Job Demands & Worker Health

NIOSH Research Report

Job Demands and Worker Health

Main Effects and Occupational Differences

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FOREWORD

It is with great pride that we of the Stress Research Section, Behavioral and Motivational Factors Branch, National Institute for Occupational Safety and Health present this report on Job Demands and Worker Health. Since NIOSH was first created in 1970, our section has been conducting research aimed at identifying and evaluating the impact of psychological job stress on physical and mental health of fostering practices which will either reduce job stress or improve an individual's adjustment to it.

We have learned a great deal about work over the past four years. Most importantly, we have come to appreciate the serious impact of psychological job stress on the lives and welfare of American workers. It is hoped that this and subsequent reports on job stress will serve to acquaint the research community and general public with the importance of this "hidden" work hazard.

This report presents an examination of more than a dozen different stressors in each of twenty-three diverse jobs. The patterns of job stress are described, the associated psychological and physiological strains in the worker are reported and the correlations between stress and strain are examined. The mass of data from this study is so great that further analysis efforts are required. Thus, two additional reports are anticipated, one will examine the interaction between characteristics of the person and the stress in his work environment and the other will be on the role of social support in mitigating the strain effects of job stress.

In closing I would like to express our sincere appreciation to Drs. John R. P. French, Jr., Sidney Cobb, Robert Caplan and others at the Institute for Social Research, University of Michigan for their diligent, conscientious and always professional efforts on this project.

ACKNOWLEDGMENTS

The research which is reported in this volume is the product of many individuals and groups, each playing a different but an essential role. We wish to acknowledge gratefully and to describe (all too briefly) their contributions.

The financial support for this research was provided by Contract # HSM-99-72-61 from the National Institute of Occupational Safety and Health. Their two key figures in initiating and planning the project were Dr. William Kroes and Dr. Bruce Margolis. Dr. Kroes has provided continuous guidance and help throughout the project including extensive editorial comments on this volume. His sensitivity to the social significance of knowledge about job stress and health has influenced the project from beginning to end. We thank Joe Hurrell of NIOSH for collecting all of the data on policemen.

The researchers at the Institute for Social Research at the University of Michigan collected the remainder of the data. Terry Roth was responsible for collecting and for analyzing in the laboratory all the blood samples. Van Harrison, Richard Pinneau, and Robert Caplan, with the assistance of the Institute for Social Research field staff, administered the questionnaire. Melinda Wagner managed the data, helped to set up the coding, prepared tables and appendices and performed innumerable editorial services. Cathy Rockett did the majority of the coding. Ross Vickers wrote Appendix C and performed the analysis described therein. We are indebted to the Computer Services Facility of the Institute for help with the analysis of the data. A full range of expert secretarial services was proved by Mary Cullen, Bonnie Wilde, and Cynthia Tysinger.

Finally, we would like to express our appreciation to all those companies, unions, and other organizations and to their participating members for their cooperation in carrying out the study.

The authors of this report are listed in alphabetical order because the project was a team effort in which all authors participated in many phases of the research as well as in the actual writing. French and Cobb initiated the project and took major responsibility for planning it. French was involved primarily in the development of the theory and in the later analysis and writing. Cobb was responsible from beginning to end for the physiological and medical data. Caplan coordinated our efforts, taking primary responsibility during the long absences of Cobb and French. Harrison and Pinneau shared responsibility with the others for design of the questionnaire, strategy of analysis and interpretation of the results.

ABSTRACT

This study examines occupational differences in psychological stresses in the job environment and the impact of stress on affective and physiological strains and on illnesses reported by the worker. Four hypotheses were tested: (1) Job stresses will produce strains in the worker; (2) traits, needs, and abilities of the worker will also affect strain; (3) the goodness of fit between the job stresses and the characteristics of the worker will have an even stronger impact on strain; and (4) these strains, in turn, will raise the rates of illness.

Twenty-three jobs were selected to represent a wide range and variety of job stresses, and care was taken to include jobs known to have high rates of illness such as air traffic controllers and train dispatchers. A questionnaire was administered to 2010 men employed in these jobs, and physiological data (blood pressure, heart rate, serum cholesterol, thyroid hormone, serum uric acid, and serum cortisol) were collected from 390 men in eight of the twenty-three jobs. The questionnaire measured twenty job stresses, seventeen strains and a variety of demographic and personality variables. Most of the twenty-three multiple item measures of stress and strain had reliabilities of .75 to .85.

The hypothesis that job stresses produce affective strains is strongly supported. Job dissatisfaction is most strongly influenced (correlations greater than .30) by underutilization of skills and abilities, simple and repetitive work, low participation in making decisions which affect one's work, job insecurity, and poor social support from one's immediate superior and from others at work. Poor social support also influences affective depression. But these job stresses are not associated with physiological and behavioral strains in the first order analyses.

Although the needs of the person were occasionally related to affective strain, the preponderance of evidence concerning the second hypothesis showed that personality variables had no direct effect on psychological and physiological strains.

The third hypothesis was strongly confirmed for the measures of job dissatisfaction and boredom. Poor fit between the stresses on the job and the needs of the worker with respect to these stresses (complexity of the work, work load, responsibility for people, hours of overtime work) was strongly associated with dissatisfaction. The goodness of fit accounted for more variance than either the stresses in the environment or the needs of the worker.

There was only moderate support for the hypothesis that strains were

related to illnesses (cardiovascular disease, gastrointestinal problems, ulcer and respiratory infections).

There were strong occupational differences in stress and strain. Several intercorrelated stresses (low utilization of one's abilities, low participation, low complexity of work, poor fit on complexity and on responsibility for persons and on role ambiguity) are particularly high among assembly line workers, fork lift drivers, and machine tenders; but these same stresses are low among professors, family physicians, and other professions. A high demand for concentration is typical for air traffic controllers, train dispatchers, and family physicians; and the lowest concentration is required on the machine-paced assembly line. The assemblers are high on boredom and dissatisfaction with the work load. The most satisfied occupations are professors, family physicians, white collar supervisors, police, and air traffic controllers at small sites. Scientists had the lowest blood pressure of the eight occupations measured. On the whole the assemblers and relief workers on the machine-paced assembly lines have higher levels of stress and strain than any other occupation in the study.

The final chapter of the report presents a full summary of all the findings of the study, without technical discussion of the methods of research. The chapter also discusses the applications of these findings in the prevention of illness and the promotion of health and well-being.

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CHAPTER I. INTRODUCTION AND THEORY

The purpose of this project is to advance the development of an empirically valid theory of psychological stress and strain. We hope to provide dependable knowledge which can be applied to the primary prevention of distress and illness and to the promotion of psychological well-being and positive health. In the long run our aim is to find ways of preventing job stresses from impacting upon the worker--rather than ways of developing a better tranquilizer for the resulting strains.

What knowledge is required for this ultimate purpose of primary prevention? Five broad answers are involved.

(1) Since it is well known that there are large occupational differences in disease rates, it is important to find out the extent to which these differences are due to physical factors such as diet, exercise and toxic chemicals, and to what extent they are due to psychological factors. This implies that we must discover, in a quantitative way, the etiological significance of psychosocial factors. A program for prevention must be able to control job stresses which have etiological significance or else it will have no influence in preventing disease. This project tests part of a causal model of psychosocial stress and the etiology of disease.

(2) Once the causal role of job stress has been established, it is necessary to discover the specific stresses which are involved in each job. High stress jobs cannot be abolished; but if we knew exactly the dimensions of stress involved, we might be able to alter some of these stresses in such a way as to prevent disease. Thus, we need to know how the prevalence and the strength of a whole series of job stresses will vary across jobs. In this study we examine the specific stresses and strains in 23 diverse occupations.

(3) But individuals may differ in their susceptibility to specific job stresses--in their psychological and physiological response to stress and in the resulting illnesses. We need to discover the differences among individuals in susceptibility which are due to psychological factors. This knowledge would permit us to identify, within any job, those individuals at high risk due to psychological factors. We examine here the relation of personality variables, especially the coronary prone personality, to stress and strain.

(4) Given a precise knowledge of specific psychosocial stresses and of individual differences in susceptibility to them, we still need a knowledge of how to alter these job stresses. More precisely, we need a successful technology for improving person-environment fit with respect to working con-

ditions. In the last chapter of this report we make some suggestions about how to control stresses, but this project did not study the topic.

(5) Finally, our goal of promoting well-being and positive health implies that we must discover in the social environment those positive factors (like social support) which may act as a buffer between stress and strain and thus reduce illness. As these positive factors are discovered, we must learn how to provide them in adequate amount to those individuals who need the help. In this project we examine the effects of three kinds of social support on strain.

All five of these topics are addressed by the present study. All of them have been studied intensively in previous research projects in the Social Environment and Mental Health program of the Institute for Social Research at the University of Michigan. This program has focused on psychosocial stresses in the work environment and their effects on mental and physical health. It has been especially concerned with the development of a systematic and unified theory for the effects of the social environment on health. During the past seventeen years this program of interdisciplinary research in social science and medical science has utilized a wide variety of methods including surveys, experiments in the laboratory and in the field, the analysis of existing medical data, and combinations of these methods. Although our hypotheses have been drawn from a variety of sources, the approach has not been eclectic in the usual sense, for there has been a very self-conscious effort to develop a single unified theory and to test it in a programmatically planned series of studies. Because our central focus is the social and organizational environment it seemed wise to avoid the formidable problem of diagnosing and measuring the usual mental illnesses; instead we have chosen to study more easily measurable psychological variables such as job satisfaction and self-esteem and psychosomatic illnesses such as coronary heart disease and rheumatoid arthritis.

This book is a technical report written for social and medical scientists. Such researchers may want to read all of the text and even examine the appendices in some detail. The busy practitioner, who is interested in the findings rather than the methods by which they were obtained, may want to skip to the last chapter. There one will find a complete summary of the findings and a discussion of their implications for the prevention of illness and the promotion of health and well-being.

Theoretical Framework

Research on psychological stress and strain is more complex than studies of physical stress. One must deal with a larger number of variables; they are less well identified and defined; and, most important, there is no generally accepted systematic framework for viewing these problems. So the literature on stress and health shows widespread confusion and disagreement about the types of variables which should be studied, how they should be defined, and the theoretical models for relating them. Before reviewing the literature, therefore, we will present a theoretical framework which we have found to be useful in organizing the diverse findings on stress and health (Cobb, 1974b; French, 1963; French & Caplan, 1972; Kahn, Wolfe, Quinn, Snoek, & Rosenthal, 1964). The reader may use this framework as a map for viewing the domain of psychosocial factors and stress and as a guide to the specific hypotheses in this project.

Before presenting the framework for this study, two basic terms need to be defined--"stress" and "strain". In this report "stress" refers to any characteristics of the job environment which pose a threat to the individual. Two types of job stress may threaten the person: either demands which he may not be able to meet or insufficient supplies to meet his needs. For example, the difficulty of the job may exceed the person's abilities (qualitative overload), and the pay (supplies) may not be enough to support his family or match his values with regard to a fair wage for the work done (inequity). Two kinds of measures of stress will be used in this report: (1) measures of a potentially threatening dimension of the environment and (2) measures of the goodness of fit between this environmental dimension and the properties of the person. On the other hand, "strain" refers to any deviation from normal responses in the person: (a) psychological strains such as job dissatisfaction, anxiety, and low self-esteem, (b) physiological strains such as high blood pressure or elevated serum cholesterol, (c) behavioral symptoms of strain such as smoking and dispensary visits.

Figure I-1 presents the stresses in the objective environment and in the subjective environment and the resulting strains or responses in the person and how they affect health. This schema pictures the six basic types of variables and the four classes of causal relations among them. We will discuss first the six panels of variables and then the relations among them.

The Types of Variables

The schema in Figure I-1 is intended to be comprehensive in the sense that every possible variable which is relevant for explaining the effects of the social environment on the mental and physical health of the individual could be categorized in one or another of the six panels of variables. The first two panels make the basic distinction between the objective and the subjective environment, a distinction which has also been made by other students of stress (Appley & Trumbull, 1967; Levine & Scotch, 1970).

The global objective environment. The objective environment of the person refers to the environment which exists independently of his perceptions of it. It includes all of the physical environment, as studied by the physical sciences, as well as all of the social and cultural environment including all of the symbolic products such as books and spoken words. In practice we will be concerned with only that restricted part of the objective social environment which has some reasonable chance of impinging upon a person. This restricted part omits aspects of the biological environment such as food and bacteria which are important for health but which typically do not enter into our research. We focus on the objective social environment, especially on the organizations, small groups, and interpersonal relations which form a prominent part of the occupational environment. We have labelled this the global objective environment simply because most of the relevant research to be reviewed describes the person's environment in broad structural categories such as his occupation or marital status without specifying the many variables which describe this environment.

The subjective environment. The subjective environment, on the other hand, is part of the person's perceptions. It denotes what Kurt Lewin called the "psychological environment" (Lewin, 1951) and Koffka referred to as the "behavioral environment" (Koffka, 1935). It exists inside the person, as a result of his perceptions and cognitions of the external objective environment. The person's subjective environment is not open to direct observation; rather it is a construct which is inferred--usually from the verbal report of the person. However, the distinction between the objective and the subjective environment is not solely a matter of the methods of collecting the data; the two types of environment have different locations (outside vs. inside the person) and the laws which govern their behavior are different.

Responses. The responses pictured in the third box of Figure I-1 refer to affective, physiological and behavioral responses of the individual, especially to responses to the environment. We are particularly interested in those responses such as high blood pressure or smoking, which constitute risk factors or precursors of disease.

Health-illness. The next box, refers to various measures of mental and physical health and illness such as morbidity, mortality, accidents, and disabilities as well as positive states of vigor, energy, and well-being.

Social support. There are two kinds of social support: (1) tangible help, such as medical services and financial aid, and (2) emotional support such as love, affection, sympathy, understanding, friendship, intimacy, etc. provided by another person or group. It should be noted that social support

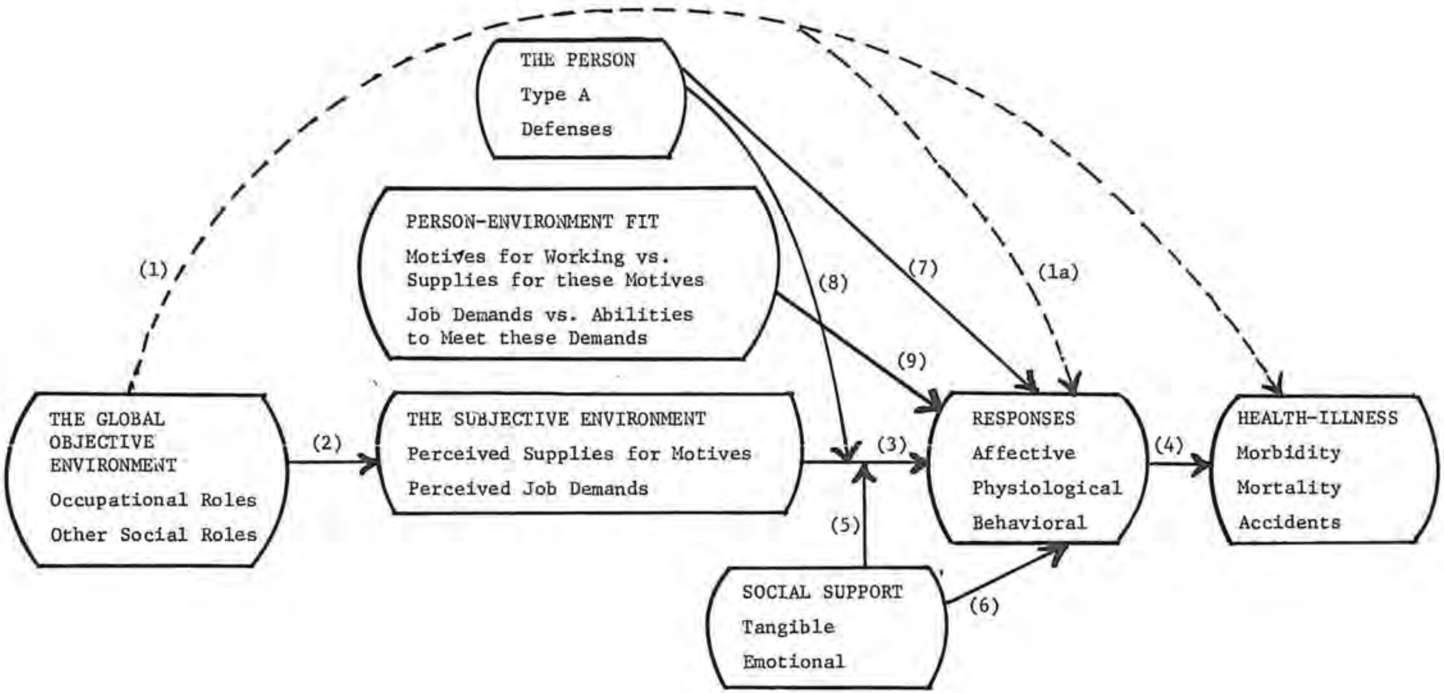


Figure I-1. A theory for the effects of social stress on health and illness. A solid arrow from one box to another represents hypothesized effects of variables in the first box on variables in the second box. An arrow terminating on another arrow indicates that the latter causal relation is conditioned by the variable at the origin of the former arrow. The arrows in broken lines represent relations which can be explained by means of the mechanisms shown in solid arrows.

fits the earlier definition of an environmental variable; it is singled out for special treatment here because it is conceived as a more or less enduring variable which is treated as a conditioner of other stress-strain relations (see below).

The person. Finally our conception of the person includes all those more or less enduring genetic or acquired characteristics of the person (whether physical, psychological, or physiological) which serve as conditioning variables on the stress-strain relation. We should point out that other more transitory states of the person such as an anxious feeling or a toothache would be categorized under responses because they are not sufficiently stable over time to be analyzed as conditioning variables in studies such as this which deal with chronic stresses.

The Classes of Relations Among Variables

The arrows in Figure I-1 represent various types of causal relations, either hypothesized or supported by empirical findings (see the review of relevant findings below). Four types of relations are denoted: direct causes, intervening variables, derived relations, and conditioning variables.

Direct causes. A solid arrow in Figure I-1 running from one box to another means that the variables in the first box are hypothesized to be direct causes of the variables in the second box. For example arrow (2) asserts that the objective environment influences various aspects of the subjective environment, so the objective demands of an occupational role will be perceived by the worker and become job demands in his subjective environment. Since there are many variables in each box, each arrow represents a whole set of hypotheses.

Intervening variables. A sequence of two solid arrows denotes a causal pathway with the middle variable acting as an intervening variable between the initial cause and the final effect. For example the objective demands of an occupational role influence the perceived job demands (the intervening variable) which in turn influences the response of job dissatisfaction (arrow (3) in Figure I-1). Of course other causal pathways which describe other mechanisms might also link the objective job stresses with responses and with health. For example carbon monoxide in the objective environment might affect oxygen transport which in turn might affect heart disease even though the carbon monoxide never existed in the subjective environment of the worker. Such a pathway may be typical for the effects of biophysical properties of the objective environment whereas psychosocial factors operate via the subjective environment as pictured in Figure I-1. Because of these alternative pathways we shall try to minimize the effects of all biophysical stresses in the current project.

Derived relations. Whenever there is a causal sequence with intervening variables we can logically deduce that there must be some indirect causal connection between two variables even when there is no direct causal relation. If A causes B, and if B causes C, then it is necessarily true that A exerts an indirect causal influence on C. Similarly, in Figure I-1 because there is a causal pathway from the global objective environment via arrows (2), (3), and (4) to illness, we can derive logically that the global environment will affect illness even though there are no direct causal relations. It follows that cross-sectional studies would find correlations between the objective environment and illness, for example occupational differences in morbidity and mortality. We treat such obtained relations as derived causal relations when we can discern no direct causal relation in either direction between the environment and the disease. Thus arrows (1) and (1a) in Figure I-1 represent findings which require an explanation of the mechanism of the disease and for which the mechanism (causal sequence of intervening variables) in the figure seems reasonable.

Conditioning variables. There is a very important distinction between those arrows which directly connect two boxes and those arrows which terminate on another arrow. The latter indicate a conditioning relationship due to a moderator variable. For example Figure I-1 shows that the effects of perceived job demands on physiological responses is conditioned by social support; alternatively we may express the same thing by saying that perceived demands will cause physiological strain only to the extent that the person lacks social support. Arrow 8 expresses another conditioning effect: stress causes strain but only to the extent that the person has a Type A coronary-prone personality. Such conditioning variables will produce statistical interaction effects.

Some Relevant Findings

We turn now to a very selective review of certain studies which throw light on the general model outlined in Figure I-1 and which suggest specific variables and hypotheses within this model. We shall also try to analyze the methodological problems in this field of research so that we may use the conclusions in formulating our own strategy of research. This review follows the same sequence as the arrows representing causal relations in Figure I-1.

The Effects of the Global Objective Environment on Health-Illness

The major hypotheses and findings state that the global objective environment has an influence on morbidity, mortality and accidents (arrow (1) in Figure I-1) and also on certain affective, physiological, and behavioral responses of the person (arrow (1a)). In this study we are centrally concerned with the effects of occupational role on health so we will examine primarily this body of literature. However, occupation is an important component of social class or socioeconomic status and it is highly correlated with other components such as income and education. Accordingly we must pay some attention to the literature on status and health. Other social roles (and other positions in the social structure) have been studied in relation to health; we will review only those studies which add weight to the general proposition that the global objective environment has a causal effect on health. Finally, we must pay some attention to studies which involve changes in jobs or in status, for they can help us to solve the very difficult "chicken and egg" problem (Which is cause and which is effect?). In its general form the problem may be stated as follows; <u>every association between a position in the social structure and strain or disease may be interpreted in two ways; (a) the environment causes the strain or disease, or (b) persons who already have the strain or disease, or a pre-disposition to it, are selected by society to fill these roles or positions or else they select themselves into these positions</u>.

<u>Occupational differences in health-illness</u>. Cross-sectional studies of occupational differences in morbidity, mortality, and accidents show very large differences (Caplan, 1971; Cobb & Rose, 1973; House, 1972; Pflanz, Rosenstein & von Uexkul, 1956; Russek, 1965; Sales & House, 1971) and several of these studies also show differences in physiological responses and precursers of disease, but the causes of these occupational differences are generally unknown. Despite the strong associations revealed, the simple epidemiological data give us very little information on the "chicken and egg" problem and they tell us nothing about the specific job stresses and strains which might account for the association.

One strain, job dissatisfaction, has been linked with mortality from heart disease in four separate sets of data by House (1972) and by Sales and House (1971). They correlated the mean job dissatisfaction in each of a set of occupations with the standardized mortality ratios for the same occupations. These mortality ratios were based on nationwide data whereas the data on job dissatisfaction came from different subjects in various locations. In all four analyses they found strong correlations; those occupations high on job dissatisfaction were also high in mortality from heart disease. However, these aggregate level correlations may not reflect similar relations at the individual level; and an examination at the individual level would have to substitute quantitative measures of risk factors for mortality ratios (which can only be used for groups). The current project will examine occupational differences in job satisfaction and associated differences in risk factors in coronary heart disease.

Status and health. Although there are strong social class (and socioeconomic status) gradients with respect to a variety of mental illnesses, psychosomatic disease, physical illnesses, interview measures of mental health, and measures of job satisfaction, these findings are neither consistent across studies or simple (Biörck, Blomquist, & Sievers, 1958; Guralnick, 1963; Hollingshead & Redlich, 1958; Rennie & Srole, 1956; Rose & Stub, 1955; Srole, Langner, Michael, Opler, & Rennie, 1962; Whitney, 1934). Again these studies typically suffer from the "chicken and the egg" problem and the problem of identifying the specific stresses involved and the intervening mechanisms (French, 1963). Taken together, the bare facts of occupational differences and of social class gradients in strain and in disease are useful indicators of the location of health problems requiring solution, are sometimes suggestive of hypotheses, but are barren with respect to conclusive evidence about causes and hints about cures.

Changes in the global environment. Turning now to longitudinal studies of events which involve changes in jobs or in status we find persuasive evidence that these environmental variables are a cause rather than a consequence of health and illness. Cobb (1974b) studied the closing of a factory and its consequences for health; he found that the temporary unemployment and job changes caused increased physiological strain, such as elevated norepinephrine levels, which persisted for as long as a year after the plant closing. In a stable organizational environment, Kasl and French (1962) studied a group of men who had changed their jobs, comparing the effects of demotion and promotion. Those men who shifted to a lower status job showed an increase in diagnosed illnesses on voluntary dispensary visits (a measure which reflects both illnesses and a tendency to visit the dispensary for psychological reasons) whereas those men who showed an increase in job status showed a decrease in dispensary visits even though they were older. At a more personal level, it has been found that widowers are at increased risk of death during the year following the death of their wives (Parkes, 1972; Parkes, Benjamin, & Fitzgerald, 1969).

Finally, there has been a good deal of research, including prospective research, using the "schedule of recent events" (Holmes & Rahe, 1967), an instrument which measures a variety of presumably stressful events such as job changes, bereavements, etc. These studies have demonstrated that one can predict from such events to subsequent illnesses of a variety of kinds including physical illnesses, depression, coronary heart disease, accidents, etc. (Dohrenwend & Dohrenwend, 1974; Myers, Lindenthal, Pepper & Ostrander, 1972; Rahe, 1972; Vinokur & Selzer, 1973). Taken together these studies of change in the global objective environment demonstrate its causal significance for health and disease. However by lumping together in one score a heterogeneous batch of events the typical studies using the schedule of recent events have only confused the problems of identifying more specific stresses; however a few important studies have shown that opposed categories of events (for example favorable vs. unfavorable events, gain events vs. loss events, etc.) do in fact have opposite effects on health (Dohrenwend, 1973; Paykel, Myers, Dienelt, Klerman, Lindenthal & Pepper, 1969; Vinokur & Selzer, forthcoming).

Family structure and disease. We have noted above that most associations between a position in the social structure and disease may be interpreted in two ways: either the environment of the position causes the disease or the disease causes the person to occupy that position; thus the interpretation of the association is equivocal with respect to which is cause and which is effect. The literature on family structure and disease, reviewed by Chen and Cobb (1960), is important because it provides strong evidence that the global environment can be a cause of disease. Two well-replicated findings are especially convincing. Many studies of diseases in adults, particularly mental illnesses, show that the disease was preceded by the deprivation, many years earlier, of one or both parents. In these studies there is no possibility that the disease caused the prior loss of a parent. The second set of studies show that asthma is more prevalent among first born than among last born whereas peptic ulcer is more prevalent among last born than among first born. Again there is no possibility that the disease is the cause of the birth order, and it is more likely that birth order affects disease. One possible mechanism for this latter effect is especially relevant to this study of occupational stress: birth order influences the choice of occupation (Cobb & French, 1966; Shaver, French & Cobb, 1970) and, as we have seen above, occupational stress influences disease.

The data on family structure and disease also point to the importance of social support as a factor in health. The effects of early parental deprivation may be due to the loss of love and emotional support for the developing child. In the adult the lack of (or loss of) emotional support may account for many of the findings on marital status and disease (Chen & Cobb, 1960; Moriyama, Krueger & Stamler, 1971). These studies generally find that married persons have lower rates of morbidity and mortality than those who are single, separated, widowed, or divorced. It may be that the better health of married people is due to more social support provided by the spouse. However, it is not known whether these are direct effects (arrow (6) in Figure I-1) or conditioning effects (arrow (5)) because these studies do not analyze for interaction effects.

This selective review of studies related to arrows (1) and (1a) in Figure I-1 suggests: (a) there is very strong evidence that the occupational role as well as other social roles have a causal influence on health and illness and also on intervening responses; (b) no adequate explanation of these effects is provided, either in terms of the specific environmental stresses involved or of the intervening mechanisms.

The Effects of the Objective Environment on the Subjective Environment

It is often assumed that subjective measures of the environment accurately reflect the objective environment, yet the effects of the objective occupational role on the person's perception of it have been studied very little. To be sure, there are some excellent studies which showed that quantitative measures of subjective stresses differed among a variety of objectively defined jobs (Caplan, 1971; House, 1972). However, these studies do not contain commensurate measures of the objective stresses in the jobs, and consequently they do not permit us to evaluate directly hypotheses about the accuracy of perceiving the objective stresses. Like these previous studies, the current study will assume that objective stresses affect subjective stresses (arrow (2) in Figure I-1) but we will not study this hypothesis directly.

The Effects of the Subjective Environment on Responses

The effects of the subjective environment on the responses of the person (arrow (3) in Figure I-1) are the central focus of the present research project. We have attempted to correct the weakness of most previous studies of the global environment by discovering the more specific dimensions of job stress and analyzing their effects on a variety of responses. Accordingly arrow (3) represents a large set of hypotheses about the effects of job stress on affective strains, on physiological strains, and on behavioral strains. The previous studies which are most directly relevant to this central thesis of the current project consist of a set of closely interrelated projects which have been carried out, during the past decade, in the Social Environment and Mental Health Program (Caplan, 1971; Cobb, 1973; Cobb, Brooks, Kasl, & Connelly, 1966; French, 1973; French & Caplan, 1970; House, 1972; Kahn, 1973; Kahn _et al._, 1964; Levitan, 1970; Mueller, 1965; Vickers, forthcoming). All of these studies dealt with multiple job stresses and all examined the effects of these stresses on multiple strains. Except for the first study, all of the studies included data on physiological strains, as well as on psychological strains. Some of the specific stresses and strains, for which there were positive findings in this body of research, are discussed in connection with the hypotheses in Figure I-2 below, and they are elaborated more fully in Chapter II and the Appendices.

The Effects of Responses on Health-Illness

In the theory outlined in Figure I-1 the responses of the individual play the role of intervening variables between the subjective environment and health-illness. The physiological responses, such as blood pressure and cholesterol levels, and the behavioral responses, such as smoking, were selected for study primarily because it is well known that these risk factors and precursors of disease do have a causal influence on illness, so no review of this large body of medical research seems necessary. The affective responses, on the other hand, were chosen for study primarily for their known relationships to job stresses, and much less is known about the relation of affective responses to illness. Accordingly it is relevant to report here some further findings on how the affective response of dissatisfaction relates to the risk of coronary heart disease. We have already noted (p. 7) that Sales and House (1971) found strong aggregate level correlations: occupations with a high level of job dissatisfaction had high standardized mortality ratios for coronary heart disease. Further analysis showed that this relationship betweeen dissatisfaction and heart disease could not be accounted for on the basis of socioeconomic status. Furthermore the relationship was specific to coronary heart disease, for there was no correlation between job dissatisfaction and several other control diseases. Using the same measures of job dissatisfaction House (1972) found individual level correlations with physiological risk factors in a sub-sample of white collar workers. Supporting evidence comes from a study by Lilljefors and Rahe (1970); they found that individuals who were high in job dissatisfaction and in life dissatisfaction were higher than their twins in risk factors and in heart disease. Though the evidence is not conclusive, it is strong enough to justify further study of job dissatisfaction as an intervening variable between job stress and coronary heart disease.

The Effects of Social Support

Although the general importance of social support for health has been mentioned above, the specific effects of support as a moderator of the stress-strain relationship has only become clear in our own research. In a series of studies of white collar men in NASA, we have found that social support from one's supervisor, from one's peers, and from one's subordinates, conditions the effects of job stress (particularly quantitative work load) on cortisol, on blood pressure, on glucose, on the number of cigarettes smoked, and on the rate of quitting smoking (Caplan, 1971; Caplan, Cobb & French, forthcoming; French, 1973; French & Caplan, 1972; Vickers, forthcoming). Generally speaking, social support seems to act as a buffer between job stress and strain: men who have high social support from others in their work environment show no effects of stress on strain.

In a study of men who were forced to change their jobs when the plant closed, it was found that cholesterol levels and serum uric acid levels became elevated but only for those men who received low social support from their wives, neighbors, and friends (Cobb, 1974b; Gore, 1973).

Similar findings are reported by Quinn (personal communication, 1973). In a national sample survey of employed men and women he examined the relationship between job stress and escapist drinking, i.e. drinking in order to avoid the stress and strain at the work place. For those who had adequate social support from their first line supervisor there was no relationship between job stress and escapist drinking, but for those with inadequate social support from their supervisors, higher levels of job stress were associated with higher levels of escapist drinking.

Taken together these three studies demonstrate the very important moderating effects of social support. Two of the studies examined only social support from people at work, whereas the third study examined social support only from people off the job. This raises the interesting question as to whether social support from one source (e.g. from one's supervisor) is substitutable for support from another source (e.g. from one's wife). The current project will throw some light on this question.

The Effects of Traits in the Person

The effects of stress on strain are also conditioned by characteristics of the person (arrow (8) in Figure I-1) such as motives for working, abilities to do the job, Type A personality characteristics, and physical properties such as height and weight or a hereditary predisposition to coronary heart disease. We use the phrase "more or less enduring" to indicate that they are stable enough to be used as predictors or conditioning variables, but they may change over longer periods of time. Because the current project focuses primarily on the effects of the environment, it treats characteristics of the person as conditioning variables as well as direct causes. The following brief review suggests that such effects of traits on health are important.

After a series of retrospective and cross-sectional studies, Rosenman and Friedman studied the Type A behavior pattern in the large longitudinal Western Collaborative Study. Their interview measures of the ambitious, hard-driving, aggressive, job involved, and time pressured behavior pattern predicted successfully to subsequent heart attack even when physiological risk factors such as blood pressure and cholesterol were controlled (Rosenman, Friedman, Straus, Jenkins, Zyzanski, & Wurm, 1970; Rosenman, Friedman, Straus, Wurm, Jenkins, Messinger, Kositchek, Hahn, & Werthessen, 1966). Because these measures of behavior patterns reflected both the influence of stresses in the environment and the characteristics of the person, we have attempted to develop a set of measures of Type A which reflect more exclusively the enduring properties of the person (Caplan, 1971; Sales, 1969; Vickers, forthcoming). Using these personality dimensions of the Type A syndrome we have discovered that several of the Type A measures do indeed condition the effects of various job stresses on strain, including physiological strains and risk factors in coronary heart disease. For example the effects of several measures of work load on systolic blood pressure, diastolic blood pressure, cortisol, and number of cigarettes smoked are significant for Type A persons but not for Type B. Thus the findings support the conditioning hypothesis represented by arrow (8) in Figure I-1 rather than the direct effects represented by arrow (7). The current report utilizes an abbreviated measure of the Type A personality pattern as a direct predictor of strain; a latter publication will report on the conditioning effects of Type A.

Our studies have also revealed that flexibility-rigidity as measured by the California Personality Inventory, has a strong enough effect on the relationship of job stress to individual strain so that it seemed wise to include it in this study (Caplan, 1971; Kahn et al., 1964). Finally, we have found it useful to use the Crowne-Marlowe (1964) measure of the need for social approval as a control on the tendency to bias one's answers to questions in the direction of the socially desirable answer. Moreover, we have identified by means of factor analysis two factors which we have called "deny bad self" and "assert good self" which condition the effects of stress on strain but which must be treated separately because their effects are sometimes different (Caplan, 1971).

It is important to note that some of the characteristics of the person listed in Figure I-1 are especially relevant to certain characteristics of the environment, and the relation between the two defines the goodness of fit between the person and his environment. For example, Figure I-1 illustrates the two main types of person-environment fit; (1) the extent to which the person's motives for working are matched by supplies for these motives in the job environment; (2) the extent to which job demands (or job requirements) are met by relevant abilities in the person. The hypothesis that goodness of fit affects the responses of the person (arrow (9)), is a more specific form of the conditioning effects of the variables in the person (arrow (8)).

Ever since Darwin's discussion of the survival of the fittest there have been many theoretical and empirical publications on the goodness of fit between a person and his environment; but the most direct antecedents of the current project are our own studies of fit in relation to stress and health (Campbell, 1973; Caplan, 1971; French, 1973; French, Rodgers, & Cobb, 1974; House, 1972; Vickers, forthcoming). Together these studies suggest that the fit between a man and his job is an important determinant of strain and consequently of health.

A Strategy for Studying Work and Health

Having outlined our conception of the panels of variables and the types of general hypotheses to be studied, we turn now to the strategy and methods appropriate for programmatic research which emerge from our analysis of the literature on the environment and health. Six principles are embodied in the current project.

1. The research should be interdisciplinary involving the collaboration of social scientists and medical scientists, because the project examines the effects of social variables on medical variables.

2. Because health and disease are multiply caused, and because there are complex interactions among the causes, we must expand our list of variables in each of the boxes in Figure I-1 by gradually adding new variables in successive studies; and this in turn requires that we employ more complex multivariate methods of analysis.

3. The chaotic state of theories about stress and health must be overcome by the systematic conceptualization of variables and the statement of hypotheses which are constructed into logically consistent theories such as the theory of person-environment fit employed in this project (French *et al.*, 1974).

4. One area where theoretical development will be especially fruitful is the identification of the mechanisms or the intervening variables which explain the effects of global occupational differences on health. This strategy of "gap filling" (French, 1963) will help to integrate knowledge from diverse approaches such as the epidemiological and the clinical.

5. As new variables are added and as our knowledge increases there must be constant improvements in conceptualization and in measurements (Cobb, 1973).

6. The selection of studies to be undertaken and the variables to be included should be guided at least in part by the possibility of prevention of illness; we should give preference to those causal variables which seem most amenable to control in programs of primary prevention.

Hypotheses to be Tested

The immediate objectives for this project are: (1) to identify the important dimensions of job stress, (2) to discover their distribution across a wide variety of jobs, (3) to examine the effects of these stresses on a broad spectrum of strain and health variables. Pursuant to these aims, the project focusses on a central subset of the hypotheses represented in Figure I-1; most of the remaining, more complex, hypotheses will be studied in a follow-up to this project. These central hypotheses for the current project are outlined in Figure I-2 where they are labelled with the same numbers as in Figure I-1.

The theory for this project hypothesizes that both job characteristics and characteristics of the person affect strain (arrows (3) and (7) in Figure I-2); it is the goodness of fit between these job characteristics and the desired levels of these characteristics which has the strongest effect on individual strain (arrow (9)). Finally, Figure I-2 shows that the various forms of individual strain affect the person's health and illness (arrow (4)). A few additional variables which are involved in minor hypotheses have been omitted from Figure I-2, but will be described in Chapter II. The more specific aims of this project are to study the following propositions.

Hypothesis 1. Job stresses impinging upon the individual (i.e., characteristics of the subjective environment and poor person-environment fit) will produce psychological, behavioral, and physiological strains. We expect a certain amount of specificity in these relations, i.e. different job stresses will have somewhat different effects.

Hypothesis 2. Personality variables will influence the level of strain. For example, Type A persons will show greater strain then Type B; defensive persons may differ from non-defensive persons on physiological and on psychological strains.

Hypothesis 3. Greater psychological, physiological, and behavioral strain will cause higher rates of reported illness.

