiovascular responsivity. It was explained to me that the study will involve completing a battery of questionnaires and participating in a psychophysiological assessment. The psychophysiological assessment will involve attaching a blood pressure cuff to my upper arm and a sensor to the top of my finger with adhesive tape, and monitoring physiological responses during a mild stressor (an IQ Quiz). These sensors are safe and easily removed. I understand that the only sensations I may experience during the psychophysiological assessment is pressure in the blood pressure cuff, but that this will pose no danger to my health and is identical to standardized medical assessment practices.

I understand that in order to earn two credit hours toward fulfilling my research requirement, I must complete all questionnaires in good faith and undergo the psychophysiological assessment. I have been assured that all information I provide on the questionnaires and the psychophysiological assessment will be confidential. All data will be reported in aggregate, and my participation will be acknowledged only to the Subject Pool staff, in order to receive credit. From my participation in this study, I will gain experience in the conduct of a psychophysiological study, and receive instruction in occupational stress, personality, and psychophysiological responsivity to stress. If I so desire, I may receive a summary of this research upon it's completion.

I acknowledge that I have been informed of the risks and benefits of this research as stated above, and I further understand that I may withdraw from the study without prejudice, forgoing credit, at any time. Therefore, I give my informed consent to participate in this research program.

______________________________ ____________
Printed Name Date

____
Signature

____
Witness (experimenter)

Appendix B

Personal Data Sheet

Psychophysiology Laboratory
Baruch College
The City University of New York

Occupational Stress Study

PERSONAL DATA SHEET

ID Number (last four digits of your SSN): __ __ __ __

Age: _______

Gender: Male Female

Job Title: ____

On the average, how many hours per week do you work? ____

Please provide a brief description of your duties:

Appendix C

Demographic Data Sheet

Psychophysiology Laboratory
Baruch College
The City University of New York

Occupational Stress Study

DEMOGRAPHIC DATA SHEET

ID Number (last four digits of your SSN): ___ ___ ___ ___

Please indicate your racial/ethnic affiliation:

___ Asian
___ Black
___ Hispanic
___ White
___ Other ______________________

What is your current living situation?

___ Single, living alone
___ Single, living with parents
___ Single, living with roommates
___ Married or living with mate

How many children do you have or are in your care? _____

Do you consider yourself to be a single parent? _____

How many credits are you registered for this semester? _____

Appendix D

Questionnaire Battery

PLEASE NOTE

Copyrighted materials in this document have not been filmed at the request of the author. They are available for consultation, however, in the author's university library.

pages 155-167

University Microfilms International

Appendix E

Psychophysiological Assessment Data Sheet

Psychophysiology Laboratory
Department of Psychology
Baruch College, CUNY

PSYCHOPHYSIOLOGICAL ASSESSMENT DATA SHEET

Subject Number ________

Assessment Date______________ Time______

History of heart or respiratory problems:

Current medications:

Vasoactive substances within the last two hours:

Condition	SBP/DBP	HR	MAP	PST
BAS 2	/			
BAS 4	/			
BAS 6	/			
Quiz 2	/			
Quiz 4	/			
Quiz 6	/			
REC 2	/			
REC 4	/			
REC 6	/			

Comments:

References

Ainsworth, T. (1984). Health care industry. In M. P. O'Donnell & T. Ainsworth (Eds.), Health promotion in the workplace (pp. 675-683). New York: John Wiley & Sons.

Albright, G. L., Andreassi, J. L., & Brockwell, A. L. (1991). Effects of stress management on blood pressure and other cardiovascular variables. International Journal of Psychophysiology, 11, 213-217.

Albright, G. L., Andreassi, J. L., & Steiner, S. S. (1988). Interactive effects of Type A personality and psychological and physical stressors on human cardiovascular functions. International Journal of Psychophysiology, 6, 315-326.

Anderson, C. (1976). Coping behaviors as intervening mechanisms in the inverted U stress-performance relationship. Journal of Applied Psychology, 61, 30-34.

Andreassi, J. L. (1989). Psychophysiology: Human behavior and physiological response (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Andreassi, J. L., Albright, G. L., & Brockwell, A. L. (1989, March). Relationship between cardiovascular responsivity and psychometric variables. Poster presented at the 20th Annual Meeting of the Association for Applied Psychophysiology and Biofeedback, San Diego, CA.

