A PSYCHOPHYSIOLOGICAL EXAMINATION
OF CORONARY-PRONENESS
IN COLLEGE MALES

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Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
DOCTOR OF PHILOSOPHY
July, 1980

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OF CORONARY-PRONENESS

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ACKNOWLEDGMENTS

I wish to express my appreciation to Dr. Philip J. Murphy, my dissertation adviser, for his guidance and many contributions to the study. I would also like to express my gratitude to committee members, Dr. Robert Stanners, Dr. Robert Schlottman, and Dr. Joseph Pearl, for their assistance and thorough critique of the study.

Special gratitude is expressed to my parents, Mr. and Mrs. K. L. Berry, for their emotional and financial support and encouragement of my academic pursuits.

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CHAPTER I

INTRODUCTION

The primary cause of death in the U.S. is coronary heart disease which results from damage to the coronary arteries or atherosclerosis (commonly called hardening of the arteries, the underlying basis for coronary heart disease). Atherosclerosis occurs when the inner layer of the coronary artery thickens due to fatty deposits. The deposits decrease the diameter of the central channel of the coronary artery and impede the flow of blood. The development of coronary heart disease (CHD) has been associated with various psychological behavioral, physiological, and social risk factors in a number of epidemiological studies and reviews (Dawber & Kannel, 1961; Brand, Rosenman, Sholtz, & Friedman, 1976; Jenkins, 1976; Glass, 1977).

Of these studies, Jenkins (1976) provides a review of recent evidence that lends support to the contributions of specific psychological, behavioral, and social risk factors to the development of coronary disease. He states that most risk factors that had been previously associated with coronary disease such as elevated blood pressure, elevated serum cholesterol, cigarette smoking, obesity, diabetes, and family history of coronary disease provide an incomplete and insensitive basis for the prediction of the disease. Cultural, social, psychological, and behavioral factors have also been found to be important predictors of CHD. Although a large amount of information involving precursors of the disease is known, Jenkins states as much still remains unknown and merits further study.

Jenkins (1976) reviewed a large body of research on precursors of CHD and in the behavioral area found support for the contribution of the coronary-prone behavior pattern (also called the Type A Behavior Pattern which is characterized by intense striving for achievement, competitiveness, time urgency, impatience, etc.) to the development of CHD. Type A behavior is associated with the following factors: prevalence of coronary disease in various populations, risk of development of coronary disease in a healthy person, degree of atheroslcerosis as determined by coronary angiography, and possible risk of reinfarction (recurrence of a heart attack) in those individuals who have coronary disease. Jenkins concludes by stating that a comparison of the studies on the major categories of psychosocial variables contributing to CHD, the studies on the Type A coronary-prone behavior pattern and its association with CHD, provide the most numerous and consistently positive findings (Rosenman, Friedman, Straus, Jenkins, Zyzanski, & Wurm, 1970; Rosenman, 1971; Bonami & Rimé, 1972; Jenkins, Rosenman, & Zizanski, 1972; Rosenman, Brand, & Jenkins, 1975; Glass & Rosenman (in press), etc.). The review shows that anxiety, depression, interference with sleep work overload, and chronic conflict situations were also found to be related to coronary disease risk. More specifically, anxiety, depression, neuroticism, and interpersonal problems have been labeled by some researchers as precursors for agina pectoris (pain in the chest caused by a temporary scarcity of blood to one or more areas of heart muscle) and coronary death, but are not consistently related to myocardial infarction (heart attack) (Medalie, Kahn, & Neufeld, 1973; Medalie, Snyder, & Groen, 1973; Floderus, 1974; Bruhn, Parades, & Adsett, 1974). Myocardial infarction, on the other hand, appears to be related to obsessive tendencies and overcontrol of emotions (Thomas & Greenstreet, 1973; Bonami & Rimé, 1972). Jenkins (1976), however, points out that this evidence on psychological factors associated with myocardial infarction is retrospective and comes from only two studies using small samples. Yet, according to Jenkins (1976), the Type A Behavior Pattern is associated with both types of coronary disease (angina pectoris and myocardial infarction). This evidence shows the importance of the Type A Behavior Pattern for CHD risk.

Current research dealing with people who have CHD or people who exhibit the coronary-prone Type A Behavior Pattern has focused on psychological variables or the interplay between psychological and physiological variables on responses to various conditions in the experimental laboratory. A series of three studies by French researchers presents some of the most recent findings in this area. Liesse, Van Imschoot, Mertens, and Lauwers (1974) administered the MMPI, the ABV (a questionnaire measuring rigidity, nervousness, and extroversion), and a dominance-submission scale to forty normal males and forty male patients with ischemic (coronary) heart disease. The significant differences that were found fell into three subgroups or clusters indicating that the coronary patients exhibited either an hysterical, obsessional, or schizoid personality pattern more than normals. This evidence did not support the existence of an exclusive coronary-prone personality pattern but did reveal a common personality component of incapacity for coping with anxiety or inadequate psychological defenses.

Liesse et al. (1974) compared physiological reactions of forty normal subjects (twenty under conditions of stress and twenty not under stress) and forty subjects with CHD (twenty stressed and twenty not stressed). Dependent measures that differentiated normals under stress and no stress conditions were: systolic and diastolic blood pressure, heart rate, respiratory rate, tidal volume, and bioclinical measures (serum cholesterol levels, etc.). These measures were interpreted as representing good adaptation and preparation of the organism for action. However, the physiological measures that differentiated CHD subjects under stress and no stress conditions were: oxygen intake, CO_2 output, respiratory quotient, respiratory equivalent, and oxygen pulse. These reactions were interpreted as indicating exhaustion of the organism or a maladaptive reaction to stress. The authors suggest three hypotheses to explain the coronary subject's relatively weak physiological reactions to stress as compared to normal subject's reactions: 1) that subjects with CHD inhibit these responses, 2) that coronary patients are accustomed to stress because they live under permanently induced stress, or 3) that their organism is impaired.

A subsequent study by Liesse, Van Imschoot, Lauwers, and Mertens (1976) compared psychological and physiological reactions under stress conditions for fifteen normals and fifteen CHD subjects (chosen from extreme scorers on a scale assessing psychological risk for CHD--this scale was developed by the authors from 11 scales taken from the MMPI, the ABV, and a dominance-submission scale (DS) and was used in their (1974) study. Each group was further subdivided into two groups making a total of four groups: normals with psychological risk factors, normals without psychological risk factors, CHD subjects with psychological risk and CHD subjects without psychological risk. Dependent measures were systolic and diastolic blood pressure, heart rate, and respiratory equivalent, and were taken under conditions of physical stress (nine minutes of pedaling on an indoor exerciser) and mental stress (performing a series of mental calculations). Results showed that subjects carrying psychological risk factors exhibited higher systolic blood pressure and respiratory equivalent during rest periods than subjects not carrying psychological risk for CHD. Interpretation of the results leads to the suggestion that subjects with psychological risk may have already adapted themselves to a customary or permanent stress level and therefore were less aroused by the experimentally induced stress. This hypotheses was one of the three suggested in the previously mentioned study (Liesse et al., 1974).

More recently, Jenkins, Zyzanski, Ryan, Flessas, and Tannenbaum (1977) have discovered a set of two independent psychological characteristics--Type A behavior and social insecurity that together predict a greater severity of atherosclerosis than either characteristic alone. These researchers administered tests measuring the coronary-prone Type A Behavior Pattern (Jenkins, 1976), anxiety and neuroticism (Bendig, 1956; Dahlstrom & Welsh, 1959; Dempsey, 1964) to ninety-five male patients undergoing coronary angiography. Results of an item analysis showed that men afflicted with serious coronary atherosclerosis are hard-driving, hard-working individuals. They are pressured to solve problems, meet deadlines, and move up the social ladder as are most people who exhibit the Type A Behavior Pattern. However, they found these same patients are uncomfortable in interpersonal relationships and feel awkward and insecure in groups as they obtain their rewards in life primarily through achievement as opposed to socializing with people. Additionally, results suggest that people suffering from severe atherosclerosis have a low threshold for becoming tense or depressed, which is supported by the Jenkins (1976) review indicating that anxiety and depression contribute to coronary disease risk.

The finding associating atherosclerosis and feelings of social insecurity is supported by earlier findings of myocardial infarction patients' inability to obtain satisfaction from social activities (Wolf, 1969), alienation from co-workers (Groen, Dreyfuss, & Guttman, 1968), prominent marital problems (Bruhn, Wolf, Lynn, Bird, & Chandler, 1968), conflicts and problems with family members and co-workers (Medalie et al. (1973) and psychosial discord (Floderus, 1974). Even though their evidence is consistent with that of other researchers, Jenkins et al. (1977) suggest that the measurement of social insecurity needs additional cross-validation before definite conclusions can be drawn as to its predictive relationship to atherosclerosis. An additional concern is that the research was not designed to discriminate whether the psychological factors preceded or followed the development of atherosclerosis. Exploratory studies are needed that examine psychological and physiological variables in individuals who have not yet developed coronary disease but who exhibit Type A behavior and/or social insecurity in order to clarify the above findings.

One researcher, Glass (1977) has done extensive research on Type A subjects from normal (non-coronary disease) populations. Although he cites some important findings from his research, he has not examined the interplay between social insecurity and Type A behavior. Glass (1977) presents a review of his research using primarily college students designated as either being Type A or Type B individuals, depending on their scores on the Jenkins Activity Survey, Form B (Jenkins et al. 1972). Glass (1977) reports that he has modified the JAS recently for use with college students and that Type B subjects are individuals who do not exhibit Type A characteristics. Glass found differences between A's and B's in three main behavioral areas showing that A's exhibit more fatigue suppression (a finding Glass feels is related to having a strong achievement orientation), time urgency, and hostility, and aggressiveness (the latter finding Glass refers to as needing further documentation) than Type B subjects. Glass also cites evidence supporting the finding that attempts by Type A individuals to master uncontrollable stressful events in their environment may be associated with coronary heart disease. Originally, he expected that Type A's would show more autonomic arousal, especially under stress, than Type B individuals. However, according to Glass, differences between A's and B's on electrodermal and self-report measures of arousal collected during and immediately after the pretreatment phase of a study did not appear. While the differences may have gone undetected because of insufficient or incorrect sampling of physiological reactions, Glass cites results from additional studies in his laboratory that have failed to show differences between A's and B's in heart rate and finger-vasoconstriction responses to stressful stimulation. Therefore, Glass has developed a cognitive (rather than physiological) interpretation to explain Type A subject's poorer task performance than B's under conditions of uncontrollable stress. He supports the idea that Type A behavior interacting with uncontrollable life stress may lead to CHD by presenting evidence that hospitallized CHD patients had significantly higher Pattern A scores than hospitalized and non-hospitalized controls. Both hospitalized coronaries and hospitalized noncoronaries had experienced at least one uncontrollable stressful loss in the twelve months prior to hospitalization as detected by their responses on the Schedule of Recent Experience (Holmes & Rahe, 1967). See Chapter II for a more complete review of Glass' research.

A summary of the literature presented thus far indicates the need for additional research, especially prospective studies, that explore the connection between psychological, behavioral, and physiological variables and CHD development. The present review showed coronary heart disease to be the major cause of death in the U.S. and of the major categories of psychosocial risk factors for CHD, the Type A Behavior Pattern is the most consistently associated risk factor for coronary disease. This does not obscure the added importance of the traditional risk factors and their association with CHD (i.e., serum cholesterol, cigarette smoking, family history of CHD, etc.). However, these traditional risk factors have proven to be insufficient for predicting CHD development reliably when considered alone. Certain psychological variables have been associated with CHD, such as anxiety, depression and social insecurity; however, it is not clear whether these variables preceded or followed the occurrence of CHD because of the prevalence of retrospective studies supporting these findings. One study found that incapacity to cope with anxiety and inadequate psychological defenses were associated with CHD, but did not find support for the existence of a specific coronary-prone personality pattern among CHD patients that were sampled from a French population. A physiological study measuring cardiovascular and respiratory responses in subjects carrying psychological risk for CHD showed the paradoxical results of these responses being lower than those of subjects without psychological risk (under conditions of stress) but higher than these same subjects when compared to them at rest. Electrodermal and finger-vasoconstriction measurements have failed to differentiate Type A (coronary-prone) subjects from Type B subjects under stress. Recently, Glass (1977) in his work on Type A behavior and stress, has shown a possible association of Type A behavior and uncontrollable stress to the development of CHD. Clearly, future research should include prospective studies on behavior patterns, psychological variables, and physiological reactions on non-coronary diseased subjects to determine if there is support for the retrospective findings currently associated with CHD.

The Present Study

The present study is designed to examine the relationship of Type A behavior and physiological and psychological reactions at rest and under stress in male undergraduates free from coronary disease. Mental stress was created by having all subjects attempt to solve a series of complex multiplication problems under timed and untimed instructions. For both conditions, subjects were told to work as quickly and accurately as they possibly could (a situation designed to elicit Type A behavior). The dependent measures obtained were compared to those exhibited by Type B males (individuals for which the coronary-prone behaviors are virtually absent). A major purpose of the study was to determine if any specific psychophysiological pattern reaction to stress exists in individuals that may have high risk for developing CHD. All subjects were males as sex (i.e., being male) has been associated with CHD risk (Dawber and Kannel, 1971). The Type A-B (coronary-prone vs. not coronary-prone) dimension allowed for the examination of the interaction between stress and Type A behavior and also provides for a comparable control group (i.e., Type B's). Type A behavior has been shown to be the major psychosocial predictor for CHD and it was hypothesized that males exhibiting this behavior pattern may have a high risk for developing CHD. Several researchers have recommended confining prospective investigations and follow-ups to the examination of individuals who have high-risk for developing CHD (Mai, 1968; Keith, Lown, & Stare, 1965; Ibrahim, Jenkins, Cassel, McDonough, & Hames, 1966).