Hypothesis 4. The goodness of the person-environment fit will produce stronger effects on strains than will either the characteristics of the work

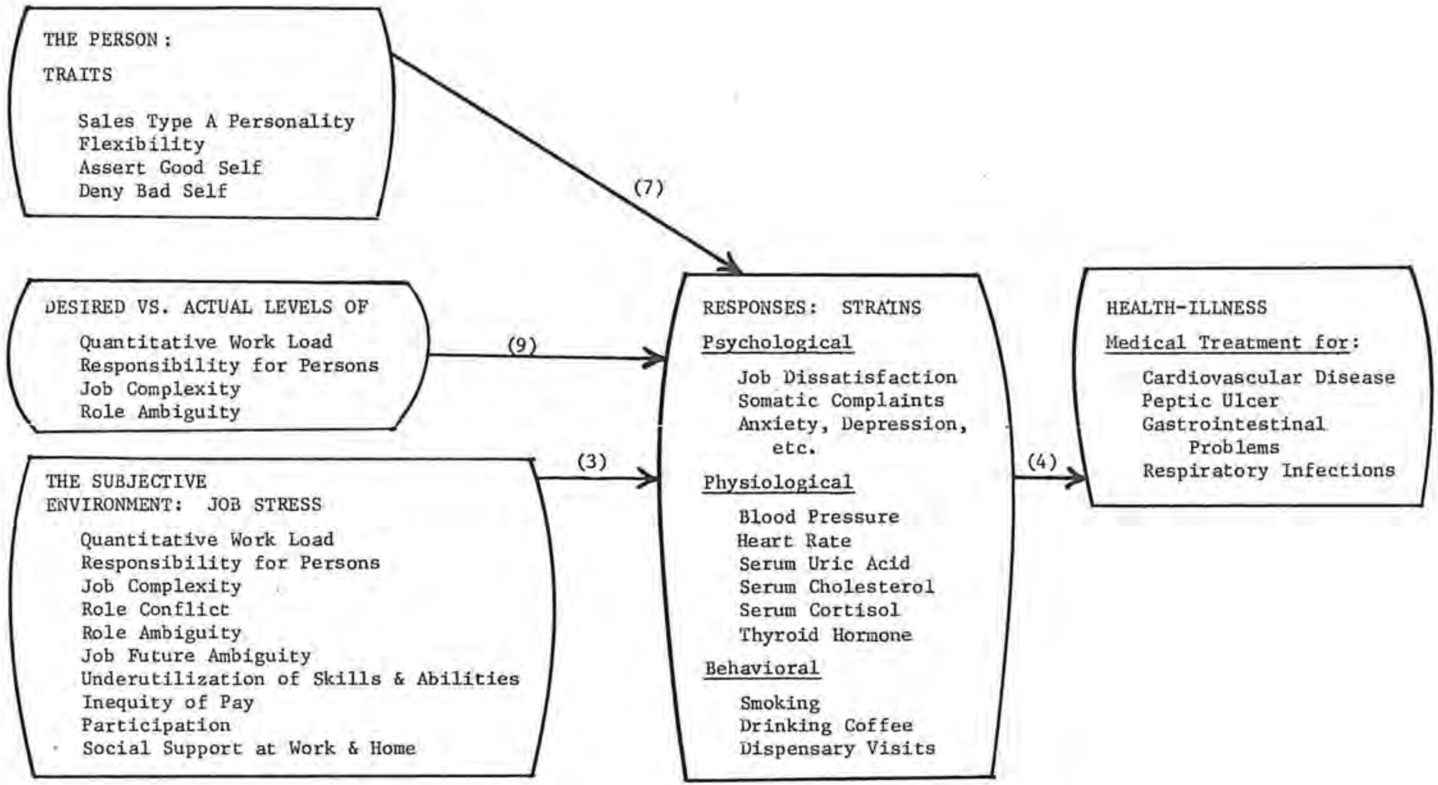


Figure I-2. A summary of the major hypotheses. Arrows represent causal relations.

ronment or the characteristics of the person.

Prediction 1. Among different jobs there will be significant differ-
s in the mean stress, the mean strain, and in personality. We expect
these differences in stress, strain, and personality will be produced
only by differences in job content and organizational setting but also
he selective processes whereby people enter into jobs or exit from them.

Prediction 2. At the ecological (i.e. occupational) level there will
ositive correlations between a variety of stresses and a variety of
hological and behavioral strains. We expect these correlations across
set of jobs because of corresponding causal relations at the individual
el, but other factors will make the correspondence less than perfect.

CHAPTER II. METHODS

This chapter discusses the methodology utilized in four major areas of the study: selection of the sample, data collection, development of the measures, and analysis of the data. The section on sampling delineates the occupations chosen for study, the criteria for including respondents in the study, the types of samples which were formed, and the characteristics of these samples. The section on data collection describes the various methods of administering the questionnaire and the collection of the physiological measures. The measures section discusses the criteria utilized for selection of measures and construction of indices and also outlines the content of the questionnaire measures and the physiological measures. The final section on methods of analyses briefly describes the statistical analyses utilized in the study.

Sample

Sampling Occupations

Table II-1 presents a list of the occupations studied in this project and their sample sizes. These diverse occupations were chosen to represent a wide variety of job demands and work conditions. No attempt was made to obtain a random sampling of all types of jobs found in the work force of the United States. Rather the aim was to represent certain types of job stresses. In Chapter IV data on the nature of job stresses are presented for each of these occupations. These data show that the array of jobs in this study represent a considerable range of job demands on every specific measure of job stress that we included. This evidence suggests that we did succeed in sampling a wide variety of occupations and work conditions.

Occupational categories. In order to determine the actual occupation to which each respondent belonged, he was asked to indicate his main occupation, the section of the organization in which he worked, and a brief description of the things he did as part of his job. These three pieces of information were used to determine occupation. Our past experience (Caplan, 1971) indicates that this method of coding occupations is superior to reliance on the person's occupational code from the personnel roster. A person listed officially as a scientist, for example, may really turn out to be an administrator when a self-description of what the person does on the job is obtained.

To simplify the presentation of our findings on occupational differences in stress and strain we will refer to groups of job titles under the rubric of a single occupational label. For example, under the continuous flow

Table II-1

Occupational Groups and Their Sample Sizes

Occupational Groups	Abbreviations Used in Tables	N
Blue Collar[a]		
Forklift driver	Forklift drvr	46
Assembler, machine paced	Assemb mach	79
Assembler, machine paced relief	Assemb relief	27
Assembler, nonmachine paced	Assemb nomach	69
Machine tender	Mach tender	34
Continuous flow monitor	Contin flow	101
Delivery service courier	Courier	20
Tool and die maker	Tool and die	77
Blue/White Collar		
Electronic technician	Elec tech	93
Policeman	Policeman	111
Train dispatcher	Dispatcher	86
Blue collar supervisor	Sup blue coll	178
White collar supervisor	Sup whte coll	42
White Collar		
Air traffic controller, large airports	ATC, large	82
Air traffic controller, small airports	ATC, small	43
Programmer	Programmer	90
Accountant	Accountant	92
Engineer	Engineer	110
Scientist	Scientist	117
Professor	Professor	74
Administrative professor	Admin prof	25
Administrator	Administrator	253
Family physician	Physician	104
Miscellaneous, gathered incidentally	Miscellaneous	57
Total		2010

[a]This ordering of occupational groups reflects--with some minor changes--an arrangement from lowest to highest Duncan SES score and therefore from lowest to highest socioeconomic status.

monitor occupational category we have included men who performed monitoring tasks under the various company job classifications of operator, relief operator, chief operator, and operating engineer. These titles are combined into one group because the basic nature of the work, its variety, level of responsibility, technology, and work place, are essentially the same and justify the inclusion of these people under the same rubric. All the occupational rubrics and the jobs which they include are presented in Appendix B.

Physical hazards avoided. This study focuses on social and psychological hazards of work, rather than physical hazards such as toxic chemicals and excessive noise levels. The list of occupations was limited to those which were not exposed to physical or chemical hazards. Thus, the sample of forklift drivers includes persons who drive propane and electrically powered forklifts but excludes drivers of gasoline-driven machines. This step was taken to eliminate persons from the sample who might be exposed to unusually high levels of carbon monoxide (CO).

The original study did not include budgetary provisions for the actual monitoring of CO and noise levels. Such monitoring would be quite expensive since many sites are involved in the study. However, checks with union and management officials at the industrial sites indicated that the CO and noise levels were within levels prescribed by the federal government. There were some sites, nevertheless, where the noise levels did seem high to our untrained ears. Obviously, there are significant differences in the noise levels and types of noise to which university professors, machine paced assemblers, and policemen, for example, are exposed. A real understanding of whether psychological stress accounts for variance in strain in a job, irrespective of noise level, requires analyses of relationships between stress and strain within a given occupation. This type of analysis is outside the scope of this first report, although it will be done with the available data base in a later volume of the series on job demands and worker health.

Organizational sites. The 23 occupational groups in our study derived from 67 different sites or organizational affiliations. If each occupational group had been sampled from a different organization, occupation and organization would have been confounded. Consequently, at least two sites or organizations were sampled for almost every occupation to separate partially the variance due to site from the variance due to occupation. We obtained many occupational groups from two or three sites and in some cases obtained an occupational group from more than five or six sites. For example, the train dispatchers in the sample represent thirteen dispatch stations located in the southern, midwestern, and eastern United States and representing four railroads which operate in a broad variety of track and train traffic conditions.

Criteria for Including Respondents in the Sample

Several criteria were used to decide whether or not a person should be asked to participate in the study. They are as follows.

Day and afternoon shifts only. The sample should include only persons from the day and afternoon (later afternoon through evening) shifts. The late night shifts were excluded. In this way we avoided the possibility that the night shift, per se, could have contributed types of stresses which our study was not designed to capture. Disruption of family and social life are examples of such stresses (Mott, Mann, McLoughlin, & Warwick, 1965).

Males only. The sample should contain only males. This step was taken for reasons which reflect the state of our work force. Because there were very few females in any of the occupations studied, it was impossible to obtain a large enough sample of females to conduct reliable research with sex as an important demographic variable. Consequently, this is a study of working men, and any extrapolation of its finding to female populations must be considered speculative until studies are able to replicate these results with women.

Volunteers. The sample must be volunteer and is, by necessity, non-random. With many organizations and several unions involved, the conditions under which a sample could be obtained varied widely depending upon the quality of management-union relationships, the ability of the participating organizations to set aside time for the completion of the questionnaires, and the interest of the employees. Textbook descriptions of how to draw a neat, random sample for generalization to the population under study are rendered purely academic under such conditions. Collecting data at each site required a negotiated agreement between the participants and the research team. Sometimes those negotiations were brief and simple. At other times, they were complex and compromises had to be made. In a section which follows, we shall describe the various ways in which people were contacted to participate and the conditions under which they participated.

We feel that these sampling conditions were quite adequate for the purpose of this study. Our goal was to test certain hypotheses about relationships between job demands and worker health. A group of persons representing a variety of occupational conditions is the most important requirement for such tests. This type of group was obtained.

Three Types of Samples

Three types of samples have been used in the analysis of the data. A description of these samples and the uses made of them follows.

Total sample. The first sample consists of all 2010 respondents. This sample is used primarily where means of the occupations are used as the raw data for analysis (such as tests of the differences in stress across the different occupational groups). This sample is described in Table II-1.

Physiological sample. The second sample consists of a subset of 390 respondents for whom we have physiological data. Table II-2 describes the eight occupational groups included in that sample. We decided to include machine paced assemblers in this sample because the literature suggested that among blue collar occupations this job involved some of the greatest degrees of stress (e.g., Blauner, 1964). Air traffic controllers were chosen because they have a high rate of psychosomatic diseases. Previous research by Cobb and Rose (1973) comparing air traffic controllers and second class airmen who were given the same periodic medical examinations indicated that the air traffic controllers had the higher rates of hypertension and peptic ulcer. Controllers from large and small airports were kept in separate groups to allow their comparison on stresses and strains. Electronic technicians were selected because preliminary field observations and interviews at air traffic control towers led us to conclude that the electronic technicians at these sites appeared to have less stress and would be a good comparison group for the air traffic controllers. Administrators were chosen because previous research (Caplan, 1971) had shown them to be a group with high job stress and a high risk of coronary heart disease. Scientists were chosen to represent a group which was low in stress and low in risk of coronary heart disease. Thus we hoped to be able to compare air traffic controllers who have high stress with electronic technicians who work at the same airports and experience a low degree of stress; and administrators who are under high stress with scientists who have a low degree of stress. Supervisors of all of these occupations formed another group. Finally, those volunteers whose occupations were not among the chosen categories were assigned to the miscellaneous group.

Random stratified sample. The third type of sample is an occupationally stratified random subsample of the 2010 men. The rationale for this third sample is as follows. Table II-1 shows that there is a considerable range in the sample sizes across the occupational groups. There are 253 administrators in the sample, for example, while there are only 20 delivery service couriers. If we were to use the total sample for analyses at the individual level our analyses would be biased toward a depiction of

Table II-2

Occupations with Physiological Data

Occupational Group	Sample N	Double Sample N[a]
Assembler, machine paced	46	28
Electronic technician	64	16
Supervisor		
blue and white collar	25	15
Air traffic controller, large airport	82	33
Air traffic controller, small airport	41	23
Scientist	55	--
Administrator	62	--
Miscellaneous	15	--
Total	390	115

[a]The number of persons from the left column who had a second blood sample drawn twenty minutes after the first.

the specific stresses of administrators and would underrepresent the stresses of couriers. To maximize the diversity and evenness of occupational characteristics we decided to build a random sample which was stratified by occupation and which included approximately 14 persons from each occupational group. The resulting random subsample consists of 318 persons. It is almost always used for analyses at the individual level.

Characteristics of the Random Stratified and Physiological Subsamples

Characteristics of the random sample in terms of age, education, and other demographic and general items of description will now be presented. In practically all cases there is little difference in the values of these parameters between the total sample in which the number in each occupational group varies, and the random sample in which the number in each occupational group is approximately the same. The most interpretable analyses in the chapters describing the results will be presented at the individual rather than at the occupational level. Consequently, sample characteristics will be presented for the sample used in those analyses, i.e. the stratified random subsample. The reader may keep in mind that the total sample is quite similar in the respects represented here. The parameters for the physiological sample will also be presented. In the paragraphs to follow we will be comparing our sample to a national sample, the 1972-73 Quality of Employment Survey (Quinn & Shepard, 1974). The Quality of Employment Survey was conducted by the Survey Research Center.[1] Data were obtained from personal interviews with a national probability sample of 1496 employed persons 16 years of age or older who worked for pay 20 hours a week or more. The national sample differs from our own in that 37.9% of the national sample are women and 10.5% of the national sample are non-white minorities. Our sample is male and white. Although we did not include a measure of race on the questionnaire few non-whites were encountered in the collection of data, particularly in the professional occupations. It is best to regard our findings as applicable to white males and not to generalize further until comparative studies indicate which findings are specific to this population subgroup. For comparison purposes, Tables II-3 through II-6 present data for only the white males in the national Quality of Employment Survey (N = 910).

Age. Table II-3 presents the distribution of age for the random sub-

[1] This survey was conducted under contract with the U.S. Department of Labor with supplemental financial support provided by NIOSH for the inclusion of questions on stress and mental and physical health.

Table II-3

Distribution of Age

Age	National Quality of Employment Survey N = 910	Random Subsample N = 318	Physiological Sample N = 390
Under 20 years	2.8%	1.3%	1.3%
20-24	11.6	6.0	4.6
25-29	16.3	16.5	17.7
30-34	14.8	13.9	18.5
35-39	10.3	15.5	21.5
40-44	10.0	11.7	17.4
45-49	10.8	13.3	7.2
50-54	9.5	12.7	7.2
55-59	7.6	4.7	3.1
60 or older	6.3	4.4	1.5
Total	100.0%	100.0%	100.0%

sample, the physiological sample, and the national sample, the 1972-73 Quality of Employment Survey. The distributions of the random subsample and the national sample are quite similar with the following exceptions: our study tends to underrepresent persons at the extremes of the age distribution, particularly among persons under 25 years of age, and overrepresent persons in the 35-54 years age bracket. The majority of persons in the physiological sample (79.7%) fall between the ages of 20 and 44.

Education. Table II-4 presents the distributions of education in our samples and in the national survey sample. Our sample overrepresents the highly educated (33.2% of our sample have at least a college degree while 18.4% of the national sample completed college). This difference is accounted for largely by the intentional inclusion of professional groups in our sample (scientists, engineers, university professors, physicians). As a result, our sample underrepresents people with less than a high school education (9.5% in this study versus 23.4% in the national sample). This underrepresentation in our sample was expected because our questionnaire required high school level reading skills whereas the national survey was conducted by interviewers. There is one point at which the national sample and our sample are quite comparable: 37.8% of the national sample has a high school education, and 35.1% of our sample has a high school education (no college). The physiological sample is made up largely of persons with educations beyond a high school diploma reflecting the selection of many professional occupations for this special sample.

Duncan Socioeconomic Status score. Duncan developed a system to rank occupations on their overall socioeconomic status, taking into account the income, education, and prestige of the typical person in the occupation (Reiss, 1961). The Duncan Socioeconomic Status (SES) scores were originally devised to divide the work force of the United States into status percentiles. The scoring system was developed in 1950 and revised in 1960. Scheffler, Rice, and Kaplan (1971) developed Duncan SES scores for all occupations in the United States as coded by the Bureau of the Census, subdivided by industry.

The Duncan SES score for each occupation in this study was obtained directly from Scheffler et al. (1971). The same Duncan SES score was used for each individual within an occupation except for blue collar supervisors and white collar supervisors. Following the occupational coding system of the Bureau of the Census, Scheffler et al. (1971) often assign the same Duncan SES score to supervisors and to the individuals they supervise (e.g., chief dispatchers and dispatchers, head accountants and accountants). In the present study each supervisor was assigned the Duncan SES score of his occupation (following Scheffler et al., 1971).

Table II-4

Distribution of Education

Education	National Quality of Employment Survey N = 910	Random Subsample N = 318	Physiological Sample N = 390
None	.1%	0.0%	0.0%
Eight years or less	11.3	1.9	1.5
Grades 9-11	12.0	7.6	2.3
Grade 12 (Completed high school)	37.8	17.1	13.6
High school and other non-college training	--[a]	18.0	25.1
Some college	20.4	22.2	25.6
Completed college (Bachelor's degree)	9.0	12.0	9.2
Advanced or professional degree	9.4	21.2	22.6
Total	100.0%	100.0%	100.0%[b]

[a]This category was not used in the national survey.

[b]Figures do not sum to precisely 100.0% due to rounding error.

The Duncan SES scores do not take into account the possibility of differences between the socioeconomic status of a typical individual in the occupation and the socioeconomic status level of individuals in our sample of the occupation. For many occupations (e.g., assembly line workers, train dispatchers, physicians) we have no reason to believe the socioeconomic status of a typical worker differs markedly from that of the average person in our sample. For a few occupations, however, our sample includes a larger proportion of individuals with either higher than average or lower than average socioeconomic status than would be typically found in the occupation. For example, the sample of administrators includes a larger proportion of high level administrators than is typical. In contrast, accountants in our sample tend to be in lower level accounting positions than those typically held by accountants. Such discrepancies should be kept in mind when interpreting data concerning Duncan SES scores.

A change in the meaning of Duncan SES scores has occurred since they were revised in 1960. Most Americans have moved up the status ladder so that the scores delineate an ordinal scale which no longer represents percentiles of the work force. Fewer and fewer Americans are employed at the low status levels and more and more Americans are employed at the high status levels. This trend is evidenced by data from the national sample presented in Table II-5. Instead of finding 10% of the national work force in each decile we find less than 10% in each of the bottom six deciles and more than 10% in the four highest deciles. The distribution of persons in our sample by Duncan SES scores differs markedly from the national sample. The physiological sample, due to its inclusion of only a few occupations, draws 84.5% of its respondents from the upper four status categories.

Income and number of dependents. Respondents were asked to indicate their gross income from the job in 1972. This was the year preceding the collection of the data. The mean gross income is $17,379 which is quite high compared to the national sample ($11,608 in 1972). Our specific inclusion of scientists, university professors, air traffic controllers, physicians, and administrators largely accounts for the high income in our sample. The standard deviation for the random sample is $11,382 which gives the reader some hint as to the great variation in pay within our sample. In the family physician category, the mean gross income was $50,813.

In the physiological sample, the mean income was $18,992 (S.D. $5,409). This mean is about the same as in the random sample although the variance is about one fourth that of the random sample. Thus the physiological sample again represents a more selected group of occupations with a more restricted range of incomes.

Table II-5

Duncan Socioeconomic Status Distributions

Duncan 'Decile'	National Quality of Employment Survey N = 910	Random Subsample N = 318	Physiological Sample N = 390
Lowest tenth	1.9%	0.0%	0.0%
Second tenth	7.1	4.7	0.0
Third tenth	4.0	22.9	12.1
Fourth tenth	8.1	2.8	0.0
Fifth tenth	7.0	9.7	0.0
Sixth tenth	9.0	8.2	3.4
Seventh tenth	10.8	23.0	69.3
Eighth tenth	14.5	5.7	0.0
Ninth tenth	17.6	18.2	15.2
Highest tenth	19.8	4.7	0.0
Total	100.0%[a]	100.0%[a]	100.0%

[a]Figures do not sum to precisely 100.0% due to rounding error.

To obtain a measure of number of dependents, each respondent was asked to answer the following question: "Not counting yourself, how many persons do you have to support either partially or completely through your earnings? Include wife, children, parents, grandparents, brothers, sisters, etc." (Questionnaire, p. 31). The sample mean was 2.85 dependents (standard deviation 1.77).

Hours worked. We sought to include persons who worked full time on their jobs. In our random sample the average number of hours worked per week, including overtime, is 45.05. The standard deviation is 8.52, with three-fourths of the men working between 35 and 50 hours per week. To put these statistics in their proper context one must know the content of the question on hours worked because it did not ask for official hours of work--it asked for the number of hours the person felt he actually worked. The question was asked as follows:

> The "forty-hour week" is a very common term. However, when people count up the hours they work, they sometimes find they work somewhat more or somewhat less than forty hours. During the average week, how many hours do you work, not counting the time you take off for meals?" (Questionnaire, p. 4).

In the physiological sample the mean number of hours worked was 41.97 (S.D. = 7.03).

Type of work hours. In the stratified random sample 73.5% of the respondents (233 persons) reported working the same hours each day. 19.2% (61) worked on a rotating shift, and 7.3% (23) worked irregular hours. Those with irregular hours included electronic technicians and physicians who were on call and dealt with emergencies, computer programmers who worked when computer time was available, and administrators and university professors who might work late into the night on a special project and then go to work late the next day.

In the physiological sample 54.8% (213) worked the same hours each day, 44.7% (174) were on a rotating shift, and .5% (2) worked irregular hours. The large number of air traffic controllers specifically chosen for inclusion in the physiological sample accounts for the high percentage of persons on rotating shifts.

Length of service in job. Table II-6 presents the percentage distribution of people in the sample by length of service. Eleven percent of the sample had been on the job less than six months. About 10% of the sample had been on the job between seven months and one year. Roughly 79% of the sample had been on the job at least one year or longer. There was 41.6% of the sample in the modal category, being on the job between one and five years. The majority of the sample had been on their jobs long enough, that is over six months, to have a reasonably good idea of their job conditions.

Table II-6

Length of Service in the Job

Length of Service	National Quality of Employment Survey N = 910	Random Subsample N = 318	Physiological Sample N = 390
Less than one month	2.8%	.6%	1.6%
1 to 6 months	23.8[a]	10.5	10.9
7 months to 1 year		9.8	9.3
Between 1 and 5 years	31.5	41.6	48.3
Between 6 and 10 years	16.4	14.6	10.3
More than 10 years	25.5	22.9	19.6
Total	100.0%	100.0%	100.0%

[a]Percent with length of service from 1 month to 1 year.

With regard to the physiological sample, the distribution of persons by length of service in the job is quite similar to that in the random subsample. In comparison to the national sample, our random subsample underrepresents the ends of the distribution and overrepresents the category comprising the one to five years of service group (41.6% in our sample, 31.5% in the national survey).

In summary, if we wanted to construct a picture of the statistically average man in this random stratified sample, he would be about 39 years of age, with a high school education, who was in the sixth "decile" of the Duncan job status index, who had been on the job in the same position for between one and five years, worked 45 hours per week, earned $17,379 for his efforts, and on these gross earnings supported himself and three dependents. Such statistics, however, are oversimplications considering the amount of individual variance on these characteristics. It is important to keep in mind that the sample was never intended to be a representative sample of the nation's work force and that it differs from the national work force in a number of ways: it is all male, white, highly paid, highly educated, irregularly distributed on the Duncan SES categories, and underrepresents the youngest and oldest workers.

Method of Data Collection

Administering the Questionnaire[2]

Respondents were contacted and informed of the study primarily at their places of work. This contact was carried out mainly through letters which indicated that management and the union (if a union was involved) approved of the study. This letter as well as the questionnaire cover letter (see Appendix A) indicated that the employee was being asked for his anonymous responses and that the questionnaire would never be seen by the employer. The individual survey data would only be seen by the research staff at the University of Michigan.

The questionnaire was designed so that a person with a high school education could complete the instrument in about one hour. Blue collar assembly line workers generally took about this long or less. On the other hand, most air traffic controllers and persons who read as part of their work completed the questionnaire in about thirty to forty minutes.

Several methods of data collection were utilized. In some cases respondents completed their questionnaires at work on work time. This was

[2]The entire questionnaire is available on request from the National Institute for Occupational Safety and Health, Stress Research Section, or from the authors at the University of Michigan.

more likely in the professional, white collar occupations. In other cases, respondents were asked to take their questionnaires home for completion. In one industry where attempts to secure management support of the study failed, men came into the union hall and completed the questionnaire there. Although management and the union usually endorsed the study, the decision to participate fell upon the individual respondent since participation was completely voluntary.

The questionnaires were distributed at the sites in a variety of ways. At some sites the personnel department sent them out in company mail. At other sites the men met in a group in a meeting room and a member of the research team distributed the questionnaires and pencils. In some cases questionnaires were mailed out directly to the respondent by our staff. To aid in collecting data on the train dispatchers we enlisted the services of the Field Office of the Survey Research Center. Trained personnel located in towns and cities near the 13 dispatching sites received packages of questionnaires and instructions on how to administer them at each dispatching tower.

The procedures for the return of the questionnaires varied according to the conditions which could be agreed upon with the participating organizations. In some cases we collected the questionnaires directly from the respondents. In other cases each volunteer was given a prepaid, preaddressed envelope so that he could return the questionnaire directly to the University by mail. Efforts on our part to urge participation, such as follow-up letters, usually met with success in gaining a greater degree of participation.

Although one cannot discuss response rates with a completely voluntary sample, we do know that participation was usually high. Based on the number of persons who were contacted and could have volunteered, machine tenders, continuous flow monitors, train dispatchers, air traffic controllers at large and small airports, and administrative professors, had excellent participation. Close to 100% of the persons contacted in these occupational categories agreed to participate. Between one-half and three-fourths of the persons contacted decided to participate in the occupational categories of electronic technician, policeman, blue collar supervisor, white collar supervisor, programmer, accountant, engineer, scientist, professor, and administrator. Some of the occupations had very low participation. This is the case among forklift drivers, assemblers (machine paced and nonmachine paced), delivery service couriers, tool and die makers, and family physicians. As low as one-fourth of the persons in these occupations who could have volunteered participated in the study.

Generally speaking, the sites in which we entered into the workplace and administered the questionnaire ourselves had the greatest degree of participation. Sites where questionnaires were mailed directly to the respondents generally had the middle level of participation. Sites where we had to resort to letters handed out at the entrance of the workplace and a questionnaire administration site away from the workplace had the lowest degree of participation.

The sometimes low rate of voluntary participation should urge the reader to be cautious about generalizing from data on any specific occupation to all persons in that occupation.

Collecting the Physiological Data

As noted above only an especially selected subset of the total sample provided physiological data. When a respondent designated for the physiological sample had completed his questionnaire, he was invited into another room where a brief medical interview was administered. This interview recorded food, caffeine-containing beverages, and tobacco consumed during the last four hours and medications during the last 24 hours. The data so obtained were coded by a supervising pharmacist for possible effects on the physiological variables. Following the interview, pulse rate and blood pressure were measured and 15 cc. of blood were withdrawn from the antecubital vein and allowed to clot at room temperature before refrigeration.

When the situation permitted, every other respondent was asked to provide a second blood sample exactly 20 minutes after the first. This provided opportunity to examine the test - retest reliability of the determinations. For two sites the blood pressures were taken and the blood samples were drawn in the plant dispensary by the dispensary staff.

Measures

This section delineates the criteria used for selecting the measures we used in the study and the criteria for construction of indices. A brief outline of the content of each of the measures will be presented. The measures are of two types: the questionnaire measures and the physiological measures. The questionnaire measures were given to all 2010 respondents. Table II-7 lists the questionnaire measures, their sources, and the reliabilities of the multiple item measures. Appendix E presents the content and response format for the questionnaire measures and item intercorrelations for the multiple item indices. Appendix G presents the intercorrelations among the questionnaire measures for the random subsample.

The physiological measures were taken from the 390 man subset of the

Table II-7

Measures of Demographic Characteristics, Subjective Environment (Stress), Personality, P-E Fit, Psychological Strain, Health Related Behavior, and Illnesses

Measures	Abbreviations used in tables	Number of items	Cross-sectional estimate of reliability[a]	Source
Demographic Characteristics				
Occupation	Occupation	3	--	
Age	Age	1	--	
Years of Schooling	Schooling	1	--	
Duncan Socioeconomic Status	Duncan SES			Scheffler, Rice & Kaplan (1971); Reiss (1961)
Income	Income	1	--	
Length of Service	Length Serv	1	--	
Subjective Environment (Stress)[b]				
Hours Worked per Week	Hrs Wkd/Week	1	--	ISR national surveys
Hours of Overtime per Week	Hrs Ovrtim/Wk	1	--	ISR national surveys
Unwanted Overtime	Unwntd Ovrtim	1	--	
Quantitative Work Load-E	Qnt Wk Ld-E	7	.71	Caplan (1971); Quinn _et al_ (1971)
Combined Quantitative Work Load	Comb Qnt WkLd	11	.83	Combined score of the Qnt Wk Ld-E index and additional items from Quinn & Shepard (1974)
Variance in Work Load	Varince Wk Ld	3	.79	Based on presurvey interviewing
Responsibility for Persons-E	Resp Person-E	4	.89	Caplan (1971), presurvey interviewing

Table II-7

Measures of Demographic Characteristics, Subjective Environment (Stress), Personality, P-E Fit, Psychological Strain, Health Related Behavior, and Illnesses

(continued)

Measures	Abbrevia-tions used in tables	Number of items	Cross-sectional estimate of reliability[a]	Source
Job Complexity-E	Complexity-E	6	.72	Theoretical and empirical research of Hackman & Lawler (1971); Kohn (1969); Quinn & Shepard (1974)
Concentration	Concentration	1	—	
Role Conflict	Role Conflict	3	.80	Theoretical and empirical research of Kahn et al (1964); Kahn & Quinn (1970)
Role Ambiguity-E	Role Ambig-E	4	.84	Kahn et al (1964); Caplan (1971)
Job Future Ambiguity	Future Ambig	4	.79	Vickers (forthcoming); Quinn et al (1971)
Underutilization of Abilities	Underutilzat	3	.85	Taylor & Bowers (1972); Caplan (1971)
Inequity of Pay	Ineqty of Pay	3	.81	Theoretical and empirical research of Adams (1965); Quinn et al (1974)
Equity: Income as % of Deserved Income	Equity % Income	1	--	
Participation	Participation	3	.80	Likert (1961); Caplan (1971); and modifications based on theoretical conceptualizations

Table II-7

Measures of Demographic Characteristics, Subjective Environment (Stress), Personality, P-E Fit, Psychological Strain, Health Related Behavior, and Illnesses

(continued)

Measures	Abbreviations used in tables	Number of items	Cross-sectional estimate of reliability[a]	Source
Social Support from Supervisor	Support Sup	4	.83	The support measures are based on theoretical and empirical research of Pinneau (1972); Taylor & Bowers (1972); Likert (1961); Gore (1973)
Social Support from Others at Work	Support Othrs	4	.73	
Social Support from Wife, Friends, and Relatives	Support Home	4	.81	
Personality				
Sales Type A Personality	Sales Type A	9	.74	Sales (1969); See also Appendix C
Flexibility	Flexibility	7	.71	Gough (1957)
Assert Good Self	Assert Good	7	.57	Crowne & Marlowe (1964); Lillibridge (1970)
Deny Bad Self	Deny Bad	7	.62	Crowne & Marlowe (1964); Lillibridge (1970)
Personal Preferences				
Quantitative Work Load-P	Qnt Wk Ld-P	7	.60	The general theoretical formulations of the 'P' and 'Fit' indices were developed from French et al (1974). The source of the content for each specific measure is list-
Responsibility for Persons-P	Resp Person-P	4	.87	

Table II-7

Measures of Demographic Characteristics, Subjective Environment (Stress), Personality, P-E Fit, Psychological Strain, Health Related Behavior, and Illnesses

(continued)

Measures	Abbreviations used in tables	Number of items	Cross-sectional estimate of reliability[a]	Source
Job Complexity-P	Complexity-P	6	.71	ed after the 'E' form of the measure (e.g., for Quantitative Work Load-P, see Quantitative Work Load-E). See also Appendix D.
Role Ambiguity-P	Role Ambig-P	4	.86	
Person-Environment Fit				
Quantitative Work Load-Fit	Qnt Wk Ld-PE	7	.71	The general theoretical formulations of the 'P' and 'Fit' indices were developed from French *et al* (1974). The source of the content for each specific measure is listed after the 'E' form of the measure (e.g., for Quantitative Work Load-P, see Quantitative Work Load-E). See also Appendix D.
Responsibility for Persons-Poor Fit	Resp Person-PE	4	.74	
Job Complexity-Poor Fit	Complexity-PE	6	.72	
Role Ambiguity-Poor Fit	Role Ambig-PE	4	.74	
Psychological Strain				
Job Dissatisfaction	Job Dissat	4	.85	Quinn & Shepard (1974)
Work Load Dissatisfaction	Wk Ld Dissat	3	.82	Theoretically derived for this study
Boredom	Boredom	3	.86	Theoretically derived for this study.

Table II-7

Measures of Demographic Characteristics, Subjective Environment (Stress), Personality, P-E Fit, Psychological Strain, Health Related Behavior, and Illnesses

(continued)

Measures	Abbrevia- tions used tables	Number of items	Cross-sectional estimate of reliability[a]	Source
Somatic Complaints	Somat Cmplnts	10	.76	Gurin et al (1960), Langner (1962)
Depression	Depression	6	.83	Cobb (1970); Zung (1965)
Anxiety	Anxiety	4	.75	Cobb (1970). The items also overlap with those used in Gurin et al (1960), and Spielberger et al (1970).
Irritation	Irritation	3	.80	Cobb (1970)
Health Related Behavior				
Smoker-non-Smoker	Smoker	1	--	
Ex-Smoker	Ex-Smoker	1	--	
Number of Cigarettes Smoked (if > 0)	Cig Smoked >0	1	--	
Number of Cigarettes in Last 4 Hours	Cig 4 Hours	1	--	Physiological sample only
Cups of Coffee	Coffee	2	--	
Caffeinated Drinks	Caffein Drnks	3	--	
Caffeinated Drinks in Last 4 Hours	Caff 4 Hours	1	--	Physiological sample only
Obesity Index	Obesity	2	--	

Table II-7

Measures of Demographic Characteristics, Subjective Environment (Stress), Personality, P-E Fit, Psychological Strain, Health Related Behavior, and Illnesses (continued)

Measures	Abbreviations used in tables	Number of items	Cross-sectional estimate of reliability[a]	Source
Recency of Dispensary Visit	Disp Visit	1	—	
Staffed Dispensary Visit	Stffd Dis Vis	1	—	Only for persons indicating they had a staffed dispensary
Illnesses				
Cardiovascular Disease	Cardiovascular	2	—	
Peptic Ulcer	Peptic Ulcer	2	—	
Gastrointestinal Problems	Gastrointest	2	—	
Respiratory Infection.	Respiratory	2	—	

[a]The estimate of reliability is computed using the following formula (cited in Nunnally, 1967):

$$r_{kk} = \frac{k\bar{r}_{ij}}{1+(k-1)\bar{r}_{ij}}$$

where k is the number of items in the test, and $\bar{r}_{ij}$ is the average intercorrelation between items in the test. This is based on the occupationally stratified random subsample of the total sample, n=318.

[b]In addition to these stress measures the study has two items measuring aspects of job security (job obsolescense and availability of similar jobs) and one item measuring the perceived equity in opportunities to utilize one's skills.

total sample which we have labelled the physiological sample. Table II-8 lists the physiological measures and gives reliability information for these measures. Appendix H presents the intercorrelations of both the questionnaire measures and the physiological measures for the physiological sample.

Selection Criteria

In many cases established measures of stress, strain, and personality traits were available and appropriate to our needs. These measures had been used in previous research at the University of Michigan and elsewhere and had known reliabilities and demonstrated validities. In other cases, on the basis of field interviews with persons in the occupations of interest, we uncovered stresses for which there were no previously developed satisfactory measures.

For most measures of job stress we drew on the theoretical and empirical work of organizational psychologists such as Likert (1961), Kahn, et al. (1964), Bowers and Seashore (1966), and Coch and French (1948). In one case we discovered that a potential source of stress among air traffic controllers was the variance in work load, so an index was built to measure this new variable. Kahn and Quinn (1970) have recently elaborated some of their theory regarding role conflict. Consequently, we created a set of items based directly on this elaboration in an attempt to tap role conflict in its most intense manifestation. The findings of Gore (1973) suggested that social support from outside of work might complement social support in the work place. Consequently, we felt that new measures of social support had to be created which tapped these sources of support. In the area of person-environment fit much of the work was in a pioneer state (French, et al., 1974). We had found our previous attempts to measure the goodness of fit between the person and the environment less than adequate and decided on certain methodological changes.

Length of questionnaire. We started with a very large list of variables and items which we felt should be included in a study of job stress and health. The list was then pared down to meet a maximum time limit of one hour and fifteen minutes for completing the questionnaire. If the questionnaire had been longer, we would have decreased both the participation of respondents and the cooperation of the companies and unions involved. The questionnaire items were designed to be readable by persons with a high school education.

To determine the actual length of time required to complete items we pretested various subsets of the items on 43 males employed in blue collar assembly and millwright jobs in the automotive industry. The time required to complete items was carefully recorded. When the men had completed the items, our research staff asked them for comments regarding whether the items measured what we wanted them to, and whether there might be terms in them which others might misunderstand or find confusing. The men were most helpful in this regard.

On the basis of the timings (.42 minutes per item) the maximum length of the questionnaire was set and some indices of lower priority were eliminated. The questionnaire was printed in a highly readable type face and format suggested by the publications division of the Institute for Social Research, and the printing was done professionally.

Construction of Indices

To construct indices and other multi-item measures in the study, a number of criteria were used. First, the average intercorrelation of an item with other items measuring the same concept had to be significant for the random stratified sample. Second, the average correlation of an item with other items in the same index had to be higher than the average correlations of the item with items from other indices. This last criterion provided evidence of discriminant validity among the items. Third, an inspection of the inter-item correlations for any one index had to indicate that the items were, for the most part, interrelated within both a blue collar occupation (machine paced assembler) and a white collar occupation (professor). These two occupations were chosen to represent the diversity of the total sample. With this last criterion in place we would be assured of high index reliability for each measure even when it was being used to assess the nature of work in markedly different work environments.

Of the 152 items for potential use in the construction of indices, only 12 items failed to meet these criteria and consequently had to be excluded. Thus the original questionnaire proved to be very efficient in terms of the percentage of items useful for index construction.

Measures of Subjective Environment (Stress)

The estimated reliabilities of the multiple item measures of subjective environment are presented in Table II-7. They ranged from .71 to .89. To clarify the meaning of the various subjective indices, each of these and some of the other questionnaire variables are defined and illustrated below.

Quantitative work load refers to the amount of work the person is given to do, e.g., "How much time do you have to do all your work?" By contrast, qualitative work load (not included in the present study) would refer to the difficulty of the work with regard to the intellectual or motor skills which are required, that is, the difficulty of any one task. We have two measures of quantitative work load, the Quantitative Work Load-E index and the Combined Quantitative Work Load index. The items in the Work Load-E index were designed for use with commensurate P items (see below) in the construction of a measure of person-environment (P-E) fit with respect to work load. The Combined Work Load index includes both the seven Work Load-E items and four marker items from the Quinn and Shepard (1974) national study. The latter group of items was included in the present study to allow the comparison of our results with theirs. By including all eleven items in the Combined Work Load index we achieve an increase in reliability over that provided by the E index alone (see Table II-7).