Barefoot, J. C., Dahlstrom, W. G., & Williams, R. B. (1983). Hostility, CHD incidence, and total mortality: A 25-year follow-up study of 255 physicians. Psychosomatic Medicine, 45(1), 59-63.

Beehr, T. A. & Newman, J. (1978). Job stress, employee health, and organizational effectiveness: A facet analysis, model, and literature review. Personnel Psychology, 31, 665-699.

Beehr, T. A. & Schuler, A. S. (1982). Stress in organizations. In K. M. Rowland & G. R. Ferris (Eds.), Personnel management. Boston: Allyn & Bacon.

Bentler, P. M. & Bonett, D. G. (1980). Significance tests and goodness-of-fit in the analysis of covariance structures. Psychological Bulletin, 88, 588-606.

Bernardo, M., de Flores, T., Valdes, M., Mestre, L., & Fernandez, G. (1987). Coronary heart disease and psychological variables: Is Type A enough to increase the risk? Personality and Individual Differences, 8(5), 733-756.

Bhagat, R., McQuaid, S., Lindholm, H., & Segovis, J. (1985). Total life stress: A multimethod validation of the construct and its effects on organizationally valued outcomes and withdrawal behaviors. Journal of Applied Psychology, 70(1), 202-214.

Blumenthal, J. A., Williams, R. B., Kong, Y., Rosenman, R. H., & Thompson, L. W. (1978). Type A behavior pattern and coronary atherosclerosis. Circulation, 58, 634-639.

Booth-Kewley, S. & Friedman, H. S. (1987). Psychological predictors of heart disease: A quantitative review. Psychological Bulletin, 101(3), 343-362.

Breaugh, J. (1981). Predicting absenteeism from prior absenteeism and work behaviors. Journal of Applied Psychology, 66(5), 555-560.

Brief, A. P., Burke, M. J., George, J. M., Robinson, B. S., & Webster, J. (1988). Should negative affectivity remain an unmeasured variable in the study of job stress? Journal of Applied Psychology, 73(2), 193-198.

Campbell, D. T. & Stanley, J. C. (1963). Experimental and quasi-experimental designs for research. Boston: Houghton Mifflin Company.

Cannon, W. B. & de la Paz, D. (1911). Emotional stimulation of adrenal secretion. American Journal of Physiology, 28, 64-70.

Caplan, R., Cobb, S., French, J., Van Harrison, R., & Pinneau, S. (1975). Job demands and worker health: Main effects and occupational differences. Washington, DC: U. S. Government Printing Office.

Carmody, T. P., Crossen, J. R., and Weins, A. N. (1989). Hostility as a health risk factor: Relationships with neuroticism, Type A behavior, attentional focus, and interpersonal style. Journal of Clinical Psychology, 45(5), 754-762.

Catalyst (1990). Women in corporate management: Results of a Catalyst survey. New York: Author.

Cervone, D. (1991). The two disciplines of personality psychology. Psychological Science, 2 (6), 371-376.

Check, J. V. P. & Dyck, D. G. (1986). Hostile aggression and Type A behavior. Personality and Individual Differences, 7(6), 819-827.

Chen, P. Y. & Spector, P. E. (1991). Negative affectivity as the underlying cause of correlations between stressors and strains. Journal of Applied Psychology, 76(3), 398-407.

Chess, S. & Thomas, A. (1978). Temperamental individuality from childhood to adolescence. In S. Chess & A. Thomas (Eds.), Annual progress in child psychiatry and child development (pp. 223-244). New York: Brunner/Mazel.

Clarkson, T. B., Manuck, S. B., & Kaplan, J. R. (1986). Potential role of cardiovascular reactivity in atherogenesis. In K. A. Matthews, S. M. Weiss, T. Detre, T. M. Dembroski, B. Falkner, S. B. Manuck, & R. B. Williams (Eds.), Handbook of stress, reactivity, and cardiovascular disease (pp. 35-48). New York: John Wiley & Sons.

Cook, W. & Medley, D. (1954). Proposed hostility and pharisaic-virtue scales for the MMPI. Journal of Applied Psychology, 38, 414-418.