The dependent variables for the physiological measures were heart rate, EMG (specifically forearm muscle tension), respiration, and blood pressure. Baseline and in-task levels of heart rate, EMG, and respiration were recorded on a polygraph. Blood pressure readings were taken before and after the task designed to evoke mental stress. Heart rate baselines have been shown to be higher for Type A's than Type B's and it has been hypothesized that they may be accustomed to a permanently higher stress level than normal (Dale & Eagan, 1975; Dale et al., 1976). Therefore, Type A individuals may be over-working their hearts or cardiovascular system even at rest, resulting in a situation that could lead to premature coronary or cardiovascular difficulties. Heart rate was monitored in the present study to determine if these findings would replicate and to determine heart rate reactions during mental stress.

Electromyograph (muscle tension) levels were also measured as Glass (1977) and Friedman and Rosenman (1960) had reported that Type A individuals exhibit tense, hyperactive movements under mental stress more frequently than Type B's. Friedman and Rosenman (1960) specifically found that fist and jaw clenching was evident in the Type A individuals they examined.

Respiration rate, inhalation fractions, and the slopes of both the inspiratory and expiratory limbs of the respiratory wave form were recorded for all subjects at rest and under stress. Carver, Coleman, and Glass (1976) found that percentage values of maximum aerobic capacity (determined by analysis of expired air) was significantly greater for Type A subjects as compared to Type B's ($p<.01$) after a treadmill task. The authors concluded that A's were more likely to perform at the limits of their endurance. Others have suggested that factors such as oxygen consumption may more accurately reflect physiological strain and, therefore perceived exertion, than other factors such as heart rate (Noble, Metz, Pandoff, Bell, Cafarelli, & Sime, 1973). Friedman and Rosenman (1960) found Type A's with CHD exhibited frequent deformities in respiratory patterns with greater excursions of the upper chest and more vertical ascent of the inspiratory limb (as compared to normals) under mental stress, indicating that A's have more labored breathing.

The fourth physiological measure is blood pressure which was recorded before and after the mental stress task. Shekelle, Schoenberger, and Stamler (1976) have shown that there is little evidence of a relationship between prevalence of hypertension and the Type A Behavior Pattern. However, Rosenman et al. (1966) found that elevated diastolic blood pressure enhances the risk of coronary disease only when this factor occurs in Type A men. McGinn et al. (1964) found that Pattern A traits such as hostility (when induced by acute frustration manipulation) produced episodic rises in both systolic and diastolic blood pressure. More recently, Scherwitz, Berton, and Leventhal (unpub.) reported that Type A's more often responded to a stress interview with increased diastolic blood pressure, whereas B's showed decreased blood pressure. Glass (1977) felt these findings suggested the possibility that future studies may uncover associations between the behavior pattern and increased blood pressure.

The psychological variables that were investigated were social insecurity, subjective ratings of physical and mental fatigue, time sense, and task performance, and anxiety, hostility, and depression. A life stress rating was also obtained for each subject for the past year.

Recently, Jenkins et al. (1977) found that Type A behavior and social insecurity together predict a greater severity of atherosclerosis than either variable alone. However, as previously mentioned, it is not known whether the social insecurity preceded or followed the atherosclerosis. Therefore, the present study evaluated the subject's feelings of social insecurity in an attempt to clarify the above finding.

Each subject's life stress rating for the past year was also examined in order to check for possible uncontrollable physiological and psychological stresses. Glass (1977) found that uncontrollable life stress had preceded coronary events if it had occurred in the twelve month period prior to the attack. He felt that uncontrollable life stress interacting with Type A behavior oculd precipitate coronary disease based on research findings on Type A behavior and uncontrollable stress.

Subjective ratings of physical and mental fatigue, time sense, and task performance were obtained after the experimental task. The purpose of these ratings is to try and replicate Glass' findings that provide empirical support for the existence of characteristic traits expected in Type A individuals. Anxiety, hostility, and depression scores were obtained in order to determine if psychological findings from retrospective studies represent a risk for CHD as opposed to a reaction to having CHD.

A Symptom Checklist was given to all potential subjects before the experiment in order to check for the possibility of coronary or cardiovascular symptoms. Any subject with such symptoms was not included in the study.

One assumption about the interplay of Type A behavior and uncontrollable stress made by Glass (1977) is that Type A individuals exert greater effort than Type B individuals in order to control stressful events that are perceived as a threat to their sense of control. Glass' research, designed to test the validity of the above assumption, shows that Type A individuals can adjust to and overcome threats to their sense of environmental control. However, the adjustments seem to result in Type A's becoming less resistant to stress. The active coping behaviors that Type A's utilize in their attempt to control stressful events apparently extinguish if not rewarded and result in frustration and psychological exhaustion. Eventually, there appears a reversal of behavior where A's show more signs of helplessness than B's. The after-effects of this style of reacting are believed to involve autonomic and biochemical changes that further the development of coronary disease (Glass, 1977). The present study examined reactions of Type A's and Type B's at rest and under mental stress in order to look more closely at the interplay of the behavior pattern and stress. It was hypothesized that Type A's, by virtue of their classification of being competitive, achievement oriented, time urgent, hard-driving individuals would work harder and show different physiological reactions in-task (and perhaps at rest) than Type B subjects.

Additionally, the present study was designed to determine if there is a psychophysiological link between the presumed causal factors for CHD development (i.e., being male, being Type A, and perhaps being socially insecure) and a possible psychophysiological pattern reaction to stress. Clarification of a possible psychophysiological link in the development of CHD could aid in establishing a starting point for the designing of appropriate preventive treatment strategies for individuals who have high risk for development of CHD. Current treatment programs tend to be primarily rehabilitative in nature and are aimed at older individuals who are already suffering from CHD and/or who are chronic Type A's (Suinn, 1974, 1975).

To summarize, the hypotheses to be investigated are that Type A individuals would exhibit higher levels of physiological tension as measured by EMG, heart rate, blood pressure, and respiration indices. Additionally, it was expected that Type A individuals would report lower estimates of mental and physical fatigue and an accelerated sense of time passage as compared to Type B individuals.

CHAPTER II

A SELECTED REVIEW OF THE LITERATURE

This review will be divided into the following sections: Type A vs. Type B Behavior Patterns; Type A Behavior and CHD; Psychological Studies and CHD; Physiological Variables, Stress, and CHD: Psychological Studies and the Type A Behavior Pattern; the Interplay of Stress and Type A Behavior; and Physiological Studies and the Type A Behavior Pattern.

Type A vs. Type B

A major selection variable for subjects in the present study is the classification into the Type A Behavior Pattern vs. the Type B Behavior Pattern. The Type A Behavior Pattern is described as an action-emotion complex in which an individual engages in a chronic and excessive struggle with his environment in order to obtain an unlimited number of things in the shortest period of time or to fight against opposition to these goals. The Type A individual has enhanced personality traits of aggressiveness, ambitiousness, and competitive drive, is work oriented with a preoccupation regarding deadlines and exhibits impatience, a strong sense of time urgency, and abruptness of gesture and speech.

On the other hand, the Type B individual does not exhibit these enhanced personality traits and does not often display concern with deadlines, time urgency, or hostility. These people are generally more relaxed, easy going, and move and speak at a slower pace than Type A people. Although the Type A Behavior Pattern is related to personality, it usually emerges only when certain conditions or challenges in the environment evoke the particular pattern of responses in certain predisposed individuals (Friedman & Rosenman, 1974). The conditions that evoke this pattern of behavior will be discussed in another section of this review.

Type A Behavior and CHD

Jenkins (1976) concluded that the Type A Behavior Pattern is the risk factor most consistently and positively associated with CHD than any of the other major categories of psychosocial variables thought to be associated with CHD. In a study of risk factors associated with myocardial infarction on 2,951 men ages 39 to 59, multivariable discriminant function equations showed the Type A score to be the strongest single predictor of recurrent CHD than all of the other variables studied. The Type A score was not affected by whether it was measured before or after the initial CHD event. Number of cigarettes smoked daily, and serum cholesterol level accounted for additional variance (Jenkins, Zyzanski, & Rosenman, 1976).

Evidence also exists associating the Type A Behavior Pattern with atherosclerosis as Type A patients show a greater degree of occlusion than Type B's (Blumenthal, Williams, Kong, Thompson, Jenkins, & Rosenman, 1975; Zyzanski, Jenkins, Ryan, Flessas, & Everist, 1976). Type A behavior may raise the risk of CHD by its association with increased development of atherosclerotic plaques (Jenkins, 1976). In a recent, large-scale study of biological and social risk factors that are associated with coronary disease, Shekelle, Schoenberger, and

Stamler (1976) found a significant correlation between Type A score and coronary disease when age, serum cholesterol level, diastolic blood pressure, and cigarette smoking were statistically controlled for. In addition, the Type A score was positively associated with socioeconomic status and only weakly related to cigarette smoking. When controlling for socio-economic status, no sex difference was found for mean Type A scores, but younger men and women (ages 25-44) had higher mean Type A scores than older men and women (ages 45-64).

In a quote from their book, Type A Behavior and Your Heart, Rosenman and Friedman (1974) outlined the critical importance of the Type A Behavior Pattern and CHD:

> In the absence of the Type A behavior pattern, coronary heart disease almost never occurs before seventy years of age, regardless of the fatty foods eaten, the cigarettes smoked, or the lack of exercise. But when this behavior pattern is present, coronary heart disease can easily erupt in one's thirties or forties (p. 1).

The idea that emotional and behavioral factors might be associated with CHD is not new and, in fact, dates back to the 18th century (Heberdeen, 1772; and Parry, 1799). Osler (1910) noted that patients he treated that were suffering from angina pectoris exhibited a characteristic pattern of overt behavior that allowed him to diagnose new angina patients simply by observing their mannerisms and external appearance as they entered his office. In a 1936 study of CHD patients, Menninger and Menninger noted the frequent display of a personality that was strongly aggressive. Support for Osler's and the Menninger's observations was provided by Dunbar (1943) who confirmed that patients with CHD were hard-driving, goal-directed individuals. Kemple (1945) made the observation that CHD patients were both overly ambitious and compulsively attempted to obtain goals that incorporated power and prestige.

In spite of the similarity of the above mentioned observations, Rosenman (1974) states that surprisingly, none of these investigators pursued their findings until he and other researchers became intrigued with the literature in the 1950's. It eventually became obvious that most of the classic risk factors associated with CHD such as fat-enriched diets, serum lipids, cigarette smoking, physical inactivity, and heredity were present in only a minority of the population (Rosenman, 1971) and that only a minority of CHD victims were characterized by these risk factors (Rosenman and Friedman, 1971). Additionally, a significant occurrence of CHD was observed in individuals in which these risk factors were absent (Rosenman, Friedman, Jenkins, Straus, Wurm, and Messinger, 1966). Another finding that showed traditional risk factors such as dietary intake could not be primarily responsible for CHD was the phenomenon of the American white female's well known relative immunity to CHD (Friedman, 1969). Clearly, the American white female's protection from CHD could not be due to dietary differences in fat consumption compared to her male counterpart as shown by Friedman and Rosenman (1957). Several studies that Rosenman (1974) cites show that a specific sex hormone could not be responsible for the American white female's low incidence of CHD because Italian, Mexican, African, and American Black females are not similarly protected from CHD and yet have the same hormonal make up as the American white females. Therefore, the major difference between the American white female and her male counterpart seemed to be her relative lack of contact with the competitive, stressful, socio-economic environment of the American business world. Friedman and Rosenman (1974) state that in the past fifty years, CHD has increased fivefold in the United States but the average individual's intake of cholesterol and animal fat has not increased since 1910.

All of this evidence lends support to the contribution of the hard driving-competitive Type A Behavior Pattern and the stresses of modern society to CHD development. Rosenman (1974) estimates that at least 50 percent of the male population in large American urban complexes will exhibit the Type A Behavior Pattern and that the Type A Behavior Pattern is increasing in industrialized societies.

The Type A Behavior Pattern can influence serum cholesterol, lipid, and insulin levels and the discharge of norepinephrine. Rosenman (1974) reports that clinical data show that healthy individuals who are fully developed Type A's exhibit hypercholesterolemia, hyperlipemia, hyperinsulinemia, and excess discharge of norepinephrine which are the same biochemical imbalances frequently observed in CHD patients. This was interpreted as evidence of the causal relationship of the Type A Behavior Pattern to blood fat and hormone abnormalities that may precede or actually precipitate CHD. The Type A Behavior Pattern does appear to be associated with the occurrence of CHD. However, after examining the methods of research used to relate the Type A Behavior Pattern to coronary heart disease, elevated serum cholesterol levels, decreased clitting time and increased norepinephrine secretion, Keith et al. (1965) conducted a study using 189 males, ages 35-55, who were examined in three hospitals. A total of three groups were selected for the study; these were: 1) patients with CHD, 2) patients with peptic ulcer, and 3) controls having neither disease. Behavior pattern ratings were made by individuals who had no prior knowledge of the patient's medical diagnosis. In addition, cholesterol levels were taken for 87 men and Friedman and

Rosenman's (1960) polygraph procedure was used with 65 men. Results showed that among coronary patients, only half were Type A individuals. However, noncoronary patients were associated with an inverse (of Type A) behavior pattern. Levels of serum cholesterol were found not to be related to behavior type. Another finding was that the polygraph method did not differentiate coronary and noncoronary patients. However, interview ratings on patients, 35-44 years of age correctly identified two-thirds of coronary victims but when patients were 45-49 years of age, only one-third were correctly classified with the interview. After dividing coronary patients into those with angina pectoris and those with myocardial infarction, patients with angina were significantly correlated with the Type A behavior pattern.