Other measures dealing with work load include Hours Worked per Week, Hours of Overtime per Week, and hours of Unwanted Overtime per week. All three of these measures are taken from the respondents' self-reports in the questionnaire. The Unwanted Overtime measure was computed as the difference between the Hours of Overtime per Week and the number of the hours which the man reported he wanted to work.

Variance in Work Load refers to the extent to which the pace of the work remains steady or varies. In jobs such as that of the air traffic controller, for example, we have observed that the pace varies and reaches peaks during certain air traffic rush hours such as around 5:00 p.m.

Responsibility for Persons-E involves responsibilities for persons' futures, their job security, their well-being, and their lives. This type of responsibility should be distinguished from responsibility for <u>things</u> which would deal with responsibility for budget, equipment, and specific tasks or projects.

Job Complexity-E subsumes a number of diverse job characteristics: coming into contact with other people, finding that the task is seldom the same from one assignment to the next, having to handle each group of persons one works with somewhat differently, and working on many jobs in different states of completion at the same time. The noncomplex job is characterized as the opposite--being relatively uncomplicated and very predictable from day to day.

Role Conflict refers to the presence of two or more conflicting demands from role senders (superiors, peers, subordinates). The conflicting demands may come from the same person or from more than one person. The conflicts may involve time, that is, you are unable to perform task A and also perform task B at the same time, or they may involve competing legitimate requests one of which might negate the other (superior A asks you to cancel an order; superior B asks you to ship the order).

Role Ambiguity-E refers to uncertainty or ambiguity about what is required of you in the job: "How often are you clear about what others expect of you?" The person may find himself in a circumstance or role for which there is no precedent.

Job Future Ambiguity refers to the amount of certainty the person has about his job security and career security in the future. "How certain are you about whether your job skills will be of use and value five years from now?"

Underutilization of Abilities refers to the lack of use of one's particular skills and abilities including those which a person may have developed in vocational training or as part of academic studies.

Inequity of pay refers to whether a person feels that his pay is what he deserves. Determining what one deserves depends on both the effort that one puts into work and the compensation that others get for their work. The compensation of others may serve as a standard by which one can judge whether the dollar value of one's salary is equitable or not. The items in the Inequity of Pay index ask the respondent to make comparisons between what he earns and what others who might serve as reference points earn. A second measure of pay inequity was computed from data on the respondents' reported income from his job. Besides asking how much income a man received from his employment we asked how much he felt that he should have earned, considering his ability, experience, and effort. The Equity: Income as % of Deserved Income index reflects a man's income as a percentage of what he felt he should have received. We used a percentage rather than a difference score for this measure of equity/inequity because of the great range in income. It seemed to us that a $1000 discrepancy between "earned" and "deserved" income would have much greater significance for a man earning $6,000 than for a man earning $60,000. The percentage score takes such differences into account.

Participation is defined as the amount of influence the person has on shared decisions which affect him. Sharing is an important element in this definition. The person must participate with others. Making decisions without others is not considered participation--rather it is a sign of autonomy or complete authority. For example, "How much do you decide with others what part of a task you will do?" is an item utilized in the Participation index.

The items on Social Support cover the extent to which people around the employee provide support by being good listeners or by being persons he can rely on when help is needed. The following is a sample of the questions:

"How much does each of these people go out of their way to do things to make your work life easier for you?" The respondent was asked to answer this question with regard to three categories of people: "A. Your immediate supervisor, B. Other people at work, and C. Your wife, friends and relatives".

In addition to the several measures of environmental characteristics which are present on the job (E indices), four indices were developed to measure the amount of some environmental characteristics which a person would like to have on his job (P indices): Quantitative Work Load-P, Responsibility for Persons-P, Job Complexity-P, and Role Ambiguity-P. These P indices parallel their E counterparts in content. For example, a Quantitative Work Load-E item is "How much work load do you have?" and the matching Quantitative Work Load-P item is "How much work load would you like to have?" The content of the P indices is presented in Appendix E and their reliabilities are presented in Table II-7.

Measures of Personality.

Four measures of personality were used in this study. The item content of all the personality measures is found in Appendix E. The Sales Type A Personality subset is a nine item index derived from a larger pool of 50 items originally devised by Sales (1969). Appendix C describes the subsetting procedure used to derive this measure. The items are based on the research of Friedman and Rosenman (e.g., Rosenman, et al., 1970) which depicts the Type A person as hard driving, involved in work activities, competitive, feeling a sense of time urgency, persistent, and achievement-oriented. For example, "I hate giving up before I'm absolutely sure that I'm licked".

These traits have been observed in anecdotal and retrospective studies of coronary patients (e.g., Dunbar, 1948). The work of Rosenman and Friedman represents one of the first truly systematic attempts to relate these traits to risk of coronary heart disease. Table II-7 presents the estimated reliability of this measure and the other personality measures in the study.

The Flexibility scale comes from the California Personality Inventory (Gough, 1957). The flexible person is characterized as an individual who does not require that everything be in its place, can tolerate words such as "probably," "approximately," and "perhaps," and is willing to show a change of mind rather than rigidly stick to one point of view. The rigid person is characterized as the opposite.

Assert Good Self and Deny Bad Self are two seven-item factors derived by Lillibridge (1970) from the Crowne-Marlowe Need for Social Approval Scale. Persons who score high on Assert Good Self answer "true" on the true-false measure to items such as, "I never hesitate to go out of my way to help someone in trouble." A high score on the Assert Good Self index may characterize a person who wants to put his best foot forward in order to win social approval. Persons who score high on Deny Bad Self answer "false" on items such as "I sometimes try to get even, rather than forgive and forget." Deny Bad Self can be thought of as a measure of denial--a defense mechanism. Although the items in these two measures all derive from the same Crowne-Marlowe scale, their correlation was only .49 for our random sample.

Measures of Person-Environment Fit

A number of studies and theories (Caplan, 1971; French, 1973; French, et al, 1974; Murray, 1938; Pervin, 1968) suggest that the fit between personality and job environment may be an important predictor of strain. The goodness of fit may explain variance in strain in addition to that accounted for by either personality or environment. Strain would result from discrepancies between either environmental demands and an individual's abilities to meet them or between an individual's needs and environmental supplies to meet those needs.

To measure the degree of fit between the respondents' perceptions of certain aspects of their environments and of themselves, the men were asked to rate the extent to which a work characteristic was present on the job and the amount of that characteristic they would prefer to have on the job. Each person-environment "item" actually consists of two commensurate parts, an environment item (E) paired with a person item (P), e.g., "How much work load do you have?" and "How much work load would you like to have?" Responses to both the E and P questions were marked on identical Likert scales which typically ranged from 1 (Very Little) to 5 (A Great Deal). The amount of the characteristic desired by the person (P) was subtracted from the amount present in the job (E) to produce a score representing the person-environment (P-E) fit. A score of "0" represents perfect fit (i.e., no discrepancy). A negative discrepancy occurs when environment provides less of the characteristic than the person wants. A positive discrepancy score occurs when the environment requires more of the characteristics than the person wants.

In some instances the relationship between P-E fit indices and strain may have a curvilinear U-shape (Caplan, 1971; French, 1973; French et al., 1974). When fit is perfect the level of strain is lowest. As either negative or positive discrepancy in fit occurs, the level of strain will increase (following the two arms of the "U" curve upward).

While the relationship between P-E fit and strain may not be linear, it is expected that most measures of job demands (E) will be linearly related to strain in first-order analyses. To compare the percentage of variance in strain accounted for by job demands (E) and by P-E fit, both the E and P-E fit relationships to strains need to be described by the same statistical measure. The same statistical measures can be applied to both if P-E fit indices with curvilinear relationships to strains are transformed to indices with linear relationships to strain. The methods used to identify curvilinear P-E fit-strain relationships and transform them to linear relationships are detailed in Appendix D. It was not necessary to transform the Quantitative Work Load-Fit index since it was found to have linear relationships to strains. The original P-E fit indices of Responsibility for Persons, Job Complexity, and Role Ambiguity were found to have U-shaped relationships to strains. By taking the absolute value of the fit item scores constituting these indices, transformed indices were produced which have linear relationships to strains. The scores on these transformed indices have a low value of "0", representing perfect fit, with increasing score values reflecting increasing discrepancy between the person and the environment (E<P or E>P), i.e., poor fit. The transformed indices are labeled Responsibility for Persons-Poor Fit, Job Complexity-Poor Fit, and Role Ambiguity-Poor Fit. The reliabilities of the four fit indices range from .71 to .74 (see Table II-7).

Quantitative Work Load-Fit measures the discrepancy between the amount of work load reported by an individual and the amount he would prefer. A low score indicates work underload (E<P), a midrange score indicates good fit on work load (P = E), and a high score indicates work overload (E>P).

Responsibility for Persons-Poor Fit measures the magnitude of discrepancy between the amount of responsibility for the well-being of others (reported by the person on the job) and the amount of this type of responsibility desired by the individual. Low scores on this and the two following indices indicated good fit and high scores indicated poor fit.

Job Complexity-Poor Fit measures the magnitude of discrepancy between the amount of complexity in the job and the individual's preferences for complex activities. These activities include working on a variety of tasks, working with different groups of people, and working on several tasks at different stages of completion.

Role Ambiguity-Poor Fit measures the magnitude of the discrepancy between the degree to which the individual is uncertain of others' expectations concerning his work and the degree to which he prefers uncertain expectations, for example, "How often are you clear on what others expect of you?" versus "How often would you like to be clear on what others expect of you?"

Measures of Psychological Strain

Table II-7 presents the measures of psychological strain used in this study, their sources, and the cross-sectional reliabilities of the measures. These measures have all been used in previous studies where their reliabilities and validities were demonstrated. The range of reliability coefficients among these measures is from .75 to .86.

Three types of job satisfaction were measured. The first is referred to as Job Dissatisfaction because it refers to dissatisfaction without alluding to specific aspects of work. The measure has nonspecific items such as "All in all, how satisfied would you say you are with your job?" Two measures tapped more specific reactions to the job: Work Load Dissatisfaction and Boredom. Work Load Dissatisfaction deals with how satisfied people are with their work load. The measure includes items such as "I am unhappy about my current work load." The Boredom measure contains items such as "The work on my job feels dull," and "I feel bored with the work I have to do." The full item content and the interitem correlations for these job satisfaction indices and for the other psychological strains appear in Appendix E.

Indices of Somatic Complaints, Anxiety, Depression, and Irritation were also included in our questionnaire. As should be evident in Table II-7, several of the measures had multiple origins with each creator giving very similar items a slightly different twist in the stem leading into the items. We wanted all the items measuring anxiety, depression, and irritation to have the same stem and response scale so that we would not end up with some indices (or even items within indices) being measured on four point scales and some being measured on two, three or five point scales. We also wanted to orient the items toward the measurement of states rather than traits. It is possible to measure state anxiety as well as trait anxiety simply by changing the stem. Trait anxiety would tap a personality disposition. We were interested in anxiety which varied as a function of the job environment. The stem was consequently worded to reflect how the person felt nowadays rather than how the person generally felt: "When you think about yourself and your job nowadays, how much of the time do you feel this way?" Similar wording of the stem was utilized in measuring somatic complaints so that we could tap symptoms which may have arisen only recently: "Have you experienced any of the following during the past month . . .?"

The measure of Somatic Complaints includes a variety of symptoms (e.g., sweating palms, upset stomach, loss of appetite, trouble sleeping, heart beating faster than usual) which have been observed in persons suffering from neuroses or from severe psychological stress (bankruptcy, having failed an exam, thinking about an upcoming evaluation of one's work, disasters, and so forth).

Thirteen items comprising three affect indices were selected from nineteen items of the questionnaire on the basis of their intercorrelations and on rational grounds. The measure of Anxiety includes three items referring to the negative side of this feeling state (nervous, jittery, fidgety) and one referring to its absence (calm). The measure of Depression was derived from a factor analysis by Cobb (1970) of the Zung (1965) scale. The Depression measure contains both negatively worded items (depressed, sad, blue, unhappy) and positively worded items (good, cheerful). The three positively worded items were included in our measures even though the effect was to increase the correlation between the Anxiety and Depression indices. They were included because their scoring had to be reversed, and thus they served to reduce the proportion of response style variance in their indices (see Bentler, Jackson, & Messick, 1971; Pinneau, 1973). The three negatively phrased items which tapped the dimension of Irritation (angry, aggravated, and irritated or annoyed) were combined into a measure of a third affect. Lazarus (1966) reviews much of the literature on stresses and their effects on anxiety, depression, and somatic problems.

Measures of Health Related Behavior

Tobacco and caffeine. We asked about smoking behavior and the consumption of caffeinated drinks. Persons indicated whether they were smokers, ex-smokers, or had never smoked. Each person answering the smoking question was coded either as currently smoking or not smoking for the variable Smoker-non-Smoker. For the Ex-Smoker variable, people who had never smoked were excluded (were given missing data values), and the remaining respondents were coded either as current smokers or as ex-smokers. These two smoking variables include pipe, cigar, and cigarette smoking.

If a respondent smoked he was asked to indicate the number of cigarettes, cigars, and pipes of tobacco smoked per day. From these data we constructed an index of cigarette consumption: Number of Cigarettes Smoked (if >0). People who indicated they did not smoke cigarettes were assigned missing data, so this variable included the smoking of cigarettes only.

All respondents indicated on the questionnaire the number of cups of coffee, decaffeinated coffee, tea, and caffeinated soft drinks such as cola which they consumed in a day. The answers given here were coded into two variables: Cups of Coffee and Caffeinated Drinks. Cups of Coffee is a measure of cups of caffeinated coffee consumed in a day. The Caffeinated

Drinks variable combines the number of caffeinated coffee, tea, and cola drinks.

For persons in the physiological sample, data on smoking and coffee drinking behavior in the last four hours were obtained by interview to correct for any influence of cigarette smoking on variables such as pulse rate and blood pressure. These data were translated into the two variables: Number of Cigarettes in Last 4 Hours, and Caffeinated Drinks in Last 4 Hours.

Obesity index. It is well known that obesity is related to psychosocial factors (Stunkard, 1974). Data on obesity were collected on the entire sample (n = 2010) because of the simplicity of obtaining these data. Cobb, Tomlin, Chun, French, and Kasl (1974) have shown that in men the correlation between reported weight and measured weight is so high (r = 0.96) that actual weighing is unnecessary. It is presumed that the same holds true for height. As a measure of obesity we elected to use the ratio, body weight in pounds over height in inches squared times 100. This decision was based on the information of Florey (1970) and Goldbourt and Medalie (1974). The procedure for collecting this information was simply to ask the respondent to write down his height and weight on the questionnaire. (See Appendix E for the content of these questions.)

Dispensary visits. We asked persons to indicate

> "When was the last time you made use of the medical or health services where you work other than for a routine physical exam (for example to get an aspirin for a headache, to take care of a sore muscle, injury or other discomfort?)" (Questionnaire p. 35)

This format was chosen as an alternative to asking the person how many times they had visited the dispensary over some set period. The latter measure, it was felt, might produce underreporting by people concerned about their health image. On the other hand, with a large sample, the chosen format would reflect to some extent persons who most frequently visited the dispensary. The logic here was that if a person most recently went to the dispensary during the last week rather than three weeks ago, then the probability that he went to the dispensary weekly was greater than if he had not gone for several weeks. As such, the Recency of Dispensary Visit variable is a somewhat unobtrusive measure of frequency of dispensary visits.

We have some questions regarding the interpretation of the data on visits to the health dispensary. Unfortunately, the term 'dispensary' is equivocal and can mean either a medical facility or a medicine cabinet containing a bottle of aspirins and a box of bandages. We have tried to determine whether or not there actually was a medical dispensary with a nurse or physician on duty at each site and have coded the responses to these items accordingly. Therefore, in addition to the measure of Recency of Dispensary

Visit, a related variable was constructed for those men who were believed to have a staffed dispensary available to them. This Staffed Dispensary Visit variable is identical to Recency of Dispensary Visit except that missing data values were assigned to those men whose dispensaries were unstaffed.

Measures of Illnesses

Information about some illnesses was available to use in the health section of the questionnaire. As may be seen in Appendix E men who indicated that they were under regular medical treatment were asked what medical condition was being treated. The men were also asked the reason for their last visit to a doctor or medical service away from their work place. The medical conditions indicated in these two questions were coded into illness and injury categories as described in Appendix F. Thus we had codes to indicate whether a subject did or did not report receiving professional medical treatment for each category of injury/illness. Although these illness data do not have the validity of medical records and do not cover all instances of treatment they probably do approximate the actual distribution of illnesses in our sample sufficiently well for some types of analysis.

From these illness codes we obtained data on the incidence of four types of illnesses which were occurring frequently enough to allow analysis. The first of these illness variables is Cardiovascular Disease and combines the first two categories in Appendix F (cardiovascular and blood pressure). By combining these two codes an illness category was defined which reflects all major cardiovascular ailments and has a sizable level of incidence. The three other illnesses which were common enough to allow analysis and which might be influenced by job stresses were Peptic Ulcer, Gastrointestinal Problems, and Respiratory Infection. Although these reports are fallible and incomplete, they are probably more valid than reports of less recent illnesses (Laurent, Cannell, & Marquis, 1972) and allow us to detect some differences between men who report treatment and those who do not.

Physiological Measures

Table II-8 lists the physiological measures used in this study and presents reliability information for these measures. The physiological measures were obtained from the subsample which we earlier designated as the physiological sample (n = 390). Table II-2 delineates the occupational groups included in this sample. Two blood specimens were collected 20 minutes apart on 115 of the respondents. This has given us an opportunity to check the test-retest reliability of our measures in a way which is not usually undertaken.

Table II-8

Physiological Measures

Measures	Abbreviations	Reliability: Different Samples 20 Minutes Apart		Reliability: Same Sample Different Days	
		N	r	N	r
Systolic Blood Pressure	Systolic BP	131	0.84	12[a]	0.99
Diastolic Blood Pressure	Diastolic BP	131	0.78	12[a]	0.99
Heart Rate	Heart Rate	127	0.81		
Serum Cholesterol	Cholesterol	111	0.91	65	0.98
Thyroid Hormone T-3	T-3	99	0.68	101	0.95
Thyroid Hormone T-4I	T-4I	99	0.77	101	0.97
Serum Uric Acid	Uric Acid	75	0.97	23	0.99
Serum Cortisol	Cortisol	96	0.70	19	0.83[b]

[a]London School of Hygiene Blood Pressure Test Tape.

[b]Correlation between values on different days. Each day's value is the mean of two determinations. (Correlations between determinations on the same sample on the same day are r = .99, n = .43).

Established physiological measures and some exploratory measures were utilized in this study. The criteria we considered in choosing these measures for inclusion were relevance and simplicity of collection and anlysis. Each physiological variable is discussed below. The discussion of each variable includes the rationale behind its inclusion, the procedures for collecting the data, and reliability and validity information. Any matters specific to a particular variable, such as effects due to seasonal variation, diurnal variation, or medication are also reported.

Blood pressure. There is substantial evidence that blood pressure is influenced by psychological and social factors. Hypertension is a well known risk factor in coronary heart disease. We wanted to include a measure of blood pressure in a study that includes air traffic controllers, since Cobb and Rose (1973) reported a considerable excess of hypertension in that occupational group.

Blood pressures were taken with the respondent seated. There was no specification as to which arm was to be used. Following the blood pressure a blood sample was drawn and information concerning medications and recently ingested food and drink was obtained. The 115 men who had two blood samples taken also had their blood pressures measured twice.

For part of the sample we have precise information as to the reliability and validity of the blood pressure information because the measurements were all made by our laboratory supervisor who collected the physiological data. This technician was carefully trained by one of the principal investigators, using the London School of Hygiene Tapes (Rose, 1965). He was tested three times during the course of the data collection--once at the beginning, once in the middle, and once toward the end. As can be seen from Table II-8, his reliability was extremely good. Not only were his correlations extremely high, but the means across his twelve subjects in the London School of Hygiene Test Tapes were very consistent. He was almost exactly right with the systolic blood pressure but was consistently about 8 millimeters high with the diastolic readings. However, in our experience, readings of two to four millimeters high in comparison to the London School of Hygiene standard are quite common. Our laboratory supervisor took all the blood pressures for machine paced assemblers, electronic technicians, supervisors, and air traffic controllers. The blood pressures on the remaining men in the physiological sample were taken by technicians at the dispensaries at their respective places of work. At these two dispensaries we had no control over the accuracy of the manometer nor of the technicians who used the manometers. As far as we were able to determine, these were all well trained technicians. We have no reliability or validity information with respect to them. However, since these technicians were all attuned to the common clinical definition of hypertension as blood pressure greater than or equal to 140/90 mm Hg, it is likely that they discriminated carefully in the neighborhood of this value but were rather less precise with lower values in the normal range.

Blood pressure is subject to momentary influences as can be seen from the fourth column of Table II-8. The correlation between the first and second blood pressure is 0.84 for systolic pressure and 0.78 for diastolic pressure. These correlations are in the range where the mean of several observations is substantially more reliable than a single observation. It is unfortunate that we do not have multiple blood pressures on all the men. In future studies at least two blood pressures should be taken on every participant.

Effective anti-hypertensive medication presents a problem in obtaining accurate measures. A systematic inquiry was made with regard to medications taken regularly and in the last twenty-four hours by respondents in the physiological sample. Five persons were eliminated from the blood pressure analysis because they reported taking anti-hypertensive medications.

Heart rate. Heart rates are easily obtained in the course of taking blood pressures. Counts were made with the fingers over the radial artery, supposedly for a period of thirty seconds. However, rather more of the rates were divisible by four than would be expected by chance, suggesting that sometimes the rates were obtained by counting for only fifteen seconds and multiplying by four. The reliability on retest 20 minutes later is moderate ($r = 0.81$). There are many momentary conditions which affect heart rate, so a moderate reliability over so brief an interval does not guarantee a reliable measure of the usual heart rate on the job. The data were so easily obtained, however, that it seemed wise to look for occupational differences.

Serum cholesterol. Cholesterol was included because of its status as a risk factor in coronary heart disease and because it is known to respond to environmental stress (e.g., Dreyfuss & Czaczkes, 1959; French & Caplan, 1970; Friedman, Rosenman, & Carroll, 1958; Sales, 1969; Thomas & Murphy, 1958; Wertlake, Wilcox, Haley, & Peterson, 1958). Serum cholesterol is easily measured in the auto-technicon (method #N-24-0; Technicon Instruments Corporation, Chauncey, New York) with considerable validity and reliability. The reliability data presented in Table II-8 appear to be satisfactory.

Four subjects were excluded from the analysis of this variable because they were taking medication which might elevate or lower their cholesterol levels. There is probably no diurnal variation in cholesterol and the seasonal variation is trivial over the period during which our specimens were collected--between early May and the middle of September, 1974 (see Table II-9).

Catecholamines. In the discussions preparatory to the issuance of the contract under which this research was done, there was attention given to the catecholamines epinephrine and norepinephrine. Frankenhaeuser (1971) has had notable success in studying these in the urine in relation to social and psychological phenomena. We (Cobb, 1974b), along with others, have had modest success in this regard. The determinations are difficult and laborious and should not be undertaken unless an experienced laboratory is at hand. When it was decided that the interviews would average a little under an hour, the collection of a timed urine specimen was ruled out, for one needs at least 90 minutes to get a specimen from which the rate of urine flow can be estimated with sufficient reliability. At the time we decided not to take urine specimens, we were involved in an attempt to develop a radioimmunoassay (RIA) for nor-metanephrine in the blood serum. If the RIA had fulfilled its promise, we would have had an extremely sensitive technique available to measure serum nor-metanephrine.

In the serum it is more suitable to measure the meta-derivative because it is slowly excreted and its level in the blood represents nor-epinephrine production by the sympathetic nerve endings over some period of time. Unfortunately, a sufficiently specific antibody did not develop so the attempt had to be abandoned. Though the blood and urinary catecholamines are useful indicators of strain, they are extremely difficult to determine reliably, and it commonly takes a year or so to get the necessary procedures stabilized at a sufficiently high level of reliability and validity. It seems that if catecholamines are to be studied in any particular research, an experienced ongoing laboratory must be at hand before the samples are collected.

Thyroid hormone. Because Levi (1972) noted variations in thyroïd function with social stress, and because the clinical literature suggests that the onset of hyperthyroidism is often associated with stressful events (Lidz, 1953; Maranon, 1921), we decided to measure thyroid function. Two measures were selected, both of which are independent of exogenous iodine. T-3 is a measure of the number of thyroxine binding globulin sites that are free. When the thyroid gland is hyperactive most of these sites are taken up. The percent retention is a measure of the added liothyroxine remaining on the column after the serum specimen has been washed through, removing whatever liothyroxine is bound by the thyroxine binding globulin. This means that high values are associated with hyperthyroidism. We used the

Table II-9

Seasonal Variations in Cholesterol, T-3, and T-4I

	Date of Collecting Data						
	May 5[a]	June 4[a]	July 4[a]	Aug 3[a]	Sept 2[a]		
	Julian Day						
	125-154	155-184	185-214	215-244	245-280	F	p<
Measure							
Cholesterol	200.2	199.9	193.7	193.1	184.7	1.43	N.S.
T-3	50.4	52.4	54.8	53.9	57.4	14.54	.001
T-4I	4.6	4.8	4.7	5.0	5.0	2.79	.03
N	81	43	122	53	33		

[a]This date indicates the first day of a 29-day interval.

Ames Laboratory Trilute method to measure T-3. The outer limits of the normal range of this method are said to be 39-64 for men.

The other measure, T-4I is a direct assessment of the amount of bound and unbound thyroxine in the serum. It was measured by the Ames Laboratory Tetralute method and the results are reported in micrograms of thyroxine iodine per 100 ml. of serum. Dividing the values reported by 0.653 would convert to micrograms of thyroxine per 100 ml. because 65.3% of the thyroxine molecule is iodine. The outer limits of normal are said to be 2.5-8.0 mg/100 ml.

Both of these procedures involve radioactive iodine measured in a gamma counter. Since a suitable gamma counter was not currently available in our laboratory, these determinations were done for us by a commercial laboratory. The test-retest reliabilities are shown in Table II-8. The results will have to be interpreted with caution because the T-3 and T-4I values are negatively rather than positively correlated ($r = -.28$). The reason for the negative correlation is not immediately apparent.

Seasonal variations in thyroid function are usually observed. Table II-9 presents data indicating that this variation is observed in our samples as well. However, since date of collection and occupation are confounded ($eta^2 = .70$), it is impossible at this stage in the analyses to tell whether these variations by season are really due to occupational differences.

Serum uric acid. For several years our research group has been interested in occupational differences in serum uric acid levels in men, and in changes in uric acid levels in response to environmental stress (Cobb, 1974b; Dunn, Brooks, Mausner, Rodnan, & Cobb, 1963; Kasl, Cobb, & Brooks, 1968). It is likely that some differences in uric acid levels might be found between occupations although it is not yet known whether the stress of the occupation elevates the uric acid levels or whether high levels of uric acid are related to self selection into certain occupations (Mueller & French, 1970).

The method used for determining the uric acid level in the serum was number N-13B in Technicon Autoanalyzer Methodology (Technicon Instruments Corporation, Chauncey, New York). The color is developed by reduction of phosphotungstate in the presence of a cyanide urea reagent. This procedure was evaluated against that of Liddle, Saegmiller, and Laster (1959), as recommended at the Second International Symposium on Population Studies of Rheumatic Diseases. The correlation between the two methods was 0.94 over a range from 2.8 mg% to 8.0 mg%. The means were almost identical. Table II-8 shows that the reliability of the method is extremely high. Uric acid levels do not appear to vary systematically with the day or season. They can, however, be influenced by various medications, especially diuretics.

Seven cases were excluded because they were taking medications which might influence their uric acid levels. (Though it is known that uric acid can be affected by the ingestion of aspirin, information about aspirin was neglected in this case because it was felt that it was incompletely reported, and that the effects were relatively small.)

Serum cortisol. Since adrenal cortex hormone levels are particularly responsive to environmental stress (Selye, 1950), we were concerned with adrenal cortical function in this study. The serum cortisol determinations were done in the laboratory of Dr. Robert M. Rose at Boston University Medical School. This laboratory is quite experienced in handling determinations of serum cortisol levels.

Despite the fact that it is now fashionable to be concerned about the episodic nature of the secretion of cortisl (Hellman, Nakada, Curti, Weitzman, Kream, Roffwarg, Ellman, Fukushima, & Gallagher, 1970) and to take samples every 20 minutes and thereby determine the frequency and magnitude of peaks, we elected to explore this variable on a more limited basis, taking double samples on only part of our sample. The result of this decision is a lowered reliability for the cortisol values. The correlations of cortisol with other variables are therefore attenuated. However, differences between groups can still be appropriately examined, though with some loss of power. So, if differences between groups are found, they will be valid. If the differences found are striking but not statistically significant, further study, with more samples per person, will be indicated.

The cortisol determinations done in Dr. Rose's laboratory were under the supervision of Mr. David Sandwisch, and were performed by the competitive protein binding method according to the protocol of Daughaday, Adler, Mariz, & Resinski (1962). The reliability data of samples 20 minutes apart are in line with the episodic secretion described by Hellman, et al. (1970) ($r = 0.70$). The within-days replicability of the laboratory is very high ($r = 0.99$, $n = 43$) but the between days reliability of the laboratory is rather low ($r = 0.83$, $n = 19$). Although the between days correlation, based on only 19 cases, is a rough estimate of the true correlation, its low value suggests that future studies should use a matched control design. In such a design the value for each case and its control would be determined in the laboratory on the same day. This procedure would increase the power of the test.

In the analysis of the data the possibility that diurnal variation contributes importantly to the total variance must be considered. As examination of the mean cortisol levels for men on the day and afternoon (swing) shifts suggests that this diurnal variation is present in our sample as well. For the 125 persons on the day shift the mean for serum cortisol is

94.9 (s.d. = 30.6); for the 81 persons on the afternoon shift, the mean is 47.8 (s.d. = 30.7). The difference is significant at $p < .0001$ ($t = 10.72$). No samples had to be excluded on the basis of known disease or medication.

Analysis considerations when using the physiological variables. The analysis, whenever possible, uses the mean of multiple determinations of each person's pulse rate, blood pressure, or serum value. In this way, the reliability of each person's score is maximized.

Analyses of physiological variables in relationship to job demands are complicated by the presence of confounding variables. Circadian and seasonal rhythms are one such class of confounding variables, and age represents another class. We have noted that cortisol varies diurnally in our sample, whereas the thyroid hormones show significant seasonal variation. The seasonal variation of T-3 and T-4I is particularly problematic because different occupations had their blood samples drawn at different times during the five month period (as noted earlier, the eta^2 between occupation and Julian date is .70). Consequently, when one compares occupational groups on mean levels of the hormones, one is also comparing hormones collected at different times in the seasonal cycle and vice versa. While it is desirable either to collect all physiological data from all occupational groups during the same relatively short time period or else to distribute the collection over time equally for all persons in each occupational group, neither of these strategies was feasible in this study. The scheduling needs of the participating sites, and the unexpected time needed to negotiate with reluctant or busy organizations added to the difficulty. As a result, we urge the reader to interpret the data on cortisol, T-3 and T-4I with caution until our future analyses of these data attempt to untangle these confoundings.

Age is another potential confounding variable in the study of physiological variables. In some of our analyses we have examined relationships between predictors and physiological dependent variables within age-stratified groups as a control on the effects of age. We have not used multiple regression techniques to produce age-adjusted scores because there are no simple linear relationships between age and our physiological variables in this study. Instead, in many instances, there are significant, complex, nonlinear relationships which cannot be corrected by such regression techniques. In the subsequent analyses of these data following the completion of this report we shall consider nonlinear multivariate techniques for the statistical control of such confounding variables.

Methods of Analysis

Univariate methods of analysis are used in this report (correlation, _t_ test, chi square, and one way analysis of variance). A two-tailed test of significance is always used. In some cases where a correction for the effects of age is appropriate, such corrections have been made by examining relationships within age groups. Multivariate analyses lie, for the most part, beyond the scope of the current report. The analyses were conducted utilizing the OSIRIS (Institute for Social Research, 1973) and MIDAS (Fox & Guire, 1973) data management and statistical analysis software for computers.

CHAPTER III. RESULTS: INDIVIDUAL LEVEL PREDICTION OF STRAINS

In Chapter I four hypotheses about the relationships between stress, personality, strain, and illness were presented and were illustrated in Figure I-2. The results of analyses to test these four hypotheses at the individual level are presented in this chapter.

Our first hypothesis proposes that job stresses produce strain in the person; the second proposes that personality characteristics also produce strain. The first section of the present chapter considers these two hypotheses simultaneously. In it we examine the consequences of stress and personality for psychological and behavioral strains within the random stratified sample of 318 men for 23 occupations. The second section evaluates these two hypotheses with respect to the consequences for the physiological strains among the 290 men comprising the physiological sample. In these two sections evidence for hypotheses 1 and 2 is examined for each strain in succession. A third section summarizes the psychological stresses with the greatest impact on worker strain.

Hypothesis 3, which states that strains influence illness, is evaluated in the fourth section of the chapter with data from our entire sample of 2010 men. Hypothesis 4 proposes that a P-E fit measure should be a better predictor of strain than is either its component person (P) or environment (E) measures alone. This hypothesis is tested in the fifth section of this chapter.

The sixth and final section discusses the problem of how ecological masking in heterogeneous samples such as the present one may obscure stress-strain relationships. Examples are presented of the types of relationships which can be obscured by such masking.

Because the present set of data is based on a cross-sectional survey rather than a longitudinal or experimental design one must of course be cautious in drawing conclusions about causality from the analyses. Any given correlation coefficient or _t_-test linking a stress and a strain may or may not be an indication that the stress is causing the strain. Some alternative possibilities are (1) that some other confounding stress is causing the strain, (2) that some other variable causes both, (3) that the two variables overlap and to some extent measure the same concept, and (4) that the stress is caused by the strain. When they are available, data bearing on these alternative interpretations are discussed.

The Predictors of Psychological and Behavioral Strains in the Random Stratified Sample

The intercorrelations of the 48 major stress, strain, personality, and demographic variables available for the random stratified sample appear in Appendix G. In order to facilitate the evaluation and interpretation of such a large amount of data (over 1100 correlation coefficients), the following discussion focuses successively on different clusters of strains, beginning with the job dissatisfactions, then moving to the measures of affective states, and finally discussing the health-related behaviors.

Dissatisfactions with the Job

Job stresses are naturally expected to have a major impact on the worker's attitudes and feelings about his job. The present research is concerned with such attitudes and feelings not only because they reflect one aspect of the quality of the men's lives, but also because they are factors whose influence extends to other domains--mental health, physical health, productivity and so forth. The consequences for mental health as reflected in anxiety, depression, and irritation are a major concern in the present study. Previous research has suggested that attitudes toward one's work also take a toll on physical well-being (see Chapter I). Keeping in mind the broad-ranging implications of worker satisfaction and dissatisfaction, we now examine some likely sources of the attitudes toward one's job.

The relation of job stresses to the employee's feelings about the job are presented in Figure III-1. In addition to a general measure of Job Dissatisfaction we have measures of Dissatisfaction with Work Load and of Boredom. We consider these last two more specific measures to be aspects or components of one's overall feeling about the job. Therefore in Figure III-1 the Boredom and Work Load Dissatisfaction measures are portrayed schematically as contained within the general measure of Job Dissatisfaction.

Figure III-1 also presents the other psychological strains, and depicts the major relationships among the different strains and between job stresses and the strains. Only the major correlations are included in the figure (i.e., $|r| \geq .20$ among strains; $|r| \geq .30$ among stresses or between stress and strain). Stresses with only small impact on the strains (i.e., do not correlate at least $\pm .30$ with any strain) are omitted from the figure.

Also missing from Figure III-1 are the Environment (E) and Person (P) indices for Job Complexity, Responsibility for Persons, and Quantitative Work Load, despite their substantial correlations with several strains. Only the P-E fit indices corresponding to these E and P indices appear because it is through their Fit scores that E and P are hypothesized to influence strain. Furthermore, the Fit variables perform better as predictors of the strains (see the P-E Fit Comparison section later in this chapter), and are less dependent on other stresses than are the E and P variables.

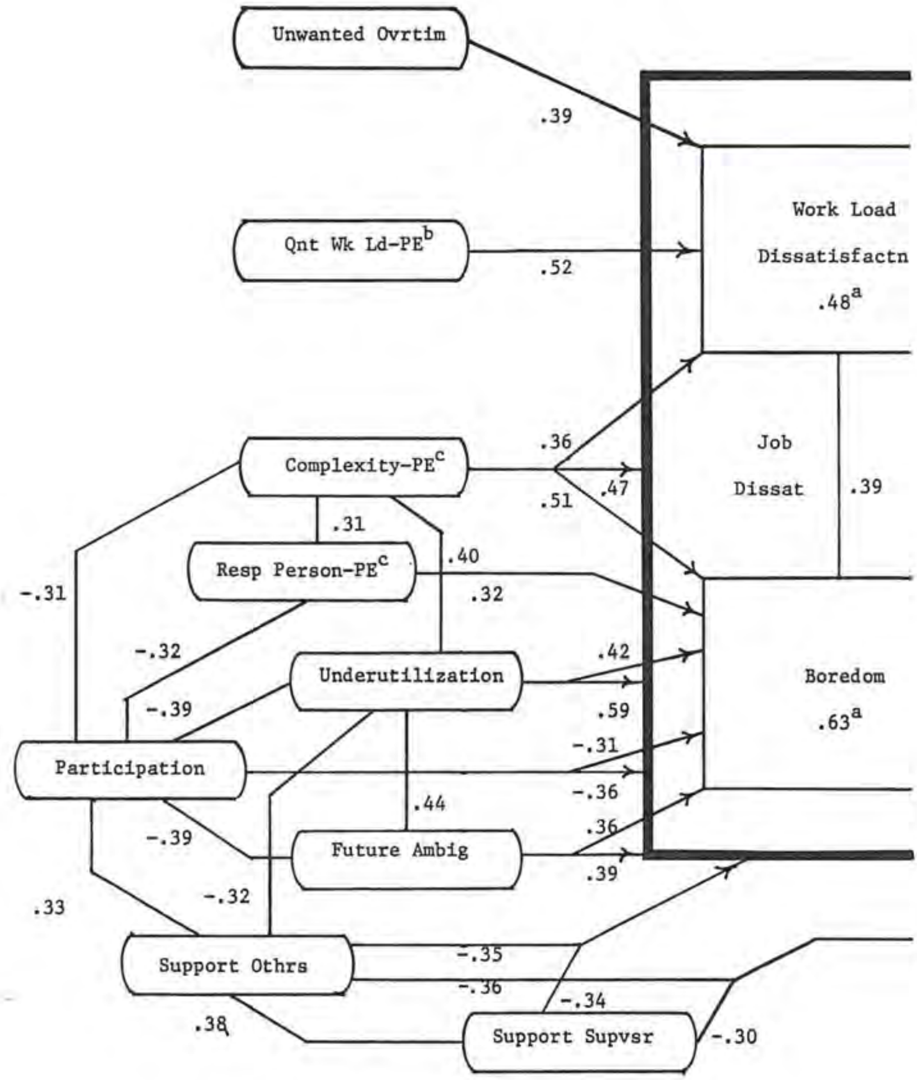
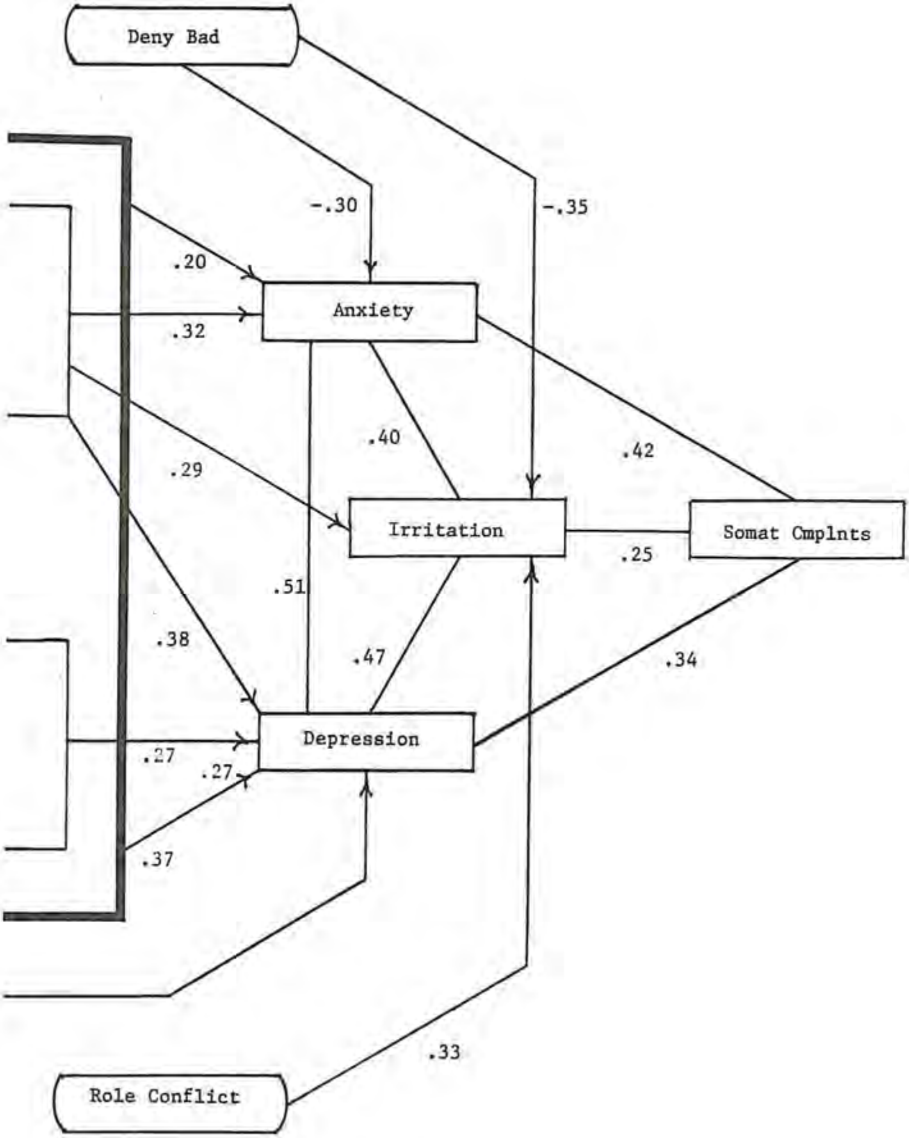


Figure III-1. An interpretation of major correlations between

Note. All correlations are based on approximately 310 men from the random stratified sample. Stress-stress and stress-strain correlations ≥ .30 and strain-strain correlations ≥ .20 are presented (except for the Job Complexity-E and Responsibility for Persons-E indices--see text). Arrows indicate suspected causal relationships; lines without arrow heads are interpreted as non-causal.



stresses and psychological strains at the individual level.