Costa, P. T., Zonderman, A. B., Mc Crae, R. R., & Williams, R. B. (1986). Cynicism and paranoid alienation in the Cook and Medley HO scale. Psychosomatic Medicine, 48(3/4), 283-285.

Cottington, E. M., Matthews, K. A., Talbott, E., & Kuller, L. H. (1986). Occupational stress, suppressed anger, and hypertension. Psychosomatic Medicine, 48(3/4), 249-260.

Drazen, M., Nevid, J. S., Pace, N., & O'Brien, R. M. (1982). Worksite-Based behavioral treatment of mild hypertension. Journal of Occupational Medicine, 24(7), 511-514.

Dubin, R., Hedley, R., & Taveggia, C. (1976). Attachment to work. In R. Dubin (Ed.), Handbook of work, organization, and society. Chicago: Rand McNally College Publishing Co.

Durel, L. A., Carver, C. S., Spitzer, S. B., Llabre, M. M., Weintraub, J. K., Saab, P. G., & Schneiderman, N. (1989). Associations of blood pressure with self-report measures of anger and hostility among black and white men and women. Health Psychology, 8(5), 557-575.

Eysenck, H. J. (1967). The biological basis of personality. Springfield, IL: C. C. Thomas.

Eysenck, H. J. (1983). Stress, disease, and personality: The 'inoculation effect.' In C. L. Cooper (Ed.), Stress research: Issues for the eighties (pp. 121-146). New York: John Wiley & Sons.

Eysenck, H. J. (1985). Personality, cancer and cardiovascular disease: A causal analysis. Personality and Individual Differences, 6(5), 535-556.

Eysenck, H. J. & Eysenck, S. B. G. (1968). Eysenck Personality Inventory [Manual]. San Diego, CA: Educational and Industrial Testing Service.

Eysenck, H. J. & Fulkner, D. (1983). The components of Type A behavior and its genetic determinants. Personality and Individual Differences, 4(5), 499-505.

Frankenhauser, M., Lundberg, U., Fredrikson, M., Melin, B., Tuomisto, M., & Myrsten, A. (1989). Sex on and off the job as related to sex and occupational status in white-collar workers. Journal of Organizational Behavior, 10, 321-346.

French, J., Caplan, R. D., van Harrison, R. (1982). The mechanisms of job stress and strain. New York: John Wiley & Sons.

French, J., Rogers, W., & Cobb, S. (1974). Adjustment as a person-environment fit. In G. Coelho, D. Hamburg, & J. Adams (Eds.), Coping and adaptation. New York: Basic Books.

Friedman, H. S. & Booth-Kewley, S. (1987). The "disease-prone personality": A meta-analytic view of the construct. American Psychologist, 42, 539-555.

Friedman, H. S. & Booth-Kewley, S. (1989). Validity of the Type A construct: A reprise. Psychological Bulletin, 104(3), 381-384.

Friedman, M. (Ed.). (1969). Pathogenesis of coronary artery disease. New York: McGraw-Hill.

Friedman, M., Manwaring, J. H., Rosenman, R. H., Donlon, G., Ortega, P., & Grube, S. M. (1973). Instantaneous and sudden death: Clinical and pathological differentiation in coronary artery disease. Journal of the American Medical Association, 225, 1319-1328.

Furnham, A. (1984). Extraversion, sensation seeking, stimulus screening and Type "A" behavior pattern: The relationship between various measures of arousal. Personality and Individual Differences, 5(2), 133-140.

Ganster, D. C., Mayes, B. T., Sime, W. E., & Tharp, G. D. (1982). Managing organizational stress: A field experiment. Journal of Applied Psychology, 67(5), 533-542.

Ganster, D. C. & Schaubroeck, J. (1991). Work stress and employee health. Journal of Management, 17(2), 235-271.

Ganster, D. C., Schaubroeck, J., Sime, W. E., & Mayes, B. T. (1991). The nomological validity of the Type A personality among employed adults. Journal of Applied Psychology, 76(2), 143-168.

Gibbs, J. O., Mulvaney, D., Henes, C., & Reed, R. (1985). Work-Site health promotion. Journal of Occupational Medicine, 27(11), 826-830.