Recent evidence has been reported showing the presence of the coronary-prone behavior pattern or its features in young adults and children. Glass (1977) observed greater serum cholesterol concentrations in extreme Type A male subjects compared to extreme Type B's as young as 19 years of age. Another recent study on students in the fifth, ninth, and twelfth grades conducted by Butensky, Faralli, Heebner, and Waldron (1976) showed that students in middle-class suburban schools reported more features of the coronary-prone behavior pattern than did students in a rural, working class school. The authors hypothesized that students in rural communities develop fewer features of the coronary-prone behavior pattern because the roles they try to achieve are well-defined and more readily attainable than the roles of suburban students which are seen as more open-ended and uncertain of attainment. These authors suggest a more effective prevention for CHD may be accomplished by implementing methods that counteract the development of a chronic coronary-prone behavior pattern among young adults as opposed to relying on the current methods of altering the more ingrained behavior patterns of middle aged men already afflicted with CHD (Suinn, 1974) or the behavior patterns of chronic Type A individuals (Suinn, 1975).

Psychological Studies on CHD

Jenkin's 1976 review of recent evidence supporting psychological and social risk factors for coronary disease contains results from both retrospective and prospective studies on the association of anxiety and neuroticism to CHD. More specifically, coronary disease has been associated with anxiety, depression, psychophysiological complaints (somaticizing), general nervousness, sleep disturbances, fatigue, and emotional drain. Most of these symptoms match the kinds of symptoms associated with emotional stress reactions, which seems important as Glass (1977) noted the possible interplay of stress and the Type A Behavior Pattern to CHD development.

In a study by Eastwood and Trevelyan (1971) 2,200 English citizens were screened for psychological symptoms and then called in for a psychiatric interview to verify their self-reports. Thirty-seven men and eighty-seven women (exhibiting chronic mild anxiety and depression) were matched with controls who had not reported psychological symptoms and both groups received complete cardiologic examinations. The anxious-depressed group was found to have more evidence of possible and probable coronary disease and this finding was significant for both males and females. The fact that 90 percent of the subjects, observed as having possible or probably coronary disease, were unaware they had this abnormality reduces the chance that the study contained retrospective bias.

Rimé and Bonami (1973) administered the MMPI to thirty coronary subjects, thirty hypertensive subjects, and thirty fracture subjects who were matched for age and socio-economic status. Coronary subjects were shown to differ significantly from the hypertensive group in only one area, introversion (coronary subjects were higher on introversion than hypertensives). The comparison between the coronary and fracture groups showed the coronaries to have significantly higher elevations than the latter group on scales reflecting anxiety, social introversion, and feminine interests. Group profile analysis showed the neurotic triad (psychosomatic V) appeared quite often in both the coronary and the fracture groups. The authors also found the coronary profile to match very closely with profiles describing psychosomatic groups found in a handbook of MMPI profiles.

Women having either angina pectoris or myocardial infarction were asked whether they had experienced sustained stress (tension, fear, anxiety, or sleep disturbances related to interpersonal conflicts) in a Swedish study by Bengtsson, Hällström, and Tibblin (1973). The women with coronary disease were much more likely to report experiencing this type of stress continuously for a year or more than healthy subjects. However, with this retrospective study it is difficult to separate out whether the cardiovascular disease or the emotional symptoms appeared first.

A retrospective study by Wardwell and Bahnson (1973), on the other hand, did not show any group differences between myocardial infarction patients and hospitalized and healthy controls on four measures of anxiety. The myocardial infarction group did score higher on scales of alienation and psychopathology than the hospitalized controls but were not different from healthy controls on these measures.

While these studies have examined more general associations of anxiety and neuroticism to coronary disease, several other studies have found specific measures of anxiety and depression to be related to coronary disease. A study by Thiel, Parker, and Bruce (1973) compared fifty patients with myocardial infarction and fifty, age-matched healthy controls on several psychological variables. The myocardial infarction patients scored much higher on anxiety and depression scales than controls and significantly more often reported feelings of nervousness, sleep disturbances, and dyspnea (labored breathing). In addition, the myocardial infarction group reported having been anxious and depressed for a considerable time before the first myocardial event. Bruhn et al. (1974) found a relationship between depression and increased risk of recurrent myocardial infarction and death in an Oklahoma sample using a short depression scale derived from the MMPI.

In an important study, Segers, Graulich, and Mertens (1974) selected men with coronary disease from a sample of 1,695 males volunteering for a heart-disease screening program. All of the selected coronary subjects also completed psychological tests. Results showed that men with coronary disease scored higher than men free of disease on scales measuring manifest, covert, and total anxiety. After dividing patients with CHD into those who had consulted a doctor for cardiac symptoms and those who had not, it was shown that the former group had significantly higher scores on the Zung depression scale, the manifest and total anxiety scales, and on the high frustration of drive scale (Q4 on Cattell's 16PF test). Patients who had not been previously diagnosed as having coronary disease did not differ from healthy controls on the majority of measures taken. Results were interpreted as possibly being related to selective biases associated with the entry of diagnosed patients into the screening program, or to anxiety and depression that developed as a result of having coronary disease, or to the fact that clinically unrecognized cases were primarily "silent infarctions" (occlusion of one or more of the three main coronary artery branches without any overt symptoms of an infarct). Several studies have shown that patients with "silent infarctions" may exhibit different risk-factor profiles and different psychosocial characteristics when compared to individuals with acute symptomatic myocardial infarction or angina pectoris without infarction (Wolpert, Yaryura-Tobias, & Kertzner, 1971; Rosenman, Friedman, & Jenkins, 1967).

An Irish study comparing cancer patients and coronary patients provides support for the argument that elevated indices of anxiety and neuroticism follow as a result of any severe disease (Finn, Mulcahy, and Hickey, 1974). Both groups had similar elevations on Cattell 16 PF scales of anxiety whereas healthy controls (matched with both groups for age and occupation) scored significantly lower on these scales than both the coronary and cancer groups.

A previously mentioned study on psychological correlates of coronary angiographic findings in males showed that patients with more serious coronary atheromatous obstructions scored significantly higher than those patients less diseased on all four scales of the Jenkins Activity Survey (a test measuring the Type A coronary-prone behavior pattern) and on anxiety and depression scales (derived from the Bendig and the MMPI). However, these same subjects also scored lower on a denial scale when compared to subjects with less artery disease. Significantly higher scores on scales for hypochondriasis, depression, and admission of symptoms were obtained from subjects rated as having more frequent and intense angina pain. This finding also lends itself to the idea that the psychological symptoms may in fact be a reaction to more severe disease (Zyzanski et al., 1976).

An earlier study on psychological correlates of coronary artery disease by Miller (1965) involved an analysis of verbal samples of coronary disease patients and controls under various interview conditions (least, moderate, and most structured interviews). Results indicated that coronary disease patients scored significantly higher than controls on measures of anxiety, hostility inward, and ambivalent hostility (as measured by Gottschalk, Gleser, and Springer, 1963), but significantly lower on achievement need (measured by a scale derived from two subscales, McClelland, Atkinson, Clark, and Lowell, 1953; and O'Connell and Lundy, 1961). Differences were attributed to the patient's reactions to their myocardial infarctions. Age was also a significant variable as younger coronary patients were found to report more psychological disturbances than their older counterparts.

Other studies have shown an association of "somaticizing" and "emotional drain" (Friedman, Ury, & Klatsky, 1974; Wardwell & Bahnson, 1973) and sleep disturbances (Mayou, 1973; Thiel, Parker, & Bruce, 1973; and Friedman et al., 1974) with coronary disease. Wolfe and Bruhn (1969) developed a theory of "emotional drain," characterized by a state of both physical and mental exhaustion that leads to infarction. This theory has received support from the Kaiser-Permanente Study

(Friedman et al., 1974) and from Kavanagh and Shepard (1973), who obtained reports of increased tiredness and poor general health in the week preceding infarction from 102 survivors of the attack. Friedman et al., however, point out that symptoms of these types (somaticizing, sleep disturbance, and emotional drain) may be subclinical manifestations of cardiovascular disease and may be early signs of the approaching disease rather than risk factors for CHD.

To summarize, there are a sizeable number of studies relating psychological variables to CHD using either retrospective or prospective data. Generally speaking, "emotional drain," "somaticizing," and sleep disturbances have been associated with coronary disease (the results being more consistent for angina pectoris than for myocardial infarction). Depression and anxiety have also been associated with coronary disease; however, these emotions may be a reaction to feelings or morbidity associated with having a major life-threatening disease.

Several studies have focused on a variety of psychological defense reactions as they have been previously associated with CHD. Croog, Shapiro, and Levine (1971) found support for the exaggerated use of the defense of denial among survivors of myocardial infarction. Out of 345 survivors of infarction, 20 percent denied they had ever had a heart attack within only three weeks of the event. In fact, denial seemed to be a prominent characteristic in many aspects of the lives of these individuals. Candidates for future infarction have been found to be restricted in imagery, more tightly self-controlled, and more fearful of independent expression than people who are not candidates for the disease (Thomas & Greenstreet, 1973; Bonami & Rimé, 1972).

As mentioned previously, coronary and hypertensive patients scored markedly higher than fracture patients (and the standardized norms) on a scale associated with obsessive-compulsive tendencies (Rimé & Bonami, 1973). Jenkins (1976) feels this finding supports Dongier's (1974) observation that individuals having myocardial infarction as opposed to angina pectoris use obsessive-compulsive defenses, repression, rigid control of emotions, pragmatic "operational thinking," and have only a limited fantasy life.

Physiological Variables, Stress, and CHD

Several studies have examined physiological mechanisms through which stress may increase the development of CHD (Friedman, 1969; Eliot, 1974; Rosenman & Friedman, 1974). These mechanisms include increases in serum cholesterol and blood pressure; acceleration of the speed of development of damage to the inner layer of the coronary arteries over time; and increased aggregation of blood platelets (substances in the blood that facilitate coagulation) which become incorporated into the arterial plaques responsible for the narrowing of coronary blood vessels and aterosclerosis (Glass, 1977).

Rosenman and Friedman (1974) present a summary of studies that document a positive association between level of cholesterol in the blood and stressful life events. Further, Keys, Taylor, and Blackburn (1971), in an experimental study measuring physiological reactions to a cold-pressor test (requiring subjects to insert their forearms into a container of icewater), showed that during the cold-pressor test, a rise in diastolic blood pressure was the strongest single predictor of subsequent coronary disease. The next two strongest physiological predictors were elevated serum cholesterol levels and elevated resting systolic blood pressure (Keys et al., 1971). Thomas and Greenstreet (1973) found that a rise in systolic blood pressure induced by the cold-pressor test was predictive of CHD. This result conflicts with the Keys et al. finding. In a different type of study, Eastwood and Trevelyan (1971) found stress (as measured by amount of psychiatric disturbance) to be significantly associated with presumed CHD. These studies show the importance of psychological and central nervous system reactions to stress and CHD risk.

Psychological Studies and the Type A Behavior Pattern

Until recently there has been almost no systematic evidence indicating that individuals classified as Type A actually exhibit excessive achievement striving, time urgency, and hostility. Five years ago, Glass (1977) undertook a research project designed to provide empirical documentation of Pattern A characteristics and to clarify the hypothesized relationship between Pattern A and psychological stress to the development of coronary disease.

In an experimental study investigating time consciousness and achievement striving of the Type A coronary-prone behavior pattern, Burnam, Pennebaker, and Glass (1973) found that college-age Type A subjects attempted reliably more difficult arithmetic problems than Type B subjects on a task for which all subjects were told there was no time limit for completion. Type A subjects worked on the task at near maximum capacity regardless of the presence or absence of a time limit; whereas, Type B's put forth more effort only when a specific deadline was given for the task. Results also showed that Type A subjects judged a time lapse of one minute sooner than Type B subjects. The time estimation and performance findings were interpreted by the authors as evidence of the use of the Type A Behavior Pattern as a coping strategy for maintaining control over the physical and social environment.

In another study mentioned by Glass (1977) it was reported that Type A subjects remembered significantly more verbal and pictoral items on a test of immediate recall than did Type B's ($p<.02$). The superior performance of Type A subjects on this memory task was attributed to their higher achievement motivation as instructions had stressed the importance of remembering as many items as possible. It is important to note these results were not due to I.Q. differences between the two groups of subjects as standard measures of I.Q. have been found to be unrelated to the Type A behavior pattern (correlations are less than .10). Glass (1977) also states that although correlations between Type A behavior and indices of social class are statistically significant, they are generally low (approximately .23) as shown by Shekelle, Schoenberger, and Stamler (1976).

In the review of his research on Type A subjects, Glass (1977) reports that the way Type A's live their daily lives is also indicative of achievement striving. Data collected from 22 Type A's and 24 Type B's (all white college male undergraduates at the University of Texas) in an interview pertaining to past and present athletic, social, scholastic, and extracurricular activities revealed several significant differences between life style for the two groups. Reliably more academic honors were earned by Type A students as compared to Type B students. Additionally, 60 percent of Type A's stated they would go on to graduate or professional school and 70 percent of the Type B students planned to go to work or get a job. Another interesting finding was that in high school, Type A's participated in more sports and won more athletic awards than Type B's, who reported significantly more participation in social activities. Glass (1977) interpreted these findings as evidence supporting the notion that Type A individuals exhibit more drive, ambition, and involvement in certain activities (i.e., sports, academics) than do their Type B counterparts. Type A's are seen as active, hard-driving individuals whose goals include achievement and success rather than interpersonal (social) involvements.