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[a]Correlations with the overall Job Dissatisfaction index.

[b]High Score indicates greater work load than desired; low score indicates less than desired.

[c]High score indicates poor fit (either more or less than desired).

It is possible that correlations between job stresses and job dissatisfactions reflect overlap in the content of the measures. While such an explanation cannot be ruled out, the wording of the stress and strain items was designed so that the former ask for the respondent's description of his environment or his relation to it while the latter items ask for his feelings about these conditions. The causal relations between stress and strain depicted in Figure III-1 follow this conceptual distinction between the men's descriptions of and feelings about their job situations.

Boredom. From Figure III-1 and Appendix G it is apparent that three stresses stand out as the best predictors of Boredom: Underutilization of Abilities ($r = .59$), Job Complexity-Poor Fit ($r = .51$), and Job Complexity-E ($r = -.51$). The four next best stresses all have predictive power of the magnitude $r = .30$ to $.36$: Job Future Ambiguity, Participation, Responsibility for Persons-Poor Fit, and Responsibility for Persons-E. These correlations seem to indicate that the employee who reports a high degree of boredom in his work is especially likely to feel that his skills and abilities are not being utilized, to rate his work low on complexity, and to have a poor fit between the amount of complexity he wants and the amount provided by his job. To a lesser extent the bored worker is likely to score high on uncertainty about the future of his job and career, to be low on participation in the decision-making process on his job, to have little responsibility for other persons, and to have a poor fit between the available and desired responsibility for persons on the job.

Each one of these seven job characteristics is a part of common conceptions of the most boring type of work. However, since all seven of these stresses are considerably intercorrelated (ranging from $r = .23$ to $.54$ in magnitude) some of the stresses may not influence boredom but may correlate with it simply because they are associated with those stresses which do have an impact on the workers' feelings of boredom. The Underutilization and Job Complexity-Poor Fit indices may measure causes of Boredom since excessively simple, repetitive, and unchallenging work is precisely what one would expect to lead to high boredom. On the other hand, future ambiguity and low responsibility for persons may not cause boredom but may simply tend to be found in the same situations where there is little opportunity for utilization of skills and where the work is uncomplicated and boring.

In the case of Participation we have an example of a variable whose correlations with strains may partially reflect its influence on other stresses, e.g., Underutilization. According to this interpretation, participation tends to reduce boredom, but this reduction is produced at least partially through the improved utilization, fit on complexity, and so forth, which participation makes possible. A recent field experiment in our program (Campbell, 1973) found that participation did, over time, seem to influence other stresses. Of particular relevance here is Campbell's finding that participation was associated with later improvement in P-E fit with respect to responsibility for persons (his study did not include measures of underutilization or complexity).

The seven stresses which are associated with high Boredom also show consistent correlations with other variables in the study. Most noteworthy of these other confounding factors are Income, Years of Schooling, and the Duncan Socioeconomic Status (SES) of one's occupation. Income and Schooling may be conceived of as components of the SES ratings since they were taken into consideration in Duncan's rating procedure (Reiss, 1961) and do correlate highly with SES ($r = .53$ and $.72$, respectively) in the present study. The negative relation of SES to Boredom and to stresses is consistently greater than that of either Income or Schooling. Because SES is so highly correlated with some of the major stresses and strain, its correlations with these variables are presented in Figure III-2.

An examination of that figure indicates how strongly some of the relationships between stresses and Boredom are confounded by SES. Whenever a variable confounds a hypothesized causal relationship to such a degree, one must consider the possibility that the causality is not what one has hypothesized. In the present case of Boredom it is possible that some other variables not in the present study but which accompany low socioeconomic status are responsible for high levels of boredom. We currently have no reason for believing such an explanation applies here. Instead it seems most likely that low SES is a non-causal accompaniment of occupations where underutilization is high and complexity is low and that it is largely the presence of these two stresses which results in the high levels of boredom observed in the low SES occupations.

In considering the likely origins of boredom it is interesting to note that the Boredom index is highly related to SES and varies considerably between occupations (occupation accounts for 42% of the Boredom variance). Yet Boredom also ranges widely within occupations. This within-occupation variation in Boredom seems accountable by one of our other stress measures: Job Complexity-Poor Fit. This measure is only moderately related to Underutilization, Complexity-E, and SES ($r = .40$, $-.41$, and $-.31$ respectively). Nor does occupation account for as much of the variance of Complexity-Poor Fit (16%) as it does for Underutilization (39%) or Complexity-E (41%). We can expect to find a separate within-occupation relation between Complexity-Poor Fit and Boredom. Thus although boredom is largely a problem of the low SES occupations, poor fit with respect to job complexity may result in boredom in almost any line of work.

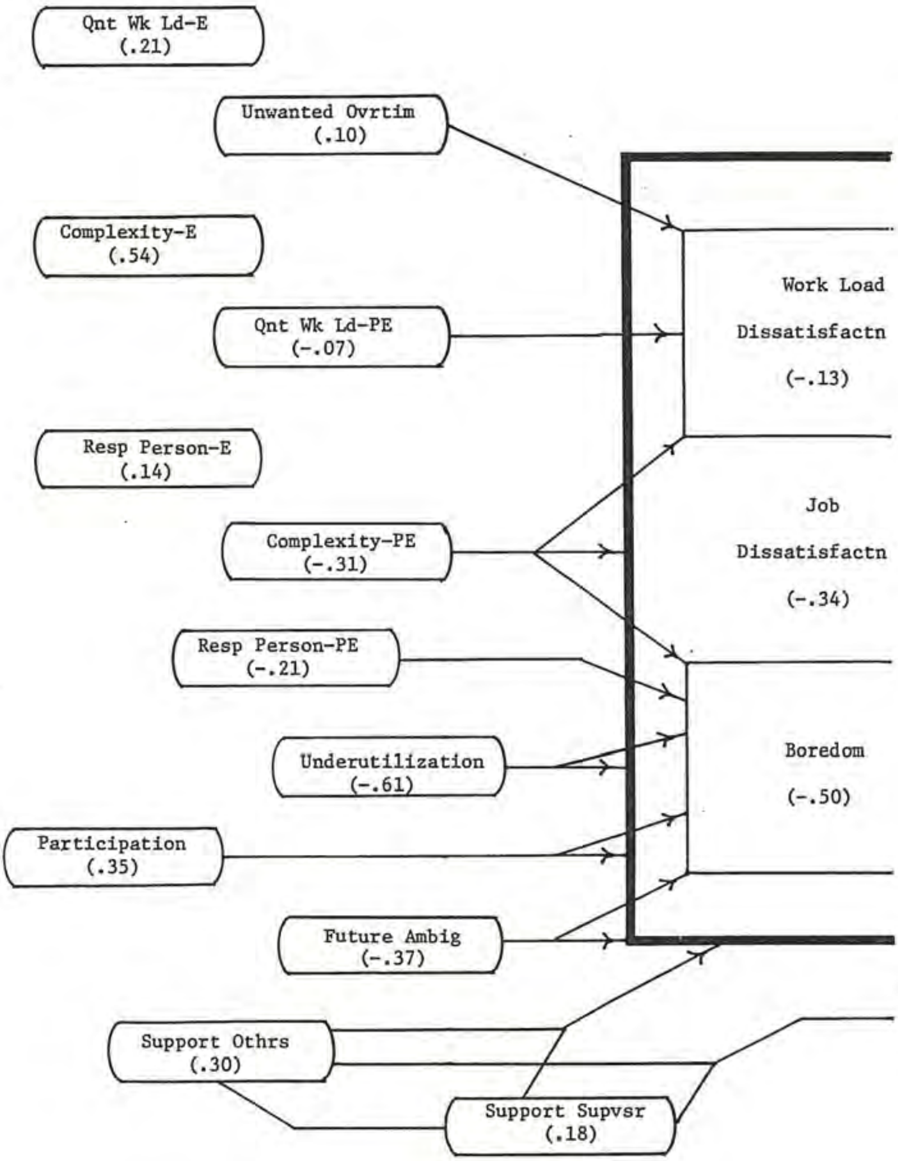
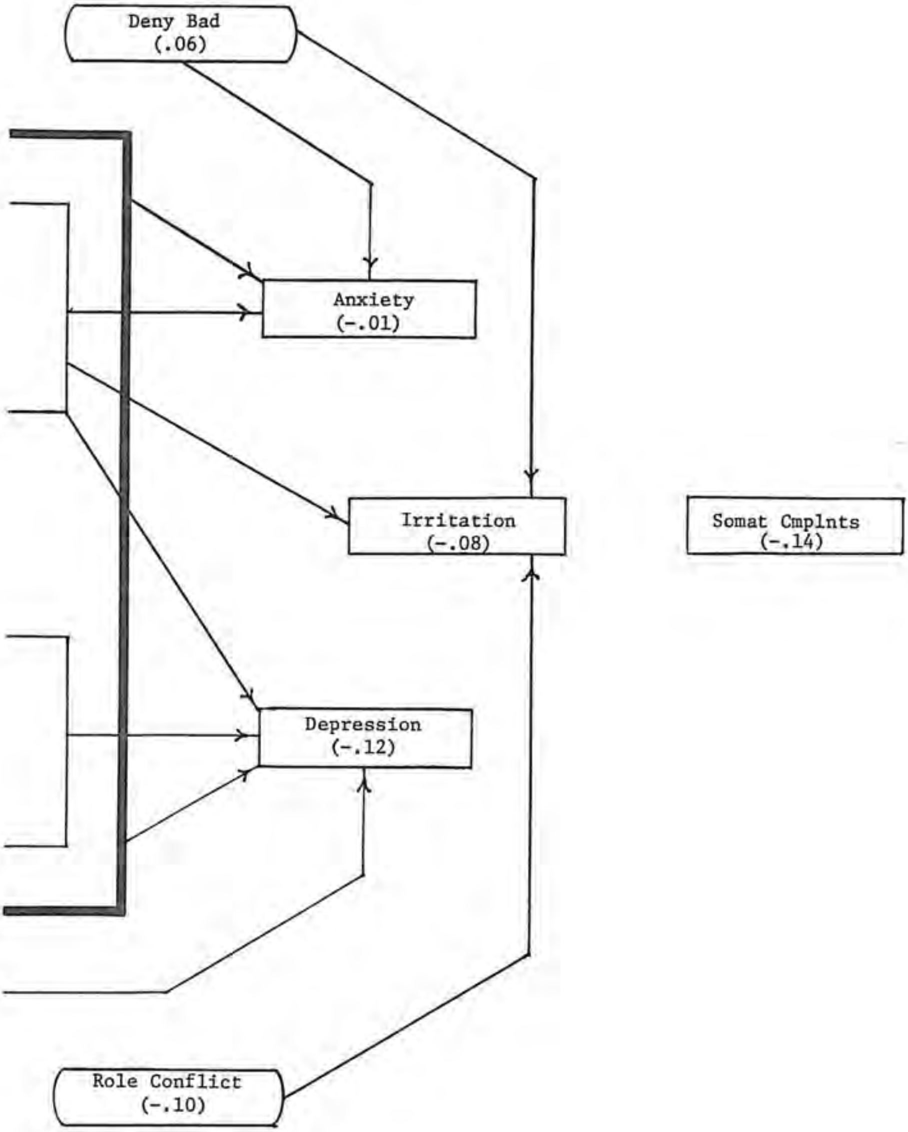


Figure III-2. Correlations of Duncan SES with

Note. Numbers in parentheses are the correlations of the Duncan SES scores with the variable named. Arrows indicate hypothesized causal relationships as presented in Figure III-1. Correlations are based on the random stratified sample of 310 men ($|r| \geq .12$, $p < .05$; $|r| \geq .15$, $p < .01$).



the psychological strains and their predictors.

Work Load Dissatisfaction. As may be seen in Figure III-1, there are three stresses which correlate over .30 with Work Load Dissatisfaction: Hours of Unwanted Overtime ($r = .39$ for those 207 individuals having any overtime), Quantitative Work Load-Fit ($r = .52$), and Job Complexity-Poor Fit ($r = .36$).[1] The E and P components of the Quantitative Work Load-Fit index also correlate with Work Load Dissatisfaction ($r = .33$, $-.34$, respectively). It is the discrepancy between P and E (i.e., the Work Load-Fit index) which seems best to explain Work Load Dissatisfaction (see the detailed comparison between E, P, and fit later in this chapter). This advantage of fit over E and P is consistent with our conception of P and E as affecting strains primarily through P-E fit (cf. Chapter I of this report and French, Rodgers, & Cobb, 1974).

Quantitative Work Load-Fit is the best single predictor of Work Load Dissatisfaction, followed by Unwanted Overtime. While the items in the index of Work Load-Fit requested the respondent's subjective sense of work load, the Unwanted Overtime measure was computed from the respondent's estimates of work load in objective units of time: Hours of Overtime per Week minus the number of those hours respondents said they had wanted to work. Unwanted Overtime correlates only .28 with Work Load-Fit and thus seems to get at another type of demand which has a separate impact on Work Load Dissatisfaction. These two measures of work load might be considered to correspond respectively to (1) demands for more of one's time than one wants to give, and (2) demands for one to produce more in any given period of time than one would want.

The third major predictor of Work Load Dissatisfaction, Job Complexity-

[1] In addition to the subjective measures of quantitative work load, a potential objective measure of quantitative work load was available for the air traffic controllers in the study. A record is kept of the number of aircraft handled at each control tower. The number of aircraft handled at each control tower during the day and evening of data collection was divided by the number of men working at these times to produce a measure of average number of aircraft handled per man, i.e., a measure of the average quantitative work load per man. It was expected that strains would correlate positively with the average number of aircraft handled per man. The few significant correlations which appear are generally either uninterpretable or trivial.

We do not regard this lack of findings as evidence that objective work load is unrelated to health factors. Rather these results seem to indicate that an understanding of the relationship between the objective work load of air traffic controllers and their health requires more sophisticated measures of work load. As noted in the volume by Corson, Bernhard, Catterson, Fleming, Lewis, Mitchell, and Ruttenberg (1970) accurate measurement of controller work load requires one to take into account factors such as airport conditions, weather and equipment. Also, measures of differences in some of these factors would need to be made at the individual level rather than the site level.

Poor Fit, is uncorrelated with the other two predictors ($.10 < r < -.10$, n.s.), and the likely reasons for its predictive power ($r = .36$) are different from the reasons for the power of the work load measures. One possible explanation is that there is an interactive (non-additive) relation between fit on complexity and fit on work load. More specifically, it is possible that poor fit on work load (in the direction of $E > P$, having more work load than one wants) is more stressful when there is poor fit on complexity. In other words, excessive work load is more unpleasant when the nature of the work disagrees with one's desires. This proposition leads to the prediction that Work Load-Fit will show a stronger correlation with Work Load Dissatisfaction when the work is too complex or too simple (i.e., there is poor complexity fit) than when it has the desired degree of complexity. A preliminary examination of data relevant to this prediction was made by dividing the random sample into groups with good and poor fit on Job Complexity. The correlation of Work Load-Fit and Work Load Dissatisfaction was modest for the group with good fit on complexity ($r = .30$), but it was substantially higher ($r = .59$) in the group with poor fit on complexity. These correlations are significantly different in the predicted direction ($p < .005$).

Job Dissatisfaction. The general index of Job Dissatisfaction correlates with Boredom ($r = .63$) and Work Load Dissatisfaction ($r = .48$), with several of the stresses which predict to Boredom, and with two Social Support indices (see Figure III-1). The stresses most strongly associated with Job Dissatisfaction are those which best predict Boredom: Underutilization ($r = .42$ with Job Dissatisfaction) and Job Complexity-Poor Fit ($r = .47$). The two stresses which correlate most highly with Work Load Dissatisfaction, Work Load-Fit and Unwanted Overtime, have fairly low correlations ($r = 19$, $.20$) with the index of Job Dissatisfaction. The present set of correlations suggests that boredom accounts for a larger part of one's feelings of overall satisfaction with the job than does work load dissatisfaction.

It is important to note that Job Dissatisfaction also has a moderate correlation with Socioeconomic Status ($r = -.34$) as do many of its predictors (Figure III-2). This confounding probably reflects the tendency for there to be greater levels of some but not all stresses in the lower status occupations. Although a part of job dissatisfaction stems from environmental situations such as underutilization which tend to be found in the lower status jobs, other factors such as poor fit on job complexity, low social support, and work load stresses may exist and produce dissatisfaction at any level of SES.

The data summarized in Figure III-1 suggest that boredom and work load are major areas of the worker's overall satisfaction or dissatisfaction with his job. Those data also suggest that other factors probably also have a sizable impact on overall satisfaction. One reason for drawing this conclusion is the fact that the multiple correlation of the Boredom and Work Load Dissatisfaction measures with Job Dissatisfaction is only .68 (considerably less than the .85 reliability of the Job Dissatisfaction index). Another reason for looking beyond boredom and work load dissatisfaction is the fact that some of the stresses, such as the Social Support indices, have their highest correlations with Job Dissatisfaction rather than with the Boredom or Work Load Dissatisfaction indices. Even Job Future Ambiguity and Participation, which correlate well with Boredom, show somewhat higher correlations with the Job Dissatisfaction index than with Boredom.

In order to account for additional variance in Job Dissatisfaction it may be necessary to measure stresses not included in this study. Before drawing such a conclusion it will be necessary to discover whether the present set of stress measures provides better predictive power when a thorough (multivariate and interactive) analysis of the data is performed (see also the final section of this chapter on Ecological Masking). Such analysis is forthcoming.

Comparing results from the data on job dissatisfaction obtained by Quinn et al. (1971) for a national probability sample with our sample from 23 occupations, we find some differences. Quinn's data showed underutilization and supervisor support to be predictive of job dissatisfaction in the same directions as our data do. In the national sample, however, supervisor support was the better of the two predictors and was in fact the best predictor of job dissatisfaction (eta = .37, unsigned curvilinear correlation coefficient). This is not greatly different from the results in our sample ($r = -.34$). The better performance of underutilization in our sample ($r = .42$ compared to eta = .25 in the national sample) may be the result of our sample characteristics, especially the relatively large numbers of very highly utilized men (e.g., physicians, professors) and of highly underutilized men (e.g. forklift drivers, machine paced assemblers). Such greater variance in underutilization probably contributes to its importance in accounting for worker dissatisfaction.

Many other results from Quinn's study are not directly comparable to ours because of differing variables and measuring instruments. Portions of our instruments are included in the measures of a later national study (Quinn & Shepard, 1974) and will be available for comparative analyses at a future date.

Affective States and Somatic Complaints

The nature of one's employment conditions constitutes a major source of most Americans' self-images. Because it has such a psychologically central place in the person's life, it naturally has a major impact on the mental health or illness of the worker. To assess the impact of stress on psychological health, the present study includes measures of three affective states (anxiety, depression, and irritation) and a report of bodily symptoms of psychological significance. These affective states are important not only as indicators of mental health and well-being, but also because of the potential psychosomatic impact of mental strain on physical health.

The relations of these strains to the job dissatisfactions (for $|r| \geq .20$) and to their other predictors (for $|r| \geq .30$) are summarized in Figure III-1. The arrows indicating that job dissatisfaction leads to (causes) negative affect reflect our interpretation that attitudes and feelings about the job are likely to be determinants of the person's more general affective states.

The three affective measures and Somatic Complaints are positively associated with each other (r ranges from .25 to .51). Some of this association may be the result of response style or social desirability components common to the four measures. Our measure of denial, Deny Bad Self, provides some evidence of the social desirability type of component. The correlation of Deny Bad Self with Depression ($r = -.26$), Anxiety ($r = -.30$), and Irritation ($r = -.35$) may partially reflect the presence of denial in the way respondents answered the affect items. The magnitude of the correlation of these three affect measures with Deny Bad Self is greatest where all items in the index are negatively worded (the Irritation index) and least where the negatively worded items were partially balanced with two positively worded items (the Depression index). Undoubtedly this bias accounts for part of the intercorrelations of the three measures. The following findings indicate, however, that any response bias in these measures is not so large as to have prevented the measures from showing considerable discriminant validity (Campbell & Fiske, 1959). The measures demonstrate considerable specificity in responding to stresses.

The moderate intercorrelations among the affective measures may also reflect the existence of depression as a syndrome among some of the men. The presence of several individuals displaying such a depression syndrome, including high levels of anxiety, irritation, and depression (depressed affect), would contribute to the intercorrelations of the three affect indices. Although one would not expect many individuals in a sample from an employed population to be suffering a full depression syndrome, future analyses of the data can examine this possibility.

Depression. Our index of depression correlates moderately with each of the measures of job dissatisfaction but shows little relation to those stresses which predict best to the dissatisfaction measures. Among the job stresses, personality characteristics, and demographic variables, only the two work-related Social Support measures show correlations of .30 or better with Depression. These apparent effects of support from supervisor and from others at work are consistent with previous research showing the importance of social support in preventing depression (e.g., Gore, 1973).

The association of Depression with the job dissatisfactions may reflect the effects of depressed states (from any causes) on feelings about one's job as well as the effects of job dissatisfactions on one's depression. It is well established that in clinical depression the individual is likely to report feeling less enjoyment from many activities normally satisfying to him and to feel bored and uninterested in them (Beck, 1973). We have no way presently to determine to what extent our data might reflect the consequences of depression for job dissatisfaction.

Anxiety. Our measure of Anxiety, compared to that of Depression, has a slightly weaker set of correlations with the job dissatisfactions. Only the correlation with Work Load Dissatisfaction exceeds .30. No stress variable reaches that level of correlation, and the Deny Bad Self index is the only notable correlate of Anxiety outside the psychological strains. Boredom is less correlated with Anxiety than is Work Load Dissatisfaction. This does not seem surprising because Dissatisfaction with work load is far more likely to reflect the presence of uncertainty and anticipation (e.g., about performance failures) than is boredom, and these types of negative expectations have often been identified as central to the development and nature of anxiety (e.g., Lazarus, 1966; Lazarus & Averill, 1972).

Irritation. Like Anxiety, Irritation correlates with Work Load Dissatisfaction and with Deny Bad Self. Unlike Depression and Anxiety, however, Irritation correlates well with Role Conflict ($r = .33$). This effect of conflicting demands from one's role senders is predictable since interpersonal difficulties may be expected to produce irritation. Similarly, the negative association of Irritation with Social Support from Supervisor and from Others at Work, though not great, is in the expected direction ($r = -.21$ and $-.22$, respectively; $p < .0005$).

Few stresses correlate high enough with the affective measures or with Somatic Complaints to warrant inclusion in Figure III-1 (i.e., $|r| \geq .30$). Yet there are several instances of low-level correlations ($.20 \leq |r| \leq .29$, $p < .0003$) between these strains and stress variables (e.g., Work Load-PE, Unwanted Overtime, and Role Conflict; see Appendix G). Taken individually these relationships provide little predictive power, but they can be expected to add significantly to multivariate prediction of the affective strains.

Health Related Behaviors and Obesity

Psychosocial job stresses may impact on health through overt behavioral responses to such situations. The amounts and types of food and drug consumption are variables with which we are concerned because of their health implications. In the present study we have measured smoking, caffeine consumption, Dispensary Visits, and Obesity. All these health related measures have consistently low levels of correlation with other variables.

Smoking and caffeine. An examination of the smoking variables reveals a significant difference in education between smokers, ex-smokers (those who used to smoke but have quit), and those who never smoked (see Table III-1). The data from our sample indicate that apparently men with less education are more likely to start smoking and less likely to stop once they have started. There is little evidence that the amount of smoking depends on education, since for those 126 men who currently smoke, Number of Cigarettes Smoked correlates only $-.16$ ($p < .07$) with Years of Schooling.

SES and Flexibility also differ between these three smoking groups, but these differences are less significant, statistically, than the educational differences. The fact that both SES and Flexibility are highly related to Years of Schooling ($r = .72$ and $.47$, respectively) suggests that their differences between smoking groups may be attributable to their association with education.

There is a consistently positive relation in our data between smoking behavior and caffeine consumption. Table III-1 shows that rates for consumption of both Coffee and Caffeinated Drinks are highest for current smokers and lowest for those who never smoked. Furthermore, among those subjects who average one or more cigarettes per day, Number of Cigarettes Smoked is positively associated with both Cups of Coffee and Caffeinated Drinks ($r = .38$ and $.39$, respectively; $p < .0001$ for both). These associations between smoking and caffeine consumption are independent of any educational effects since Years of Schooling is not significantly related to either Cups of Coffee or Caffeinated Drinks. Caffeine and nicotine consumption may both reflect a motive which has been termed "arousal seeking" (see Schubert, 1965).

The stresses and psychological strains show only minor differences (attributable to chance variation) between the Smoker/Ex-Smoker/Never-smoked groups. None of them correlates significantly with Number of Cigarettes Smoked. Similarly, the caffeine consumption variables are not predictable from any of the psychological variables (stress, personality, or strain) in the random stratified sample.

Obesity. Our measure of obesity shows no significant correlates, but does have significant occupational differences which are discussed in Chapter

Table III-1

Significant Differences between Men Who Smoke, Who Have Quit Smoking, and Who Have Never Smoked

Variable	Mean Values			F	p <
	Smokers (N=155)	Quitters (N=78)	Never Smoked (N=83)		
Schooling[a]	13.5	14.9	15.4	14.4	.0001
SES	49.6	57.9	58.6	4.8	.009
Flexibility	2.18	2.30	2.40	4.9	.009
Cups of Coffee	3.82	3.00	2.25	7.9	.0005
Caffeine Drinks	4.96	3.88	3.75	5.0	.007

[a]In number of years.

IV. Here again future analyses within occupations will be necessary for us to determine whether this strain is influenced by specific stresses in some occupational groups.

Dispensary visits. In these first correlational analyses, neither of the two variables measuring recency of dispensary visits shows any noteworthy correlations with the psychological measures. This lack of relationship exists despite occupational differences in dispensary behavior (discussed in Chapter IV). We may expect that the predictors of dispensary visits also differ between occupations and between sites. Such differences are likely to occur not only because of differences in physical conditions which might instigate dispensary visits but also because of social class and even local differences in norms about how one ought to deal with physical symptoms. The presence of such occupational differences may obscure the relationships of stresses to dispensary visits within the random sample. Within-occupation analyses at some future date should shed more light on the susceptibility of dispensary visits to job stresses.

Predicting Psychological and Behavioral Strains--Discussion

In accord with Hypothesis 1 we find that many of the job stresses (both subjective environment and P-E fit) are associated with high levels of certain strains. Also as predicted, there is considerable specificity in the relation of stresses to strains. For example, Underutilization is associated with high Boredom but not with high Work Load Dissatisfaction; Hours of Unwanted Overtime correlates with Work Load Dissatisfaction but not with Boredom.

Our second hypothesis, that personality characteristics influence strain, does not find strong support in the present analysis of our data. Our prediction of greater strain among Type A individuals is not substantiated by correlations with the psychological-behavioral strains. In accordance with our predictions, defensive people (high Deny Bad Self scorers) do tend to have somewhat low levels of psychological strain, although it is possible that this relationship exists only because the defensive subjects were denying their dissatisfactions and unpleasant feelings as they filled out the questionnaire. The general lack of first order relationships between personality and psychological-behavioral strains is congruent with our previous findings. Often in the past it has been necessary to examine personality as one type of factor in a multivariate interactive analysis (e.g., Caplan, 1971; Cobb, 1974b). The present set of analyses were not designed to account for these more complex relationships.

To summarize the types of relationships described in the first section of the chapter, our set of measures most easily predict the strains which are most closely related to men's work: Boredom, Work Load Dissatisfaction, and overall level of Job Dissatisfaction. As expected, the measures of more general affect such as Depression and Anxiety are less highly associated with stresses on the job. Certainly this result is expected since factors outside one's job will influence one's affective condition.

In general, Somatic Complaints, Smoking, and other health related variables are the least predictable strains. We have little information from previous studies regarding the effects of job stresses on these strains. Perhaps several of these strains will prove to depend on interactions between stresses and personality variables. Past data on cigarette smoking (Caplan, 1971) present examples of such interactive processes.

The magnitudes of the stress, strain, and personality interrelationships in the present data set are not always great. We view the apparent lack of strong relationships for some strains as largely due to the limited types of analysis which we have performed to date. The fact that complex interactions and occupational differences are not considered in the above results means that the correlations presented probably underestimate considerably the magnitude of the actual (multivariate and interactive) relationships between stress, personality, and strain.

Predictors of Physiological Strains

The correlations of psychological and behavioral variables with the physiological strains appear in detail in Appendix H, with the major correlations also appearing in Table III-2. The data were obtained from the sample of 390 men who volunteered to have their blood pressure measured and a sample of their blood drawn. In interpreting the correlations discussed in this section the reader should note that some variations in sample size occur from correlation to correlation (as indicated in Appendix H) because of missing data. The reader should also be aware of the likelihood that some of the relationships described are attenuated by the limitations of first-order, linear correlation coefficients as well as by occupational differences. These problems of attenuation are discussed more fully at the end of this section of the chapter.

Heart Rate

The major correlates of heart rate are the smoking variables. Number of Cigarettes Smoked in the Last Four Hours preceding data collection is the best single predictor ($r = .41$). Caplan (1971) and House (1972) both found similar correlations of heart rate with cigarette smoking.

There is a slight association in our sample between heart rate and Caf-

TABLE III-2

Major Correlations of the Physiological Variables[a]

		1	2	3	4	5	6	7	8	9	10	11
1	Heart Rate	--										
2	Systolic BP	.20	--									
3	Diastolic BP	.13	.61	--								
4	Cholesterol	.13	.20	.25	--							
5	Cigs 4 Hours	.41	.18	.06	.08	--						
6	Caffein 4 Hours	.13	.09	.11	.02	.31	--					
7	Obesity	.05	.30	.32	.22	.01	.06	--				
8	Age in Years	.07	.06	.14	.27	-.13	-.09	.13	--			
9	Schooling	-.09	-.27	-.22	-.02	-.25	-.15	-.15	-.02	--		
10	Hours of Work	-.03	-.18	-.08	.02	-.10	-.10	-.09	.06	.48	--	
11	Role Ambiguity	-.07	-.14	-.11	.01	-.09	-.13	-.01	.04	.26	.30	--

[a]Correlations are taken from Appendix H; N varies from 271 to 380 as shown in Appendix H. Two-tailed significance for the .05 level requires a correlation of approximately .11, and for the .01 level a correlation of approximately .14.

feinated Drinks in the Last Four Hours (r = .13) which may be due to the correlation between Caffeinated Drinks and Number of Cigarettes (r = .31) rather than to a separate effect of caffeine on heart rate. In any case, the positive relation of cigarette and caffeinated drink consumption to heart rate is consistent with the known effects of caffeine and nicotine.

Blood Pressure

Systolic and diastolic blood pressure are moderately correlated (r = .61) and share several correlates in common. Both the systolic and diastolic blood pressures correlate moderately with the Obesity Index (r = .30, .32) and with Years of Schooling (r = -.27, -.22). The correlations with Obesity are similar to those we observed within NASA for scientists, engineers, and administrators (Caplan, 1971).

There are some differences between systolic and diastolic blood pressure in the degree to which they correlate with other variables. For example, we find a somewhat higher correlation of systolic blood pressure with heart rate (r = .20 versus .13) and with Number of Cigarettes Smoked in the Last Four Hours (r = .18 versus .06). These correlations are somewhat lower than those found at NASA by Caplan. Caplan found that both systolic and diastolic blood pressure were well correlated with heart rate (r = .30 and .31, respectively). For the NASA subjects who did smoke, Caplan found cigarette consumption also correlated with systolic and diastolic blood pressure (r = .32 and .21, with N = 52). Being limited to smokers, however, Caplan's correlations between smoking and blood pressure are based on a considerably smaller sample and are lower in statistical significance ($p < .02$ and .14, respectively).

The negative correlations of Schooling with blood pressure in our sample appear to be partially a result of the greater obesity and higher cigarette consumption among the less educated men (Schooling is correlated with Obesity, r = -.15, and Cigarettes, r = -.25). Stresses which directly influence blood pressure may also be greater in the jobs of the less educated men and thus further account for the correlation of blood pressure with Schooling. However, the stresses in our study which most highly confound the education-blood pressure relationship are even less correlated with systolic blood pressure (Role Ambiguity-E, r = -.14; Hours Worked per Week, r = -18) than is Schooling (r = -.27). The significant correlations of systolic blood pressure with Hours of Work and with Role Ambiguity-E may be merely artifacts of their associations with education (r = .48 and .26, respectively). Other correlations of stresses with the blood pressures are barely significant and may be chance events.

Serum Cholesterol

In agreement with Caplan's (1971) findings, our data show that cholesterol is most highly correlated with age ($r = .27$). We also find that in our sample cholesterol is significantly related to diastolic and systolic blood pressure and to obesity ($r = .20$, $.25$, and $.22$, respectively), whereas Caplan found nonsignificant relations ($r = .17$, $.16$, and $-.09$, respectively) between cholesterol and these variables. Although Caplan's sample was restricted to a more homogeneous set of occupations (administrators, scientists, and engineers), the explanation for these differences is not immediately apparent. In a heterogeneous sample similar to ours, House (1972) found that age-adjusted values of cholesterol were unrelated to systolic and diastolic blood pressure (both age-adjusted; $r = .06$ and $.04$, respectively; $N = 288$).

No measure of stress, personality, or psychological strain correlates convincingly with cholesterol. The set of such correlations shows only about the number of significant correlations to be expected by chance. Even the Sales measure of Type A Personality, designed to tap individual tendencies toward Friedman and Rosenman's Type A "coronary prone" behavior pattern, shows only a borderline correlation ($r = .12$) with cholesterol. Stress and personality effects on cholesterol may operate differently at different ages and thus be obscured in the present analyses. An analysis of this possibility will be essential during the next phase of data analysis.

Serum Cortisol

Another measure of physiological strain which shows a significant number and magnitude of correlations with the demographic, environmental, and personality variables is serum cortisol. In fact five of the 31 correlations of cortisol with these three types of predictors are significant at the .01 level, more than for any other physiological measure (see Appendix H).

Unfortunately the meaning of these correlations is highly uncertain because cortisol is subject to considerable diurnal variation, the serum values reaching a maximum in the morning and declining through the day and evening. Thus the subjects who worked during the day and had their blood sample drawn during the morning or afternoon had significantly higher cortisol values than did the evening workers ($p < .0001$). Perhaps the modest but significant positive correlations of cortisol with Age, Schooling, Hours of Work, Hours of Overtime, and Equity of Income represent the effect of their confounding with time of day. Testing the differences of these demographic and stress variables for the day and evening workers shows that these variables, like cortisol, are considerably higher in the day shift workers ($p < .0001$ in each case) than in the evening workers. These differences in psychological and environmental characteristics exist probably because three occupations, administrators, scientists, and electronic technicians were collected solely during the day, while two others, large airport air traffic controllers and machine paced assemblers were often collected during the evening. An examination of the occupational means in Table IV-15 shows that the ATC's and assemblers are much lower on the correlates of cortisol than are the occupations of administrator, scientist, and electronic technician--thus supporting this explanation.

In conclusion, given this magnitude of confounding, the present data do not confirm or deny the existence of any causal relationship between cortisol and its stress or demographic correlates. Only when later analyses are performed, controlling for diurnal variation, will we be able to make judgments about such causality.

Thyroid Hormones

There are some correlations between thyroid hormone T-3 and our questionnaire measures which demand attention. The highest and most interesting of these is the correlation between T-3 and Years of Schooling ($r = .28$). Flexibility, being a correlate of Schooling ($r = .32$) also shows a significant relation to T-3 ($r = .15$). Before attempting to make any type of psychophysiological interpretation of these correlations, possible confounding factors must be considered, as was necessary in the case of cortisol.

The greatest potential for confounding of T-3 correlations comes from the seasonal variation of this thyroid hormone (discussed in Chapter II). Because of the temporal arrangement of our data collection, Schooling and Flexibility show seasonal differences in our sample which parallel those of T-3. Schooling correlates more highly with Julian date of collection than it does with T-3 ($r = .43$ and $.28$, respectively), and Flexibility correlates about equally with both ($r = .14$ and $.15$ respectively). Since T-3 is correlated .34 with date of collection, its correlations with Schooling and Flexibility cannot be interpreted as evidence of any causal relations.

The other correlations of T-3 with environmental stresses and with personality measures appear to be only chance level statistics. The significant negative correlation with age ($r = -.18$) has no apparent psychological interpretation and partially represents confounding with collection date. The correlation of T-3 with Number of Cigarettes smoked in the Last Four Hours ($r = -.15$) is another effect of the confounding between T-3, Schooling, and collection date, since smoking is associated with lower levels of education ($r = -.25$).

The correlations of some psychosocial variables with our other measure of thyroid functioning, T-4I, are statistically significant, but quite low in magnitude ($-.12 \leq r \leq .16$). These correlations (e.g., with Role Ambiguity, $r = .16$) also appear to be attributable to a confounding with seasonal variation.