Girodo, M. (1991). Personality, job stress, and mental health in undercover agents: A structural equation analysis. Journal of Social Behavior and Personality, 6(7), 375-390.

Greenglass, E. R. & Julkunen, J. (1989). Construct validity and sex differences in Cook-Medley hostility. Personality and Individual Differences, 10(2), 209-28.

Harbin, T. J. (1989). The relationship between the Type A behavior pattern and physiological responsivity: A quantitative review. Psychophysiology, 26(1), 110-119.

Hardy, J. D. & Smith, T. W. (1988). Cynical hostility and vulnerability to disease: Social support, life stress, and physiological response to conflict. Health Psychology, 7(5), 447-459.

Harris, M. (1980). Culture, people, nature: An introduction to general anthropology (3rd. ed.). New York: Harper & Row.

Hayduk, L. A. (1987). Structural equation modeling with LISREL: Essentials and advances. Baltimore, MD: The Johns Hopkins University Press.

Helin, P. & Hanninen, O. (1988). Gender and personality effects on psychophysiological activation in an instructor candidates' teaching test. Journal of Psychophysiology, 2, 49-59.

Hendrix, W. H. (1989). Job and personal factors related to job stress and risk of developing coronary artery disease. Psychological Reports, 63, 1136-1138.

Hendrix, W., Nestor, K., & Troxler, R. (1985). Behavioral and physiological consequences of stress and its antecedent factors. Journal of Applied Psychology, 70(1), 188-201.

Herd, J. A. (1978). Physiological correlates of coronary-prone behavior. In T. M. Dembroski, S. M. Weiss, J. L. Shields, S. G. Haynes, & M. Feinleib (Eds.), Coronary-Prone behavior (pp. 129-136). New York: Springer-Verlag.

Herd, J. A. (1986). Neuroendocrine mechanisms in coronary heart disease. In K. A. Matthews, S. M. Weiss, T. Detre, T. M. Dembroski, B. Falkner, S. B. Manuck, & R. B. Williams (Eds.), Handbook of stress, reactivity, and cardiovascular disease (pp. 49-70). New York: John Wiley & Sons.

Hodapp, V., Neuser, K. W., & Weyer, G. (1988). Job stress, emotion, and work environment: Toward a causal model. Personality and Individual Differences, 8(5), 851-859.

Holt, R. R. (1982). Occupational stress. In L. Goldberger & S. Breznitz (Eds.), Handbook of stress: Theoretical and clinical aspects (pp. 419-444). New York: Macmillan.

Houston, B. K. & Kelly, K. E. (1989). Hostility in employed women: Relation to work and marital experiences, social support, stress, and anger expression. Personality and Social Psychology Bulletin, 15(2), 175-182.

Houston, B. K., Smith, M. A., and Cates, D. S. (1989).

Hostility patterns and cardiovascular reactivity to stress. Psychophysiology, 26(3), 337-342.

Howard, J. H., Cunningham, D. A., & Rechnitzer, P. A. (1976). Health patterns associated with Type A behavior: A managerial population. Journal of Human Stress, 2(1), 24-31.

Howard, J. H., Cunningham, D. A., & Rechnitzer, P. A. (1986). Role ambiguity, Type A behavior, and job satisfaction: Moderating effects on cardiovascular and biochemical responses associated with coronary risk. Journal of Applied Psychology, 71(1), 95-101.

Ivancevich, J. & Matteson, M. (1981). Stress and work. Glenview, IL: Foresman Co.

Ivancevich, J. & Matteson, M. (1984). A Type A-B person-work environment interaction model for examining occupational stress and consequences. Human Relations, 37(7), 491-513.

Ivancevich, J., Matteson, M., & Preston, C. (1982). Occupational stress, Type A behavior, and physical well-being. Academy of Management Journal, 25, 373-391.

Jackson, S. E. & Alvarez, E. B. (1992). Working through diversity as a strategic imperative. In S. Jackson & Assoc. (Eds.), Diversity in the workplace: Human resources initiatives (pp. 13 - 29). New York: The Guilford Press.