The achievement orientation of the Type A individual is seen as being very strong as Friedman (1969) describes the Type A individual as one who confidently believes with sufficient effort any task can be mastered or any obstacle can be overcome. In following with this notion, Carver, Coleman, and Glass (1976) conducted an experiment to test their hypothesis that Type A's might suppress or deny feelings of fatigue more so than Type B's in order to persist at a task and master it. Ten extreme Type A subjects and eleven extreme Type B subjects (subjects scoring in the upper and lower 20 percentiles were chosen respectively for the two groups from an N of 800 University of Texas undergraduates) were required to walk continuously on a motorized treadmill at increasingly steeper inclines. Subjects also rated their fatigue on this test on an 11 point scale at 2 minute intervals and maximum rate of oxygen consumption (maximum aerobic capacity) was also assessed. Even though there were no significant differences between A's and B's physically, Type A's obtained an oxygen absorption rate of 91.4 percent of their maximum capacity as compared to the B's, who reached an average rate of only 82.8 percent of their capacities. Glass (1977) concludes that A's appear to work at a level close to the limits of their endurance and, at the same time, the A's rated their level of fatigue significantly lower than B's on the last four ratings prior to the end of the treadmill task and also on the overall fatigue rating (means = 5.2 for Type A's and 6.2 for Type B's, $p<.04$). Glass interprets the fatigue suppression finding in this way:

> Denial or suppression of fatigue has instrumental value for A's because it aids in their struggle for attainment of desired goals, in this case superior treadmill performance. The acknowledgement of fatigue, on the other hand, might interfere with successful task mastery--a situation that A's could not easily tolerate (p. 48).

Glass reports that Type A and B individuals differ in their sense of time urgency. Burnam et al. (1973) found that A's become impatient with delay and reported a time interval of one minute passed reliably faster than did B's. Glass, Snyder, and Hollis (1974) found that on a task involving differential reinforcement of low rates of responding (DRL task) that A's scores were significantly lower than B's (medians - 66.5 and 77.6, $p<.05$). A detailed analysis showed that A's did poorly because they became impatient and were unable to wait long enough after previous reinforcement. Behavioral observations showed that approximately 48 percent of the A's, as compared to 12 percent of the B's, exhibited tense and hyperactive movements in a DRL session in one of Glass' studies. Glass reports findings from a complex reaction time task given to Type A and Type B subjects that supports the above results, indicating that A's do exhibit more time urgency and impatience than do B's.

The third major component of the Type A Behavior Pattern involves hostility and aggressiveness. Friedman and Rosenman (1974) have made judgments (based on clinical observations) that Type A individuals are more hostile than Type B's. Carver et al. (1976) designed a study that would provide systematic evidence as to whether or not Type A individuals are more hostile than B's. The specific hypothesis to be tested was that Type A's were expected to react with enhanced aggressiveness towards a person who denigrated their efforts to perform a complex task. Subjects were given an opportunity to administer electric shocks to the harassing confederate (cf. Buss, 1961). Results showed that A's were not uniformly more aggressive than B's. However, Type A's who were harassed delivered higher levels of shock than their counterparts who were not harassed ($p<.01$), whereas Type B's who were harassed did not shock at a reliably higher level than B's who were not harassed ($p>.30$). Apparently, Type A individuals become more aggressive only under certain arousing conditions.

Interplay of Stress and the Type A Behavior Pattern

Glass and Singer (1972, p. 181) describe the coronary-prone behavior pattern as a "characteristic style of responding to environmental stressors that threaten an individual's sense of control." Type A individuals are seen as being typically engaged in a struggle for control over their environment and the behaviors they exhibit (competition, time urgency, aggression, etc.) are attempts to regain or establish control over their environment. Krantz, Glass, and Snyder (1974) tested the hypothesis that Type A's are reacting in attempts to control their environment. Twenty Type A's and twenty Type B's were exposed to 12 bursts of 100-decibel noise. Half of the A's and half of the B's were randomly assigned to the "Escape Condition" (a pretreatment in which they were allowed to escape from the noise by pressing the appropriate levers). The rest of the subjects were in the "No Escape" condition (they were not able to stop the sound). A RT task comprised the "test phase" of the study (long intertrial intervals were used) and came after the noise pretreatment. Response latencies (in msec) averaged across RT trials was the major dependent measure. Results showed that the "Escape-No Escape" noise pretreatment did induce differential perceptions of lack of control as evidenced by responses on a postexperimental questionnaire (which asked, "How much control did you feel you had over the termination of the noise?"). The mean for subjects in the "No Escape" condition was 1.7 and the mean was 418 in the "Escape" condition ($p<.001$). A reliable interaction between behavior pattern and type of pretreatment ($p<.005$) showed that A's were slower than B's on the choice RT test given after pretreatment for the Escape condition (Ms=493.2 and 427.8, $p<.05$). However, "No Escape" A's appeared to have been motivated by exposure to the uncontrollable stressor and performed more rapidly on the RT task, whereas "No Escape B's" performance was impaired by prior uncontrollability (Ms=438.2 and 519.0, $p<.05$). Glass' interpretation of these findings is that the threat of the uncontrollable stress seems to have motivated Type A's to respond rapidly on the RT task and to keep the impatience they felt during the long foreperiods of the task from interfering with their performance. The effect is the opposite for Type A's who were in the "Escape" pretreatment before the RT task (Glass felt these A's were distracted by their impatience and subsequently performed slower on the task). Type B subjects gave up their attempts at success on the RT task after exposure to the uncontrollable stressor and Type A subjects (similarly exposed) actually tried harder to do well. Glass sees this as an attempt by the A's to regain environmental control after experiencing a situation in which they had no environmental control.

In order to establish conceptual replication of the results found in the above study, Krantz et al. (1974) examined the effects of uncontrollability on subsequent task performance for which delayed responding was the criterion for success. A DRL (differential reinforcement of low rates of responding) task was given after a pretreatment in which half of the A's (N=11) and half of the B's (N=12) were exposed to controllable stress and half of the A's (N=10) and half of the B's (N=12) were exposed to uncontrollable stress. Random positive and negative reinforcement ("correct" or "incorrect" feedback) was given to subjects afrer each response made in solving two cognitive tasks for the uncontrollable stress pretreatment. Contingent reinforcement (subjects were told responses were "correct" when they were correct and "incorrect" when they were incorrect) was given to induce perceived controllability in the controllable stress condition. The results replicated the findings of the previously mentioned RT study and showed that again, enhanced task performance occurred for Type A subjects after exposure to uncontrollable stress even though a delayed response was considered correct for this DRL task.

Glass concludes that Type A behavior appears under a certain set of eliciting conditions (i.e., perceived threats to environmental control) and that Type A behavior comprises a strategy that is developed for coping with uncontrollable stress. The improved performance of Type A's is seen as reflecting attempts to assert and maintain environmental control after its loss has been threatened. Experimental support for this interpretation was provided by studies using partial reinforcement procedures that were perceived as inducing varied levels of uncontrollability (Glass, 1977).

Much of Glass' research utilizes paradigms generated by Seligman in his learned-helplessness research. Seligman's (1975) learned-helplessness hypothesis is: uncontrollable pretreatment results in learning that instrumental responding is independent of outcomes. This type of learning results in low expectations of reinforcement which depress response initiation and cause proactive impairment of learning the association between responding and reinforcement. Glass and Singer (1972) and others have shown that behavioral responses to aversive stimuli depend on an individual's history of failure or success in attempts at controlling his environment. It is important to note that Seligman's learned-helplessness theory has received support from studies using both human and animal subjects (Glass & Singer, 1972; Hiroto, 1974; Roth & Kubal, 1975; Seligman & Maier, 1967).

Glass (1977) hypothesized that extended exposure to uncontrollable stress would lead to a perception of noncontingency between responses and outcomes, thereby leading the individual to give up efforts at control and experience learned helplessness. Glass thought these effects would be greater in Type A individuals as compared to Type B's because

Type A's are expected to experience lack of control over a stressor as more threatening than B's would. Even though A's may initially increase their efforts at control when threatened by its loss, Glass hypothesized that prolonged exposure to uncontrollable stress would result in greater helplessness in A's than B's since they exhibit a hypo-responsive style of coping with uncontrollable environmental stress. To test this hypothesis, Glass conducted two studies on learned helplessness and extended exposure to uncontrollable stress with Type A and B subjects. The paradigm included an initial exposure to loud (105 decibels) or moderate (78 decibels) noise in order to induce differential degrees of stress. Half of the subjects within each stress-level condition were in the "No Escape" condition (unable to escape from noise) and half were in the "Escape" condition (noise termination was possible by manipulating two rotary switches). Subjects were 60 undergraduate males and approximately half were Type A's and half Type B's for each treatment condition. The test phase of the study used the same noise intensities as the pretreatment, but all subjects could escape or avoid the noise by responding appropriately with a shuttle box lever. Dependent variables taken during the test phase were number of trials taken to achieve a criterion of three consecutive avoidance and/or escape responses. Analysis of variance revealed an Escape-No Escape main effect ($p<.01$), a stress level by A-B interaction ($p<.02$), and a significant three-way interaction ($p<.02$). Subsequent contrasts showed that Type A's in the No-Escape High Stress condition took significantly more trials to learn the escape response than did A's in the Escape-High Stress condition ($p<.05$). No difference was found for Escape and No Escape B's under High Stress. Under Moderate Stress, No Escape B's took more trials to reach criterion than Escape B's ($p<.05$), and there was no difference between Escape and No Escape A's under Moderate Stress. Initially, Glass felt the interaction between stress level and responses of A's and B's to extended exposure to uncontrollable stress might be explained in terms of autonomic arousal (i.e., A's are more aroused than B's). However, no reliable associations were found for the A-B variable on electrodermal and self-report measures of arousal collected during and immediately after the pretreatment phase of the study. Therefore, he proposed a cognitive interpretation to explain the results of the above mentioned study and another similar study he conducted to assess salience (which was systematic variations in the prominence of reinforcement-subjects were required to keep a record of whether their responses were correct or incorrect. The results for both studies were distinctly similar; in the second study, Type A's showed more helplessness (i.e., more trials to an anagrams criterion) after the uncontrollable pretreatment if the cues signifying lack of control were made salient ($p<.05$). Type A's showed little evidence of helplessness ($p<.20$) when cues were low in salience. The results of the two studies differed as Type B's after the uncontrollable pretreatment under conditions of low salience took only a few more trials to reach criterion than controllable B's in the low salience condition ($p=.10$). The resulting cognitive interpretation put forth by Glass is that Type A's exhibit helplessness after prolonged exposure to high stress only under conditions of high salience as they are forced to accept (eventually) their lack of environmental control.

Physiological Studies and the Type A Behavior Pattern

Several studies previously mentioned have examined physiological variables in Type A individuals (see Liesse et al., 1976; Jenkins, et al., 1977; Glass, 1977--all in Chapter I). In addition to the above studies, Friedman and Rosenman (1960) developed a psychophysiological test that was designed to detect the Type A coronary-prone behavior pattern in patients with coronary disease. The test consisted of polygraph recordings of physiological reactions (respiratory and body movements and hand clenching) of subjects who listened to a tape recording of two monologues designed to evoke some degree of irritation or impatience in the subject. Subjects were divided into three groups: 1) 20 private patients (under age 60) with clinical CHD and of whom 19 clearly exhibited the overt behavior pattern A, 2) 15 non-CHD controls (under age 60) who exhibited overt pattern B; and 3) 7 neurotic individuals who exhibited characteristic signs of functional cardiovascular disease (FCVD) who showed no evidence of any clinical coronary or cardiovascular disease. Results of observations made during the test showed that 13 of the 20 people in the Type A (CHD) group frequently fidgeted or changed body position, alternately contracted and relaxed their jaw muscles, grimaced with obvious irritation, exasperation, or hostility, and frequently clenched both hands into tight fists during the recorded monologues. Respiratory findings showed that the Type A (CHD) group and the FCVD group exhibited a unique breathing pattern (their polygraph respiratory patterns showed frequent deformities indicating greater excursions of the upper chest and more vertical ascent of the inspiratory limb as compared to normals who did not show this pattern). No consistent changes in respiratory rate was noted for the three groups during the test. Hand clenching was the measure that most clearly differentiated the Type A (CHD) group from the other two groups as the Type A (CHD) subjects clenched their hands into fists (14 out of 20 in the group) at least once or more during the recorded monologues; whereas, no one in the other two groups clenched their hands at all during the test. The authors conclude that the test is capable of detecting the presence of behavior pattern A in patients already suffering from CHD. In addition, they felt that the test could detect behavior pattern A in subjects free of CHD since most of the patients in the CHD group tested claimed they had exhibited traits of competitive zeal, a severe sense of time urgency, etc. since high school. Therefore, Friedman and Rosenman (1960) felt that the polygraph and behavioral observation results found in their study were due to the presence of behavior pattern A rather than to the presence of CHD.