Predicting Physiological Strains--Discussion

The univariate correlational analyses performed on the present data set provide little support for Hypotheses I and II (Chapter I) about the effects of environmental stresses and personality on physiological strains. The highest correlations between these predictors and the physiological strains seem to be attributable to confounding by variables such as smoking, education, and diurnal or seasonal variation.

The negative results are not surprising. In previous research we have found that the relations of stress and personality with strains are often complex (cf. Caplan, 1971). For one thing, the stresses do not necessarily combine additively; they often interact. Nor are the relationships always linear, especially where physiological parameters are involved. Furthermore, it may be necessary to control for other variables such as seasonal or diurnal variation (see Chapter II) or age in order to uncover the stress-strain relationships. The control of these variables may require more than the use of partial correlations since some of these relationships are also non-linear.

Our difficulties are not eliminated simply by devising curvilinear means of adjusting for variables such as age. There may be reasons for not making such adjustments. An example of such a reason may be found in the case of age and blood pressure. By looking ahead to Tables IV-7 & 8 one sees the occupational differences in the way blood pressure varies with age. Systolic blood pressure, for example, increases with age in most occupations but tends to decrease slightly in at least one occupation (administrators). The question must be raised as to whether we want to adjust blood pressure for the general age effects (averaged across all occupations) or whether we want to select an analysis technique which considers occupational differences in the way blood pressure changes over time. Such possible differences could reflect the cumulative effects of exposure to differing occupational stresses over time and thus are central to the hypotheses of the present research. When we perform analyses in which all occupations are combined, such differences are "masked." This problem of ecological masking of occupational differences is discussed further in the final section of this chapter.

Our intention in enumerating the complexities facing the analysis of these physiological data has been to discourage the reader from drawing hasty conclusions from the correlational findings we have presented. While those findings seem to suggest that psychosocial factors have little or no impact on physiological functioning, we would argue that no such conclusion should be drawn. Experimental studies have already firmly established the significance of psychosocial dimensions for human physiology (e.g., Levi, 1972; Mason, 1973; Obrist, Black, Brener, & DiCara, 1974). We believe that the complexities of our data reflect the complexities of social and of psychophysiological processes and require sophisticated and sensitive multivariate analysis. With proper attention to such detail (e.g., Caplan, 1971; Cobb, 1974b; Gore, 1973) we expect to untangle some of these complexities for a future report.

The Stresses Most Highly Related to Strains

In the preceding sections we have examined each of the strains measured in this study and discussed the variables which appear to cause them. Preparatory to proposing programs of primary prevention it is crucial to determine the overall significance of each of the numerous stresses as a source of strain and illness. In the present section we shall reexamine the relationships already presented, with the goal of assessing which stresses most need to be alleviated because of their consequences for mental and physical health. These assessments are necessarily tentative as they apply only to our random sample composite of 23 occupations. Our judgments may change to some extent with further analysis, especially with consideration for occupational differences. With these cautions in mind it is possible to discern that particular stresses do stand out strongly in these early analyses.

Underutilization of one's skill and abilities and poor fit with regard to job complexity appear as especially serious problems. They are the stresses most strongly correlated with Job Dissatisfaction ($r = .47$ and $.42$, respectively). Participation and Future Ambiguity also have major correlations with Job Dissatisfaction ($r = -.36$ and $.39$, respectively). These four primary stresses tend to be found together and are greatest for the low socioeconomic occupations. They are associated not only with the measure of general Job Dissatisfaction but also with the Boredom index, and, in the case of poor fit on complexity, with Work Load Dissatisfaction.

Social support appears to be another variable of major importance to the psychological well-being of the workers in our sample. Low Support from Supervisor and from Others at Work are associated not only with Job Dissatisfaction but also with Depression. These two support variables are the only stresses to correlate at or above .30 with Depression. Social support is a variable of especial significiance because a program for primary prevention of job-related strains may often be able to increase the supportiveness of interpersonal relations in technologies where the job tasks themselves are not easily changed.

Role Conflict is also a noteworthy stress because it is the stress most highly associated with Irritation (r = .33). Although it is not highly related to the measures of job dissatisfaction, it correlates more consistently with Anxiety, Depression, and Irritation, than does any other stress. It is also the only stress to correlate at or above .20 with Somatic Complaints (r = .25). Role conflict, like social support, may sometimes be a problem which one can address through organizational and interpersonal adjustments which do not require alterations in the technology of the occupations.

Two other stresses related to work load also warrant attention. Both the amount of unwanted overtime and the subjective sense of quantitative work overload show substantial positive correlations with Work Load Dissatisfaction (r = .39 and .52, respectively). Although the effects of these variables on the global Job Dissatisfaction measure are apparently not great (correlations of .20 and .19), these overload measures are related to the affective strains. Aside from the Support and Role Conflict measures, these two stresses appear to have the greatest impact on the affects. The effects of subjective quantitative work overload are primarily evident with depression and irritation (r = .27 for both), while the effects of unwanted overtime seem to lie with anxiety (r = .21) and irritation (r = .20).

We have just seen that four different groups of stresses have considerable effects on the mental health of the workers we have studied. In the analyses to date we have not yet been able to determine that certain of these stresses have definite consequences for the physical health of the workers. Yet because these four types of stresses have considerable consequences for the workers' attitudinal and emotional states, it is these four areas which must be prime suspects in our further analysis with health variables.

Reported Illnesses

Hypothesis 3 in Chapter I postulates that high levels of psychological, physiological, and behavioral strain will cause higher rates of reported illness. We do not have data on all recent illnesses in our sample or on all occurrences of any particular illness. We have instead approximate measures of the health problems of the respondents--the reason for the most recent visit to doctor and reasons for any current medical treatment.

Four illness categories discussed in the medical literature in relation to psychological stress and strain appear in our data with sufficient frequency to permit analysis: Cardiovascular Disease (includes hypertension), Respiratory Infection, Gastrointestinal Problems, and Peptic Ulcer. These illnesses were first examined for evidence of age differences. As can be seen in Table III-3, Cardiovascular Disease is reported significantly more often among men aged forty years and above than by men under forty (12.5% and 2.6% of the men, respectively). This age difference may be interpreted as some evidence for the validity of the illness reports. Respiratory Infections are <u>less</u> common among the older workers (12.7% compared to 21.1%). The frequency of Gastrointestinal Problems and Peptic Ulcer do not differ between the age groups.

Obesity is probably the strongest example of a strain which predicts to an illness. As a well-documented risk factor in heart disease, the index of obesity should be greater among the men reporting Cardiovascular Disease. Our data do show a significant ($p < .0001$) difference of that type. This finding provides further evidence of validity for the men's illness reports.

Anxiety is the psychological strain which is most striking in its relation to illness variables. The Anxiety scores are significantly higher ($p < .003$) among the men who report Gastrointestinal Problems (including diarrhea, constipation, colitis, gall bladder, nervous stomach, stomach trouble, etc.) than among men who do not report such disorders. For the under-forty years group, Anxiety is also higher ($p < .002$) among men reporting Peptic Ulcer, but there is no difference for the older group. These findings support Hypothesis 4, but one must be cautious about assuming that anxiety <u>causes</u> the illness. Not only is a state of anxiety capable of influencing visceral processes, but judgments about one's anxiety may be influenced by cues from one's body (Schachter, 1971). It is also possible that <u>knowledge</u> that one is ill (e.g., has an ulcer) may itself be a <u>source</u> of anxiety (about one's health). Despite the difficulty of drawing causal conclusions from cross-sectional data, the present findings of an association of Anxiety with Gastrointestinal Problems and with Peptic Ulcer suggest that we may succeed in identifying conditions in the job environment which play a causal role in these two types of ailments.

There are negative and significant relationships of reported Respiratory Infections with Income ($p < .0001$), Duncan SES ($p < .0001$), and Years of Schooling ($p < .002$). The lower socioeconomic status (reflected by these variables) of individuals recently having respiratory Infections (including colds, coughs, flu, sinus problems, sore throats, etc.) immediately suggests that they suffer from greater exposure to the elements and also from more contact with a variety of people. The influence of exposure and contact will be seen again in the data on occupational differences (Chapter IV).

There are other instances in the present data where a stress or strain variable differs between men reporting and men not reporting the different types of illness. In several cases the group reporting Cardiovascular

Table III-3

Illness Rates by Age Group

Illness	Age < 40 years (N = 1027)	Age $\geq$ 40 years (N = 969)	χ^2	p<
Cardiovascular Disease	2.6%	12.5%	71.6	.0001
Respiratory Infections	21.1	12.7	25.0	.0001
Gastrointestinal Problems	4.7	5.2	0.4	N.S.
Peptic Ulcer	1.2	1.8	1.6	N.S.

Disease has a higher level on a stress or strain but also has significantly greater variance on that stress or strain. When the difference in variances is considered, the mean differences are non-significant. In a few other cases we find a lower variance in a stress or strain among the men reporting treatment for the disease. Such distributional differences, together with some nearly significant mean differences, may later prove interpretable through non-parametric analysis.

Comparison of Commensurate E, P, and P-E Fit Measures

Hypothesis 4 states that a person-environment (P-E) fit measure will predict strain better than either its corresponding environment (E) or person (P) measures. Measures of E predict strain from the level of environmental characteristics, ignoring information concerning the person's preferences for these characteristics. Measures of P predict strain from the level of a person's preferences, ignoring information concerning his environment. Measures of P-E fit, however, predict strain from the discrepancy between the characteristics in a person's environment and his preference for them. Because P-E fit measures take into account the interactions between the environment and the person, they are theoretically expected to predict strain better than measures of either E or P.

An example of the superior predictive ability of a P-E fit measure is found in the relationships between Depression and the E, P, and P-E fit measures of Job Complexity. Figure III-3 illustrates the relationships between Depression and the Job Complexity-E and Job Complexity-P. Neither of these relationships reaches the .05 level of significance. Knowing either the level of complexity in the job or the worker's preferences for complexity in his job does not provide adquate information to predict whether or not he is likely to be depressed. By understanding the impact of environmental characteristics in relation to the person's preferences for them, however, predictions concerning depression can be made.

When the level of complexity present in a job matches the level of job complexity preferred by the person (i.e., E = P), strain associated with job complexity should be at a minimum. Too little job complexity (E < P) suggests that the person finds his work overly simplified and routine, with higher levels of strain likely to result. On the other hand, a job which is too complex for the person (E > P) may result in threat of failure which also produces higher strain. This curvilinear (i.e., U shaped) relationship is illustrated by the dotted line in Figure III-4. The solid line in this figure presents the relationship between Depression and P-E fit on Job Complexity actually observed in the stratified random sample. The observed relationship is significant ($p < .002$) and generally parallels the theoretical curve with depression lowest at the point of perfect fit and increasing as misfit increases in either direction.

House (1972) compared the ability of measures of motivations, gratifications, and the fit between them to predict several psychological strains. He compared the effects of measures of motivations and of gratifications. The former are somewhat comparable to measures of preference of the person and the latter are somewhat comparable to our measures of the environment. When he compared the ability of motivations, gratifications, and the fit between them to predict psychological strains, he found that the gratifications (E measures) predicted them better than the fit measures. House attributes the comparative weakness of the fit measures to the methodological problem of contamination of the measures. For example, when asked about the extent to which a job involves interesting work (a gratification) the worker is likely to respond in terms of how interesting the work is to him. This response is contaminated by the individual's perception of his fit with the job. (The effects of contamination are discussed in more detail at the end of this section.)

Caplan (1971) and Vickers (forthcoming; see also French, 1973) attempt to provide a better test of the relative predictive ability of E, P, and P-E fit measures by using less contaminated measures of environmental characteristics and personal preferences. The participants in these studies were scientists, engineers, and administrators at NASA space flight centers. The studies found that even though the P-E fit measures usually showed weaker relationships with strains than the E measures, the P-E fit measures generally explained some variance in strains not accounted for by the E and P measures. These comparisons of the E, P, and P-E fit measures are inconclusive, however, because the range of P-E fit scores reported by the participants was limited, probably reducing the observed predictive strength of the P-E fit measures. The lack of range in P-E fit scores was attributed to the relative homogeneity of environment and personality characteristics of NASA scientists, engineers, and administrators compared to the diversity of environment and personality characteristics in the general working population.

The present study, in contrast to these previous studies, uses some measures which are less likely to be contaminated and it includes participants from a wide range of work environments and with a correspondingly wide range of personality characteristics. Both a good range and distribution of scores were obtained across the E, P, and P-E fit measures included in the present study. At least 25% of the random sample scores for each P-E fit variable are distributed across two or more standard deviations on either side of the point of perfect fit ($E - P = 0$). These E, P, and P-E fit mea-

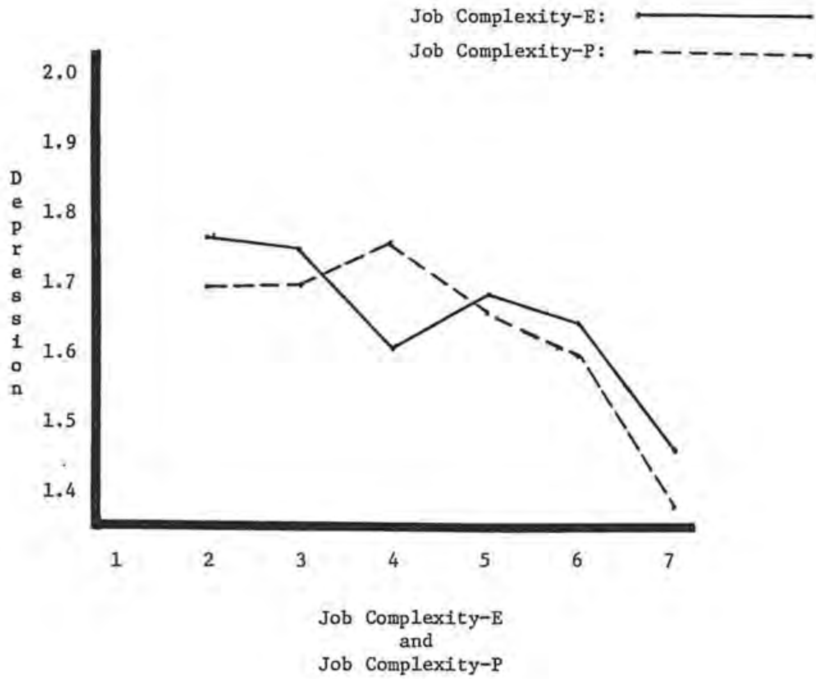


FIGURE III-3. Relationships between scores on Depression and scores on Job Complexity-E and Job Complexity-P. These relationships have eta values of .14 (N.S.) and .19 (N.S.) respectively, and are based on the random stratified sample.

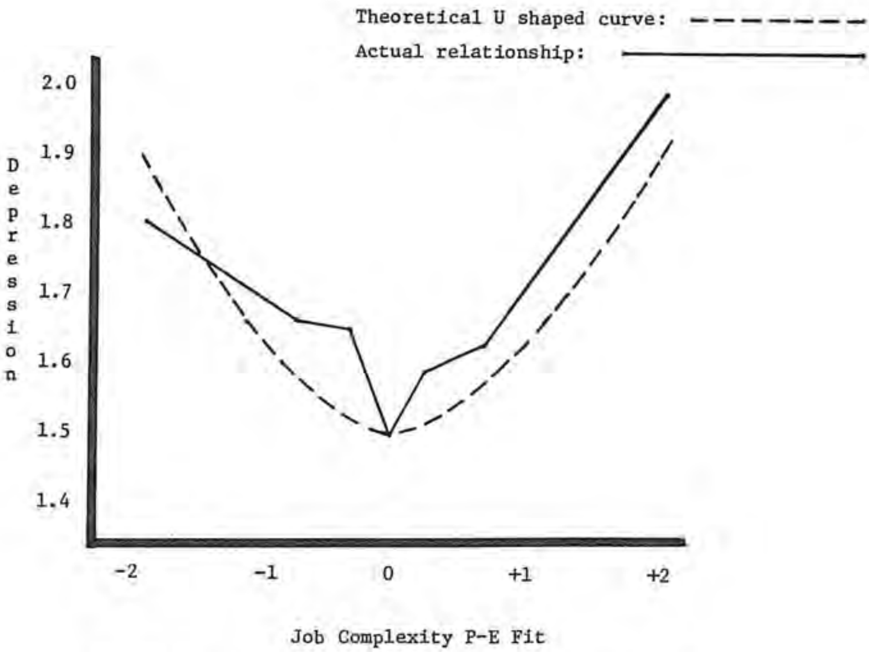


FIGURE III-4. Theoretical and actual relationships between Job Complexity P-E Fit and Depression. The actual relationship has an eta value of .26 ($p < .002$) and is based on the random stratified sample.

sures can be compared across the full range of their possible scores, permitting broader conclusions to be drawn about their comparative usefulness in predicting strain than was possible in previous studies.

Method of Comparing Commensurate E, P, and P-E Fit Measures

As mentioned in Chapter II and described in detail in Appendix D, the P-E fit measures in this study were examined to determine the pattern of their relationships with strain. The P-E fit indices of Job Complexity, Responsibility for Persons, and Role Ambiguity were found to have curvilinear relationships to strains similar to the relationship illustrated in Figure III-4. Since a measure must have a linear relationship with strain for correlational analysis to be appropriate, these three P-E fit measures were transformed by taking the absolute value of the fit item scores constituting these indices. This transformation produced a set of indices with linear relations to strains. The indices have a low value of "0", representing perfect fit, with increasing score values reflecting increasing discrepancy between the person and the environment ($E < P$ or $E > P$), i.e., poor fit. The transformed indices were labeled Job Complexity-Poor Fit, Responsibility for Persons-Poor Fit, and Role Ambiguity-Poor Fit. An additional P-E fit measure, Quantitative Work Load-Fit, was found to have a linear relationship with strains so no transformation of this index was necessary. A low score indicates work underload ($E < P$), a midrange score indicates good fit on work load ($P = E$), and a high score indicates work overload ($E > P$). The four fit measures with linear relations to strains have been used in the correlational analyses presented in this report.

Hypothesis 4 can be tested by comparing the correlations of the E, P, and P-E fit measures with strains. The correlations between the various E, P, and P-E fit indices and all of the strains measured in this study are included in the correlation matrices presented in Appendices G and H. Almost none of the correlations of the E, P, and P-E fit indices with health behaviors and physiological strains are significant and therefore they are of little use in determining which measure best predicts strain. Correlations between E, P, and P-E fit measures and psychological strains, however, are often significant and permit meaningful comparisons of predictive strength. The significant correlations between psychological strains and the E, P, and P-E fit measures of each of the constructs (Job Complexity, Responsibility for Persons, Role Ambiguity, and Quantitative Work Load) are presented in the first three columns of Tables III-4 through III-7, respectively.

Hypothesis 4 concerns the comparative predictive ability of the E, P and P-E fit measures. It is therefore the magnitude (i.e., the size disregarding the sign) of the correlation between a predictor and strain that determines which predictor is better. Also, it must be remembered that there is some random variation in the strength of a correlation from sample to sample. McNemar (1969) suggests a test to determine whether or not the differences between correlations are likely to reflect real differences in predictive power. This test was used to check the differences of the magnitudes of the correlations between each psychological strain and each set of E, P, and P-E fit indices. The outcome of these tests is presented in the center columns of Tables III-4 through Table III-7. An index may be judged to relate more strongly to strains than the other two indices when the magnitude of its correlations with strains are significantly higher than the magnitude of the correlations of the other two indices with strains.

Results of Comparison of Commensurate E, P, and P-E Fit Measures

Job Complexity. Table III-4 presents the correlations relating the E, P, and Poor Fit indices of Job Complexity to the psychological strains. It shows that the Job Complexity-Poor Fit index is clearly more strongly related to the strains than are either of the other two indices. Taking into account whether the correlations between the indices and a strain differ significantly from each other, the Job Complexity-Poor Fit index has the highest correlations with strain three times, ties with the Job Complexity-E twice, and ties with the Job Complexity-P index twice. Thus, the Job Complexity-Poor Fit index has correlations with strains equal to or higher than those of the other two indices in every instance.

Responsibility for Persons. Table III-5 presents the correlations relating the E, P, and Poor Fit indices of Responsibility for Persons to the psychological strains. The correlations between the indices and strains are lower than the comparable correlations between the Job Complexity indices and strains. The significant correlation of the Responsibility for Persons-Poor Fit index with the job dissatisfactions replicates the relationship found in the NASA studies between similar (though not identical) Responsibility for Persons P-E fit measures and measures of overall satisfaction.

No one index of Responsibility for Persons appears to correlate consistently more strongly with the strains than the other two indices. Table III-5 shows that the correlations differ significantly for only Boredom. The E and Poor Fit indices of Responsibility both have stronger correlations with it than does the Responsibility for Persons-P index.

Role Ambiguity. Table III-6 presents the correlations relating the E, P, and Poor Fit indices of Role Ambiguity to the psychological strains. In

Table III-4

Correlations Between the Psychological Strains and the E, P, and Poor Fit Indices of Job Complexity

	r^a			Differences between r's[b]		
Psychological Strains	E	P	Poor Fit	P & E	P & Poor Fit	E & Poor Fit
Job Dissat	-.31	-.30	.47		*	*
Boredom	-.51	-.34	.51	*	*	
Wk Ld Dissat	NS	-.17	.36	*	*	*
Somat Cmplnts	NS	NS	.16	*	*	
Anxiety	NS	NS	.21		*	*
Depression	NS	-.12	.22			*
Irritation	NS	NS	.15			*

Note. These analyses were performed on data from the random stratified sample, n = 318.

[a] $|r| \geq .12$, $P < .05$; $|r| \geq .15$, $P < .01$; nonsignificant correlations are not reported.

[b] The difference between the magnitude of the correlations of the E, P, and Poor Fit indices with each strain was tested using a procedure by McNemar (1969, p. 158). Significant differences ($t > 1.96$, $P < .05$) between the magnitudes (i.e., absolute values) of correlations are indicated by an asterisk (*).

Table III-5

Correlations Between Psychological Strains and the E, P, and Poor Fit Indices of Responsibility for Persons

	r^a			Difference between r's[b]		
Psychological Strains	E	P	Poor Fit	E & P	P & Poor Fit	E & Poor Fit
Job Dissat	-.26	-.15	.23			
Boredom	-.30	NS	.32	*	*	
Wk Ld Dissat	NS	-.15	NS			
Somat Cmplnts	-.13	NS	NS			
Anxiety	NS	NS	NS			
Depression	-.13	-.16	NS			
Irritation	NS	NS	NS			

Note. These analyses were performed on data from the random stratified sample, n = 318.

[a] $|r| \geq .12$, $P < .05$; $|r| \geq .15$, $P < .01$; nonsignificant correlations are not reported.

[b] The difference between the magnitude of the correlations of the E, P, and Poor Fit indices with each strain was tested using a procedure by McNemar (1969, p. 158). Significant differences ($t > 1.96$, $P < .05$) between the magnitudes (i.e., absolute values) of correlations are indicated by an asterisk (*).

Table III-6

Correlations Between Psychological Strains and the E, P, and and Poor Fit Indices of Role Ambiguity

	r[a]			Difference between r's[b]		
Psychological Strains	E	P	Poor Fit	E & P	P & Poor Fit	E & Poor Fit
Job Dissat	.17	NS	.19		*	
Boredom	NS	NS	.17		*	
Wk Ld Dissat	.16	NS	.13			
Somat Cmplnts	NS	NS	NS			
Anxiety	.17	NS	NS	*		*
Depression	.19	NS	NS			
Irritation	NS	NS	NS			

Note. These analyses were performed on data from the random stratified sample, n = 318.

[a] $|r| \geq .12$, $P < .05$; $|r| \geq .15$, $P < .01$; nonsignificant correlations are not reported.

[b] The difference between the magnitude of the correlations of the E, P, and Poor Fit indices with each strain was tested using a procedure by McNemar (1969, p. 158). Significant differences ($t > 1.96$, $P < .05$) between the magnitudes (i.e., absolute values) of correlations are indicated by an asterisk (*).

Table III-7

Correlations Between Psychological Strains and the E, P, and Fit Indices of Quantitative Work Load

	r^a			Differences between r's[b]		
Psychological Strains	E	P	Fit	E & P	P & Fit	E & Fit
Job Dissat	NS	-.26	.19	*		*
Boredom	-.19	-.28	NS		*	
Wk Ld Dissat	.33	-.34	.52		*	*
Somat Cmplnts	NS	NS	NS			
Anxiety	NS	NS	.13			
Depression	NS	-.29	.27	*		*
Irritation	.21	-.15	.27		*	

<u>Note</u>. These analyses were performed on data from the random stratified sample, $n = 318$.

[a] $|r| \geq .12$, $P < .05$; $|r| \geq .15$, $P < .01$; nonsignificant correlations are not reported.

[b] The difference between the magnitude of the correlations of the E, P, and Fit indices with each strain was tested using a procedure by McNemar (1969, p. 158). Significant differences ($t > 1.96$, $P < .05$) between the magnitudes (i.e., absolute values) of correlations are indicated by an asterisk (*).

all cases the correlations are low (r < 20). Though the correlations between Role Ambiguity-Poor Fit and the job dissatisfactions are low, they are statistically significant, replicating the relationship found in the NASA studies between a similar measure of P-E fit on role ambiguity and a measure of overall job satisfaction.

Table III-6 shows that the E index is more highly correlated with Anxiety than the other two indices. The E and Poor Fit indices are more highly correlated than is the P index with Job Dissatisfaction and with Boredom. The correlations of the indices do not differ significantly for the remaining four strains.

The relative strength of Role Ambiguity-E over Role Ambiguity-Poor Fit in predicting Anxiety may result from a methodological problem. As discussed in Appendix D, the relationships between P-E fit on Role Ambiguity and the affective strains are too low to determine whether or not the relationships are linear or curvilinear. These relationships were assumed to be curvilinear and the predictive power of Role Ambiguity-Poor Fit was compared with that of the corresponding E and P measures. If, however, the relationships are assumed to be linear, the predictive power of P-E fit on Role Ambiguity should be compared with that of the corresponding E and P measures. For this latter case, the E and P-E fit measures predict equally well. Until the relationships between affective strains and P-E fit on Role Ambiguity are examined further, it can be concluded that there is little, if any, difference between the predictive power of the E and P-E fit measures of Role Ambiguity.

Quantitative Work Load. Table III-7 presents the correlations relating to the E, P, and Fit indices of Quantitative Work Load to the psychological strains. With three exceptions, the indices have significant correlations ($.15 \leq r \leq .52$) with the three job related dissatisfactions as well as with Depression and Irritation. The indices generally have no significant correlations with Somatic Complaints and Anxiety. The overall relationship between the Quantitative Work Load-Fit index and the three job related dissatisfactions tends to replicate the statistically significant relationship found in the NASA studies between a similar measure of P-E fit on quantitative work load and a measure of overall job satisfaction.

The Quantitative Work Load-Fit index has the highest correlation with Work Load Dissatisfaction. The Quantitative Work Load-Fit index ties the P index in having the highest correlation with Irritation. The E and P indices have the highest correlation with Boredom. All three indices have low correlations with Somatic Complaints and with Anxiety. No one index has correlations with strains which are consistently higher than or equal to those of the other two indices. The Quantitative Work Load-Fit index comes the closest with correlations with all of the strains except Boredom which are higher than or equal to those of the other two indices.

Discussion: Comparison of Commensurate E, P, and P-E Fit Measures

The hypothesis that P-E fit should predict strains better than the E or P is not consistently supported for all strains by the results presented in the preceding section. The analyses focused on the psychological strains because the physiological strains were unrelated to P-E fit and to environmental stresses. The Job Complexity-Poor Fit index predicts psychological strains as well or better than its corresponding E or P indices. Both the E and Poor Fit indices of Responsibility for Persons perform about equally in predicting the psychological strains. The Role Ambiguity-Poor Fit index performs no better than the corresponding E index in predicting strains. Finally, the Quantitative Work Load-Fit index performed as well or better than its corresponding E and P indices in six instances and worse in one instance. Considering the E, P, and P-E fit measures across all four constructs (Job Complexity, Responsibility for Persons, Role Ambiguity, and Quantitative Work Load), the P-E fit measures perform on the average as well or better than the E or P measures.[1]

Two methodological limitations, contamination and unreliability, may have reduced the relationships between P-E fit measures and strain compared to the relationships of E and P measures with strain. Contamination may unduly inflate the predictive power of E and of P, whereas unreliability may unduly reduce the predictive power of P-E fit.

Contamination occurs when a person's report of the subjective environment is likely to be affected by his reported needs and abilities and vice versa. Contamination refers to the fact that an index or measure taps more than the construct it was intended to assess. Generally, bias in perceiving a stimulus (in this case either environmental characteristics or personal preferences) increases with increasing ambiguity in the stimulus.

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[1] A set of multiple regression analyses, not reported here, supports the conclusion that P-E fit measures predict a significant amount of variance in strain even after the predictive power of E and P measures has been taken into account. Each P-E measure accounts for significant variance in two or more strains beyond that which is accounted for by their corresponding E or P measures separately. Also, for the three P-E fit measures for which the analysis was appropriate (Job Complexity, Responsibility for Persons, and Role Ambiguity), each measure accounts for significant variance in two or more strains beyond that accounted for by the corresponding E or P measures together. These results support the assertion of P-E fit theory that P-E fit does predict effects of interactions between a person and his environment not accounted for by separate measures of the person and the environment.

It is therefore likely that measures of the subjective environment or person which utilize response scales which are abstract and relative such as "a little" or "a lot" may be prone to such contamination. For example, when the respondent is asked to rate the amount of work load in the respondent's job, what may be "a lot" or "a little" for one person may depend on that person's abilities and needs. Consequently, the response of the person tends to be a reflection of (i.e., tends to be contaminated by) person-environment fit rather than measuring only the environment. Similarly, a rating of how much work load a person wants (P) may be biased toward the actual work load (E) so that the P measure also tends to reflect person-environment fit. When such contamination is present, both the percentage of variance in strain accounted for by the indices of E and P may be higher than one would ordinarily expect because each measure reflects person-environment fit as well as the construct it was intended to measure.

One possible way of avoiding the problem of contamination is to construct response scales which are couched in absolute rather than in relative terms (and which have a true zero point). In order to measure the load of phone calls, for example, one might ask the person to report the actual number rather than to indicate "a lot" or "a little". Another alternative is to develop unambiguous anchors for the response scales.

Our measures of Job Complexity-E, P, and Poor Fit represent this latter type of instrument. The respondent is presented with bi-polar vignette descriptions of two <u>other</u> persons' jobs (e.g., Mike's job and Jim's job). For the measure of E, the respondent then indicates which job is most like his own. For the measure of P, the respondent indicates which job he would most prefer ("a job exactly like Mike's," "a job somewhat like Mike's," "a job halfway between Mike's and Jim's," and so on). Appendix E describes the "Mike-Jim" items used in this study. Our other measures of P-E fit (Responsibility, Work Load, Role Ambiguity) use the abstract and relative type of response scales ranging from "a little" to "a lot" or similar response categories. The relatively good predictive power of the P-E fit measures of Job Complexity, compared to the power of the other measures of P-E fit, may be due in part to the reduction of contamination in the response scales of the complexity measure. To obtain empirical support for this assumption, future studies should use the multitrait-multimethod matrix (Campbell & Fiske, 1959) so that the same P-E fit construct can be related to measures of strain using the two different forms of response scales found in this study.

With regard to problems of unreliability in P-E fit scores, Cronbach and Furby (1970) point out that a difference score, such as P-E, can magnify the unreliability of the score's components, P and E. Consequently, it is possible to obtain a P-E score which is less reliable than the respective P and E components which were used to compute the discrepancy.

For only two of the four measures of P-E fit in our study do we see any evidence that the P-E fit score does have less reliability than its components. These two indices are Responsibility for Persons-Poor Fit and Role Ambiguity-Poor Fit. The estimated reliabilities of these two Poor Fit indices are both .74. The estimated reliabilities for the P and E indices of Responsibility are .89 and .87, respectively; the estimated reliabilities for the P and E indices of Role Ambiguity are .84 and .86, respectively. For the measures of Job Complexity and Quantitative Work Load, there are no differences in reliability between the P-E fit index and its two components (see Table II-7). The comparatively lower reliabilities of the Poor Fit measures of Responsibility for Persons and of Role Ambiguity may partially explain the finding that when the fit measures are compared to their commensurate E and P measures, the predictive power of the fit measures of Responsibility for Persons and of Role Ambiguity are comparatively weaker than the predictive power of the fit measures of Job Complexity and Quantitative Work Load.

For the practical purpose of monitoring job stress (see Chapter V), it would be desirable to develop very brief measures and to eliminate all unnecessary items. Despite the fact that the E components in some instances explain as much as the P-E indices in the data just considered, we would be hesitant to suggest that one should dispense with the P-E measures in these cases and only assess E. Further replication of these findings would be required before such steps might be suggested, particularly since we have only taken a preliminary look at the validities of the various measures of person-environment fit and their components. In any event, the economy of omitting components of a P-E fit index should only be adopted when one has evidence for the population under study that one component predicts as well as all three combined. Obviously persons who wish to test hypotheses relating to person-environment fit must include measures of fit, including both the components.

Ecological Masking

Ecological masking of relationships may occur when data from several homogeneous groups are combined and analyzed as one heterogeneous group. In the present study some ecological masking is likely to occur since data from approximately 14 men from each of 23 occupations (i.e., 23 relatively different groups) were combined to produce the random stratified sample used in the preceding analyses in this chapter. Combining these occupational groups obscures the relationship between a stress and a strain when either (1) the relationship is <u>conditioned</u> by a variable which has different mean levels in various occupations or (2) the average level of a stress or a strain is <u>confounded</u> with a variable which has different mean levels in various occupations. The processes by which such conditioning and confounding result in ecological masking are explained below.

Ecological Masking Produced by Conditioning Variables

When the relationship between a stress and a strain is conditioned by another variable, the relationship changes as the level of the conditioning variable changes. Ecological masking results when the level of the conditioning variable differs from one occupation to another, resulting in different relationships between the stress and the strain within each occupation.

For example, differences in the relationship between Quantitative Work Load-Fit and Work Load Dissatisfaction are obscured by masking due to the conditioning effects of Job Complexity-Poor Fit. When fit on job complexity is poor, the relationship between fit on work load and work load dissatisfaction is stronger ($r = .59$) than when fit on job complexity is good ($r = .30$). The relationships between fit on work load and work load dissatisfaction which occur in occupations with low and high fit on job complexity are of the form represented in Figure III-5. Table IV-3 (Chapter IV) shows that the mean level of fit on job complexity varies a great deal across the different occupations in this study. When data from all of the occupations are combined (i.e., in the random stratified sample) an intermediate relationship ($r = .52$) is obtained. Consequently, the overall correlation between Quantitative Work Load and Work Load Dissatisfaction underestimates the strength of their relationship within occupations where fit on job complexity is poor and over-estimates the strength of their relationship in occupations where fit on job complexity is good.

Figure III-6 illustrates a more striking case of ecological masking due to conditioning effects. When the correlation between a stress and a strain is negative within one occupation and positive within another, the correlation found in the data from both occupations may be nearly zero.

Exploratory analyses of the relationships between some stresses and strains within a few occupations suggest that conditioning effects are masking some relationships in the stratified sample analyses. Table III-8 presents four correlations between stress and strain within the random stratified sample and within each of five occupations. The correlations of each of the stress-strain pairs differ greatly among the occupations. These differences suggest that some other variables condition the stress-strain relationships. Additional multivariate and within occupation analyses must be performed to identify other conditioning variables which may produce ecological masking of relationships between stress and strain.

Ecological Masking Produced by Confounding

When variables are confounded they are related in such a way that their effects are not separable. For confounding to result in the ecological masking of a stress-strain relationship, some third variable must first be related to either the stress or the strain. If the confounded variable has different mean levels for various occupations, the occupations will also have different mean levels for the related stresses or strains.

Analyses have not yet been performed to identify masking effects due to confounding in this study. Therefore, a hypothetical example will be used to illustrate the confounded relationships in Figure III-7. This figure demonstrates that ecological masking may occur when the mean level of a strain varies across occupations while the mean level of a stress remains the same. In Figure III-7, the same positive relationship between Role Conflict and Somatic Complaints is assumed to occur within each of the three occupations. The mean level of Role Conflict is drawn to be about the same within each occupation although the occupations differ in their mean level of Somatic Complaints. Such a difference in occupational mean level of Somatic Complaints could occur if increased Underutilization of Skills and Abilities produces higher levels of Somatic Complaints and if the level of Underutilization is different for various occupations (i.e., Underutilization is confounded with occupation). When hypothetical data from the three occupational groups are combined, no relationship is found between Role Conflict and Somatic Complaints. Figure III-8 illustrates the occurrence of ecological masking when the mean levels of both stress and strain covary across occupations.

By comparing Figures III-5 and III-6 with Figures III-7 and III-8, the distinction between ecological masking produced by conditioning and ecological masking produced by confounding is made clear. Conditioning produces ecological masking because the stress-strain relationship differs across occupations even though the mean levels of the stress and strain are the same for each occupation. Confounding produces ecological masking because the mean level of stress and/or of the strain differs across occupations even though the stress-strain relationship is the same for each occupation. It should be noted that conditioning and confounding may both exist and contribute simultaneously to ecological masking.

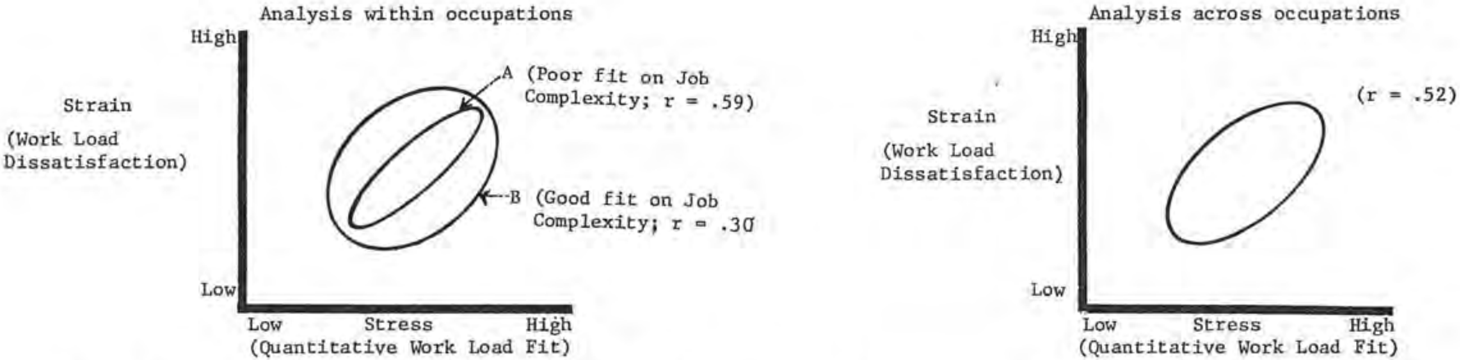

Figure III-5. Ecological masking due to occupational conditioning of stress-strain relationship: strong and weak correlations within occupations.

Figure III-6. Ecological masking due to occupational conditioning of stress-strain relationship: negative and positive correlations within occupations.

Table III-8

Examples of Variation in Stress-Strain Correlations in the Stratified Sample and in Five Occupations

Correlated Variables	Stratified Sample (318)[1]	Assembler Machine (79)	Policemen (111)	ATC Large & Small (125)	Accountant (92)	Administrator (253)
Qnt Wk Ld-PE & Wk Ld Dissat	.52	.64	.37	.29	.49	.26
Qnt Wk Ld-PE & Job Dissat	.19	.40	.22	.12	.21	.04
Support Sup & Depression	-.30	-.28	-.30	-.25	-.59	-.28
Support Others & Depression	-.36	-.34	-.09	-.38	-.48	-.22

[1]The approximate number of observations used to compute the correlations is presented in parentheses. The exact number of observations varies slightly for each pair of variables because of missing data.