Jamal, M. (1985). Relationship of job stress to job performance: A study of managers and blue collar workers. Human Relations, 38(5), 409-424.

Jenkins, C. D., Rosenman, R. H., & Friedman, M. (1966). Components of the coronary-prone behavior pattern: Their relation to silent myocardial infarction and blood lipids. Journal of Chronic Disease, 19, 599-609.

Jenkins, C. D., Zyzanski, S. J., & Rosenman, R. H. (1971). Progress toward validation of a computer-scored test for the Type A coronary-prone behavior pattern. Psychosomatic Medicine, 33, 193-202.

Jenkins, C. D., Zyzanski, S. J., & Rosenman, R. H. (1979). Jenkins Activity Survey [Manual]. New York: The Psychological Corp.

Jennings, C. & Tager, M. (1981). Good health is good business. Medical Self-Care, Summer, 14.

Jensen, A. R. (1962). An empirical theory of the serial-position effect. Journal of Psychology, 53, 127-142.

Jones, J. W. & Boyce, M. W. (1990). Job stress and counterproductivity. Paper presented at the APA/NIOSH Conference, Work and Well-Being: An Agenda for the 90's, Washington, DC.

Jöreskog, K. & Sörbom, D. (1984). PC-LISREL: Version 6.13 [Computer program]. Mooresville, IN: Scientific Software, Inc.

Jöreskog, K. & Sörbom, D. (1989). LISREL 7: User's reference guide [Computer manual]. Mooresville, IN: Scientific Software, Inc.

Juszczak, N. M. & Andreassi, J. L. (1987). Performance and physiological responses of Type A and Type B individuals during a cognitive and perceptual-motor task. International Journal of Psychophysiology, 5, 81-89.

Karasek, R. A. (1979). Job demands, job decision latitude and mental strain: Implications for job redesign. Administrative Science Quarterly, 24, 285-308.

Karasek, R., Baker, P., Marxer, E., Ahlbom, A., & Theorell, T. (1981). Job decision latitude, job demands and cardiovascular disease: A prospective study of Swedish men. American Journal of Public Health, 71, 694-705.

Karasek, R. A., Gardell, B., & Lindell, J. (1987). Work and non-work correlates of illness behavior in male and female Swedish white collar workers. Journal of Occupational Behavior, 8, 187-207.

Karasek, R. A. & Theorell, T. (1990). Healthy work: Stress, productivity, and the reconstruction of working life. New York: Basic Books.

Kelly, K. K. & Houston, K. (1985). Type A behavior in employed women: Relation to work, marital, and leisure variables, social support, stress, tension, and health. Journal of Personality and Social Psychology, 48(4), 1067-1079.

Keppel, G. (1982). Design and analysis: A researcher's handbook (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall, Inc.

Keys, A., Taylor, H. L., Blackburn, H., Brozek, J., Anderson, J., & Simonsen, E. (1971). Mortality and coronary heart disease among men studied for 23 years. Archives of Internal Medicine, 128, 201-214.

Kirkcaldy, B., Thome, E., & Thomas, W. (1989). Job satisfaction amongst psychosocial workers. Personality and Individual Differences, 10(2), 191-196.

Kirmeyer, S. L. & Biggers, K. (1988). Environmental demand and demand engendering behavior: An observational analysis of the Type A Pattern. Journal of Personality and Social Psychology, 54(6), 997-1005.

Kirmeyer, S. L. & Diamond, A. (1985). Coping by police officers: A study of role stress and Type A and Type B behavior patterns. Journal of Occupational Behavior, 6, 183-195.

Kushnir, T. & Melamed, S. (1991). Work-Load, perceived control and psychological distress in Type A/B industrial workers. Journal of Organizational Behavior, 12(2), 155-168.

Lacey, J. I., Bateman, D. E., & Van Lehn, R. (1953). Autonomic response specificity: An experimental study. Psychosomatic Medicine, 15, 8-21.

Lacey, J. I. & Lacey, B. C. (1958). Verification and extension of the principle of autonomic response specificity. American Journal of Psychology, 71, 50-73.

Lichtenstein, P., Penderson, N., Plomin, R., de Faire, U., & McClearn, G. E. (1989). Type A behavior pattern, related personality traits and self-reported coronary heart disease. Personality and Individual Differences, 10(4), 419-426.