More recently, Dale, Anderson, Klions, and Morton (1976) examined physiological and psychological variables in Type A and Type B individuals in a study on heart rate control as a function of feedback, field dependence, and coronary proneness. Subjects were classified as Type A or B on the basis of their scores on Bortner's (1969) coronary proneness scale. Three variables were examined: modality of feedback (heart rate, respiration or muscle tension feedback, information manipulating style of the subject (field dependent or field independent), and stress level of the participant's cardiovascular system (coronary prone: Type

A or Type B). It was hypothesized that Type A individuals would be under more stress and as a result have less control over their heart rate than Type B individuals. Field independent subjects were expected to be able to control their heart rate better than field dependent subjects particularly in the absence of feedback as Dale and Anderson (1973) found that field independent subjects were superior in heart rate control to field dependent subjects. Coronary prone (Type A) subjects were also expected to exhibit a higher basal heart rate due to the fact that they would be under more stress. Dale and Eagan (1975) reported an earlier finding that showed a high correlation between coronary proneness and heart rate baselines during a heart rate control experiment ($r=.54$, $df=10$, $p<.05$). Subjects were divided into four groups: field independent-coronary prone (Type A) N=7, field dependent (Type A) N=5, field independent (Type B) N=9, and field dependent (Type B) N=7. All subjects were undergraduates selected for participation based on their Embeded Figures Test and Coronary Proneness Test scores. Results showed that field independent subjects have higher basal heart rates than field dependent subjects when they are Type A but the reverse was true for Type B individuals. Instructions (speed, constant, or slow) were significant in that instructions to speed one's heart rate yielded an increase from the constant condition of 3.78 beats per minute ($F\ (2,48)=20.07$, $p<.05$). However, coronary proneness and field dependence were not significant as group variables. Field dependent Type A's with heart rate feedback showed a higher heart rate under instructions to slow the rate than under constant instructions. No effects in an analysis of variance on respiration frequency or muscle tension responses were significant. Respiration feedback, though, resulted in superior performance for field independent, Type A subjects in heart rate acceleration (this finding is significant at the .05 level). A complex four way interaction in the ANOVA on heart rate indicated that field dependence and coronary proneness have effects on heart rate control that are specific to the situation (i.e., instruction and feedback type).

In a biofeedback study, Weiss (1977) investigated the role of verbal instructions in the ability of 20 Type A and 20 Type B subjects with normal blood pressure to increase blood pressure. Subjects were given two sessions of continuous auditory feedback based on pulse wave velocity (PWV) and were asked to increase blood pressure. Four sets of instructions (two specific and two non-specific) were given to all subjects. Results of ANOVAs sowed specific instructions to be superior to non-specific instructions in increasing PWV. Computer analysis of respiration, heart rate, and PWV were made. Heart rate was higher for Type A subjects in the specific instruction groups, than for Type B's in this group. Specific vs. non-specific instructions X Type A vs. Type B x trial vs. rest was significant ($p<.05$). Type A's were found to generally have higher heart rates than Type B's. Additionally, Type A's were found to be breathing at a considerably faster rate than Type B's when given specific verbal instructions ($p<.05$).

CHAPTER III

METHOD

Subjects

Twenty-eight male subjects were recruited from undergraduate psychology and business classes on the basis of their responses on a modified Bortner scale (a rating scale for measurement of the Type A coronary-prone behavior pattern, Bortner, 1969). Only male subjects were used in the present study as being male is associated with high risk of development of coronary disease (Dawber & Kannel, 1961; Brand et al., 1976) and because the Bortner was developed on males.

Two groups of fourteen subjects each made up the sample for the present study. Groups were as follows: Group I - Type A subjects (characterized by hard-driving, competitive, time urgent, etc. qualities); and Group II - Type B subjects (characterized by the absence of the above qualities). Only subjects who had consistent test-retest scores on the Bortner and who reported no cardiovascular symptoms were included in the study.

Instruments

A modified version of the Bortner scale for coronary-proneness was used for subject selection. The Bortner (1969) is a short, objectively scored rating scale made up of 14 separate pairs of descriptive phrases or adjectives. Each pair of adjectives or phrases describes two kinds of contrasting behavior representing elements of either the Type A or Type B Behavior Pattern (i.e., Not Competitive (B response), Very Competitive (A Response). On the standard form of the Bortner, each pair of items is separated by a line one and a half inches in length. Instructions to subjects are "Each of us belongs somewhere along the line between these two extremes. For example, most of us are neither the most competitive nor the least competitive person we know. For the 14 items below mark a vertical line where you think you belong between these two extremes." Scores are computed by measuring to the nearest sixteenth of an inch from the beginning of the non-A end of the line to the point marked by the subject. Therefore, higher scores are presumably indicative of a higher degree of Type A characteristics. Ratings are then summed over all 14 pairs of items and then weighted to obtain the final score. The modification of the Bortner that was used for the present study involves replacing the 1½ inch line separating each pair of items with a five point Likert-type scale. A score of 5 was adjacent to Type A items and a score of 1 adjacent to Type B items so that high scores indicate association with Type A behavior and low scores inidicate association with Type B behavior (Appendix A). Inter-item reliability of the Bortner is .68, and the 14 items version, the 7 item version, and the weighted version significantly discriminated between groups of subjects who had been classified as Type A or Type B individuals by the original interview method (Friedman and Rosenman, 1959). A drawback to the use of the Bortner is that it relies on subject's self-evaluation and is susceptible to response bias in a socially desirable direction (Bortner, 1969).

The Multiple Affect Adjective Check List (MAACL) was administered to all subjects upon completion of the experiment. This test measures three emotions--anxiety, hostility, and depression, and one of its suggested uses is as a tool in research investigations on biochemical, physiological, and affective changes over time. The test consists of 132 adjectives that are alphabetically arranged in three columns on one side of a single sheet. There are two forms identical except for the instructions. One form instructs the subjects to mark an X beside the words that describe how they generally feel and the other form refers to who the subjects feels now--today. Internal reliability on the "today" form using a college-student population is: anxiety - .79, depression - .92, and hostility - .90. Test-retest reliability for this same form (seven day interval) is: anxiety - .21, depression - .21, and hostility - .15 (since the "today" form shows day to day fluctuations, retest coefficients are expected to be low). Only the anxiety scale on the "General" form has reliability coefficients reported and they are: .72 - internal reliability and .68 - retest reliability. No reliability information is available on the test's total affect score. The "General" form of the MAACL anxiety scale correlates between .57 and .62 with the Manifest Anxiety Scale (MAS) when both were taken by college students. Depression scores on the general form of the MAACL are related to scores on the depression, psychasthenid, and schizophrenia scales of the MMPI. Hostility scores on the MAACL are associated with MMPI psychasthenia and schizophrenia scales for males (Zuckerman & Lubin, 1966, Appendix B).

A Symptom Checklist was administered to all potential subjects. Cardiovascular symptoms were interspersed with other physiological symptoms on this checklist. Additional items were included to detect family history of heart disease or cardiovascular difficulties (Appendix C).

The Schedule of Recent Experience (SRD) (Holes & Rahe, 1967) was also given to subjects in the study. Subjects indicate which, if any, of a specified set of events have happened to them during the past year. Each event has an assigned weighting and varies from those for which the subject has control, such as "change in residence" to those for which the subject may have no control, such as "death of a close friend." The score is a sum of the weights of the checked items (Appendix D).

The Security-Insecurity Inventory was given to all subjects prior to the experiment in order to obtain a measure of social insecurity and to see if it is associated with Type A behavior (Maslow, Birsh, Honigman, McGrath, Plason, and Stein, 1952). The S-I Inventory consists of 75 questions to which the testee responds true-false of ?. Test-retest reliability (two week interval) is .84. Split-half reliability is .86 and .92 for the odd-even method and pairing technique, respectively. The S-I Inventory correlates with Thurstone's Neurotic Inventory (r=.68), the Bernreuter (r=.58) and Allport's Ascendance-Submission scale (r=.53). Direct measures of the validity of this test are lacking in the empirical literature.

A Post-task questionnaire was given to all subjects after each phase of the experimental task. Subjects were asked to estimate how well they did on each task, how long it took them to complete it, and how much mental and physical fatigue they experienced during the task.

Apparatus

A Gradd Model 7D polygraph with separate channels for monitoring EMG, heart rate, and respiration was used to record baselines and in-task physiological reactions. A standard blood pressure cuff and gauge was used to obtain blood pressure readings.

EMG levels were recorded by placing two active and one ground electrode on the subject's right forearm flexor muscle. Test-retest reliability on muscle action potentials on the forearm flexor during mental work (addition) is .938. The same coefficient for stress-frustration conditions is .798 (Voas, 1952).

Respiration was monitored by attaching a thermistor to the inside of the subject's nostril.

Heart rate was recorded by placing electrodes on both forearms of each subject and a ground electrode on the left ankle.

An intercom was used to communicate with the subject from the lab and to allow the subject to communicate his responses to the experimenter.

Procedure

Screening

All potential participants were given the modified version of the Bortner during class time. A retest of the Bortner, the Security-Insecurity Inventory, the Schedule of Recent Experience, and the Symptom Checklist were administered to the subjects in a session approximately one week before the experimental phase of the study. Subjects with no cardiovascular symptoms and consistent test-retest scores on the Bortner were eligible to participate in the study. The Type A group was made up of 14 subjects who scored one standard deviation (4.08) above the mean (43.25, raw scores of 47 or above). The Type B group included 14 subjects who scored one standard deviation below the mean, raw scores of 39 or below. Test-retest reliability for a sample of 42 undergraduate males for the Bortner was .72 overall, .62 for Type As, and .73 for Type B's.

Experimental Phases

For the second session, subjects were ushered into an experimental suite and were seated in a comfortable chair. The following instructions were then told to the subject:

> We are interested in measuring your physiological responses while you are doing arithmetic problems. In order to measure these responses, I'll be attaching several devices to your arms, nose, and ankle. These are for the purpose of monitoring signals from your body and will in no way stimulate you. After these are attached, I will leave you here for about 5 minutes during which I want you to sit quietly and relax. After the 5 minutes are up, I will return and give you the instructions for the arithmetic task. Any questions?

The experimenter then attached the electrodes and thermistor to the subject and left the room. Baselines were recorded for two minutes following a five minute habituation period. The experimenter returned to the room and obtained a blood pressure reading. This completed the first phase of the study.

Phase 2 was a two-part mental stress task requiring subjects to solve two sets of 10 complex multiplication problems mentally. The problems were a series of 3 digit numbers that were to be multiplied by a 1 digit number (Appendix I). Each problem appeared on a separate card and the cards were attached to a ring-binder in a notebook to make it easy to turn rapidly to the next card. Comparable problems were used for both the timed and untimed portions of the task. The timed and untimed instructions were counterbalanced for the subjects in each group. Instructions for the untimed portion of the task were:

> Your task will be to do problems in mental arithmetic. You are to work these multiplication problems out in your head in the order given. As soon as each problem is solved, report your answer out loud and I will hear it in the next room. Although there is no time limit on this task, be sure and work as quickly and accurately as you possible can. Any questions before we begin?

The experimenter then left the room and after a 30 second post-instruction baseline period had passed, instructed the subject to begin. An event marker was used to mark various phases of the experiment on the chart paper. Readings for heart rate, EMG, and respiration were monitored during the entire task. When the subject finished the first part of the arithmetic task, the experimenter returned to the room, took a blood pressure reading, and administered the post-task questionnaire.

Instructions for the second part of the arithmetic task were then given to the subject:

> Now we are going into the second part of the experiment. Again, work these problems out in your head in the order given. There will be a time limit for each problem this time, therefore I will ask you for your answers when the time is up. Be sure and work as quickly and accurately as you possibly can.

Subjects were instructed to begin after another 30 second post-instruction baseline period had passed. For this timed task, the experimenter asked the subject for an answer after 45 seconds were up. At the end of the second part of the task, the experimenter returned to the room, took a blood pressure reading and administered a post-task questionnaire. At this time, subjects were also administered the MAACL and were partially debriefed and thanked for their participation. Subjects were contacted later for a final debriefing.

Design

Independent Measures

The independent between subjects variable used in the study was the Type A vs. Type B Behavior Pattern. Fourteen subjects were assigned to each group depending on their scores on the Bortner. All subjects were administered the same treatment (arithmetic task). Within subjects variables were the post-instruction baseline periods for the timed and untimed tasks and the timed and untimed tasks.

Dependent Measures

Baseline measures were recorded for heart rate, EMG, respiration rate, inhalation fraction, inspiratory slope and expiratory slope, and blood pressure. In-task readings of these variables were recorded with the exception of blood pressure which was recorded after each phase of the experimental task. Psychological measures included a measure of social insecurity; anxiety, hostility, and depression scores from the MAACL; and self-estimates of task performance, time to complete the task, and physical and mental fatigue. Actual task performance and time to completion of each task and life stress ratings were also recorded.

CHAPTER IV

RESULTS

Introduction

The results will be presented in two major sections. The first section will contain results of the analyses on physiological measures and the second section will contain the results of the analyses on psychological and life stress indices for the two behavior pattern groups. Analyses on performance data will appear at the end of the second section.

Comparisons of Physiological Measures for Type A and Type B Individuals

This section includes a comparison of baseline measures on heart rate, muscle tension, respiration, and blood pressure for Type A vs. Type B individuals. In addition, results of analyses performed on physiological data recorded during or after the three phases of the experimental task (30-second, post-instruction baseline period, and timed and untimed portions of the arithmetic task) are included in this section.

In order to investigate the hypothesis that persons exhibiting the Type A Behavior Pattern may have higher baseline measures on physiological indices than those of Type B individuals, t-tests were performed on the baseline data on heart rate, forearm muscle tension, respiration, and blood pressure. Type A's did not differ from Type B's on baseline measures of heart rate, t(26 df)=.984, p>.05, one-tailed. There were no group differences on baseline measures of forearm muscle tension, t(26 df)=.372, p>.05, one-tailed. No differences between groups were found on baselines for the four respiration indices. The resulting t values and probabilities for these indices were: inhalation fraction, t(26 df)=.399, p>.05, one-tailed; inspiratory slope, t(26 df)=.11, p>.05, one-tailed; expiratory slope, t(26 df)=.424, p .05, one-tailed; and respiration rate, t(26 df)=.514, p>.05, one-tailed. There was a marginal finding of group differences on baselines for diastolic blood pressure, t(26 df)=1.61, p=.058, one-tailed with Type A's exhibiting higher diastolic blood pressure baselines as compared to Type B's. Mean diastolic baselines were 78.286 (S.D.=11.391) for A's and 69.714 (S.D.= 16.3209) for B's. However, no group differences were found on baseline measures for systolic blood pressure, t(26 df)=.08, p>.05, one-tailed. (See Appendix E for non-significant means on baseline measures.)