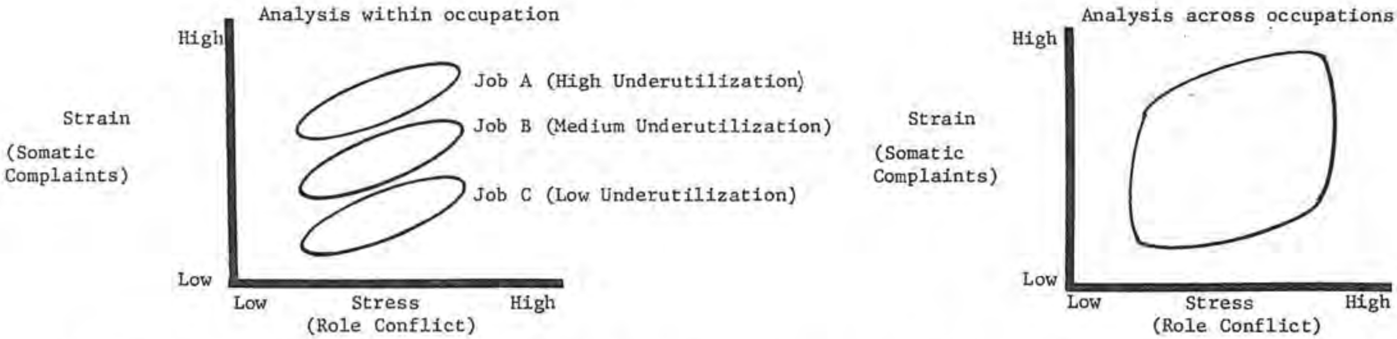

Figure III-7. Hypothetical case of ecological masking of a stress-strain relationship due to confounding of occupations with strain.

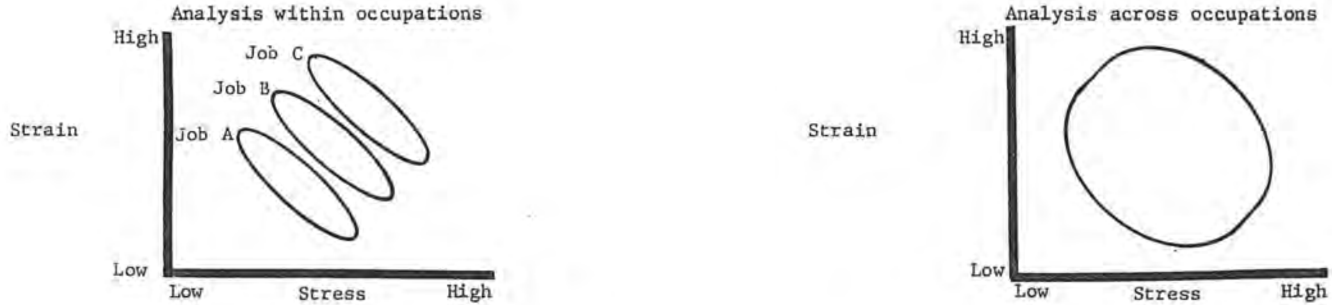

Figure III-8. Ecological masking of a stress-strain relationship due to confounding of occupations with both stress and strain.

Conclusions Concerning Ecological Masking

The correlational analyses presented in this chapter provide a description of the relationships found between stresses, personality characteristics, and strains in men from several occupations. However, because of ecological masking through conditioning and confounding, these relationships may not reflect all of the relationships between stresses, personality characteristics, and strains within each occupation.

The analyses presented in this chapter should be repeated within each occupation--or at least within groups of similar occupations--in order to pin down the actual relationships between stress and strain in different types of jobs. These analyses will be performed in the next phase of this project, and the analyses should uncover additional stress-strain relationships within the various occupations.

Summary of the Individual Level Results

The results described in the present chapter provide support for each of the four hypotheses described in Chapter I. In the present data we find evidence that job stresses lead to psychological strain, that personality variables are related to degree of psychological strain, that some strains affect reported illnesses, and that P-E fit predicts better to strain than do either the environmental conditions or the person's desired job conditions.

The proposition that job stresses lead to strain (Hypothesis 1) is well supported by correlations between job stress measures and psychological strains, especially the job dissatisfaction indices (summarized in Figure III-1). Underutilization, low Job Complexity-E, and Job Complexity-Poor Fit are associated with a high degree of boredom. Several other stress measures are associated with Boredom ($r \geq .30$) but not as highly as the above three. These are Future Ambiguity, low Responsibility for Persons-E, and Responsibility for Persons-Poor Fit. All these stresses are greater in the low socioeconomic occupations, as is Boredom (see the correlations with Duncan SES scores in Figure III-2).

Another set of stresses is associated with Work Load Dissatisfaction. Subjective Quantitative Work Load-Fit, a measure of the degree of excess work load, stands out as the best predictor. Work Load-E, Unwanted Overtime, and Job Complexity-Poor Fit also correlate ($r \geq .30$) with Work Load Dissatisfaction. We also find evidence that the Work Load-Fit and Complexity-Poor Fit are interacting in the prediction of Work Load Dissatisfaction, with Work Load-Fit having greater consequences for Work Load Dissatisfaction when fit on Complexity is poor.

Our general index of Job Dissatisfaction, which is associated with the Boredom and Work Load Dissatisfaction components, is highly correlated with Complexity-Poor Fit and Underutilization. Job Dissatisfaction is also associated ($r \geq .30$) with high Future Ambiguity, low Participation, low Complexity-E, and low Social Support from Supervisor and from Others at Work.

We also find some associations ($r \geq .30$) between stresses and our measures of affective strain. Role Conflict is associated with Irritation; low Support from Supervisor and from Others at Work are associated with Depression. The affective strains are positively correlated with the other psychological strains, including the job dissatisfactions and Somatic Complaints.

The behavioral and physiological strain measures do not show significant correlations with job stresses, or with personality characteristics, excepting a few which seem to be artifacts of a confounding with other variables. We expect that any causal relationships between the job stresses and the behavioral/physiological strains will require multivariate analyses which consider curvilinear and interactive relationships.

Hypothesis 2 says that personality variables influence strain. The correlational analyses in this chapter provide only one piece of evidence for such influence. That evidence, the negative association of Deny Bad Self with Anxiety and Irritation, is open to a possible response bias (social desirability) interpretation. It is likely that the present data will later reveal, as past studies have, that the effects of personality occur through interaction with stress factors.

Hypothesis 3 postulates an effect of strains on reports of treatments for certain illnesses. We find that two strains, Obesity and Anxiety, show evidence of such effects. Obesity is associated with reports of Cardiovascular Disease, in accordance with findings elsewhere. Anxiety shows a positive association with Gastrointestinal Problems and for the younger men (< 40 years) with Ulcer. These findings are subject to alternative interpretations considering the self-report nature of the illness reports, but they provide preliminary support for this hypothesis. An additional finding about the illness reports is a greater rate of Respiratory Infections among the men of lower socioeconomic status. This outcome for the low SES groups perhaps originates with their high degree of physical exposure.

According to Hypothesis 4, P-E fit measures of stress should predict strain better than do corresponding measures of the environment or of the environment desired by the person. Data on psychological strains generally provide support for this hypothesis. P-E fit indices performed consistently better in the case of Job Complexity and usually better in the case of Work Load. For Responsibility for Persons there was little difference between the E and P-E fit measures. The Role Ambiguity-E measure, however, performs slightly better than Role Ambiguity-Poor Fit. Thus we find clear evidence of the superiority of the P-E fit in the majority but not in all instances.

In addition to the evidence already described in support of our hypotheses about the effects of stresses and personality characteristics on strains, we expect to uncover more such relationships. As we have indicated earlier in the chapter, stress and personality variables are expected to have interactive and non-linear relationships with some strains, relationships which are not well described by the correlation coefficients used to date. Furthermore, as described in the section on ecological masking, occupational differences in the effects of stress and personality on strain probably mask important additional evidence.

CHAPTER IV. RESULTS: A COMPARISON OF STRESS AND STRAIN IN 23 OCCUPATIONS

The preceding chapter was concerned with how various stresses, personality characteristics, and strains are related across individuals in the study. By averaging the scores of individuals within each occupation, occupational scores for the various stress, personality, and strain measures can be produced. These ecological (i.e., group) level scores can be analyzed to evaluate the predictions and hypotheses made at the end of Chapter I.

The first prediction states that there will be significant differences among occupations in the mean levels of stress, strain, and personality. The first section of this chapter reports the occupational differences in the mean level of each measure in the study. The discussion of these differences includes comparisons of the findings with previous research.

The second prediction states that at the ecological level there will be positive correlations between a variety of job stresses and a variety of strains. The second section of this chapter presents the relationships found between measures at the ecological level. This section replicates at the ecological level many of the analyses which were done at the individual level and reported in Chapter III. The set of analyses which can be performed at the ecological level is limited to some extent, however, because of the small number of cases (N = 23 occupations).

Occupational Differences

Tables IV-1 through IV-5 present means, standard scores, and standard deviations of demographic and personality characteristics, stresses, strains, and reported diseases for all twenty-three occupations. The accompanying text attempts to highlight the findings by concentrating on the occupations which fall primarily at the extremes of the distribution for each variable. In some cases, occupations which fall between the extremes will be discussed when those findings aid in understanding the data.

Sometimes we present the findings in terms of the actual mean value of the variable and at other times we discuss the standard scores. Mean values are used when the units of the scale are commonly used and understood such as hours of work, dollars earned, or years of education. The standard score is used for unfamiliar scales with no clear zero point. The index score on role ambiguity or on amount of responsibility are examples of the latter type of score. The standard scores have a mean of 100 and a standard deviation of 80. The standard deviation represents a standard deviation from the mean of the random stratified sample so that the reader can get an idea of how extreme an occupation is with regard to other occupations (see also the legend in Table IV-1).

F tests were performed to test for occupational differences in demographic characteristics, job stress, personality, and strain. For practically all variables examined in this study these F tests were statistically significant at $p < .001$. Consequently, unless otherwise noted, the F tests produced a significant main effect due to occupation. While each F test indicates the presence of significant variance in some particular stress or strain as a function of occupation, the difference between any two specific occupations may or may not be significant. Appendix I presents the means and standard deviations of each variable for each occupation so that the reader can compute Student's t for the significance of the difference between any two occupations of particular interest.

Before turning to the data the warning is repeated here that we are dealing with a nonrandom sample of persons within each occupational group.

Occupational Differences in Demographic Characteristics

Table IV-1 presents the occupational means for the demographic characteristics of age, education, income, socio-economic status, and tenure.

Age. The five occupations with the oldest persons in them are the administrative professors (49.6 years of age), tool and die makers (48.9), physicians (47.0), continuous flow monitors (45.3), and train dispatchers (44.5). The occupations with the youngest persons in them are assemblers on machine paced lines (29.8 years), police (30.0), relief workers on the machine paced assembly lines (33.1), computer programmers (33.1), ATCs in small airports (33.0), and ATCs in large airports (34.6).

Education. The average education of the sample is 12 years or a high school education. The six occupations with the highest levels of education came from the professions: administrative professors, professors, and physicians (19.0 years), scientists (18.3 years), engineers (16.8 years), and programmers (16.5 years). The blue collar occupations require relatively little formal education. The groups with the least formal education were the forklift drivers (11.0 years), couriers (11.2 years), relief workers (11.5 years), machine paced assembly line workers (11.9 years), machine tenders (12.0 years), tool and die makers (12.2 years), and assemblers on nonmachine paced lines (12.2 years).

Gross income in 1972. While the average income of men in the random sample was \$17,379 (S.D. = \$11,382), the occupations differ markedly from this mean. The five highest paid groups were the family physicians (\$50,813), administrative professors (\$32,076), administrators (\$26,317),

TABLE IV-1: DEMOGRAPHIC STATISTICS BY OCCUPATION

Legend

Tables IV-1 through IV-5 present occupational means for most variables in the present study. Each variable is named in abbreviated form at the top of a column. A more detailed description of the variables is available in Table II-7 and in the text of Chapter II. The units of measurement are indicated in parentheses beneath the variable names. Where the units of a variable are arbitrary rating scale units, standard scores (denoted "SS" in the tables) have been used. Standard scores for the occupational means were computed by the formula:

$$SS = \left[\left(\frac{\text{occupation mean} - \text{random sample mean}}{\text{random sample S. D.}} \right) \times 80 \right] + 100.$$

Thus the standard scores have means of 100 and standard deviations of 80.

At the bottom of each variable's column is the mean and standard deviation for the 310 men of the random stratified sample. These means and standard deviations are not standardized for any variable. Thus their values may be used to locate mean values on the rating scales in the questionnaires. The reader should refer to Appendix E for the precise item content and method of index construction. For the raw means and standard deviations of each occupation, see Appendix I.

The approximate sample size for each occupation appears in Table IV-1. These values vary slightly from variable to variable because of missing data. Appendix I presents the exact sample sizes associated with each mean.

TABLE IV-1(CONT'D): DEMOGRAPHIC STATISTICS BY OCCUPATION

	NO. MEN (#)	AGE (YEARS)	SCHOOLING (YEARS)	DUNCAN SES ([a])	INCOME ($)	LENGTH SERV (SS[b])
FORKLIFT DRVR	46	39.7	11.0	17	10271	131
ASSEMB MACH	79	29.8	11.9	21	9790	19
ASSEMB RELIEF	27	33.1	11.5	21	10140	75
ASSEMB NOMACH	69	38.9	12.2	21	11260	68
MACH TENDER	34	34.2	12.0	22	11548	78
CONTIN FLOW	101	45.3	12.5	23	12556	139
COURIER	20	45.0	11.2	32	8747	89
TOOL AND DIE	77	48.9	12.2	50	12889	144
ELEC TECH	93	38.7	13.2	62	14725	101
POLICEMAN	111	30.0	14.3	40	12530	63
SUP BLUE COLL	178	41.9	13.0	53	14779	89
SUP WHTE COLL	42	40.3	14.6	78	18494	89
DISPATCHER	86	44.5	12.7	40	13801	168
ATC, LARGE	82	34.6	13.1	69	20754	135
ATC, SMALL	43	33.0	13.1	69	15764	98
PROGRAMMER	90	33.1	16.5	65	14269	67
ACCOUNTANT	92	38.9	15.1	78	10802	64
ENGINEER	110	38.0	16.8	87	17321	70
SCIENTIST	118	39.8	18.3	80	20011	88
PROFESSOR	74	43.9	19.0	84	23827	126
ADMIN PROF	25	49.6	19.0	84	32076	105
ADMINISTRATOR	253	41.9	16.5	62	26317	55
PHYSICIAN	104	47.0	19.0	92	50813	169
RNDM SMPL MEAN		39.4	14.4	54	17379	4.3
RNDM SMPL S.D.		11.1	2.9	25	11382	1.2

[a]Percentile scores as devised by Duncan (Reiss, 1961).

[b]SS denotes standard scores as described in the legend.

professors ($23,827), and air traffic controllers at the large airports ($20,754). The occupational groups with the lowest incomes in the sample were the couriers ($8,747), assembly line workers on machine paced lines ($9,790), assembly relief men ($10,140), forklift drivers ($10,271), and accountants ($10,802). Education is clearly related to financial compensation since the correlation between education and income across the twenty-three occupations is .76, $p < .001$.

Duncan socioeconomic status. Given the distributions on education and income, the Duncan index describing occupational status holds few surprises. Physicians have the highest status score followed by engineers, professors, both administrative and nonadministrative, and scientists. All of these groups are beyond one standard deviation of the mean of the stratified random sample and fall in or above the eightieth Duncan percentile. On the lower side of the distribution we find the forklift drivers, machine paced and unpaced assembly line workers, assembly line relief men, machine tenders, and continuous flow monitors. All of these groups fall one standard deviation below the mean of the random sample.

Duncan SES scores were originally constructed as a function of the average income and education levels in occupations. For a few occupations in the sample the patterns of Duncan SES scores differs noticeably from the pattern of values of average level of education and income in the occupations. One cause for such discrepancies is a change in the education level or salary of a typical person in the occupation since 1960, the year for which the standardized scores were most recently revised. For example, during the past several years the average education level of policemen has increased, a change which is not reflected in their Duncan SES score. Discrepancies between a Duncan SES score and the average salary or level of education in an occupation can also result when the occupational sample does not reflect the national population of the occupation. For example, many of the administrators in our sample are executives as evidence by the sample of administrators averaging some post-graduate education and a salary over $26,000. The comparatively low Duncan SES score of 62 represents the socioeconomic status of an administrator in lower-middle management, a more typical administrative position.

Length of service. We are interested in the person's length of service in his current job for its potential value as an indicator of length of exposure to stressful and nonstressful job environments. Occupations which hold their occupants for short periods of time may have little effect on long term health or illness. On the other hand, a long period of service in a highly stressful occupation could produce effects of stress which accumulate over time.

The five occupations with the longest average service among their members are the physicians, train dispatchers, tool and die makers, continuous flow monitors, and ATCs at the large airports. People in these jobs have been employed in their current position with their current employer between six and ten years. The occupations with the shortest service are assemblers on machine paced lines (7 months to one year) and administrators, police, accountants, and computer programmers (between one and five years--the broad categories reflecting the intervals used in the questionnaire).

Occupational Differences in Personality

It is quite likely that persons with different personality traits are found in different occupations. Self-selection, selection by the organization, and changes in personality traits as a result of socialization by the job may all produce such differences. It is important to know about such differences in the study of stress and health because, according to our model in Figure I-1 (Chapter I), people with different types of traits may experience different levels of strain (arrow 7). Furthermore, the effects of stress on strain may vary according to the personality of the individual (arrow 8). If there are occupational differences in personality, then they will need to be controlled through multivariate analyses in order to understand the occupational differences in strain which are due solely to job demands. As previously indicated, such multivariate analyses will be covered in a subsequent report.

Type A. The findings on personality characteristics of each occupation are presented in Table IV-2. Two occupational groups have by far the highest scores on the Sales Type A index. These groups are the administrative professors (standard score = 155) and the family physicians (149). The findings on administrative professors are in keeping with previous research on professors and administrators in academic settings (French, Tupper & Mueller, 1965; Mueller & French, 1970). Those studies showed that the administrators had higher scores on measures of achievement orientation than did the professors. The measures of achievement orientation used in those studies (drive, achievement, leadership, range of activities, pushing ones self, positive attitude toward pressure) are very similar to our conceptualization and measurement of Type A.

While we know of no studies of Type A among the medical professions, Russek (1960, 1962) reports that general practitioners, such as family physician, have a much greater risk of coronary heart disease than medical specialists. Perhaps future studies will show that some of this risk is due to the Type A orientation of the general practitioners.

TABLE IV-2: PERSONALITY CHARACTERISTICS BY OCCUPATION

	TYPE A (SS[a])	FLEXIBILITY (SS)	ASSERT GOOD (SS)	DENY BAD (SS)
FORKLIFT DRVR	87	40	138	123
ASSEMB MACH	63	76	93	91
ASSEMB RELIEF	74	79	125	76
ASSEMB NOMACH	84	64	116	94
MACH TENDER	81	61	119	94
CONTIN FLOW	67	95	109	111
COURIER	85	61	128	120
TOOL AND DIE	126	66	125	108
ELEC TECH	93	106	109	91
POLICEMAN	89	87	93	91
SUP BLUE COLL	108	83	119	114
SUP WHTE COLL	95	104	106	100
DISPATCHER	98	56	116	100
ATC, LARGE	102	95	100	108
ATC, SMALL	94	87	103	105
PROGRAMMER	69	146	67	85
ACCOUNTANT	74	101	106	102
ENGINEER	82	135	90	91
SCIENTIST	106	160	74	88
PROFESSOR	106	200	67	73
ADMIN PROF	155	180	71	73
ADMINISTRATOR	111	124	87	91
PHYSICIAN	149	129	96	100
RNDM SMPL MEAN	5.21	2.26	1.57	1.44
RNDM SMPL S.D.	0.93	0.52	0.25	0.27

[a]SS denotes standard scores as described in the legend of Table IV-I.

Among the blue collar workers, the occupation with the highest standard score on Type A is tool and die making (126). The least Type A groups are the assemblers on machine paced lines (63) and the continuous flow monitors (67).

Flexibility. Flexibility correlated .92 with education level in the across-occupational analyses. Consequently we find that professors (standard score = 200) and administrative professors (180) have the highest scores on Flexibility. Scientists (160), computer programmers (146), engineers (135), and physicians (129) also have relatively high scores.

Most of the occupational groups which lie below the mean are blue collar. Forklift drivers (40) have the lowest score on Flexibility (or the highest score on the rigid end of the dimension). The next lowest group is train dispatchers (56).

The high scores on Flexibility for the highly educated groups may indicate goodness of fit between these persons and their jobs. Academics live in a world where yes and no answers to problems are rare. The endless search for knowledge is highly dependent on the ability to seek contradictions and ambiguities. For the physician as well, great flexibility is required. No prescription is ever a certain cure. Indeed, there may be great uncertainty concerning the diagnosis. Physicians must work with probabilities and approximations as do most scientists. The rigid person, by contrast, tends to agree with the questionnaire item which says that "Our thinking would be a lot better off if we would just forget words like 'probably', 'approximately', and 'perhaps.'" These persons should fit best in occupations where clear rules exist for making decisions. So it seems likely that selective processes are partly responsible for the correlation (across occupation) of .92 between Flexibility and education; perhaps it is also true that education increases Flexibility.

Assert Good Self; Deny Bad Self. These two measures may be thought of as defense mechanisms. A person scores high on Assert Good Self when he reports he always acts in socially appropriate ways. A person scores high on Deny Bad Self when he reports he never acts in socially inappropriate ways. As Figure I-1 in Chapter I indicates, defenses may ameliorate the effects of job stresses on the amount of strain experienced by the employee. On the other hand high stress jobs might arouse a lot of defensiveness. Therefore no clear prediction can be made about how these measures of defense will vary across jobs.

The five occupations with the highest scores on Assert Good Self are all blue collar, and tend to have poor person-environment fit although not all of them have especially high levels of job stresses. Forklift drivers have the highest standard score on Assert Good Self (138), followed by couriers (128), tool and die makers (125), and relief workers on the machine paced assembly lines (125). At the other end of the continuum lie the professors (67), computer programmers (67), administrative professors (71), and scientists (74). While these professional occupations do have high levels of education this does not explain their low defensiveness because these measures of defense are not appreciably related to years of schooling.

Turning to Deny Bad Self we find that the forklift drivers (123) and the couriers (120) have the highest scores whereas the professors (67) and administrative professors (71) have the lowest scores. Although the relief workers from the machine paced lines had relatively high scores on Assert Good Self, they join the professors with their low scores on Deny Bad Self (76).

Occupational Difference in Job Stress

The occupational differences in job stress are presented in Table IV-3.

Measures of work load. Number of hours of work per week, number of hours of overtime and of unwanted overtime, and indices of subjective quantitative work load and variance in work load have all been used to assess aspects of work load. Each one of the measures is examined below to determine which occupational groups have the most and least work load.

The physicians (58.4 hours per week) and administrative professors (56.4) reported working the most total hours per week. They are followed by university professors (51.6), blue collar supervisors (47.6), tool and die makers (46.9), and scientists (46.6). In a study of the work load of university professors (Mueller & French, 1970), professors reported working 57.6 hours per week whereas administrators at the university reported working 59.0 hours per week. These latter data showed a trend similar to those we have just reported.

The least number of hours worked is reported by the ATCs at the large (38.1) and small (38.7) airports. These figures reflect strict federal regulations of the number of hours which a controller may work per week, and during any one shift. The other occupations at the low end of the distribution all reported working about forty hours per week. These occupational groups include the forklift drivers, relief men, accountants, electronic technicians, and continuous flow monitors.

What people consider overtime hours depends on how they view the meaning of work hours in their job. Professors and administrative professors report working twelve (51.6 hours per week) and sixteen (56.4 hours per week) hours beyond the traditional forty hour week. Nevertheless, professors report only 31 percent (3.6 hours) of their eleven hours as overtime whereas administrative professors report 70% (11.4 hours) of their hours as over-

TABLE IV-3: STRESS STATISTICS BY OCCUPATION

	HRS WRKD/WK (HOURS)	HRS OVRTIM/WK (HOURS)	UNWANTD OVTIM (HOURS)	QNT WK LD-E (SS[a])	CMB QNT WKLD (SS)
FORKLIFT DRVR	40.4	3.5	1.2	113	105
ASSEMB MACH	41.1	4.0	1.1	84	81
ASSEMB RELIEF	40.5	3.0	0.2	84	74
ASSEMB NOMACH	41.9	5.7	1.9	77	63
MACH TENDER	42.9	4.3	0.5	96	94
CONTIN FLOW	40.8	4.4	0.4	51	38
COURIER	39.1	1.7	0.5	84	79
TOOL AND DIE	46.9	4.3	2.1	83	75
ELEC TECH	40.2	2.2	0.7	84	81
POLICEMAN	46.1	6.4	1.5	87	97
SUP BLUE COLL	47.6	6.8	3.3	119	118
SUP WHTE COLL	43.7	3.8	2.0	98	104
DISPATCHER	41.7	2.8	1.6	146	156
ATC, LARGE	38.1	0.4	0.5	81	110
ATC, SMALL	38.7	0.9	0.0	74	94
PROGRAMMER	42.2	3.2	1.2	60	60
ACCOUNTANT	40.6	1.9	1.2	100	95
ENGINEER	43.3	3.6	1.4	92	91
SCIENTIST	46.6	5.0	1.1	93	85
PROFESSOR	51.6	3.6	1.5	104	109
ADMIN PROF	56.4	11.4	3.6	173	171
ADMINISTRATOR	48.7	6.4	1.5	121	121
PHYSICIAN	58.4	6.7	3.2	175	181
RNDM SMPL MEAN	45.1	4.6	1.3	3.56	3.54
RNDM SMPL S.D.	8.5	6.3	3.0	0.53	0.59

[a]SS denotes standard scores as described in the legend of Table IV-1.

TABLE IV-3(CONT'D): STRESS STATISTICS BY OCCUPATION

	VARIANCE WKLD (SS^a)	RESP PERSNS-E (SS)	JOB COMPLXTY-E (SS)	CONCENTRATION (SS)	ROLE CONFLICT (SS)
FORKLIFT DRVR	86	83	23	32	126
ASSEMB MACH	42	50	5	9	105
ASSEMB RELIEF	53	55	43	42	133
ASSEMB NOMACH	55	72	27	43	125
MACH TENDER	77	74	34	82	116
CONTIN FLOW	89	85	89	73	83
COURIER	80	77	42	76	89
TOOL AND DIE	81	62	83	112	116
ELEC TECH	108	57	92	95	113
POLICEMAN	133	150	162	110	92
SUP BLUE COLL	116	136	143	94	119
SUP WHTE COLL	112	144	149	119	102
DISPATCHER	146	152	132	160	138
ATC, LARGE	163	108	110	171	80
ATC, SMALL	167	104	104	167	55
PROGRAMMER	75	35	110	112	84
ACCOUNTANT	82	41	78	99	88
ENGINEER	82	44	121	98	113
SCIENTIST	61	65	109	94	75
PROFESSOR	73	101	146	100	56
ADMIN PROF	94	174	177	113	122
ADMINISTRATOR	104	144	172	96	116
PHYSICIAN	108	189	183	159	66
RNDM SMPL MEAN	2.93	2.84	4.75	5.37	1.71
RNDM SMPL S.D.	0.69	1.27	1.13	1.29	0.63

[a] SS denotes standard scores as described in the legend of Table IV-1.

TABLE IV-3(CONT'D): STRESS STATISTICS BY OCCUPATION

	ROLE AMBIGUITY (SS[a])	FUTURE AMBIG (SS)	UNDERUTILIZAT. (SS)	INEQUITY OF PAY (SS)	EQUITY % INCOM (%[b])
FORKLIFT DRVR	125	141	166	89	91.4
ASSEMB MACH	117	160	212	64	86.5
ASSEMB RELIEF	104	99	176	69	78.6
ASSEMB NOMACH	104	138	163	89	86.3
MACH TENDER	123	170	162	87	87.3
CONTIN FLOW	75	119	132	66	90.1
COURIER	62	91	139	73	88.1
TOOL AND DIE	77	132	66	129	82.6
ELEC TECH	99	83	61	129	88.0
POLICEMAN	101	52	64	120	80.6
SUP BLUE COLL	100	102	93	112	89.7
SUP WHTE COLL	109	96	81	109	89.4
DISPATCHER	67	84	101	122	87.1
ATC, LARGE	62	58	89	107	81.4
ATC, SMALL	32	43	82	112	85.8
PROGRAMMER	138	97	83	110	87.1
ACCOUNTANT	121	103	85	147	86.4
ENGINEER	133	126	74	109	88.7
SCIENTIST	136	108	55	98	90.7
PROFESSOR	116	76	18	114	90.8
ADMIN PROF	118	52	39	96	89.9
ADMINISTRATOR	110	97	71	100	89.6
PHYSICIAN	60	27	10	96	90.9
RNDM SMPL MEAN	2.01	2.73	2.68	2.79	87.8
RNDM SMPL S.D.	0.83	1.00	1.24	0.88	12.4

[a] SS denotes standard scores as described in the legend of Table IV-1.

[b] Income earned as a percentage of income felt to have been deserved.

TABLE IV-3(CONT'D): STRESS STATISTICS BY OCCUPATION

	PARTICIPATION (SS[a])	SUPPORT SUP (SS)	SUPPORT OTHERS (SS)	SUPPORT HOME (SS)
FORKLIFT DRVR	58	72	67	91
ASSEMB MACH	46	56	65	76
ASSEMB RELIEF	57	47	44	68
ASSEMB NOMACH	72	67	77	60
MACH TENDER	36	71	39	95
CONTIN FLOW	106	142	137	101
COURIER	63	125	83	94
TOOL AND DIE	97	79	90	64
ELEC TECH	94	97	100	66
POLICEMAN	81	119	111	105
SUP BLUE COLL	123	122	85	93
SUP WHTE COLL	130	120	102	108
DISPATCHER	111	108	79	93
ATC, LARGE	120	78	105	91
ATC, SMALL	122	97	138	112
PROGRAMMER	119	116	90	68
ACCOUNTANT	88	122	93	93
ENGINEER	107	96	86	75
SCIENTIST	119	116	100	82
PROFESSOR	124	137	107	116
ADMIN PROF	170	129	156	136
ADMINISTRATOR	139	118	100	95
PHYSICIAN	104	128	143	94
RNDM SMPL MEAN	2.88	2.89	3.08	3.49
RNDM SMPL S.D.	1.04	0.75	0.60	0.59

[a]SS denotes standard scores as described in the legend of Table IV-1.

TABLE IV-3(CONT'D): STRESS STATISTICS BY OCCUPATION

	QNT WK LD-PE (SS[a])	RESP PERSON-PE (SS)	COMPLEXITY-PE (SS)	ROLE AMBIG-PE (SS)
FORKLIFT DRVR	123	135	142	137
ASSEMB MACH	118	142	184	104
ASSEMB RELIEF	113	91	125	116
ASSEMB NOMACH	91	128	154	135
MACH TENDER	133	110	160	173
CONT IN FLOW	58	107	101	89
COURIER	83	159	116	142
TOOL AND DIE	85	129	93	120
ELEC TECH	76	140	105	81
POLICEMAN	77	69	63	95
SUP BLUE COLL	101	79	105	100
SUP WHTE COLL	76	69	68	80
DISPATCHER	137	92	118	79
ATC, LARGE	72	120	115	83
ATC, SMALL	68	100	95	67
PROGRAMMER	68	98	97	90
ACCOUNTANT	95	127	116	100
ENGINEER	77	95	85	100
SCIENTIST	90	101	75	83
PROFESSOR	131	68	66	97
ADMIN PROF	163	73	66	87
ADMINISTRATOR	91	63	65	84
PHYSICIAN	152	57	53	84
RNDM SMPL MEAN	0.23	1.23	0.95	1.07
RNDM SMPL S.D.	0.64	0.88	0.85	0.84

[a]SS denotes standard scores as described in the legend of Table IV-I.

time. This suggests that the extra hours beyond the forty hour work week are seen in a more positive light by professors and in a less positive light by administrative professors. As the French et al. (1965) study of university professors points out, many professors consider the hours beyond a forty hour week not as overtime but simply as part of the time they need to put in to perform their job as they desire. "I would work the hours anyway even if no one asked me," said one professor summing up this viewpoint. For the administrative professor, however, those hours are "busy work." Consistent with this, we find that the administrative professors put in more unwanted overtime (3.6 hours per week) than any other occupation whereas the other professors are about average.

The air traffic controllers from the large and small airports report the least amount of overtime per week (.4 and .9 hours, respectively). The delivery service couriers (1.7), accountants (1.9), and electronic technicians (2.2) also report few hours of overtime. The other occupations fall close to the middle of the distribution.

Unwanted overtime is also reported by blue collar supervisors (3.3 hours per week), physicians (3.2), tool and die makers (2.1), and white collar supervisors (2.0). ATCs at the small airports report no unwanted overtime and little is reported by the continuous flow monitors (.4), the ATCs at large airports (.5), the couriers (.5), and the machine tenders (.5).

The subjective Quantitative Work Load index provides us with a distribution of work load across the occupations fairly similar to that provided by the measure of total hours worked per week (the two measures intercorrelate across occupations .74). The administrative professors and physicians again have the highest scores and the ATCs have the lowest scores.

The Combined Quantitative Work Load measure consists of the Quantitative Work Load-E items plus some additional items. The two quantitative work load measures have almost identical patterns of scores ($r = .95$ across occupations).

Variance in Work Load, however, deals with a different aspect of the work. We decided to include a measure of variance in work load after observing the flow of work in the air traffic control towers. It became apparent that this change in the work pace was one of the unique features of air traffic control work compared to many other occupations. The findings substantiate this observation. The ATCs at the large (163) and small airports (167) have the highest standard scores on the index of Variance in Work Load. The train dispatchers (146) have the next highest Variance in Work Load score followed by policemen (133). The assemblers working on machine paced lines have the lowest scores (42) followed by the relief men on these lines (53) and the assemblers on unpaced lines (55). The busy professors (73), administrative professors (94), and physicians (108), however, fall close to the midpoint of the occupational means.

Responsibility for Persons. This is a particularly intriguing variable because we have a number of occupations which, on the basis of common sense, would appear to have great responsibility for persons: air traffic controllers, police, train dispatchers, physicians, and perhaps supervisory personnel such as foremen. One might also argue that professors have great responsibility for persons since they train people for various career paths. The amount of responsibility people in the occupations actually perceive themselves as having follows--with a few surprising exceptions--our common sense expectations. The physicians clearly are the group which reports the highest responsibility for the lives, well-being, and futures of others (standard score = 189). The administrative professors also report high responsibility for persons (174). Their colleagues, the professors, however, fall right on the mean (101). The administrative professor must make decisions which affect the job security and morale of the department members; he often shoulders the responsibility for chairing committees on tenure and promotion. In fact at the time of the study, several of the administrative professors were faced with the responsibility for dealing with a severe budget cut by reducing the professional staff.

Both the police (150) and the train dispatchers (152) also see themselves as having relatively high Responsibility for Persons. The ATCs, however, are a surprise to us. Regardless of the size of airport, they have scores very close to the mean (small sites = 104; large sites = 108). These ATC scores will be further discussed in a later section of this chapter which deals specifically with air traffic controllers.

Blue and white collar supervisors and administrators, although not reporting extremely high amounts of Responsibility for Persons, do have standard scores which are about one-half standard deviation above the mean of the random sample (136, 144, and 144 respectively). There are a number of occupational groups by contrast, with very low standard scores on Responsibility for Persons: computer programmers (35), accountants (41), engineers (44), assemblers on machine paced lines (50), relief workers (55), electronic technicians (57), and scientists (65).

Job Complexity. Three occupations are about one standard deviation above the mean of the random sample with respect to Job Complexity: physicians (183), administrative professors (177), and administrators (172). Police also see their jobs as relatively complex (162). Close to one-half standard deviation above the mean we find the blue and white collar supervisors (143 and 149 respectively) and the university professors (146).

The noncomplex jobs, as perceived by the persons in them, are machine paced assembly (5), forklift driving (23), and nonmachine paced assembly (27). Machine tenders (34), couriers (42), and relief men (43) also see their jobs as involving relatively little complexity.

Concentration. In preliminary interviews with employees in the various occupations under study, we were particularly impressed by the demands for attention or concentration required in two types of work, air traffic control and train dispatching. They are jobs where a failure to concentrate on the radar view screen or the electronic train traffic control board could result in a serious accident and a loss of lives and material. We therefore developed an item to tap this demand for attention so that we would be able to compare the amount of concentration in these two jobs with the amounts required in the other jobs under study.

As expected, the findings show that the ATCs have the highest standard scores (large airports = 171; small = 167). The train dispatchers (160) and physicians (159) also report relatively high demands for concentration in their work.

The job with the least amount of required concentration is assembly work on the machine paced lines (9). The forklift drivers (32), the relief men (42), and the assemblers on nonmachine paced lines (43) also have quite low scores on job demands for concentration and attention.

Role Conflict. There is not as much spread on the scores for this stress as there is for many of the other stresses. Nor does there appear to be a clear division between the blue-white collar or manual versus nonmanual labor in the magnitude of Role Conflict. Train dispatchers report the most acute Role Conflict (138), followed by relief men (133), forklift drivers (126), assemblers on nonmachine paced lines (125), and administrative professors (122). Preliminary interviews with the forklift drivers early in the study suggested that they would have high Role Conflict. They reported working under dual supervision. On one hand they report directly to a main supervisor. On the other hand, departments which need materials often try to countermand the orders of the driver's main supervisor by getting the drivers to change the priorities by which they deliver goods to the work stations.

The train dispatcher suffers role conflict because he must handle the demands of private customers who ask for special and quick dispatching of loads of perishable goods on freight trains while meeting the demands for timely arrival and departure of passenger trains. There is also room for conflicting demands from the engineers (who communicate by radio-telephone) who want to maintain a certain schedule and the dispatcher's supervisors who may have other ideas in mind as they survey the total pattern of train traffic. As one dispatcher mentioned "each engineer thinks his train is the most important". Consequently the dispatcher may receive conflicting demands from two or more engineers. The dispatcher also may have to reconcile the demands of supervisors of track repair work crews who want a clear track for long enough to get their work done, company supervisors who want the work scheduled for specific hours so that overtime pay can be avoided, and people in the sales and transportation divisions who want the work on the track done at hours which involve minimal delay of the freight trains. Devoe's (1974) recent study of the train dispatcher's job supports these observations.

Administrative professors, as our own experience tells us, often become involved in conflicting demands which emanate from particular subprograms within their department or school. They may also find themselves caught between the desires of the university administration and the faculty members they serve.

While blue collar supervisors have often been called the men in the middle, they are close to average in acute Role Conflict (119). There is really no outstandingly conflict free occupation in the sample. The three lowest mean values belong to the ATCs at the small airports (55), the professors (56), and the physicians (66). In the latter two occupations people rarely have more than one immediate superior. In fact, they are usually their own supervisor. Hence the opportunities for conflict are quite low. The ATCs at the large airports have a Role Conflict standard score of 81 which is higher but not significantly higher than the score for their counterparts at the small airports. These small sites with their smaller work forces may have better communications and working relationships among the employees. Another environmental variable, social support, indicates that the quality of working relations is better at the small sites.

Role Ambiguity. Ambiguity regarding what others expect of an employee in his work is highest for the computer programmer (standard score = 138), the scientist (136), and the engineer (133). In all of these jobs other persons may come to these people with a problem which is not precisely defined to begin with and consequently may serve as a source of ambiguity. In the case of the scientist in basic research, the expectations of others may be intentionally vague--"study what you like as long as you contribute to scientific understanding".