Llorente, M. (1986). Neuroticism, extraversion and the Type A behavior pattern. Personality and Individual Differences, 7(3), 427-429.

Loehlin, J. C. (1987). Latent variable models: An introduction to factor, path, and structural analysis. Hillsdale, NJ: Lawrence Erlbaum Assoc.

Lowe, R. & McGrath, J. (1971). Stress, arousal and performance: Some findings call for a new theory.

(Project Report No. AF 1161-67) AFOSR.

Malmo, R. B. (1962). Activation. In A. J. Bachrach (Ed.), Experimental foundations of clinical psychology (pp. 386-422). New York: Basic Books.

Malmo, R. B. & Shagass, C. (1949). Physiologic study of symptom mechanisms in psychiatric patients under stress. Psychosomatic Medicine, 11, 25-29.

Manuck, S. B., Craft, S., & Gold, K. J. (1978). Coronary-prone behavior pattern and cardiovascular response. Psychophysiology, 15(5), 403-411.

Manuck, S. B. & Krantz, D. S. (1986). Psychophysiologic reactivity in coronary heart disease and essential hypertension. In K. A. Matthews, S. M. Weiss, T. Detre, T. M. Dembroski, B. Falkner, S. B. Manuck, & R. B. Williams (Eds.), Handbook of stress, reactivity, and cardiovascular disease (pp. 11-34). New York: John Wiley & Sons.

Manuso, J. (1983). The Equitable Life Assurance Society Program. Preventive Medicine, 12, 658-662.

Matteson, M. T. & Ivancevich, J. M. (1982). Type A and B behavior patterns and self-reported health symptoms and stress: Examining individual and organizational fit. Journal of Occupational Medicine, 24(8), 585-589.

Matteson, M. T. & Ivancevich, J. M. (1987). Controlling work stress: Effective human resource and management strategies. San Francisco: Jossey-Bass.

Matthews, K. A. (1988). Coronary heart disease and Type A behaviors: Update on and alternative to the Booth-Kewley and Friedman (1987) quantitative review. Psychological Bulletin, 104(3), 373-380.

Matthews, K. A., Glass, D. C., Rosenman, R. H., & Bortner, R. W. (1977). Competitive drive, pattern A, and coronary heart disease: A further analysis of some data from the Western Collaborative Group Study. Journal of Chronic Disease, 30, 489-498.

Meglino, B. (1977). Stress and performance: Are they always incompatible? Supervisory Management, 22(3), 2-12.

Microsoft (1986). Word: Version 3.11 [Computer program]. Redmond, WA: Microsoft, Inc.

Motowildo, S. J., Packard, J. S., & Manning, M. R. (1986). Occupational stress: Its causes and consequences for job performance. Journal of Applied Psychology, 71(4), 618-629.

Mowday, R., Porter, L., & Steers, R. (1982). Employee-organizational linkages: The psychology of commitment, absenteeism, and turnover. New York: Academic Press.

Muranaka, M., Lane, J. D., Suarez, E. C., Anderson, N. B., Suzuki, J., & Williams, R. B. (1988). Stimulus-specific patterns of cardiovascular reactivity in Type A and Type B subjects: Evidence for enhanced vagal reactivity in Type B. Psychophysiology, 25(3), 330-338.

Murphy, L. R. (1984). Occupational stress management: A review and appraisal. Journal of Occupational Psychology, 57, 1-15.

Musante, L., Treiber, F. A., Davis, H., Strong, W. B., & Levy, M. (1992). Hostility: Relationship to lifestyle behaviors and physical risk factors. Behavioral Medicine, 18(1), 21-26.

Nicholson, N., Brown, C., & Chadwick-Jones, J. (1976). Absence from work and job satisfaction. Journal of Applied Psychology, 61, 728-737.

Norušis, M. (1990). SPSS/PC+: Version 4.0 [Computer program]. Chicago, IL: SPSS, Inc.

Ohman, A., Nordby, H., & Svebak, S. (1989). Components of Type A behavior and task-induced cardiovascular activation. Psychophysiology, 26(1), 81-88.