In order to determine how individuals in the two behavior pattern groups prepare themselves physiologically for mental work, heart rate, muscle tension, and respiration indices were examined for the 30-second post-instruction baseline periods prior to the timed and untimed portions of the arithmetic task. Six mixed design Groups (2) X Instructions (2) ANOVAs were performed on the data. The between subjects variable was the two behavior pattern groups (Type A vs. Type B) and the within subjects variable was the post-instruction baseline period for the two tasks (Timed vs. Untimed). Group differences were predicted for the 30-second, post-instruction baseline periods with Type A's being expected to exhibit higher physiological responses as compared to Type B's. Results of the analyses on heart rate, muscle tension, inhalation fraction, inspiratory slope, expiratory slope, and respiration rate are presented in Tables I through VI.

Table I shows that only the Instructions main effect was significant in the ANOVA on heart rate. Heart rate for both groups was higher during the 30-second, post-instruction baseline period for the timed portion of the task as compared to the corresponding period for the untimed portion. This finding, however, only approached significance, $\underline{F}$ (1,26)=3.9239, p=.055.

This same design ANOVA for inhalation fraction (Table II) produced non-significant results for group and instruction effects but yielded a significant Groups X Instructions interaction, $\underline{F}$ (1,26)=9.3702, p=.005. A Newman-Keuls test for multiple comparisons on the means for the above interaction yielded one significant comparison between the means for the untimed and timed post-instruction periods for Type B's (p<.05). Type B's exhibited a higher mean inhalation fraction during the post-instruction baseline period for the timed task ($\bar{X}$=.3938) as compared to their means for the untimed post-instruction baseline period ($\bar{X}$=.3344). This showed a greater exertion during preparation for the timed task as opposed to the untimed task for Type B's. Type A's level of exertion on this measure was not significantly different for either set of task instructions ($\bar{X}$=.3779 for untimed instructions and $\bar{X}$=.3504 for timed instructions, p=NS) nor were these means significantly different from the corresponding means on inhalation fraction for Type B's.

The Groups X Instruction Period ANOVA on expiratory slope (Table III) yielded a significant main effect on Instructions, $\underline{F}$ (1,26)=4.379,

TABLE I

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS AND INSTRUCTIONS ON POST-INSTRUCTION BASELINES FOR HEART RATE (b.p.m.)

Source	Ss	df	MS	F	P
Between Ss					
Group (A)	129.02	1	129.02	.294	NS
Ss within groups	11425.03	26	439.42		
Within Ss					
Instructions (B)	90.02	1	90.02	3.924	.055
AxB	58.02	1	58.02	2.529	NS
BxSs within groups	596.46	26	22.94		

TABLE II

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS AND INSTRUCTIONS ON POST-INSTRUCTION BASELINES FOR INHALATION FRACTION

Source	Ss	df	MS	F	P
Between Ss					
Group (A)	0.000	1	0.000	0.00	NS
Ss within groups	0.200	26	0.008		
Within Ss					
Instructions (B)	0.004	1	0.004	1.27	NS
AxB	0.026	1	0.026	9.37	.005
BxSs within groups	0.073	26	0.003		

p<.05, showing that both groups had steeper expiratory slopes ($\overline{X}$=.8049) (indicating more exertion) during the post-instruction baseline period for the timed portion of the task as compared to a more shallow expiratory slope (X=.7217) after the instructions for the untimed task.

TABLE III

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS AND INSTRUCTIONS ON POST-INSTRUCTION BASELINES FOR EXPIRATORY SLOPE

	Summary of Analysis of Variance				
Source	Ss	df	MS	F	P
Between Ss					
Group (A)	0.0014	1	0.0014	0.0045	NS
Ss within groups	8.0692	26	0.3104		
Within Ss					
Instructions (B)	0.0969	1	0.0026	4.3785	.04
AxB	0.0026	1	0.0026	0.1184	NS
BxSS within groups	0.5752	26	0.0221		

The Groups X Instruction Period ANOVAs on inspiratory slope (Table IV), respiration rate (Table V), and EMG (Table VI) yielded no significant main nor interaction effects. Therefore, on these baseline measures only inhalation fraction showed any group differences.

On in-task data, six mixed design Groups (2) X Tasks (2) X Items (10) ANOVAs were performed on heart rate, muscle tension, and respiration

TABLE IV

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS AND INSTRUCTIONS ON POST-INSTRUCTION BASELINES FOR INSPIRATORY SLOPE

Summary of Analysis of Variance					
Source	Ss	df	MS	F	P
Between Ss					
Group (A)	0.214	1	0.214	.228	NS
Ss within groups	24.449	26	0.940		
Within Ss					
Instructions (B)	0.065	1	0.065	1.148	NS
AxB	0.085	1	0.085	1.510	NS
BxSs within groups	1.472	26	0.057		

TABLE V

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS AND INSTRUCTIONS ON POST-INSTRUCTION BASELINES FOR RESPIRATION RATE (cycles per minute)

Summary of Analysis of Variance					
Source	Ss	df	MS	F	P
Between Ss					
Group (A)	8.6429	1	8.6429	0.241	NS
Ss within groups	932.7139	26	35.8736		
Within Ss					
Instructions (B)	0.6429	1	0.6429	0.1183	NS
AxB	0.0714	1	0.0714	0.0131	NS
BxSs within groups	141.2855	26	5.4341		

indices to test the hypothesis that Type A's may exert themselves more than Type B's during mental stress. The between subjects variable was the two behavior pattern groups (A vs. B) and the two within subjects variables were tasks (Timed vs. Untimed) and items within each task (10 arithmetic problems).

TABLE VI

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS AND INSTRUCTIONS ON POST-INSTRUCTION BASELINES FOR EMG (p-pmv)

	Summary of Analysis of Variance				
Source	Ss	df	MS	F	P
Between Ss					
Group (A)	352.20	1	352.20	1.162	NS
Ss within groups	7880.73	26	303.10		
Within Ss					
Instructions (B)	49.59	1	49.59	.355	NS
AxB	9.10	1	9.10	.065	NS
BxSs within groups	3631.66	26	139.68		

This ANOVA on heart rate yielded a significant main effect on Items F (9,234)=2.757, p<.005, showing mean heart rate differences on certain items for both groups collapsed across tasks. A significant main effect on Tasks, F (1,26)=8.236, p<.008, was also found indicating that both groups had higher mean heart rates during the timed portion of the arithmetic task as compared to during the untimed portion (Table VII).

TABLE VII

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS, TASKS, AND ITEMS FOR IN TASK DATA ON HEART RATE (b.p.m.)

Summary of Analysis of Variance					
Source	Ss	df	MS	F	P
Between Ss					
Group (A)	147.0875	1	147.0875	.02	NS
Ss within groups	147128.3750	26	5658.7812		
Within Ss					
Items (b)	4337.9062	9	481.9895	2.757	.005
AxB	1703.3945	9	189.2661	1.083	NS
BxSs within groups	40904.4805	234	174.8055		
Tasks (C)	3041.1160	1	3041.1160	8.236	.008
AxC	253.8015	1	253.8015	.687	NS
CxSs within groups	9600.3203	26	369.2429		
BxC	2027.5793	9	225.2866	1.288	NS
AxBxC	1431.8926	9	159.0992	.909	NS
BxCxSs within groups	40944.6797	234	174.9772		

This same design ANOVA on EMG (muscle tension) resulted in only one significant effect on the interaction of Tasks X Groups, F (1,26)=6.114, p<.05. An LSD test for pairwise comparisons was performed on the means of interest. The largest difference between two means was between the means for Type A's on timed vs. untimed tasks (X=34.53 timed-24.58 untimed=9.95, LSD (.05)=25.04, p=NS). Since the comparisons of interest did not result in significance, no further analyses were performed on this data. One reason why it was hard to obtain significance on these pairwise comparisons was the size of the error term. An examination of the EMG data revealed a range of 7.50 microvolts to 120 microvolts, indicating a large variability between scores (Table VIII).

TABLE VIII

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS, TASKS, AND ITEMS FOR IN TASK DATA ON EMG (p-pmv)

Summary of Analysis of Variance					
Source	Ss	df	MS	F	P
Between Ss					
Group (A)	115.5321	1	115.5321	.04	NS
Ss within groups	83818.1875	26	3223.7764		
Within Ss					
Items (B)	1458.1089	9	162.0121	64	NS
AxB	2686.3364	9	298.4817	1.19	NS
BxSs within groups	58746.4102	234	251.0958		
Tasks (C)	1447.7146	1	1447.7146	1.39	NS
AxC	6351.2891	1	6351.2891	6.11	.02
CxSs within groups	27010.2734	26	1038.8564		
BxC	2742.8713	9	304.7634	1.22	NS
AxBxC	1779.6716	9	197.7413	.78	NS
BxCxSs within groups	58674.3672	234	250.7451		

The Groups X Tasts X Items ANOVA on inhalation fraction yielded only a significant main effect on Items, F (9,234)=2.0, p<.05 showing both groups differed on this measure of respiration for certain items (Table IX).

The same design ANOVA on expiratory slope yielded only a significant main effect on Items F (9,234)-4.304, p<.001 (Table X).

TABLE IX

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS, TASKS, AND ITEMS FOR IN TASK DATA ON INHALATION FRACTION

	Summary of Analysis of Variance				
Source	Ss	df	MS	F	P
Between Ss					
Group (A)	0.0119	1	0.0119	.208	NS
Ss within groups	1.4843	26	0.0571		
Within Ss					
Items (B)	0.0623	9	0.0069	2.003	.04
AxB	0.0311	9	0.0035	9.999	NS
BxSs within groups	0.8090	234	0.0035		
Tasks (C)	0.0072	1	0.0072	0.898	NS
AxC	0.0071	1	0.0071	0.889	NS
CxSs within groups	0.2087	26	0.0080		
BxC	0.0338	9	0.0038	1.116	NS
AxBxC	0.0282	9	0.0031	0.932	NS
BxSs within groups	0.7866	234	0.0034		

TABLE X

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS, TASKS, AND ITEMS FOR IN TASK DATA ON EXPIRATORY SLOPE

Summary of Analysis of Variance					
Source	Ss	df	MS	F	P
Between Ss					
Group (A)	0.2947	1	0.2947	0.127	NS
Ss within groups	60.2267	26	2.3164		
Within Ss					
Items (B)	1.0356	9	0.1151	4.304	.001
AxB	0.1379	9	0.0153	0.573	NS
BxSs within groups	6.2560	234	0.0267		
Tasks (C)	0.0930	1	0.0930	0.617	NS
AxC	0.2642	1	0.2642	1.754	NS
CxSs within groups	3.9167	26	0.1506		
BxC	0.0902	9	0.0100	0.449	NS
AxBxC	0.1535	9	0.0171	0.766	NS
BxCxSs within groups	5.2120	234	0.0223		

The ANOVAs for respiration rate and inspiratory slope yielded no significant main nor interaction effects (Tables XI and XII). Therefore, no significant differences between groups that were of interest were found for the analyses on in-task data. (See Appendix H for significant means on in-task ANOVAs.)

Two mixed design Groups (2) X Tasks (2) ANOVAs were performed on blood pressure data which was recorded at the end of the timed and untimed phases of the task. The between subjects variable was the behavior pattern groups (A vs. B) and the within subjects variable was tasks

(Timed vs. Untimed). These ANOVAs yielded no significant main nor interaction effects. (See Appendix F for the ANOVA summary tables on these analyses.)

TABLE XI

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS, TASKS, AND ITEMS FOR IN TASK DATA ON RESPIRATION RATE (cycles per minute)

Source	Summary of Analysis of Variance				
	Ss	df	MS	F	P
Between Ss					
Group (A)	6.6446	1	6.6446	0.212	NS
Ss within groups	8132.3594	26	312.7830		
Within Ss					
Items (B)	60.0804	9	6.6756	0.800	NS
AxB	96.1232	9	10.6804	1.280	NS
BxSs within groups	1952.2439	234	8.3429		
Tasks (C)	12.9018	1	12.9018	0.917	NS
AxC	13.5161	1	13.5161	0.961	NS
CxSs within groups	365.6323	26	14.0628		
BxC	70.8661	9	7.8740	1.122	NS
AxBxC	35.8944	9	3.9883	0.569	NS
BxCxSs within groups	1641.6887	234	7.0158		

TABLE XII

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS, TASKS, AND ITEMS FOR IN TASK DATA ON INSPIRATORY SLOPE

	Summary of Analysis of Variance				
Source	Ss	df	MS	F	P
Between Ss					
Group (A)	0.0068	1	0.0068	0.0007	NS
Ss within groups	257.3762	26	9.8991		
Within Ss					
Items (B)	1.1437	9	0.1271	1.8074	NS
AxB	0.7507	9	0.0834	1.1865	NS
BxSs within groups	16.4514	234	0.0703		
Tasks (C)	0.0223	1	0.0223	0.0749	NS
AxC	0.0209	1	0.0209	0.0703	NS
CxSs within groups	7.7330	26	0.2974		
BxC	0.8804	9	0.0978	1.1760	NS
AxBxC	0.2872	9	0.0319	0.3836	NS
BxSs within groups	19.4649	234	0.0832		

Group Comparisons on Psychological and Life Stress Indices, Self-Estimates, and Task Performance

This section compares the two behavior pattern groups on several psychological measures administered before or after the experimental portion of the study. The measures given prior to the study were the life stress index (Schedule of Recent Events) and the measure of social insecurity (Secuirty-Insecurity Inventory). Group comparisons on anxiety, depression, and hostility (MAACL) which were administered after the experimental task are reported. Lastly, group comparisons on actual time to completion for each task and task performance and self-estimates of task performance, time to completion of task, and physical and mental fatigue experienced during the task are reported.