The least Role Ambiguity is reported by the ATCs at the small airports (32). The next most unambiguous job environments belong to the physicians (60), the ATCs at the large airports (62), the couriers (62), and the train dispatchers (67). In the case of the ATCs, the dispatchers, and the couriers, the job is clearly laid out in the manuals or on the work order sheets. There are no vague expectations about what should be done. In the case of the physician, self employment may largely eliminate the possibility that "others at work" may have expectations about the physician's role which are ambiguous to the physician.

Job Future Ambiguity. The jobs which are characterized by high role ambiguity are not necessarily the same jobs as those with Future Ambiguity in them. Future Ambiguity refers to uncertainty about one's career future and is likely to vary with economic conditions and with the ability of one's company to perform some valued service. These are aspects of work life which, unlike demands for concentration or complex demands, are not necessarily an inherent part of the occupational technology itself.

The jobs with the highest Future Ambiguity in this study are the assemblers on the machine paced lines and the machine tenders. The well known high rates of turnover in assembly line work suggest that many people enter such jobs undecided about their future ambitions and certainly with no firm commitment to assembly work for the rest of their work life. The high Future Ambiguity of the machine tenders probably reflects the conditions of the company that most of them were working in at the time of the study. A number of layoffs had recently been completed before the employees were studied, and further layoffs were in the planning stages. It is likely many of the "survivors" still were not too certain about whether the future layoffs would cost them their jobs.

The physicians (27) have the least Future Ambiguity--most of them being self-employed and committed to their occupations. Other groups with relatively low Future Ambiguity include the ATCs from the small and large sites (standard scores of 43 and 58 respectively), the police (52) , and the administrative professors (52). All of these groups are probably correct in concluding that their jobs will be valued as much five years from now as they are today. For the most part the administrative professors have tenure. Consequently, their Future Ambiguity is understandably low.

Underutilization of Abilities. These occupational means closely parallel those for Complexity. The least complex jobs have the most Underutilization and both variables show large differences from one job to another. Assemblers on machine paced lines (212), relief men (176) , assemblers on nonmachine paced lines (163) , forklift drivers (166) and machine tenders (162) all report relatively high Underutilization of Abilities. Physicians (10), university professors (18), administrative professors (39), scientists (55), electronic technicians (61), police (64), and tool and die makers (66) do not report as much Underutilization.

Inequity of Pay. The extent to which an individual feels his pay is equitable is measured two ways. The Inequity of Pay measure asks a worker to judge how fair his pay is compared to that of important referent others (e.g., others who have the same job, others at the same organization who have different jobs). The Income as a Percent of Deserved Income measure compares the individual's pay for the previous year to the amount he feels he should have been paid.

The occupational scores for the Inequity of Pay measure show that all occupational groups believe that they are at least somewhat undercompensated compared to other persons. This finding is in agreement with a recent national survey by the Survey Research Center of the Institute for Social Research which showed that pay inequities bother large numbers of employees throughout the United States (Strumpel, 1974). As Strumpel notes, much of the sense of inequity over the past two years (1972-1974) may be due to the role of inflation which is seen as taking away some of the wage increases which people earned for their skill and effort.

The assemblers on machine paced lines (standard score =64) , the continuous flow monitors (66), and the relief men on assembly lines (69) most believe they are equitably paid (at least at the time of the study). Their perceptions of equity could just as well indicate that these groups have strong unions which are effective in bargaining for good wages as they could indicate that the industries related to these occupations are able to fairly compensate for the specific job demands in the occupations.

Accountants (147) report the most Inequity of Pay. Remember that the items ask the employee to judge the pay in comparison to what the employee believes others earn. The accountants, it would seem, are in a unique position to make such comparisons since they frequently have access to information about others' salaries and wages. For other types of employees, the wages of others are a vague guess and they may have less reality and perhaps little subsequent impact on their perceptions of equity and inequity. Perhaps more important, our sample of accountants were fifth from the bottom in gross income, which is lower than any other white collar occupation.

When inequity is computed as the ratio of gross income earned to gross income the person believes he or she should have received, the accountants (income/deserved income = 86%) fall very close to the mean of the distribution (88%). The relief men on the Assembly lines (79%), the police (81%), and the ATCs at the large airports (81%; ATCs at the small airports have a score of 86%) have the smallest ratio (most undercompensated). The forklift drivers (91%), the physicians (91%), the university professors (91%), and the scientists (91%) have the highest ratio (least undercompensated). The other occupations fall very close to the mean of the distribution.

Consequently, asking people if they are fairly compensated or not and inferring the fairness of their compensation from their just and actual earnings provide different estimates of which occupations have the most and least.

(At the individual level these two measures correlated -.35--this correlation is negative because Inequity of Pay is scored as a measure of inequity while the percent income measure is scored as a measure of equity.)

Although neither measure of inequity predicts very strongly to psychological strain at the individual level of analysis, the ratio of earned to desired salary is the better of the two predictors. The ratio correlates -.26 ($p < .001$) with Work Load Dissatisfaction whereas the measure of perceived inequity is less strongly related to Work Load Dissatisfaction ($r = .13$)

Participation. The administrative professors report the highest levels of participation with others in decisions (170). The next highest occupations are the administrators (139), white collar supervisors (130), and professors (124). Most of the other white collar occupations hover near the mean of the distribution. The physicians (104) are probably at the mean because they do not participate with others in making decisions; they make job related decisions by themselves except in difficult cases when another physician may be consulted. Participation is lowest among the machine tenders in this sample (36) followed by the assemblers on machine paced lines (46) , the assembly relief men (57), and the forklift drivers (58).

Social Support. An examination of the means of all twenty-three occupations shows that Social Support from the Immediate Supervisor is highest for the continuous flow monitors (142) and lowest for the relief workers on assembly lines (47) and the assemblers on the machine paced lines (56). The continuous flow monitors come from only one site. Consequently their high score on Support could reflect the quality of the management-employee relations present in that particular site rather than any inherent quality of such relations among continuous flow monitors and their superiors in general.

Administrative professors (156) and physicians (143) have the highest scores on Social Support from Others at Work. Much of this probably reflects the support they receive from peers and colleagues. A lack of superiors in general, may explain why the scores for these two occupations on Support from Supervisor is relatively close to the mean of the distribution. The ATCs at the small sites (138) and the continuous flow workers (137) have the third and fourth highest scores on social support from others at work. Low Social Support from Others at Work is reported by machine tenders (39), relief men (44), assemblers on machine paced lines (65), and forklift drivers (67).

The highest degree of Social Support from Wife, Friends and Relatives is reported by the administrative professors (136). Considering that they have high scores for many of the stresses in the study, the support from family and friends seems most appropriate. The least amount of support from family and friends is reported by assemblers on nonmachine paced lines (60), tool and die makers (64), electronic technicians (66), relief men (68), and computer programmers (68). The rest of the groups have scores which lie very close to the mean of the distribution of occupational means.

Person-Environment Fit. The fit between individuals and their jobs was measured along four dimensions: quantitative work load, job complexity, responsibility for persons, and role ambiguity.

Quantitative Work Load-Fit measures the direction of fit so that a score near the mean (standard score = 100) represents good fit, smaller scores indicate a lighter work load than is wanted and larger scores indicate a heavier work load than is wanted. Occupations with the highest scores on Quantitative Work Load-Fit (indicating the highest work overload) are administrative professors (163), family physicians (152), train dispatchers (137), and machine tenders (133). Occupations with the most extreme work underload are continuous flow monitors (58), computer programmers (68), and air traffic controllers at small airports (68).

Job Complexity-Poor Fit, Responsibility for Persons-Poor Fit, and Role Ambiguity-Poor Fit all measure the extent to which fit on their respective dimensions is good or poor. No distinction is made as to whether poor fit results from a preference that the job environment be either higher or lower on the dimension. Low scores indicate good fit on the measure and higher scores indicate increasingly poorer fit between the person and the environment.

The occupations with the poorest fit on job complexity have low socioeconomic status: machine paced assemblers (184), machine tenders (160), non-machine paced assemblers (154), and fork lift dirvers (142). Occupations with good fit on job complexity generally have fairly high socioeconomic status: family physicians (53), policemen (63), administrators (65), and professors and administrative professors (66). Occupational differences on Responsibility for Persons-Poor Fit tend to follow a similar pattern with socioeconomic status. Couriers (159), machine paced assemblers (142), electronic technicians (140), and fork lift drivers (135) have the poorest fit on responsibility for persons while family physicians (57), administrators (63), and professors (68) have the best fit. Occupational differences on Role Ambiguity-Poor Fit tend to split between the blue collar and white collar occupations. Most blue collar jobs have average to poor fit scores on role ambiguity, with machine tenders (173), couriers (142), and fork lift drivers (137) having the worst fit. Most white collar jobs have average to good fit scores on role ambiguity with air traffic controllers at small airports (67), train dispatchers (79), and white collar supervisors (80) having the best fit.

Supplementary analyses were performed to determine the nature of the misfit in the occupations with high scores on the poor fit variables. For each of these variables the occupations with the three poorest fit scores (noted above) have person-environment fit scores indicating that the individuals generally want their jobs to provide more job complexity, more responsibility for persons, or more role ambiguity than they presently provide. Some fairly high poor fit scores, however, can reflect misfit in both directions. For example, nonmachine paced assemblers have a score of 135 on Role Ambiguity-Poor Fit. The number of these individuals wanting more role ambiguity in their work is approximately equal to the number wanting less role ambiguity.

Occupational Differences in Psychological and Behavioral Strain

The findings concerning psychological strain are presented in Table IV-4.

Boredom. The assemblers on the machine paced lines report the highest levels of Boredom (207). They are followed by their relief men (175), the forklift drivers (170), and the machine tenders (169). Occupations reported to be the least boring belong to the physicians (48), the university professors (49), the administrative professors (51), the ATCs at the small airports (52), and the ATCs at the larger airports (59). The most boring jobs tend to be the least complex and the most underutilizing.

Dissatisfaction with the work load. The greatest dissatisfaction is expressed by the machine tenders (162). Though these men report levels of work load very close to the mean, they also report that their fit on work load leaves them somewhat overloaded. The dissatisfaction with the work load may not stem entirely from its level of poor fit but additionally from some quality of the work. As we have noted, machine tenders feel greatly underutilized. Each unit of work may simply add another insult to injury in meeting their needs for more challenging jobs. In support of this observation, the machine tenders report very high misfit on job complexity. Since they report low complexity in the job, it appears that this misfit is in the direction of having less complex work than they would prefer. We have already reported in Chapter III that at the individual level misfit on job complexity conditions (interacts with) work load to increase dissatisfaction with work load. The individual level correlation between Work Load-Fit and Work Load Dissatisfaction is .30 when fit on complexity is good and .59 when fit on complexity is poor.

Assemblers on machine paced lines are the next most dissatisfied with their work load (161). Judging from their Work Load Dissatisfaction scores, which are similar to the machine tenders, and their scores on Complexity, Underutilization, and misfit on Complexity, these assemblers are in a situation similar to that of the machine tenders. They are dissatisfied not so much over the amount of work as its qualitative nature.

TABLE IV-4: STRAIN STATISTICS BY OCCUPATION

	JOB DISSAT (SS[a])	BOREDOM (SS)	WK LD DISSAT (SS)	SOMAT CMPLNTS (SS)	ANXIETY (SS)	DEPRESSION (SS)	IRRITATION (SS)
FORKLIFT DRVR	136	170	132	108	103	117	104
ASSEMB MACH	153	207	161	165	129	139	104
ASSEMB RELIEF	132	175	151	157	110	143	125
ASSEMB NOMACH	135	160	120	128	85	112	104
MACH TENDER	167	169	162	137	143	126	128
CONTIN FLOW	160	122	82	85	73	70	87
COURIER	64	86	57	65	98	90	90
TOOL AND DIE	125	96	93	100	93	84	90
ELEC TECH	88	87	97	122	126	96	104
POLICEMAN	63	63	81	94	90	82	112
SUP BLUE COLL	115	85	109	111	109	101	116
SUP WHTE COLL	60	72	94	82	106	70	83
DISPATCHER	109	64	119	108	107	87	128
ATC, LARGE	79	59	72	134	112	81	84
ATC, SMALL	56	52	75	139	110	65	110
PROGRAMMER	85	96	88	94	106	104	89
ACCOUNTANT	108	107	107	100	118	106	86
ENGINEER	126	100	107	85	112	112	75
SCIENTIST	85	66	84	77	110	95	74
PROFESSOR	56	49	91	71	107	121	107
ADMIN PROF	67	51	151	82	109	110	131
ADMINISTRATOR	80	66	87	91	110	93	101
PHYSICIAN	50	48	132	74	70	73	92
RNDM SMPL MEAN	3.31	2.00	2.16	1.28	1.65	1.66	1.81
RNDM SMPL S.D.	0.84	1.02	0.94	0.28	0.51	0.51	0.53

[a]SS denotes standard scores as described in the legend of Table IV-1.

The relief workers on the assembly lines (151) and the administrative professors (151) are also relatively dissatisfied with their work loads. Their reasons, however, would appear to be quite different. The relief men find the work boring but this is hardly the case for the administrative professors. The latter reported the highest amount of Quantitative Work Load, as we have noted. They have the poorest fit on Quantitative Work Load (163)— much more work load than they would like.

Overall dissatisfactions with the job. Would you recommend your job to a friend? If you did not have to work, would you still like to do what you are doing? These types of questions provide us with a picture of how people view their jobs in general. The most dissatisfied persons in this study are the machine tenders (167) and the continuous flow workers (160). We have noted a number of stressful aspects of work that were found in the machine tenders' descriptions of their job conditions. This, however, has not been the case for the continuous flow monitors with these exceptions--they report low work load and poor fit on work load. They have poor fit because they tend to want more work to do than they actually have. This seems to be a matter of the quantity of work more than its quality since they fall right on the mean of the occupations with regard to goodness of fit on job complexity and are only somewhat above the mean on degree of Underutilization.

The most satisfied occupational groups are the physicians (49), the professors (56), the ATCs at the small sites (56) and at the large sites (79), white collar supervisors (60), the police (63), and the couriers (64). These jobs are generally complex and involve relatively high levels of Participation and low levels of Underutilization of Ability. The reasons for high job satisfaction among the couriers are not clear from our data.

Somatic Complaints. The spread is not very great on this variable since most people in the study report few or no Somatic Complaints. Thus the variable distribution is skewed. The two groups with the highest scores on Somatic Complaints are the assemblers on the machine paced lines (165) and their relief men (157). It is unlikely that their relatively high level of complaints results from age-related accumulations of strain since these two occupational groups are among the youngest in the sample. In fact age and Somatic Complaints are unrelated in the random sample in across-individual analyses ($r = -.09$), and are negatively related in across-occupation analyses ($r = -.66$). The negative relationship across occupations is probably spurious and represents the presence of higher stress in the jobs which have young work forces than in the jobs which have older work forces. The assemblers and the relief men who are relatively young, do report relatively high levels of stress in their jobs (Underutilization, low Participation, low Social Support). The occupations with the lowest scores on Somatic Complaints (couriers, 65; professors, 71; physicians, 74; and scientists, 77) have higher values for average age.

Anxiety, Depression, and Irritation. Though these three affective measures tend to be related as noted in Chapter III, they are qualitatively different. The only occupation which has very high levels of all three negative affects are machine tenders (Anxiety, 143; Depression, 126; Irritation, 128). It is not clear that these high levels on all three affective strains are associated with ordinary circumstances associated with the occupation, however, since a series of lay-offs was occurring when data from machine tenders was collected. Other occupations high on Anxiety are machine paced assemblers (129) and electronic technicians (126). The occupations with the lowest Anxiety scores are the physicians (70) and the continuous flow workers (73). The low Anxiety score for physicians may be due to their training and experience increasing their ability to remain calm in difficult circumstances.

Occupations with the highest scores on Depression are the relief workers on the machine paced assembly line (143) and the other machine paced assembly line workers (139). The occupations with the lowest scores on the Depression index are the air traffic controllers at small installations (65), continuous flow monitors (70), white collar supervisors (70), and physicians (73). One feature which distinguishes between occupations which are high and low on Depression is the extent to which others at work are seen as supportive. The occupations with the highest scores on Depression also have the poorest supportive relations with others at work, while the occupations with the lowest scores on Depression generally have very good supportive relations with others at work ($r = -.67$, occupational level analysis).

Occupations with the highest scores on Irritation include administrative professors (131), train dispatchers (128), and relief workers on the machine paced assembly line (125). In addition to expressing feelings of annoyance and anger, men in these occupations also have levels of conflicting demands (i.e., role conflict) from others which are among the highest of any occupations in the study. Occupations with the lowest scores on Irritation are scientists (74) and engineers (75). Scientists have a lower level of conflicting demands than any other occupation in the study. The level of conflicting demands for engineers, however, is about average.

In addition to the preceding psychological strains we have examined a number of behaviors which are related to health in one form or another. Smoking, coffee consumption, and visits to a medical dispensary are considered. These findings are presented in Table IV-5.

Smoking. Three measures of occupational differences in smoking behavior

TABLE IV-5: HEALTH-RELATED VARIABLES BY OCCUPATION

	% SMOKERS (%)	% EX-SMOKERS[a] (%)	#CIGS SMOKED >0[b] (#)	CUPS COFFEE (#)	CAFFEIN DRNKS (#)
FORKLIFT DRVR	68.9	24.4	17.0	2.3	4.0
ASSEMB MACH	59.5	14.5	24.6	1.9	4.6
ASSEMB RELIEF	70.4	13.6	25.7	2.5	4.9
ASSEMB NOMACH	60.9	25.0	28.0	3.3	5.1
MACH TENDER	61.8	22.2	19.1	2.4	3.7
CONTIN FLOW	49.5	37.5	16.4	4.3	5.6
COURIER	47.4	40.0	25.9[c]	2.7	4.0
TOOL AND DIE	48.1	42.2	32.2	3.6	4.3
ELEC TECH	50.5	29.9	25.1	4.0	5.3
POLICEMAN	49.5	19.7	23.9	2.9	4.4
SUP BLUE COLL	60.1	29.6	27.2	4.0	5.2
SUP WHTE COLL	40.5	48.5	27.2	3.0	4.0
DISPATCHER	59.3	29.2	28.3	4.1	5.5
ATC, LARGE	58.5	25.0	25.5	4.2	5.8
ATC, SMALL	65.1	22.2	24.9	4.0	5.4
PROGRAMMER	31.1	40.4	21.7	3.1	4.1
ACCOUNTANT	45.7	35.4	23.9	2.9	3.9
ENGINEER	33.6	47.1	24.0	3.1	4.1
SCIENTIST	27.6	40.7	17.7	2.5	3.5
PROFESSOR	33.8	43.2	27.6	2.9	3.9
ADMIN PROF	43.5	41.2	33.7[c]	3.5	4.7
ADMINISTRATOR	42.0	37.1	28.7	3.4	4.2
PHYSICIAN	31.7	45.9	27.8	3.0	4.0
RNDM SMPL MEAN	49.1	33.5	24.2	3.2	4.4
RNDM SMPL S.D.	50.1	47.3	10.6	3.0	3.2

[a]Men who have quit smoking as a percentage of men who have ever smoked

[b]Excluding men who do not smoke at least one cigarette per day.

[c]Number of smokers is less than 10.

TABLE IV-5(CONT'D): HEALTH-RELATED VARIABLES BY OCCUPATION

	DISP VISIT (SS[a])	STFFD DISP VIS (SS)	OBESITY (WT/HT SQD)
FORKLIFT DRVR	110	86	3.60
ASSEMB MACH	126	142	3.50
ASSEMB RELIEF	152	139	3.43
ASSEMB NOMACH	107	87	3.64
MACH TENDER	94	87	3.64
CONTIN FLOW	77	61	3.66
COURIER	148[b]	151[b]	3.67
TOOL AND DIE	140	108	3.69
ELEC TECH	67	82	3.68
POLICEMAN	113	145	3.64
SUP BLUE COLL	90	79	3.70
SUP WHTE COLL	90	101[b]	3.63
DISPATCHER	72	71	3.64
ATC, LARGE	78	77	3.61
ATC, SMALL	167	78[b]	3.51
PROGRAMMER	90	95	3.50
ACCOUNTANT	70	73	3.55
ENGINEER	101	61	3.48
SCIENTIST	69	51	3.46
PROFESSOR	68	88	3.40
ADMIN PROF	59	62[b]	3.60
ADMINISTRATOR	78	79	3.60
PHYSICIAN	110	101	3.59
RNDM SMPL MEAN	4.18	4.78	3.60
RNDM SMPL S.D.	3.39	2.91	0.45

[a]SS denotes standard scores as described in the legend of Table IV-1.
[b]Based on an N of fewer than 10 men.

are reported in Table IV-5: percentage of smokers, percentage of ex-smokers, and the number of cigarettes smoked per day by smokers.

Sizable differences are found in the percentage of smokers in various occupations ($\chi^2 = 109$, $p < .0001$). As has been found in other studies (e.g., U.S. Public Health Service, 1964), the percentage of smokers in an occupation is inversely related to the average level of education associated with the occupation ($r = -.83$ at the occupational level). Accordingly, blue collar occupations generally have the highest percentage of smokers: relief workers on machine paced assembly lines (70.4%), fork lift drivers (68.9%), and machine tenders (60.9%). Professional occupations generally have the lowest percentage of smokers: scientists (27.6%), computer programmers (31.1%), and physicians (31.7%).

McKennel (1969) points out that the decision to smoke is usually made during adolescence, before the individual is subject to the influence of his present occupational environment. The correlation between percentage of smokers and education most likely reflects the sociocultural background of individuals in various occupations and the influence of social values and norms to which they were exposed during their adolescence.

The proportion of persons who have quit smoking also varies greatly across occupations ($\chi^2 = 51.7$, $p < .0003$). In the case of cessation of smoking, there is a possible confounding of quit rates with the age of the person. It is conceivable that one will find a higher percentage of quitters among older persons because (a) they have had a longer opportunity in which to decide to quit, or (b) because more such persons have been told to quit by a physician. Either process would have the effect of accumulating a larger number of quitters in the older age groups. When the percent of ex-smokers is examined in each age decade from the twenties to the fifties, it is evident that the percentage of quitters does indeed increase with age although we lack the data to substantiate the reasons for this increase. These data are presented in Table IV-6.

Since the occupational groups differ significantly in their average age, it is possible that the high percentage of ex-smokers in one occupation and the low percentage in another may be due to the differences in age of the occupational groups. As a partial control for age we have divided the people in each occupational group into those 20-39 years of age and those 40-59 years of age. These twenty year intervals were used in order to keep the sample sizes in each occupational group reasonably large.

When the occupational differences in the percent of ex-smokers are examined within these two age groups, occupational differences in cessation

Table IV-6

Percent of Ex-Smokers as a Function of Age

Age Decade	% Ex-smokers	n
20	21.8	243
30	27.8	425
40	37.7	406
50	40.6	281
Total	32.3	1355

Note. $\chi^2 = 30.4$, $p<.0001$

of smoking are significant only in the group aged 20-39 years ($\chi^2 = 34.5$, $p < .05$). These findings are presented in Table IV-7. The highest point of ex-smokers in the younger group are found among the white collar supervisors (56.3 percent), the scientists (44.8), the engineers (41.2) and the programmers (36.7). The lowest percent of ex-smokers are found among the train dispatchers (10.0 percent), the assemblers on machine paced lines (15.8), the assemblers on nonmachine paced lines (16.7), and the policemen (17.2). None of the administrative professors who smoke has quit, but there are only three such persons in the age group 20-39 so the reliability of the percentage is low. For the group 40-59 years of age, the same pattern of findings is clearly evident--professionals tend to have higher rates of quitting than persons in blue collar occupations.

In the random sample the main correlate of the quit rate is education ($r = .24$). At the ecological level education and the quit rate are correlated .65. There is no first order relationship between job stress and the quit rate at the individual level of analysis. Consequently, it appears that the occupational differences in quit rate in this study may be due largely to the education or unmeasured correlates of education. Our previous research (Caplan et al., forthcoming) on a sample of professionals, where the educational level was roughly the same for all employees, suggested that the ability to quit increases with decreases in quantitative work load and that this relationship may hold primarily for persons reporting low levels of social support at work. Subsequent analyses of the present data within occupations may produce similar findings.

We have already noted that two factors seem to be associated with smoking quit rates in this study: eduction and age. If we examine the mean smoking quit rates of each occupation in Table IV-7, we can determine whether or not each occupational group shows the expected increase in the smoking quit rate as a function of age. For most of the occupations this increase is present. For assemblers on machine paced lines, a group with one of the lowest percentages of smoking quitters, no such increase is evident (15.8 percent of the younger group have ceased versus 15.4 of the older group). Similarly there are very small differences in the percentage of ex-smokers as a function of age for the accountants (34.4 versus 39.3 percent) and for the ATCs at the large sites (24.0 versus 28.6 percent), but not at the small sites (17.9 versus 37.5 percent).

Future analyses of stress and strain within occupational groups may provide some answers regarding why the quit rate for smoking increases with age in some occupations and not in others. We know from previous research that the nicotine level in cigarettes may increase the smokers ability to

Table IV-7

Occupational Differences in Quitting Smoking as a Function of Age

	Age			
	20-39		40-59	
Occupation	% Ex-Smokers	n	% Ex-Smokers	n
Forklift driver	18.2	22	33.3	18
Assembler, machine paced	15.8	38	15.4	13
Assembler, machine paced relief	18.8	16	00.0	5
Assembler, nonmachine paced	16.7	30	34.6	26
Machine tender	23.8	21	16.7	6
Continuous flow monitor	23.5	17	41.7	60
Delivery service courier	25.0	4	33.3	9
Tool and die maker	18.2	11	50.0	38
Electronic technician	30.8	39	20.0	25
Policeman	17.2	58	28.6	7
Blue collar supervisor	20.3	64	33.7	83
White collar supervisor	56.3	16	41.2	17
Train dispatcher	10.0	20	34.0	50
ATC, large airports	24.0	50	28.6	14
ATC, small airports	17.9	28	37.5	8
Programmer	36.7	30	47.1	17
Accountant	34.4	32	39.3	28
Engineer	41.2	34	52.8	36
Scientist	44.8	29	33.3	21
Professor	33.3	15	48.0	25
Administrative professor	00.0	3	50.0	12
Administrator	27.7	65	42.3	97
Family physician	20.0	5	49.0	51
Total	25.7 (S.D.=19.1)	647	39.0 (S.D.=24)	666

Note. Chi-square for persons 20-39 = 34.5 ($p<.05$), Chi-square for persons 40-59 = 24.1 (N.S.).

tolerate stress (Nesbitt, 1973) and that stress may make it difficult to quit smoking (Caplan, et al., forthcoming). Consequently smoking may have reward properties for persons experiencing job stress. If the quit rate for smoking does not increase with age in an occupation, it may mean that the levels of stress are very high in that occupation. Its members may continue to smoke regardless of age. For example, air traffic controllers often say that they "burn out" by 40 to 45 years of age. The older smokers at the large airports may be unable to quit smoking because of the amount of subjective stress that they experience. The stress level may be high enough to maintain their smoking habit as a way of reducing the impact of their stresses. Whether or not this is actually the case is a matter for further investigation.

The final measure of smoking behavior in Table IV-5 is the average number of cigarettes smoked per day by those who smoke. Occupational differences on this smoking variable are also significant ($F = 3.59$, $p < .0001$). Administrative professors average the most cigarettes per day (33.7), but the reliability of the average is low since it is based on only four men. Other occupations with high numbers of cigarettes smoked are tool and die makers (32.2 cigarettes) and administrators (28.7 cigarettes). Occupations with the lowest number of cigarettes smoked are continuous flow operators (16.4 cigarettes), fork lift drivers (17.0 cigarettes), and scientists (17.7 cigarettes).

No systematic pattern appears for the occupational differences in number of cigarettes smoked per day. The opportunity to smoke on the job is one important factor which varies greatly from one occupation to another. For example, the continous flow operators in the sample work in chemical processing installations and restrictions in the locations where they can smoke are likely to contribute to their low average. Similarly, many fork lift drivers in the sample work in food processing and handling sites where smoking is restricted. Such site specific regulations may account for much of the occupational variation in the number of cigarettes smoked.

Caffeine consumption. Occupations differ in the opportunities they provide for people to take a coffee break. Many of the ATC towers have coffee percolators near the men so they do not have to leave their posts to get a cup of coffee. On the other hand, in some assembly operations the union, after several years of negotiations, finally obtained a contract which allowed one person to leave the assembly line and fetch coffee for the other workers on the line. Furthermore, the number of ounces in a "cup" and the strength of the beverage can vary. Consequently, it is difficult to control all the factors which determine caffeine consumption when studying its distribution across occupations.

An overall index of caffeinated drink consumption (coffee, colas, and tea) assigns the highest rates of caffeine ingestion to ATCs at the large airports (5.8 drinks per day), continuous flow monitors (5.6), train dispatchers (5.5), and the ATCs at the small airports (5.4). Alertness and concentration are important demands for ATC's and train dispatchers. The occupations with the lowest caffeine consumption are scientists (3.5 cups) and machine tenders (3.7).

Dispensary visits. Two measures of dispensary use were developed. For the Recency of Dispensary Visit measure individuals were asked how long it has been since they last used the dispensary at work. A number of individuals consider using company provided medicine cabinets or aspirin to be a dispensary visit. We therefore tried to determine which individuals have access to a dispensary having at least part time medical personnel (e.g., nurse or physician). Only those visits to medically staffed dispensaries are included in the Staffed Dispensary Visit measure.

Scientists (standard score = 51) and engineers (61) have the least recent visits to a staffed medical dispensary for a reason other than a routine medical check up. Although couriers have a high standard score, it is based on only three person's visits (most couriers do not have a dispensary at work). Police (145), machine paced assemblers (142) and their relief men (139) report having visited a staffed dispensary most recently of all the occupational groups. The standard scores for the least recent visits to a staffed dispensary translate into about once every five months. The standard scores for the most recent visits translate into about once every two months.

Several factors can influence dispensary visits. Very little is known about the psychological meaning of dispensary visits. A few studies, however, do suggest that persons suffering from low self-esteem may visit the dispensary as a way of seeking some sort of psychological bolstering or support (Kasl & French, 1962; Mechanic & Volkart, 1961; Roessler & Greenfield, 1958). Of course, factors other than psychological support affect the frequency of dispensary visits. The occupational settings of scientists, engineers, and administrative professors (and most other white collar persons) have very few physical hazards in them. The settings of assembly line work, courier work (which involves loading and unloading), and police work all have much greater potential for physical accidents. Social class and local norms about how one should deal with physical symptoms also affect frequency of dispensary visits.

So far our own analyses have not uncovered enough evidence to suggest that these rates of dispensary visits are either higher or lower than might be expected considering the physical hazards of the jobs. Since many accidents may go unreported and since, in other instances, people may be particularly sensitive to accidents and deal with them in a dispensary, the data on dispensary visits should be viewed with caution. These types of equivocalities in interpreting dispensary and accident data would require a study focused specifically and in detail on these two potential indicators of job related strain.

Obesity. The ratio of weight (in pounds) divided by the square of the height (in inches) differs significantly across the occupational groups. The most ponderous group is the blue collar supervisors or foremen. The next two most ponderous groups are the electronic technicians and the tool and die makers. The least obese persons are the university professors and the relief men on the assembly line. There do not appear to be any indications that obesity varies systematically as a function of some first-order relationships with job demands. Nor is obesity correlated with age ($r = -.03$) in our random sample.

Occupational Differences in Physiological Strain

This analysis is confined to the subsample on which physiological measures were obtained. In a first examination of the data it became apparent that the individual level age is related, although not necessarily linearly, with systolic blood pressure (eta = .23, $p = .02$), diastolic blood pressure (eta = .26, $p = .001$), serum cholesterol (eta = .37, $p < .001$), T - 3 (eta = .26, $p = .007$) but not with heart rate (eta = .17, N.S.), T - 4I (eta = .19, N.S.), serum uric acid (eta = .14, N.S), and serum cortisol (eta = .21, N.S.). Consequently it is advisable to compare occupational differences in physiological strain within age strata. This is particularly important since, as was already noted, the occupational groups do differ significantly on mean age in this study.

One standard procedure for examining the effects of occupation on physiological strain while stratifying for age involves the construction of a two way analysis of variance table with occupation and age as the two main effects. However, since age and occupation are not independent of one another such an analysis does not adequately control for the effects of age. In such a case, the best procedure is to perform a separate analysis of variance of occupation for each age stratum (Snedecor and Cochran, 1967). This is the procedure which has been adopted here.

The analyses of variance are presented in Tables IV-8 through IV-15. At the bottom of each table is the F test of the main effect of occupation for that age stratum. At the side of each table is the F test of the main effect of age. Cells in the table with sample sizes of four or fewer persons are excluded from the analyses.

Table IV-8

Age-Stratified Occupational Differences in Systolic Blood Pressure (mm Hg)

Occupation[a]	Age 20-29	30-39	40-49	50-59	All Ages Combined $\overline{X}$	S.D.	N	F[b] (d.f.)	p<
Assembler, mach	124.1 (22)[c]	127.3 (6)	120.3 (3)	141.7 (9)	128.3	12.2	40		
Electronic technician	130.8 (4)	126.3 (30)	129.1 (20)	139.3 (7)	129.0	13.7	61		
Supervisors[d]	(0)	127.8 (11)	133.6 (11)	122.0 (2)	130.0	16.2	24		
ATC large airports	127.4 (20)	130.5 (42)	127.1 (19)	(0)	128.9	12.2	81		
ATC small airports	128.0 (18)	127.8 (16)	126.8 (4)	159.3 (3)	130.1	15.7	41		
Scientist	121.8 (10)	117.4 (17)	117.4 (18)	133.7 (6)	120.2	15.1	51		
Administrator	125.1 (9)	124.8 (30)	124.0 (14)	121.0 (8)	124.2	10.6	61		
$\overline{X}$	125.9	126.5	125.6	135.5	127.0			5.22 (3,355)	.002
S.D.	12.8	11.8	15.3	16.3		13.7			
N	83	152	89	35			359		
F[e] (d.f.)	.54 (4,74)	2.81 (6,145)	2.45 (4,77)	3.94 (3,26)	3.78 (6,352)				
p<[f]	N.S.	.02	N.S.	.02	.002				

[a]The Framingham study (1968) found the average systolic blood pressure of male participants by age group to be: 30-39 years, 130.2; 40-49 years, 131.7; 50-59 years, 138.5.

[b]F test of main effect of age.

[c]The number of men within the cell are noted in parentheses below the cell mean.

[d]Blue plus white collar.

[e]F test of effect of occupation. Cells with n<5 are omitted in the analysis of variance.

[f]Significance of the F ratio

Table IV-9

Age-Stratified Occupational Differences in Diastolic Blood Pressure (mm Hg)

	Age				All Ages Combined			F^b	
Occupation	20-29	30-39	40-49	50-59	$\bar{X}$	S.D.	N	(d.f.)	p<
Assembler, mach	76.8 (22)[c]	76.2 (6)	81.3 (3)	85.2 (9)	79.0	9.4	40		
Electronic technician	86.0 (4)	75.2 (30)	80.5 (20)	86.0 (7)	78.8	11.0	61		
Supervisors[d]	(0)	77.0 (11)	84.7 (11)	78.5 (2)	80.7	12.2	24		
ATC large airports	75.7 (20)	79.1 (42)	79.4 (19)	(0)	78.3	9.5	81		
ATC small airports	76.2 (18)	76.9 (16)	76.0 (4)	86.3 (3)	77.2	9.7	41		
Scientist	71.6 (10)	70.8 (17)	72.9 (18)	87.3 (6)	73.6	11.1	51		
Administrator	70.4 (9)	74.7 (30)	76.1 (14)	73.3 (8)	74.2	9.3	61		
$\bar{X}$	75.5	76.0	78.4	82.7	77.1			5.31 (3,355)	.002
S.D.	10.1	9.9	10.5	10.4		10.3			
N	83	152	89	35		359			
F^e (d.f.)	1.01 (4,74)	1.64 (6,145)	2.70 (4,77)	4.13 (3,26)	2.97 (6,352)				
p<[f]	N.S.	N.S.	.04	.02	.01				

[a]The Framingham study found the average diastolic blood pressure of male participants to be: 30-39 years, 77.7; 40-49 years, 81.0; 50-59 years, 83.0.

[b]F test of main effect of age.

[c]The number of men within the cell are noted in parentheses below the cell mean.

[d]Blue plus white collar.

[e]F test of effect of occupation. Cells with n 5 are omitted in the analysis of variance.

[f]Significance of the F ratio.

Table IV-10

Age-Stratified Occupational Differences in Heart Rate (Beats/Minute)

Occupation	Age 20-29	30-39	40-49	50-59	All Ages Combined $\overline{X}$	S.D.	N	F^a (d.f.)	p<
Assembler, mach	71.3 (22)[b]	72.8 (6)	80.3 (3)	70.0 (9)	71.9	9.6	40		
Electronic technician	64.8 (4)	75.8 (30)	74.4 (20)	77.9 (8)	74.9	11.2	62		
Supervisors[c]	(0)	76.2 (10)	77.8 (11)	59.0 (2)	75.5	11.9	23		
ATC large airports	73.8 (20)	74.6 (41)	74.1 (20)	(0)	74.3	11.9	81		
ATC small airports	78.4 (18)	74.6 (16)	77.0 (4)	77.7 (3)	76.7	9.8	41		
Scientist	71.8 (10)	73.2 (17)	74.3 (18)	69.0 (7)	72.8	11.4	52		
Administrator	71.6 (9)	71.0 (30)	75.9 (15)	74.5 (8)	72.7	10.0	62		
$\overline{X}$	73.2	74.0	75.3	72.5	74.0			.80 (3,357)	N.S.
S.D.	11.5	10.8	10.4	11.4		10.9			
N	83	150	91	37			361		
F^d (d.f.)	1.15 (4,74)	.64 (6,143)	.30 (4,79)	1.03 (3,28)	1.07 (6,354)				
p<[e]	N.S.	N.S.	N.S.	N.S.	N.S.				

[a]F test of main effect of age.

[b]The number of men within the cell are noted in parentheses below the cell mean.

[c]Blue plus white collar.

[d]F test of effect of occupation. Cells with n<5 are omitted in the analysis of variance.

[e]Significance of the F ratio.

Table IV-11

Age-Stratified Occupational Differences in Cholesterol (mg%)

Occupation[a]	Age 20-29	30-39	40-49	50-59	All Ages Combined $\overline{X}$	S.D.	N	F^b (d.f.)	p<
Assembler, mach	177 (18)[c]	179 (5)	220 (3)	196 (9)	186	30	35		
Electronic technician	252 (2)	186 (26)	217 (17)	195 (5)	200	40	50		
Supervisors[d]	(0)	183 (10)	229 (9)	180 (2)	202	50	21		
ATC large airports	178 (20)	200 (37)	206 (17)	(0)	195	36	74		
ATC small airports	184 (18)	184 (16)	238 (4)	202 (3)	191	38	41		
Scientist	171 (9)	187 (17)	206 (16)	217 (6)	194	36	48		
Administrator	192 (9)	195 (29)	211 (14)	209 (8)	200	36	60		
$\overline{X}$	182	191	214	202	196			11.83 (3,325)	.001
S.D.	34	33	41	37		37			
N	76	140	80	33			329		
F^e (d.f.)	.62 (4,69)	1.05 (6,133)	.62 (4,68)	.42 (3,24)	.92 (6,322)				
p<[f]	N.S.	N.S.	N.S.	N.S.	N.S.				

[a]The Framingham study (1968) found the average cholesterol level of male participants by age to be: 30-39 years, 221.3; 40-49 years, 236.2; 50-59 years, 238.0. The Framingham study used a method of cholesterol determination different from that used in the present study and these average cholesterol levels may therefore be based on different standards than these in the present study.

[b]F test of main effect of age.

[c]The number of men within the cell are noted in parentheses below the cell mean.