Papillo, J. F. & Shapiro, D. (1990). The cardiovascular system. In J. T. Cacioppo & L. G. Tassinary (Eds.), Principles of psychophysiology: Physical, social, and inferential elements (pp. 456-512). New York: Cambridge University Press.

Price, V. A. (1982). The Type A behavior pattern: A model for theory and practice. New York: Academic Press.

Price, V. A. (1986). Research and clinical issues in treating Type A behavior. In B. K. Houston & C. R. Snyder (Eds.), Type A behavior: Research, theory, and intervention (pp. 275-311). New York: Wiley.

Quick, J. D., Horn, R. S., & Quick, J. C. (1987). Health consequences of stress. Journal of Organizational Behavior, 8(2), 19-36.

Rhodewalt, F., Hays, R. B., & Chemers, M. M. (1984). Type A behavior, perceived stress, and illness: A person-situation analysis. Personality and Social Psychology Bulletin, 10, 149-159.

Rhodewalt, F., Sansone, C., Hill, C. A., Chemers, M. M., & Wysocki, J. (1991). Stress and distress as a function of Jenkins Activity Survey-Defined Type A behavior and control over the work environment. Basic and Applied Social Psychology, 12(2), 211-226.

Rosenman, R. H., Brand, R. J., Sholtz, R. I., & Friedman, M. (1976). Multivariate prediction of coronary heart disease during 8.5 year follow-up in the Western Collaborative Group Study. American Journal of Cardiology, 37, 902-910.

Ruberman, W., Weinblatt, E., Goldberg, J., & Chaudhary, B. S. (1984). Psychosocial influences on mortality after myocardial infarction. New England Journal of Medicine, 311, 552-559.

Russo, K. R. & Zuckerman, M. (1991). Psychological, physiological and physical characteristics of subjects at risk for essential hypertension. Personality and Individual Differences, 13(1), 61-68.

Sausen, K. P., Lovallo, W. R., & Wilson, M. F. (1991). Heart rate reactivity, behavioral pattern, and parental hypertension as predictors of cardiovascular activity during cognitive challenge. Psychophysiology, 28(6), 639-647.

Schaubroeck, J., Ganster, D. C., & Fox, M. (1992). Dispositional affect and work-related stress. Journal of Applied Psychology, 77(3), 322-335.

Schiffer, F., Hautley, L., Schulman, C., & Abelman, W. (1976). The quiz ECG: A new diagnostic and research technique for evaluating the reaction between emotional stress and ischemic heart disease. American Journal of Cardiology, 37, 41-47.

Schnall, P. L., Pieper, C., Schwartz, J. E., Karasek, R., Schlussel, Y., Devereaux, R. B., Ganau, A., Alderman, M., Warren, H., & Pickering, T. G. (1990). The relationship between 'job strain,' workplace diastolic blood pressure, and left ventricular mass index; Results of a case-control study. Journal of the American Medical Association, 263(14), 1929-1935.

Schneiderman, N. (1978). Animal models relating stress and cardiovascular pathology. In T. M. Dembroski, S. M. Weiss, J. L. Shields, S. G. Haynes, & M. Feinleib (Eds.), Coronary-Prone behavior (pp. 155-182). New York: Springer-Verlag.

Schnore, M. M. (1959). Individual patterns of physiological activity as a function of task differences and degree of arousal. Journal of Experimental Psychology, 58, 117-128.

Schuler, R. S. (1975). Role perceptions, satisfaction, and performance: A partial reconciliation. Journal of Applied Psychology, 60, 683-697.

Schuler, R. S. (1980). Definition and conceptualization of stress in organizations. Organizational Behavior and Human Performance, 25, 184-215.

Scott, W. E. (1966). Activation theory and task design. Organizational Behavior and Human Performance, 1, 3-30.

Shekelle, R. B., Gayle, M., Ostfeld, A., & Oglesby, P. (1983). Hostility, risk of coronary heart disease, and mortality. Psychosomatic Medicine, 45(2), 109-114.

Siegrist, J. & Klein, D. (1990). Occupational stress and cardiovascular reactivity in blue-collar workers. Work and Stress, 4(4), 295-304.