One-way ANOVAs comparing Type A's and Type B's were performed on scores from the Schedule of Recent Events and the Security-Insecurity Inventory which were administered prior to the experimental task. Results of these ANOVAs were non-significant indicating that the two groups did not differ on these life stress and social insecurity measures. Results of the same design ANOVAs on anxiety, hostility, and depression scores from the MAACL which was administered after the experimental task were also non-significant. (See Appendix G for the ANOVA summary tables.)

A set of six mixed design, Groups (2) X Tasks (2) ANOVAs were performed on self-estimates of mental and physical fatigue, task performance, time to completion for each task, actual time to completion for each task, and task performance (number of errors). The between subjects variable was groups (A vs. B) and the within subjects variable was tasks (Timed vs. Untimed). Results of these ANOVAs on total actual time to completion (Table XIII) and on task performance (Table XIV) yielded only main effects on Tasks which approached significance, $\underline{F}\ (1,26) = 3.787$, $p=.06$ on time to completion and $\underline{F}\ (1,26)=3.779$, $p=.06$ on actual performance. This showed that both groups took longer to complete the untimed portion of the task and got more correct responses on the untimed portion of the task. The same design ANOVA on time estimate yielded only a significant main effect on Tasks, $\underline{F}\ (1,26)= 4.559$, $p<.05$, showing that both groups estimated that it took longer to

TABLE XIII

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS AND TASKS ON TOTAL ACTUAL TIME TO COMPLETION

Source	Ss	df	MS	F	P
	Summary of Analysis of Variance				
Between Ss					
Group (A)	51546.45	1	51546.45	1.17	NS
Ss within groups	1145047.00	26	44040.27		
Within Ss					
Tasks (B)	26709.45	1	26709.45	3.79	.06
AxB	306.42	1	306.42	0.04	NS
BxSs within groups	183382.56	26	7053.17		

TABLE XIV

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS AND TASKS ON ACTUAL TASK PERFORMANCE

Source	Ss	df	MS	F	P
	Summary of Analysis of Variance				
Between Ss					
Group (A)	4.02	1	4.02	0.389	NS
Ss within groups	268.46	26	10.33		
Within Ss					
Tasks (B)	7.87	1	7.87	3.779	.06
AxB	1.45	1	1.45	0.694	NS
BxSs within groups	54.18	26	2.08		

complete the untimed portion of the task than the timed portion (Table XV). Only a main effect on groups was significant for the ANOVA on performance estimates, $\underline{F}$ (1,26)=8.32, p<.01 (Table XVI), indicating that Type A's estimated they did significantly better on the tasks than Type B's. The ANOVAs on estimates of mental fatigue yielded marginal main effects on Groups, $\underline{F}$ (1,26)=3.338, p=.08 and Tasks, $\underline{F}$(1,26)=3.296, p=.08. The main Group effect indicated that Type A's underestimated their level of mental fatigue as compared to Type B's on both timed and untimed tasks (Table XVII). The main Tasks effect indicated that both groups reported lower estimates of mental fatigue on the untimed task as compared to the timed. The ANOVA on estimates of physical fatigue yielded no significant main nor interaction effects (Table XVIII). Therefore, the significant group difference that was found was on performance estimates with Type A's giving higher estimates of their task performance than Type B's. Marginal findings on estimates of mental fatigue with Type A's underestimating their level of mental fatigue were also found. (See Appendix H for significant means on the above ANOVAs.)

Correlational Analyses

Pearson product moment correlation coefficients were calculated for both groups on the relationship of life stress and social insecurity scores to diastolic blood pressure baselines. The resulting r's were +.383 for Type A's and -.207 (df=12, p=NS) for Type B's on diastolic baselines and life stress, and +.266 for Type A's and -.261 for Type B's (df=12, p=NS) on diastolic baselines and social insecurity. These correlations showed that diastolic blood pressure was not related to amount of life stress or social insecurity of the subjects in both groups.

TABLE XV

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS AND TASKS ON TIME ESTIMATE TO COMPLETION

Source	Ss	df	MS	F	P
	Summary of Analysis of Variance				
Between Ss					
Group (A)	672.07	1	672.07	0.017	NS
Ss within groups	1043628.06	26	40139.54		
Within Ss					
Tasks (B)	51364.57	1	51364.57	4.559	.04
AxB	13954.55	1	13954.55	1.239	NS
BxSs within groups	292887.38	26	11264.89		

TABLE XVI

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS AND TASKS ON PERFORMANCE ESTIMATE

Source	Ss	df	MS	F	P
	Summary of Analysis of Variance				
Between Ss					
Group (A)	10.286	1	10.286	8.32	.008
Ss within groups	32.142	26	1.236		
Within Ss					
Tasks (B)	1.143	1	1.143	3.10	NS
AxB	0.286	1	0.286	0.78	NS
BxSs within groups	9.571	26	0.368		

TABLE XVII

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS AND TASKS ON MENTAL FATIGUE ESTIMATE

	Summary of Analysis of Variance				
Source	Ss	df	MS	F	P
Between Ss					
Group (A)	5.786	1	5.786	3.34	.08
Ss within groups	45.0714	26	1.734		
Within Ss					
Tasks (B)	0.6429	1	0.6429	3.29	.08
AxB	0.2857	1	0.2857	1.46	NS
BxSs within groups	5.0714	26	0.1951		

TABLE XVIII

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS AND TASKS ON PHYSICAL FATIGUE ESTIMATE

	Summary of Analysis of Variance				
Source	Ss	df	MS	F	P
Between Ss					
Group (A)	0.0179	1	0.0179	0.014	NS
Ss within groups	33.0357	26	1.2706		
Within Ss					
Tasks (B)	0.1607	1	0.1607	0.571	NS
AxB	0.0179	1	0.0179	0.063	NS
BxSs within groups	7.3214	26	0.2816		

CHAPTER V

DISCUSSION

The major focus of the study was to determine if a psychophysiological pattern reaction to stress exists in individuals who may have a high risk for developing CHD. This information would allow for the establishment of appropriate preventive treatment strategies for those individuals who may be prone to developing CHD. Jenkins (1976) found the Type A Behavior Pattern to be the major psychosocial predictor for CHD and it was hypothesized that males exhibiting this behavior pattern may have a high risk for developing CHD as being male is also related to CHD risk (Dawber and Kannel, 1971). The present study examined the effects of Type A behavior on physiological and psychological reactions of non-coronary diseased college males at rest and under mental stress. Subjects were screened to insure they did not have symptoms of CHD in order to differentiate whether or not findings of retrospective studies on individuals with CHD are predictive of CHD or are related to the subject's reactions to having a major life threatening disease.

Findings on physiological indices will be discussed first. It was hypothesized that males exhibiting the Type A Behavior Pattern may have a high risk for developing CHD and therefore may show higher levels of physiological tension as measured by EMG, heart rate, blood pressure, and respiration when compared to males exhibiting the opposite behavior pattern (Type B). However, comparisons of baseline measures on these physiological indices resulted in only one marginally significant finding on diastolic blood pressure which was higher for Type A's than Type B's. Although this finding must be interpreted cautiously, it may be related to the possibility of developing CHD in later life. Friedman and Rosenman (1974) state that high blood pressure does lead to premature development of severe coronary artery disease. However, the mean baseline value on diastolic blood pressure for Type A's was only 78.286, which is not indicative of high blood pressure (definite hypertension refers to blood pressure higher than 160 systolic and 95 diastolic) (Heart Facts, 1978). A long term follow-up study on Type A individuals seems necessary in order to reveal whether or not diastolic blood pressure baseline levels continue to increase. Studies are needed on effects of age and continued stress on the cardiovascular system before any definitive statement can be made as to this finding's relation to the development of CHD. This type of study is important as Rosenman et al. (1966), in their retrospective two year follow-up study on coronary heart disease, found that elevated diastolic blood pressure enhances the risk of CHD only when this factor occurs in Type A men. Additionally, a laboratory study by Scherwitz et al. (unpublished) showed that Type A's responded to a stress interview with increased diastolic blood pressure. Therefore, the marginal finding for elevated diastolic blood pressure baselines on Type A individuals sampled in the present study and the results of the two previously mentioned studies on Type A's and diastolic blood pressure indicate the need for further research in this area.

The lack of group differences on heart rate baselines contradicts the findings of Dale and Eagan (1975) and Dale et al. (1976), who found heart rate baselines to be higher for Type A's than Type B's. However, Glass (1977) failed to find differences between A's and B's in heart rate and finger-vasoconstriction responses to stressful stimulation.

It was hypothesized that Type A's would exhibit higher physiological arousal than Type B's as they prepared themselves for the arithmetic task. However, analyses on the 30-second, post-instruction baseline period prior to the arithmetic task revealed only one significant comparison of interest which showed that Type B's exhibited a higher mean inhalation fraction on respiration during the post-instruction baseline period for the times task as compared to their mean for the untimed task. This indicated that Type B's level of exertion (as measured by the inhalation fraction) was greater in preparation for the timed task as opposed to the untimed task. However, Type A's exerted themselves just as much (as measured by the inhalation fraction) prior to the timed and untimed portions of the arithmetic task, implying that they prepared themselves to work equally as hard on both tasks. This finding is related to results found by Burnam et al. (1973) which showed that Type A subjects worked on an arithmetic task at near maximum capacity (as measured by amount of arithmetic problems attempted) regardless of the presence or absence of a time limit, whereas Type B's put forth more effort only when a specific deadline was given for the task. Therefore, the present study's inhalation fraction results (in preparation for tasks) are similar to the in-task findings of the above researchers.

The present study revealed non-significant findings for group differences on in-task physiological indices. Glass (1977) failed to find differences between A's and B's in heart rate responses to stressful stimulation. The in-task data on heart rate in the present study also failed to show group differences in response to mental stress. Therefore, it seems that mental stress does not cause over-exertion of the heart in Type A subjects. Proof that the timed task was stressful comes from in-task heart rate data (significant Tasks and Items effects). Mean heart rate baselines were 72 and rose to 80 for the untimed and 85 bpm for the timed task. Verbal estimates of physical and mental fatigue for both groups were higher for the timed task also.

A study by Carver et al. (1976) on the coronary-prone behavior pattern and the suppression of fatigue on a treadmill task showed that analysis of expired air indicated greater effort among A's than B's. The biofeedback study by Weiss (1977) in which subjects were instructed to increase blood pressure, showed that Type A's were breathing at a considerably faster rate than B's when given specific verbal instructions. However, even though specific instructions were used for the arithmetic task in the present study, none of the respiration indices for in-task data revealed that A's exerted themselves more than B's. This discrepancy between the above mentioned studies and the present study may be due to the fact that both the Carver et al. and Weiss studies involved physical tasks or stress as opposed to mental stress. The respiration findings of the above researchers could be related to an interaction of physiological mechanisms required for their experimental manipulations and the Type A Behavior Pattern. It seems that the combination of mental stress and the Type A Behavior Pattern examined in this study does not affect respiration in the same way as physical stress. Future studies may need to examine analysis of expired air for subjects under mental stress in order to determine if only physical stress leads to more respiratory exertion for Type A's as compared to Type B's. Friedman and Rosenman (1960) found Type A's with CHD exhibited frequent deformities of the respiratory pattern with greater excursions of the upper chest and a more vertical ascent of the inspiratory limb (as compared to normals) under mental stress. This finding indicated that Type A's with CHD exhibited labored breathing under mental stress. Non-coronary diseased Type A's examined in the present study did not exhibit these respiratory deformities under mental stress. This suggests the possibility that Friedman and Rosenman's (1960) results on respiratory deformities on Type A's with CHD could be due to effects of coronary heart disease on respiratory systems of Type A's.

Glass (1977) and Friedman and Rosenman (1960) reported that Type A individuals exhibit tense, hyperactive movements under stress more frequently than Type B's. Forearm muscle tension levels measured in the present study failed to show this difference. Future studies may need to monitor facial EMG levels as jaw clenching is also supposed to be more evident in Type A's under stress as compared to Type B's.

Blood pressure data obtained after each phase (timed and untimed) of the arithmetic task also revealed no group differences. It is possible that continuous readings on blood pressure for Type A's under mental or physical stress might show episodic fluctuations on this measure as several researchers have found some associations between blood pressure and Type A behavior under stress (Rosenman et al., 1966; McGinn, Harburg, Julius, & McLeod, 1964).

Therefore, for physiological indices sampled in the present investigation, only two group differences were found. The first was the marginal finding on diastolic blood pressure baselines which was higher for Type A's than Type B's. The other finding indicated that Type B's prepared to work harder on the timed portion of the task (as measured by inhalation fraction) as opposed to the untimed task, whereas the inhalation fraction for Type A's indicated they prepared to work equally as hard on both tasks.

Life stress ratings revealed no group differences. For both groups, average life stress ratings were moderate and only weakly correlated to diastolic blood pressure baselines. Further psychophysiological investigations should examine Type A individuals who have experienced high levels of life stress (especially uncontrollable life stress) in order to determine if uncontrollable life stress and Type A coping behaviors may lead to CHD as suggested by Glass (1977). Group comparisons on social insecurity, anxiety, hostility, and depression were also nonsignificant. A retrospective study on Type A's suffering from atherosclerosis suggested that social insecurity may increase risk for CHD (Jenkins et al., 1977). However, diastolic blood pressure baselines were only weakly correlated to social insecurity scores for Type A's in the present study. Other studies reviewed by Jenkins (1976) hypothesize (retrospectively) that anxiety and depression contribute to coronary disease risk. However, healthy Type A's in the present study did not show elevations on these measures. Therefore, it could be hypothesized that the findings from the above mentioned studies are reactions to having a major life threatening disease.