Smith, T. W. & Frome, K. D. (1985). What's so unhealthy about hostility? Construct validity and psychosocial correlates of the Cook and Medley Ho scale. Health Psychology, 4(5), 503-520.

Smith, T. W., Pope, M. K., Sanders, J. D., Allred, K. D., & O'Keefe, J. L. (1988). Cynical hostility at home and work: Psychosocial vulnerability across domains. Journal of Research in Personality, 22, 525-548.

Steffy, B. D. & Jones, J. J. (1988). Workplace stress indicators of coronary-disease risk. Academy of Management Journal, 31(3), 686-698.

Sternbach, R. A. (1966). Principles of psychophysiology. New York: Academic Press.

Sutherland, V. J. & Cooper, C. L. (1991). Personality, stress and accident involvement in the offshore oil and gas industry. Personality and Individual Differences, 12(2), 195-204.

Thomas, A. & Chess, S. (1985). Genesis and evolution of behavioral disorders: From infancy to early adult life. Annual progress in child psychiatry and child development (pp. 140-158). New York: Brunner/Mazel.

Thomas, A., Chess, S., & Korn, S. (1982). The reality of difficult temperament. Merrill-Palmer Quarterly, 28(1), 1-20.

Waldron, I., Zyzanski, S. J., Shekelle, R. B., Jenkins, D. C., & Tannenbaum, S. I. (1977). The coronary-prone behavior pattern in employed men and women. Journal of Human Stress, 3(4), 2-18.

Watkins, P. L., Ward, C. H., Southard, D. R. (1987). Empirical support for a Type A belief system. Journal of Psychopathology and Behavioral Assessment, 9, 119-134.

Watkins, P. L., Ward, C. H., Southard, D. R., & Fisher, E. B. (1992). The Type A belief system: Relationships to hostility, social support, and life stress. Behavioral Medicine, 18(1), 27-32.

Watson, D. & Clark, L. A. (1984). Negative affectivity: The disposition to experience aversive emotional states. Psychological Bulletin, 96(3), 465-490.

Weidner, G., Friend, R., Ficarrotto, T. J., & Mendell, N. R. (1989). Hostility and cardiovascular reactivity to stress in women and men. Psychosomatic Medicine, 51(1), 36-45.

Wenger, M. A. (1941). The measurement of individual differences in autonomic balance. Psychosomatic Medicine, 3, 427-434.

Wenger, M. A. (1948). Studies of autonomic balance in Air Force personnel. Comparative Psychology Monographs, 19.

Wenger, M. A., & Cullen, T. D. (1972). Studies of autonomic balance in children and adults. In N. S. Greenfield & R. A. Sternbach (Eds.), Handbook of psychophysiology (pp. 535-569). New York: Holt, Rhinehart, & Winston.

Williams, R. B. (1986). Patterns of reactivity and stress. In K. A. Matthews, S. M. Weiss, T. Detre, T. M. Dembroski, B. Falkner, S. B. Manuck, & R. B. Williams (Eds.), Handbook of stress, reactivity, and cardiovascular disease (pp. 127-144). New York: John Wiley & Sons.

Williams, R. B., Haney, T. L., Lee, K. I., Kong, Y., Blumenthal, J. A., & Whalen, R. E. (1980). Type A behavior, hostility, and coronary atherosclerosis. Psychosomatic Medicine, 42(6), 539-549.

Wistow, D. J., Wakefield, J. A., & Goldsmith, W. M. (1990). The relationship between personality, health, symptoms and disease. Personality and Individual Differences, 11(7), 717-723.

Wright, R. A., Contrada, R. J., & Glass, D. C. (1985). Psychophysiological correlates of Type A behavior. Advances in Behavioral Medicine, 1, 39-88.

Zyzanski, S. J. (1978). Coronary-Prone behavior pattern and coronary heart disease: Epidemiological evidence. In T. M. Dembroski, S. M. Weiss, J. L. Shields, S. G. Haynes, & M. Feinleib (Eds.), Coronary-Prone behavior (pp. 25-40). New York: Springer-Verlag.

Zyzanski, S. J., Jenkins, C. D., Ryan, T. J., Flessas, A., & Everist, M. (1976). Psychological correlates of coronary angiographic findings. Archives of Internal Medicine, 136, 1234-1237.