Analyses of task performance and time to completion for both tasks showed the two groups performed equally as well and did not differ in the actual time it took to complete the arithmetic tasks. However, Type A's estimated that they performed significantly better on the task than did Type B's. This could be related to Type A's preoccupation with achievement and strong competitive drive. Type A's underestimated their level of mental fatigue (this finding was marginally significant) as compared to Type B's, even though they worked as hard as Type B's on both the untimed and timed portions of the task. The study by Carver et al. (1976) on the coronary prone behavior pattern and the suppression of fatigue on a treadmill task showed that Type A's worked harder but exhibited more fatigue suppression than Type B's. It seems that a cognitive explanation is appropriate to show how Type A's may eventually overwork themselves mentally or physically. Type A's are compelled to achieve certain goals and are notorious for being hard-driving individuals; however, cognitively, they seem to overlook their level of exhaustion. Over a period of time, therefore, Type A's may be likely to work past their limits of endurance to achieve certain goals and this could strain their cardiovascular system. This is supported by Type A's overestimate of task performance, underestimate of level of mental fatigue, and lack of differential respiratory exertion to varying demands of the tasks.

Due to the relatively weak physiological findings found in the present investigation it is suggested that future studies on Type A behavior and coronary disease risk also take into account some of the other risk factors associated with CHD as they may interact with the behavior pattern to contribute to CHD development. It may also be possible that developing CHD does not manifest itself physiologically at least for the variables examined in the present study. It should be mentioned that Glass (1977) found higher serum cholesterol levels in Type A subjects as young as 19 years of age, compared to Type B's, and it is possible that other physiological indices might detect developing CHD. The findings in the present study indicate the need for further investigations before any definitive plans can be made for appropriate preventive treatment strategies. However, at present, it seems that cognitive therapeutic interventions or general relaxation therapies that take into account lifestyle of Type A's could be helpful.

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APPENDIXES

APPENDIX A

BORTNER

Instructions: The phrases below describe extremes of behavior. Each of us belongs somewhere on the line between the two extremes. For example, most of us are neither the most competitive nor the least competitive person we know. We would like you to mark an X on that portion of the line where you think you fall between the two extremes. BE SURE AND BEGIN on item #136 on your answer sheet. In order to transfer your answers from this page to the answer sheet, mark the number that corresponds to that portion of the line either #1, 2, 3, 4, or 5, according to where you marked the X. There should be only one answer per item.

	1	2	3	4	5	
136. Never late.						Casual about appointments.
137. Not competitive						Very competitive.
138. Anticipates what others are going to say (nods, interrupts, finishes for them).						Good listener, hears others out.
139. Never feels rushed, even under pressure.						Always rushed.
140. Can wait patiently.						Impatient when waiting.
141. Goes "all out."						Casual.
142. Takes things one at a time.						Tries to do many things at once. Thinks about what to do next.
143. Emphatic in speech (may pound desk).						Slow, deliberate talker.
144. Wants good job recognized by others.						Only cares about satisfying self.
145. Fast (eating, walking, etc.).						Slow doing things.
146. Easy going.						Hard driving.
147. Keeps feelings inside.						Expresses feelings.
148. Many interests.						Few interests outside work.
149. Lacking ambitious drive.						Ambitious.

APPENDIX B

MULTIPLE AFFECT ADJECTIVE

CHECKLIST (MAACL)

Mark an "X" beside the words which describe "how you feel now, today."

1. __ active
2. __ adventurous
3. __ affectionate
4. __ afraid
5. __ agitated
6. __ agreeable
7. __ aggressive
8. __ alive
9. __ alone
10. __ amiable
11. __ amused
12. __ angry
13. __ annoyed
14. __ awful
15. __ bashful
16. __ bitter
17. __ blue
18. __ bored
19. __ calm
20. __ cautious
21. __ cheerful
22. __ clean
23. __ complaining
24. __ contented
25. __ contrary
26. __ cool
27. __ cooperative
28. __ critical
29. __ cross
30. __ cruel
31. __ daring
32. __ desperate
33. __ destroyed
34. __ devoted
35. __ disagreeable
36. __ discontented
37. __ discouraged
38. __ disgusted
39. __ displeased
40. __ energetic
41. __ enraged
42. __ enthusiastic
43. __ fearful
44. __ fine
45. __ fit
46. __ forlorn
47. __ frank
48. __ free
49. __ friendly
50. __ frightened
51. __ furious
52. __ gay
53. __ gentle
54. __ glad
55. __ gloomy
56. __ good
57. __ good-natured
58. __ grim
59. __ happy
60. __ healthy
61. __ hopeless
62. __ hostile
63. __ impatient
64. __ incensed
65. __ indignant
66. __ inspired
67. __ interested
68. __ irritated
69. __ jealous
70. __ joyful
71. __ kindly
72. __ lonely
73. __ lost
74. __ loving
75. __ low
76. __ lucky
77. __ mad
78. __ mean
79. __ meek
80. __ merry
81. __ mild
82. __ miserable
83. __ nervous
84. __ obliging
85. __ offended
86. __ outraged
87. __ panicky
88. __ patient
89. __ peaceful
90. __ pleased
91. __ pleasant
92. __ polite
93. __ powerful
94. __ quiet
95. __ reckless
96. __ rejected
97. __ rough
98. __ sad
99. __ safe
100. __ satisfied
101. __ secure
102. __ shaky
103. __ shy
104. __ soothed
105. __ steady

106. __ stubborn
107. __ stormy
108. __ strong
109. __ suffering
110. __ sullen
111. __ sunk
112. __ sympathetic
113. __ tame
114. __ tender
115. __ tense
116. __ terrible
117. __ terrified
118. __ thoughtful
119. __ timid
120. __ tormented
121. __ understanding
122. __ unhappy
123. __ unsociable
124. __ upset
125. __ vexed
126. __ warm
127. __ whole
128. __ wild
129. __ willful
130. __ wilted
131. __ worrying
132. __ young

APPENDIX C

SYMPTOM CHECKLIST

Do you now have or have you ever had any of the following?
Mark those items that apply with a check in the space provided.

___ Skin problems

___ High blood pressure (hypertension)

___ Muscular pains

___ Chest pains

___ Tics

___ Elevated glucose levels

___ Stomach aches

___ Electrocardiogram (EKG) abnormalities

___ Headaches

___ Ulcers

___ Hyperventilation

___ One or more family members (blood related) who sustained premature cardiovascular disease (high blood pressure, heart attack, or stroke)

___ Dizziness

___ A medically diagnosed heart problem

___ Excessive sweating

___ Elevated serum cholesterol

___ Digestion problems

Name________________________________ Height________ Weight________

APPENDIX D

SCHEDULE OF RECENT EXPERIENCE

Below is a list of events which people may experience at one time or another. Place a check beside those events, if any, which have occurred to you within the past year.

___ 1. Death of spouse
___ 2. Divorce
___ 3. Marital separation
___ 4. Jail term
___ 5. Death of close family member
___ 6. Personal injury or illness
___ 7. Marriage
___ 8. Fired at work
___ 9. Marital reconcilation
___10. Change in health of family member
___11. Sex difficulties
___12. Gain of new family member
___13. Change in financial state
___14. Death of close friend
___15. Change to a different line of work
___16. Change in number of argument with spouse
___17. Mortgage over $10,000
___18. Foreclosure of mortgage or loan
___19. Change in responsibilities at work
___20. Trouble with in-laws
___21. Outstanding personal achievement
___22. Wife beginning or stopping work
___23. Beginning or ending school
___24. Revision of personal habits
___25. Trouble with boss
___26. Change in work hours or conditions
___27. Change in residence
___28. Change in schools
___29. Change in recreation
___30. Change in social activities
___31. Mortgage or loan less than $10,000
___32. Change in sleeping habits
___33. Change in number of family get-togethers
___34. Change in eating habits
___35. Vacation
___36. Minor violations of the law

APPENDIX E

NON-SIGNIFICANT MEANS ON BASELINE MEASURES

Heart Rate	Mean
Group A	69.2143
Group B	73.8571
Forearm Muscle Tension	**Mean**
Group A	27.4029
Group B	25.0921
Inhalation Fraction	**Mean**
Group A	0.3701
Group B	0.3629
Inspiratory Slope	**Mean**
Group A	1.4597
Group B	1.4960
Expiratory Slope	**Mean**
Group A	0.8189
Group B	0.8864
Respiration Rate	**Mean**
Group A	14.5714
Group B	13.7857
Systolic Blood Pressure	**Mean**
Group A	133.286
Group B	133.429

APPENDIX F

ANOVA SUMMARY TABLES FOR

BLOOD PRESSURE

TABLE XIX

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS AND TASKS ON DIASTOLIC BLOOD PRESSURE

Source	Summary of Analysis of Variance Ss	df	MS	F	P
Between Ss					
Group (A)	265.7695	1	265.7695	0.60	NS
Ss within groups	11510.3906	26	442.7073		
Within Ss					
Tasks (B)	44.6426	1	44.6426	2.19	NS
AxB	0.6428	1	0.0316	.03	NS
BxSs within groups	528.7129	26	20.3351		

TABLE XX

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS AND TASKS ON SYSTOLIC BLOOD PRESSURE

Source	Summary of Analysis of Variance Ss	df	MS	F	P
Between Ss					
Group (A)	7.1446	1	7.1445	.008	NS
Ss within groups	21977.5977	26	845.2919		
Within Ss					
Tasks (B)	10.2856	1	10.2856	.400	NS
AxB	18.2854	1	18.2854	.712	NS
BxSs within groups	667.4268	26	25.6703		

Diastolic Means Untimed	Diastolic Means Timed	Systolic Means Untimed	Systolic Means Timed
A 81.29	79.71	A 140.43	140.14
B 77.14	75.14	B 140.00	142.00

APPENDIX G

ANOVA SUMMARY TABLES FOR NON-SIGNIFICANT

PSYCHOLOGICAL INDICES

TABLE XXI

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS ON LIFE STRESS RATINGS

Source	Summary of Analysis of Variance				
	Ss	df	MS	F	P
Between *Ss*					
Group	914.286	1	914.286	0.09	NS
Ss within groups	255005.062	26	9807.887		

TABLE XXII

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS ON SOCIAL INSECURITY

Source	Summary of Analysis of Variance				
	Ss	df	MS	F	P
Between *Ss*					
Group	51.572	1	51.572	0.29	NS
Ss within groups	4649.137	26	178.812		

TABLE XXIII

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS ON ANXIETY

Summary of Analysis of Variance					
Source	Ss	df	MS	F	P
Between Ss					
Group	0.036	1	0.036	0.004	NS
Ss within groups	225.214	26	8.662		

TABLE XXIV

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS ON HOSTILITY

Summary of Analysis of Variance					
Source	Ss	df	MS	F	P
Between Ss					
Group	0.571	1	0.571	0.05	NS
Ss within groups	297.285	26	11.434		

TABLE XXV

ANALYSIS OF VARIANCE SUMMARY TABLE FOR EFFECTS OF BEHAVIOR PATTERN GROUPS ON DEPRESSION

Summary of Analysis of Variance					
Source	Ss	df	MS	F	P
Between Ss					
Group	1.75	1	1.75	0.05	NS
Ss within groups	908.35	26	34.94		

APPENDIX H

SIGNIFICANT MEANS FOR IN-TASK ANOVAS

TABLE XXVI

SIGNIFICANT MEANS FOR IN-TASK ANOVAS

Heart Rate — I

Items ($\bar{X}$'s for both groups and tasks combined)

1	2	3	4	5
82.9821	90.7857	84.5714	82.8929	81.4286
6	**7**	**8**	**9**	**10**
81.8214	81.0714	81.8393	81.7143	81.0536

Tasks ($\bar{X}$'s for both groups combined)

Untimed $\bar{X}$	Timed $\bar{X}$
1	2
80.6857	85.3464

EMG — II

Groups x Tasks

	Untimed $\bar{X}$	Timed $\bar{X}$
	1	2
A's	24.5796	34.5308
B's	30.4067	26.8869

Inhalation Fraction — III

Items ($\bar{X}$'s for both groups and tasks combined)

1	2	3	4	5
0.3552	0.3555	0.3645	0.3457	0.3383
6	**7**	**8**	**9**	**10**
0.3364	0.3341	0.3508	0.3372	0.3314

Expiratory Slope — IV

Items ($\bar{X}$'s for both groups and tasks combined)

1	2	3	4	5
0.7272	0.7091	0.7324	0.6525	0.6720
6	**7**	**8**	**9**	**10**
0.6200	0.6171	0.6438	0.6301	0.6202

TABLE XXVI (Continued)

Actual Time to Completion (Seconds)		V
Tasks ($\bar{X}$'s for both groups combined)		
Untimed 1	Timed 2	
386.4641	342.7856	

Actual Performance		VI
Tasks ($\bar{X}$'s for both groups combined)		
Untimed 1	Timed 2	
5.6071	4.8571	

Time Estimate		VII
Tasks ($\bar{X}$'s for both groups combined)		
Untimed 1	Timed 2	
384.1069	323.5356	

Performance Estimate		VIII
Groups ($\bar{X}$'s for both tasks combined)		
A's	B's	
3.7143	2.8571	

Mental Fatigue		IX
Groups ($\bar{X}$'s for both tasks combined)		
A's	B's	
2.3214	2.9643	
Tasks ($\bar{X}$'s for both groups combined)		
A's	B's	
2.5357	2.7500	

APPENDIX I

ARITHMETIC PROBLEMS FOR TASKS

Part One	Part Two
643 x 8	659 x 8
937 x 6	978 x 6
829 x 4	873 x 4
742 x 6	739 x 6
374 x 9	368 x 9
498 x 6	472 x 6
247 x 6	276 x 8
963 x 7	946 x 7
793 x 8	764 x 8
476 x 9	437 x 9

VITA

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