[d]Blue plus white collar.

[e]F test of effect of occupation. Cells with n<5 are omitted in the analysis of variance.

[f]Significance of the F ratio.

Table IV-12

Age-Stratified Occupational Differences in T-3 (mg%)

	Age				All Ages Combined				
Occupation	20-29	30-39	40-49	50-59	$\overline{X}$	S.D.	N	F[a] (d.f.)	p<
Assembler, mach	53.5 (13)[b]	54.2 (6)	47.7 (3)	52.1 (9)	52.7	4.3	31		
Electronic technician	59.9 (3)	52.8 (25)	51.4 (16)	49.1 (5)	52.4	5.1	49		
Supervisors[c]	(0)	51.6 (9)	51.4 (11)	49.2 (2)	51.3	3.2	22		
ATC large airports	53.8 (20)	53.3 (38)	54.6 (17)	(0)	53.7	5.8	75		
ATC small airports	51.1 (15)	51.6 (16)	51.5 (4)	51.3 (2)	51.4	4.7	37		
Scientist	57.8 (9)	56.9 (16)	51.1 (15)	53.6 (5)	54.8	5.9	45		
Administrator	57.9 (9)	58.2 (27)	54.4 (13)	54.1 (5)	56.9	6.3	54		
$\overline{X}$	54.5	54.3	52.4	51.9	53.7			3.43 (3,309)	.02
S.D.	5.2	5.9	5.8	4.0		5.7			
N	69	131	79	28			313		
F[d] (d.f.)	4.50 (4,61)	4.39 (6,130)	1.46 (4,67)	1.52 (3,20)	5.96 (6,306)				
p<[e]	.003	.0004	N.S.	N.S.	.0001				

[a]F test of main effect of age.

[b]The number of men within the cell are noted in parentheses below the cell mean.

[c]Blue plus white collar.

[d]F test of effect of occupation. Cells with n<5 are omitted in the analysis of variance.

[e]Significance of the F ratio.

Table IV-13

Age-Stratified Occupational Differences in T-4I (mg%)

	Age				All Ages Combined			F^a	
Occupation	20-29	30-39	40-49	50-59	$\overline{X}$	S.D.	N	(d.f.)	p<
Assembler, mach	5.08 (13)[b]	4.63 (6)	5.23 (3)	5.01 (9)	4.99	.73	31		
Electronic technician	4.97 (3)	4.29 (25)	4.91 (16)	4.72 (5)	4.58	.90	49		
Supervisors[c]	(0)	4.55 (10)	4.78 (11)	4.75 (2)	4.68	.70	23		
ATC large airports	5.01 (20)	4.43 (38)	4.47 (17)	(0)	4.59	.76	75		
ATC small airports	4.65 (15)	4.89 (16)	4.83 (4)	5.00 (2)	4.79	.93	37		
Scientist	4.59 (9)	5.09 (16)	4.99 (15)	4.82 (5)	4.92	1.03	45		
Administrator	5.33 (9)	4.72 (27)	5.26 (13)	4.20 (5)	4.90	.74	54		
$\overline{X}$	4.93	4.60	4.88	4.76	4.76			3.00 (3,310)	.04
S.D.	.78	.90	.82	.67		.84			
N	69	138	79	28			314		
F^f (d.f.)	1.68 (4,61)	1.93 (6,131)	1.96 (4,67)	1.66 (3,20)	1.88 (6,307)				
p<[e]	N.S.	N.S.	N.S.	N.S.	N.s.				

[a]F test of main effect of age.

[b]The number of men within the cell are noted in parentheses below the cell mean.

[c]Blue plus white collar.

[d] F test of effect of occupation. Cells with n<5 are omitted in the analysis of variance.

[e]Significance of the F ratio.

Table IV-14

Age-Stratified Occupational Differences
in Serum Uric Acid (mg%)

	Age				All Ages Combined			F[a]	
Occupation	20-29	30-39	40-49	50-59	$\overline{X}$	S.D.	N	(d.f.)	p<
Assembler, mach	6.15 (19)[b]	5.97 (6)	7.50 (3)	5.55 (8)	6.10	1.32	36		
Electronic technician	6.60 (3)	6.23 (26)	6.24 (17)	6.82 (5)	6.31	1.28	51		
Supervisors[c]	(0)	6.09 (10)	6.36 (11)	5.85 (2)	6.20	1.06	23		
ATC large airports	6.32 (20)	6.51 (36)	6.75 (15)	(0)	6.51	1.28	71		
ATC small airports	6.61 (17)	6.10 (15)	5.85 (4)	7.70 (3)	6.42	1.52	39		
Scientist	6.25 (8)	6.03 (15)	5.95 (15)	6.05 (6)	6.05	1.04	44		
Administrator	5.60 (8)	5.60 (27)	5.99 (12)	5.67 (7)	5.70	1.09	54		
$\overline{X}$	6.27	6.12	6.29	6.11	6.20			.44 (3,314)	N.S.
S.D.	1.39	1.21	1.22	1.30		1.26			
N	75	135	77	31			318		
F[d] (d.f.)	.72 (4,67)	1.55 (6,128)	1.06 (4,65)	1.85 (3,22)	2.62 (6,311)				
p<[e]	N.S.	N.S.	N.S.	N.S.	.02				

[a]F test of main effect of age.

[b]The number of men within the cell are noted in parentheses below the cell mean.

[c]Blue plus white collar.

[d]F test of effect of occupation. Cells with n<5 are omitted in the analysis of variance.

[e]Significance of the F ratio.

Table IV-15

Age-Stratified Occupational Differences
in Cortisol (mg%)

Occupation	Age 20-29	30-39	40-49	50-59	All Ages Combined $\bar{X}$	S.D.	N	F[a] (f.d.)	p<
Assembler, mach	6.71 (19)[b]	7.15 (6)	12.40 (3)	8.58 (9)	7.70	3.94	37		
Electronic technician	7.47 (3)	7.62 (26)	9.19 (18)	12.25 (4)	8.53	3.80	51		
Supervisors[c]	(0)	9.51 (8)	7.43 (11)	7.70 (2)	8.25	4.56	21		
ATC large airports	6.86 (19)	5.22 (37)	6.19 (16)	(0)	5.87	3.65	72		
ATC small airports	7.21 (18)	8.73 (15)	7.23 (4)	9.37 (3)	7.94	3.66	40		
Scientist	8.36 (10)	9.38 (17)	9.74 (17)	8.87 (7)	9.23	3.07	51		
Administrator	8.10 (9)	9.34 (27)	10.04 (14)	9.20 (7)	9.30	3.07	57		
$\bar{X}$	7.26	7.74	8.66	9.26	8.01			3.28 (3,325)	.03
S.D.	3.50	3.86	3.96	3.13		3.78			
N.	78	136	83	32			329		
F[d] (d.f.)	.56 (4,70)	5.20 (6,129)	3.06 (4,71)	.11 (2,20)	6.69 (6,322)				
p<[e]	N.S.	.0001	.03	N.S.	.0001				

[a]F test of main effect of age.

[b]The number of men within the cell are noted in parentheses below the cell mean.

[c]Blue plus white collar.

[d]F test of effect of occupation. Cells with n<5 are omitted in the analysis of variance.

[e]Significance of the F ratio.

Separating the respondents into age groups, although adding more statistical control on the effects of age, does involve sacrifices. The resulting cell sizes for each occupational group are very small. The collection of physiological data was exploratory, and for exploratory purposes we are prepared to live with such small cell sizes. The reader, however, should use extreme caution in attempting to generalize from the findings about to be presented to the occupational populations which these samples represent.

Blood Pressure. The analyses of occupational differences in systolic and diastolic blood pressure are presented in Tables IV-8 and IV-9, respectively. There is no significant occupational difference in either systolic or diastolic blood pressure for the age group 20-29. For each of the age groups thereafter, however, there are some significant differences.

In the age group 30-39 years the main difference is between the scientists and all other occupations. The scientists have the lowest systolic blood pressure (117.4 mm Hg). Diastolic blood pressure does not differ significantly as a function of occupation in this age group ($p = .14$). Nevertheless, the scientists again tend to have the lowest diastolic blood pressure (70.8 mm Hg) which is to be expected since the two blood pressures are positively related to one another in the physiological sample ($r = .61$). None of the other occupational groups in this age stratum differ significantly from one another on either measure of blood pressure.

Comparing the persons in their forties the same pattern is again evident--the scientists stand apart from everyone else with their low systolic and diastolic blood pressures. In the stratum of persons 50-59 years of age the scientists no longer have the lowest blood pressures of the compared groups. The administrators (eight of them) occupy that position. Furthermore, the administrators differ significantly ($p = .05$ or less) from all other groups except the scientists.

The tendency for scientists to have lower blood pressure levels than administrators parallels results from our previous research at NASA (French & Caplan, 1970). In that study the 47 scientists, mean age 36, had a systolic blood pressure of 131.8 whereas the 48 administrators, mean age 44.4 had a systolic blood pressure of 134.6. The diastolic blood pressure levels of the scientists and the administrators were 81.5 and 85.0 respectively. These levels are considerably higher than those found in the current study. NASA at the time of that study was a highly stressed organization in terms of objective quantitative work load (Mockbee, 1970). This stress may have accounted for the differences in blood pressure between our sample and the NASA sample.

Heart rate. The analysis of occupational differences in heart rate is presented in Table IV-10. There is no significant difference in heart rate as a function of occupation. This finding is the same for all age groups.

Serum Cholesterol. The analyses of occupational differences in serum cholesterol is presented in Table IV-11. There is no significant occupational difference in serum cholesterol, nor do we know of other studies which report occupational differences.

Thyroid hormones. The analyses of occupational differences in T-3 and T-4I are presented in Tables IV-12 and IV-13, respectively. T-3 does differ significantly as a function of occupation in the 20-29 and 30-39 year old strata. The differences are accounted for by the scientists and administrators who have the highest T-3 levels. Both occupations differ significantly from the other occupations (remember occupations with cell sizes of five or less are excluded in the analysis), and the other occupations do not differ significantly from one another. There are no significant differences in T-3 as a function of occupation for the persons in their forties and fifties.

T-4I shows no main effect of occupation. The relatively large standard deviation of the individual values precludes testing for normal differences in T-4I in a sample this size.

In the cases of both T-3 and T-4I it is very difficult to interpret the findings. We have already noted that there are significant seasonal variations in thyroid hormones which are confounded with the dates on which the different occupational groups had their blood samples taken. Consequently, until further analyses of these samples can be made which deal with these seasonal factors, we feel that the data should not be interpreted as a representation of occupational differences in physiological strains.

Serum uric acid. The analysis of occupational differences is serum uric acid is presented in Table IV-14.

The overall mean level of serum uric acid (6.2 mg%) is very close to that found by Acheson and O'Brien (1966) in a sample of men from New Haven, Connecticut.

Unlike most of the other physiological variables in this study, serum uric acid does not vary significantly with age. The level of serum uric acid does, however, vary significantly ($p < .02$) with occupation. Occupational groups with the highest levels of serum uric acid are air traffic controllers at large airports, air traffic controllers at small airports, and radar technicians at airports (the only electronic technicians from whom physiological measures were obtained). Mueller, Kasl, Brooks, and Cobb (1970) reviewed several studies where individuals with high levels of serum uric acid tend to be achievement oriented or tend to be in stressful situations. Conclusions about the likely cause of the occupational differences in serum uric acid in the present study require multivariate analyses beyond the scope of the present report.

Serum cortisol. The analysis of occupational differences in serum cortisol is presented in Table IV-15. As was noted in Chapter II, cortisol varies as a function of time of day. One must keep this in mind when interpreting the findings on this biochemical. There are statistically significant F tests for the 30-39 and 40-49 age groups. The differences in cortisol as a function of occupation are essentially the difference between air traffic controllers at the large sites and all other occupations. The controllers at the large sites have the lowest cortisol levels.

The low cortisol levels of the controllers at the large sites can probably be easily explained in terms of the diurnal rhythm of cortisol. Approximately half of these men had their blood samples drawn in the evening between 8 and 10 P.M. when cortisol is reaching its nadir. The other occupational groups including the air traffic controllers from the small sites, by contrast, generally had their blood samples taken during the daytime when cortisol levels are normally higher. In analyses planned for a second technical report on these data we shall control for the time of day during which the sample was taken. Until then, there is little value in speculating on the meaning of the cortisol levels for the occupational groups.

Occupational Differences in Reported Diseases

In Chapter III we considered the differences in stress, personality, and strain for persons who did and did not report certain diseases as reasons why they visited a physician on their most recent visit, or as reasons for ongoing medical treatment. In this section we consider the occupational differences in the frequency or rate with which some of these reasons were given. Four diseases were considered because they are believed to have some relationship to social-psychological stresses including possibly some of the job demands considered in this study: cardiovascular diseases, peptic ulcer, gastrointestinal problems, and respiratory infections.

We again remind the reader that the respondent indicated (1) the reason for his most recent visit to the physician and (2) the reasons for any ongoing medical treatment. Whether or not the physician would have given the same diagnosis is unknown. Chapter III discusses some findings which suggest, nevertheless, that the reports by the respondents have some semblance of reliability and validity. For example, we do find the expected increase in cardiovascular disease in the older age groups. Unfortunately our sample size is too small to determine whether or not persons reporting cardiovascular disease also had higher levels of blood pressure, cholesterol, and other risk factors.

Of the four diseases considered here, two show significant main effects of occupations on the variance in the rates with which they were reported. These two disease categories are cardiovascular disease and respiratory disease. There is no occupational difference in the reported rates of peptic ulcer (the overall rate is 1.5%). Nor is there any occupational difference in the reported rates of gastrointestinal problems (the overall rate is 5.1%).

Cardiovascular disease. Table IV-16 presents the rates of disease by occupation for the cardiovascular and respiratory categories.[1] The sample sizes for each occupation are not really large enough to reliably represent the incidences of cardiovascular disease. This is the only study that we know of, however, which has such information on twenty-three rather specific occupations (as opposed to broad occupational categories such as "professional" or "managerial"). Consequently, we present these data here for future reference by persons who might wish to carry out adequate epidemiological surveys of any of these specific occupations. Unfortunately the low levels of incidence within each occupation do not allow us to control effectively for the demonstrated relation of cardiovascular disease with age as was done in Chapter III.

The four groups with the highest cardiovascular disease rates are the tool and die makers (14.3%) the family physicians (12.5%), the administrative professors (12%), and the accountants (12%). These groups all tend to be among the oldest which is the only common element shared among them. There are wide differences in education and job demands among these four occupations.

There are a number of occupational groups with relatively low mean rates of cardiovascular disease. These include the air traffic controllers at the small sites (0.0%), assemblers on machine paced lines (1.3%), air traffic controllers at the large sites (3.7%), relief workers on the machine paced lines (3.7%), and university professors (4.1%). The low rates for the air traffic controllers are not surprising since they have to pass medical screening tests to remain fully qualified and are one of the youngest groups. The workers on the machine paced assembly lines are generally too young to show much evidence of cardiovascular disease. The most intriguing group is the university professors whose rate is one third that of administrative professors. Although the administrative professors are generally older

[1]Cardiovascular disease includes reports of visits to a physician for heart attack, heart failure, angina pectoris, stroke, arteriosclerosis, any mention of heart, circulatory problems, and hypertension or high blood pressure. Respiratory infection includes colds, coughs, flu, sinus, sore throat, and tonsillitis.

Table IV-16

Occupational Differences in Reasons for Ongoing Treatment or for Visits to a Physician for Reasons Other than a Routine Checkup

Occupation	N	Percent of Participants within an Occupation Reporting: Cardiovascular Disease	Respiratory Disease
Forklift driver	46	10.9	26.1
Assembler, mach paced	79	1.3	19.0
Assembler, relief	27	3.7	29.6
Assembler, non paced	69	5.8	20.3
Machine tender	34	5.9	17.6
Contin flow	101	11.9	19.8
Courier	20	5.0	35.0
Tool and die	77	14.3	
Electronic tech	93	9.7	9.7
Policeman	111	2.7	24.3
Blue coll sup	178	7.9	19.7
White coll sup	42	4.8	19.0
Train dispatcher	86	9.3	14.0
ATC, large airports	82	3.7	28.0
ATC, small airports	43	0.0	27.9
Programmer	90	4.4	20.0
Accountant	92	12.0	18.5
Engineer	110	5.5	16.4
Scientist	117	5.1	15.4
Professor	74	4.1	6.8
Admin prof	25	12.0	8.0
Administrator	253	8.3	14.2
Family physician	104	12.5	2.9
% of participants		7.3	17.3
χ^2		36.83	54.77
p<		.03	.0001

Note. Cardiovascular disease includes reports of visits to a physician for heart attack, heart failure, angina pectoris, stroke, arteriosclerosis, any mention of heart, circulatory problems, and hypertension or high blood pressure. Respiratory infection includes colds, coughs, flu, sinus, sore throat, and tonsillitis.

(mean ages of 49.6 versus 43.9 years), they also have higher stress jobs than professors as shown in our current study and in the work of French et al. (1965) and Mueller and French (1970). Additionally, the professors' rate of reported cardiovascular disease is lower than many occupational groups which are considerably younger (see age means in Table IV-1).

Respiratory infection. Although no group appears to be particularly outstanding as a high disease rate group, both the university professors and the administrative professors have particularly low rates of reporting respiratory diseases.

In summary. The findings in Chapter III suggest that subjective job stress and psychological strain may be related to health and illness. Our sample however, is far too small to produce the type of age-corrected epidemiological data which is required to yield reliable morbidity rates for specific occupations. A larger sample would be required to relate job demands to disease entities per se. One such large scale epidemiological study is now underway by the National Institute for Occupational Safety and Health.

Some Special Comparisons

A careful interpretation of differences in stresses, personality, and strains among occupations must not only consider the different levels of each variable singly, but the combined effects of job and personality characteristics. For example, the meaning of the different levels of Job Complexity between physicians and assembly line workers is not clear without considering the implications of the levels of other characteristics of these occupations such as responsibility for persons, work load, and preferred amount of job complexity. The disentangling of the effects of these patterns of differences among occupations is likely to require the untangling of complex interactions between different job demands and profiles of personality traits.

In the absence of more complex multivariate analyses, several informative comparisons can still be made between occupations. The levels of various stresses and strains can be compared with the patterns of levels found in other research to see if existing findings are replicated. Additionally, occupations which are generally similar to each other, but which differ in some important characteristics, can be compared with each other to note the effects associated with these characteristics.

Comparisons with the 1947 Roper-Fortune Survey. In 1947 Fortune magazine conducted a survey of working conditions and satisfactions in a wide variety of occupations. They sampled over 3,000 blue collar workers in a quota sample stratified by age, sex, occupation, race and geographic area based on statistics of the 1940 Census. While the sample was not a random sample, it was more representative in its sampling than our own sample. Blauner (1964) put particular emphasis on three of the occupations in the Fortune data which represented different types of industrial technology: automotive assembly, chemical industry (continuous flow), and printing. We have data on the first two types of technologies in our sample drawn over 25 years later in 1973. Consequently, we can make some comparisons between the findings in the two studies to determine the consistency of occupational differences for these two types of work. The comparative data are presented in Table IV-17.

In 1947 a higher percentage of automotive assembly line workers compared to continuous flow workers reported that their jobs make them work too fast. These findings parallel our own which show that the assembly workers have higher scores on work load of the two occupations and on work overload (misfit on work load).

With regard to job security the assemblers in 1947 had the smallest percentage of respondents reporting that they could have a job as long as they wanted and had the greatest percentage of respondents reporting that they could expect a layoff in the next six months. We find the same pattern of results with regard to job security in our current data. In fact as this is being written (November, 1974) the automobile industry is laying off large numbers of assembly line workers and is even contemplating the shutdown of plants because of a significant decline in automobile sales. No such layoffs in the continuous flow industries have come to our attention during this same period.

In 1947 a larger percentage of assembly line workers compared to continuous flow workers reported that their job was too simple to bring out the best of their abilities while a smaller percentage of the assemblers reported that they were able to try out their own ideas on the job. In the current study assemblers on machine paced lines similarly report the most underutilization of skills and abilities of the two groups.

Although assemblers in 1947 were more likely than continuous flow workers to report job dissatisfaction (would choose a different trade), there are no differences in job dissatisfaction in the current sample. On the other hand, a greater percentage of assemblers than continuous flow workers in the 1947 sample reported monotony or boredom, and our data show the same pattern of results.

We have noted several times that our sampling was not intended to be representative. Despite this drawback, it would appear that the occupational differences in stress and strain in assembly and in continuous flow monitoring are sufficiently strong so that we have obtained considerable agreement between the two studies whose samples were drawn over 25 years apart.

Table IV-17

Stress and Strain in Automotive Assembly and Continuous Flow Jobs -
A Comparison with the 1947 Roper-Fortune Survey (Blauner, 1964)

		Std. Score		
Roper Item[a]	Comparable Index	Automotive (n=79)	Cont. Flow (n=100)	Agreement with Roper Data
a) Job makes you work too fast.	Quantitative Work Load	84	51	+[b]
b) Can have job as long as you want. c) Expect layoff in next 6 months.	Future Ambiguity	160	119	+
d) Job is too simple to bring out your best abilities. e) Can try out own ideas on the job.	Underutilization	212	132	+
f) Would you choose a different trade?	Job Dissatisfaction	153	160	-
g) My job is mostly or always dull.	Boredom	207	122	+

<u>Note</u>. The Fortune survey involved 180 automobile workers and 78 chemical workers from a representative sample of 3,000 blue collar factory workers sampled, not randomly, but to fill quotas on the basis on "sex, geographic area, race, and age according to the Census of 1940" (Fortune Survey #58, January, 1947, p. 1).

[a]In the Fortune Survey persons were asked whether they agreed or disagreed with the item's context.

[b]The percent of each occupational group agreeing with the item was taken as the indicator of whether or not the findings from the Roper-Fortune survey agree with out findings. A "+" indicates agreement; a "-" indicates lack of agreement.

Assembly line work: machine paced versus nonmachine paced lines. The selection of these two types of assembly line environments for study was intentional. A number of innovations, particularly in the automobile production industry, have attempted to move away from the fully automated assembly line. Thus, there has been a lot of publicity about the experiments by Volvo and Saab in Sweden and the work by some of the North American automobile producers on small-scale, trial bases. Our own research suggests that there are a number of significant differences in both the job stresses and the strains which are experienced by persons working in these two types of assembly line environments.

On the machine paced lines people perform the same tasks repeatedly. The movement of the line is intended to limit any variance in the rate of productivity among the line workers. On the nonpaced lines in this study, employees work in teams. Each employee works on a variety of tasks and there is some freedom in who does what. The main constraint is that each team is responsible for completing a certain number of operations on the unit it is assembling (an engine, a chasis, an interior) before that unit goes on to the next station and the next group of employees.

When these two work environments are compared in our study, the workers on the machine paced lines report lower Complexity in their work (5 vs. 27, $\underline{t} = -2.00$, $df = 147$, $p < .05$), higher amounts of Underutilization of their Skills and Abilities (212 vs. 163, $p < .0001$), and a lower demand for Concentration (9 vs. 43, $p < .05$). The latter finding suggests that in assembly line work you can pretty much let your mind wander rather than pay attention to the job. This is a common experience for persons who work in jobs which they find boring. As will be shown shortly, machine paced work is more boring than nonpaced work.

In addition to these differences in job stress, there are some trends in the data which, while only approaching statistical significance, suggest additional ways in which work differs in machine paced and nonpaced assembly lines. The persons on the nonpaced lines have a greater feeling of Responsibility for Persons (72 vs. 50, $p = .09$). They also feel that they participate more with others in decisions which affect their job (72 vs. 46, $p = .08$).

With regard to levels of strain, the workers on the machine paced lines do indeed report higher levels of Boredom (207 vs. 160, $p < .001$), of Anxiety (129 vs. 85, $p < .005$), and of Depression (139 vs. 112, $p = .05$) than employees on nonmachine paced assembly lines. Consequently, these findings suggest that the social experiments on group-oriented, nonmachine paced assembly operations are a step in the right direction.

Air traffic control: Large versus small airports. Another comparison of interest in our data concerns the differences between the large and small sites of air traffic control. Cobb and Rose (1973) found that persons at high stress (high air traffic) towers, compared to those at low stress towers had significantly higher prevalence rates for high blood pressure and peptic ulcer. In this section we would like to point out some differences in job stress and strain at the two types of sites.

The self report measures of job demands reveal few differences between large and small air traffic control sites. The large sites have significantly higher scores on Role Ambiguity (62 vs. 32, $p = .0005$), significantly higher levels of Role Conflict (80 vs. 55, $p = .05$), and lower levels of Social Support from persons at work other than their immediate supervisor (105 vs. 139, $p = .009$). Air traffic controllers at the large sites also reported more dissatisfaction regarding their work (79 vs. 56, $p = .06$). On the other hand, less anger-irritation was reported by ATCs at the large sites (85 vs. 111, $p = .04$).

Both the higher Role Ambiguity and the higher Role Conflict at the large sites may be a result of having a larger number of controllers on the shifts at the large sites than at the smaller sites (an average of 21 versus 6 controllers per shift, $p < .0001$). The ATCs have pointed out to us that the larger number of interfacility communications at the large sites does create potentially conflicting and sometimes temporarily ambiguous situations.

The higher levels of Irritation at the smaller sites is less easy to explain. Since Irritation correlates .33 with Role Conflict and -.21 with Social Support and since Role Conflict is lower and Social Support is higher at the small sites, one might have expected the levels of Irritation at the small sites to be relatively low. If there are explanations of this finding within our data, they are not apparent in the first-order analyses which are presented here. The multivariate analyses planned for the second technical report of this study will hopefully provide an answer.

Controlling plane traffic versus controlling train traffic. Air traffic controllers and train dispatchers work under many of the same stresses. Also, evidence has been reported suggesting that individuals in both occupations tend to be at higher than average risk of coronary heart disease (Cobb & Rose, 1973; Taylor et al., 1970). When the levels of various stresses and strain are examined for these two occupations, however, some interesting differences can be noted between them. Earlier in this chapter we pointed out that the train dispatchers have relatively high levels of role conflict. This is also the case when they are compared with the ATCs ($p < .001$ regardless of whether ATCs from the small or large sites are compared). When one compares the train dispatchers with the air traffic controllers, it becomes apparent that of the two types of occupations the train dispatchers are the more stressed and strained in several respects. Compared to the air traffic controllers, the dispatchers report both more work on the job (Quantitative Work Load), more work than they prefer (Quantitative Work Load-fit), more Responsibility for Persons, about the same level of demands for Concentration, more Complexity, and more Inequity of Pay. They report less Social Support from Others at Work but more Social Support from their supervisor. Of the two occupations, the dispatchers report the most Job Dissatisfaction and somewhat more Boredom but fewer Somatic Complaints.

The differences in levels of stress and strain reported by train dispatchers and air traffic controllers may result from differences between the occupations, differences in the ages of men in the occupations, and also from differences in the individuals selected into these occupations. Differences in the content of communications associated with the jobs may in part account for the higher responsibility for persons reported by train dispatchers. The contact between air traffic controllers and pilots is typically extremely brief and limited to work related communications. The contact between dispatchers and engineers and other railroad personnel is often more prolonged. Also, train dispatchers are likely to personally know men on the train crew. These more developed interpersonal relationships may increase the feeling of dealing with real people, and hence, feelings of responsibility for them.

Air traffic controllers tend to transfer to other jobs by age 50. Train dispatchers often keep their dispatching jobs until they retire. This difference in career pattern contributes to the difference in average age found for men in our sample from these occupations: air traffic controllers average 34 years while train dispatchers average 45 years. The stresses in these two jobs (e.g., concentration, variation in work load) may become more difficult for an individual to cope with as he ages. The higher levels of strain in train dispatchers may be in part due to their higher age. Additional analyses controlling for age will help resolve this question.

Differences in hiring procedures probably result in some overall differences in the abilities and personalities of individuals hired into the two occupations. Both train dispatchers and air traffic controllers are certified after successfully completing instructional work and on the job trial periods. However, train dispatchers are not formally screened for particular aptitudes or for physical and emotional problems (Devoe, 1974). In contrast, in selecting individuals for training as air traffic controllers the FAA uses standardized screening procedures including aptitude tests of important abilities and examinations for significant medical and emotional problems (Corson et al., 1970). This difference in screening procedures may contribute to the differences in fit between the abilities of the men and their job demands. Air traffic controllers as a group may tend to perceive their job as less stressful and experience less strain resulting from the job.

Administrators, engineers, and scientists. In previous research at NASA (French & Caplan, 1970) we found that administrators, compared to engineers and scientists, had the highest levels of job stress. Since we have assessed many of the same stresses in this study, the current data give us a chance to make some comparisons with this previous research. Table IV-18 presents the means on job demands and measures of strain which differ significantly for the administrators, engineers, and scientists in the current study. The table also indicates by a + or - whether or not the current findings tend to show a pattern of results similar to those in the NASA research.

A number of significant occupational differences in stress tend to show the same patterns in both studies. In both studies Subjective Quantitative Work Load and Responsibility for Persons are highest for the administrators. In both studies administrators have the highest Participation, the second highest degree of Underutilization (scientists are the least underutilized), and the most Social Support from the immediate supervisor. The only failure to replicate with regard to the pattern of job stresses is the finding on Role Ambiguity (the same measure of Role Ambiguity is used in both studies). In the NASA study, there are no significant differences in role ambiguity while in the current study the administrators report the least Role Ambiguity. This failure to replicate may be due to the levels of role ambiguity in the NASA sample as compared to the sample in the current study. While administrators, engineers, and scientists in the current study report levels of Role Ambiguity of 2.1, 2.4, and 2.4 respectively, the comparable levels at NASA are 3.0, 3.1, and 2.8--all higher than the highest value in this study. The NASA organization's high mean level of ambiguity may be strong enough to obliterate any occupational differences which might show up when the effects of organization are minimized through the inclusion of employees from several organizations. The current study, as noted, intentionally sampled multiple organizations for each job to reduce the confounding of organization and level of stress.

In both sets of data the administrators and scientists differ more from one another than the engineers do from the scientists. This is understandable in terms of the nature of the three types of jobs. The administrator must attend meetings, participate with others in decision making and exercise a fair amount of supervisory responsibility. The engineer may supervise design teams and meet for decision purposes on designs. On the

Table IV-18

Stress and Strain in Administrators, Engineers, and Scientists - Comparisons with the NASA Sample

Measure	Occupation Admin. (N=253)	Engin. (N=110)	Sci. (N=116)	F[a]	p<	Agreement with NASA[b]
Stress						
Quantitative Work Load	3.7	3.5	3.5	7.74	.0005	+
Variance in Work Load	3.0	2.8	2.6	15.49	.0001	0
Responsibility for Persons	3.6	2.0	2.3	132.06	.0001	+
Job Complexity	3.5	3.0	2.9	71.96	.0001	0
Underutilization	2.2	2.3	2.0	5.33	.006	+
Participation	3.4	3.0	3.1	10.30	.0001	+
Role Conflict	1.8	1.8	1.5	13.30	.0001	0
Role Ambiguity	2.1	2.4	2.4	9.22	.0001	-
Job Future Ambiguity	2.7	3.1	2.8	5.65	.004	0
Social Support from Supervisor	3.1	2.9	3.0	3.40	.04	+
Strain						
Job Dissatisfaction	3.1	3.6	3.2	15.25	.0001	0
Work Load Dissatisfaction	2.0	2.3	2.0	4.25	.02	0
Boredom	1.6	2.0	1.6	14.13	.0001	0
Irritation	1.8	1.7	1.6	8.68	.0002	0
Cigarettes Smoked (>0)[c]	28.7	24.0	17.7	5.25	.007	+
Blood Pressure:[d]						
Systolic	124.2	--[e]	119.7	3.47	.07	+
Diastolic	74.2	--	73.6	.50	N.S.	+

[a]F test of the main effect of occupation in accounting for significant variance in stress and strain.

[b]"+" tends to agree with NASA data, "-" disagrees, "0" indicates no comparable data.

[c]N's = 70, 18, and 19 for the three respective occupational groups.

[d]Blood pressure values are not age corrected because there is a complex nonlinear relationship between age and blood pressure. N's = 61 administrators and 54 scientists.

[e]Data not available for engineers

other hand, the scientist usually works alone with a minimum number of subordinates and may meet with others mostly for informal discussions of theory rather than for decision-making sessions about major policy matters.

A number of other findings, from data available only in our current study, further round out the difference in the nature of job demands for administrators, engineers, and scientists. The administrators report the most Complexity in their work while scientists report the least.[1] Administrators report the most Variance in Work Load as well as the most work load. This variance is probably due to frequent deadlines in administrative work. Both the data from NASA and interviews with NASA personnel indicate that deadlines are usually long term in basic research causing relatively few needs for periods of peak work load. In comparison, the frequent deadlines in administration cause frequent peaks in the work load. While scientists report the least such variance, engineers fall in the middle as a group.

Administrators have the least Job Future Ambiguity as well as the least Role Ambiguity. Of the three occupations, the biggest job security problems face the engineers. Many of our engineers are in the aerospace industry. As one administrator told us, aerospace engineers have come to expect low job security as a way of life. "They may work here for a while, leave, return again in another year, and so on. We have engineers on our staff now who have joined us two or three times now in the last six or seven years. You accept that sort of things when you are in this (aerospace engineering) business."

Turning to the findings on strain, there is one measure of psychological strain, Job Dissatisfaction, and one measure of behavioral strain, Number of Cigarettes Smoked, which can be compared to those obtained in the NASA research. While the NASA study showed no significant differences in Job Dissatisfaction among the three occupational groups, the engineers are the most dissatisfied and the administrators are the least dissatisfied in this study. Again the difference in the findings may indicate the presence of interaction effects between organizations and occupations as determinants of occupational differences in stress and strain.

With regard to the number of cigarettes smoked by smokers, the findings

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[1]This is in contrast to complexification, a term which refers to the rate at which things become or are becoming complex (Terreberry, 1968). In this regard, the previous research at NASA indicates that the degree of complexification is greatest for the scientists rather than the administrators. The items measuring complexification refer to phenomena such as "the rate at which knowledge in your field is expanding" and "the difficulty you have in keeping up with new developments". This latter phenomenon has received much attention as a central theme of Toffler's (1970) Future Shock.

from the two studies do parallel one another. In the current study, administrators average about 29 cigarettes per day while engineers and scientists smoke 24 and 18 cigarettes per day respectively. In the NASA study, administrators are again the heaviest smokers: 32 cigarettes per day. Engineers and scientists report smoking 19 and 20 cigarettes per day respectively.

Our current study includes a number of measures of strain which were not included in the NASA study. Consequently, we can paint a broader picture of these three groups with our current data. Engineers show a nonsignificant trend toward being more depressed than administrators and scientists. Engineers are more bored than administrators and scientists. Engineers are also more dissatisfied with their work load whereas the administrators and scientists are less dissatisfied. Since the engineers are the most bored, it is possible that part of their dissatisfaction about their work load stems from its boring quality. This interpretation is consistent with the finding that, of the three groups, the engineers report the most Underutilization. It would seem that the administrator's day is never routine, and the scientist's day often involves challenging steps into uncharted areas, but the engineer's day often consists of working on the development of a process, piece of equipment, or a system which the engineer finds relatively uninteresting and nonchallenging to design. With regard to anger-irritation, engineers fall in the middle whereas administrators have the highest score and scientists have the lowest scores. This latter finding is somewhat in keeping with the administrators higher scores on Role Conflict since Role Conflict and Irritation correlate .33 ($p < .001$).

We have already noted that of those men who smoke, administrators smoke the most cigarettes. This puts them at higher risk of pulmonary disorders and coronary heart disease. In addition, they are also the most overweight of the three groups, adding still another risk factor. Finally, they have higher systolic blood pressure levels than the engineers and scientists and they tend to have higher diastolic blood pressure levels. The differences across the three occupational groups in diastolic blood pressure, however, are not significant. In the NASA sample the systolic blood pressure levels of the administrators were also the highest. In both samples there is no significant linear relationship between age and systolic blood pressure. However, the age differences for the occupational groups do parallel their differences in blood pressure, with administrators being older than scientists and engineers in both studies. This confounding between occupation and age requires that we postpose any conclusions about the origins of the occupational differences in blood pressure.

As a whole these findings present a very consistent picture with regard to the scientists and a mixed picture with regard to the engineers and administrators. Almost without exception, the scientists report the least stress or job demands and appear to be the healthiest with regard to mental strains and smoking. In this regard the findings closely parallel those gathered four years earlier in March of 1969 at NASA.

The engineers and the administrators in the current study seem fairly comparable with regard to many of the stresses. With regard to the psychological strains, the engineers tend to have the highest scores (Depression, Dissatisfaction, Boredom). However, the administrators smoke more. These differences in the rank ordering of the administrators and engineers from one strain to another may in part reflect differences in the intensity of various stresses which they face in their jobs. More detailed analyses, which are planned for the future, may indicate whether some of these differences in the rank ordering on strain are also due to the different effects of stress on strain in administrators compared to engineers and scientists.

Ecological Relationships Among Stress, Personality and Strain

In the preceding section of this chapter we presented significant occupational differences in stress, personality, and strain, confirming Prediction 1. In this section we ask whether or not these occupational differences are related to one another. If they are related, Prediction 2 will also be confirmed.

The analysis of relationships between stresses, personality characteristics, and psychological and behavioral strains across occupations parallels the corresponding analysis across individuals reported in Chapter III. In presenting the analysis at the occupational level, comparisons are made with these findings from Chapter III. Where the occupational level relationships are supported by the individual level findings, such support suggests that the occupational relationships reflect psychological processes.

Some individual level analyses have not been performed at the occupational level. Analyses involving physiological strains have been omitted since the N of 7 occupations with physiological measures would produce unreliable results. Analyses of relationships between strains and reported illnesses have not been performed because the average reported illness within some occupations with small samples is unreliable. Finally, the analysis comparing commensurate E, P, and P-E fit measures has not been performed at the ecological level since P-E fit theory concerns relationships at the individual level and is more appropriately tested at that level.

One additional difference between the analyses discussed here and those in Chapter III is that the relationship between Concentration and other measures will be discussed. Concentration was not discussed at the individual level because it is a single item measure and therefore has a potentially low reliability.

Before the data are presented, a few points must be made about the meanings of individual level and ecological (i.e., occupational) level analyses. First, it is possible to obtain ecological relationships which are not replicated at the individual level of analysis. In this case a stress and a strain vary across a population of individuals without a systematic pattern of relationship to each other. Yet when the individuals are grouped by occupation, the average scores of the occupational group on the stress and the strain vary in some systematic pattern across occupations. For example, individuals with higher scores on the stress and on the strain may tend to be in some occupations while those with lower scores on both will tend to be in other occupations. When the correlation of the occupational scores (the average of the individuals within each occupation) for the stress and the strain is computed, a positive relationship would be found between them.

Second, the ecological correlation coefficients will generally be higher in magnitude than the coefficients found at the individual level. The higher ecological correlations occur because the scores of each occupation are based on the total number of respondents within the occupation, increasing the reliability of the scores and therefore their potential to correlate more highly.

Finally, the level of correlation which should be considered meaningful in the ecological analyses is much higher than in the individual analyses. The smaller the sample size, the more likely one is to obtain larger (or smaller) correlations due to chance variation. For the individual analyses (N = 318 employees) a correlation of .12 or higher is significant at the .05 level. For the ecological analyses (N = 23 occupations) a correlation must reach .41 or higher to be significant at the .05 level.

Figure III-2 presented the individual level relationships of the Duncan Socioeconomic Status Scores with stresses and strains. This socioeconomic status variable (which is closely tied to education and income) is highly correlated at the ecological level with a number of stresses and strains. These correlations are to be expected since the occupations studied covary widely in job status, stress, and strain. For example, the Duncan Socioeconomic Status index correlates -.87 with Underutilization of Abilities, -.75 with Poor Fit on Job Complexity, and .74 with Participation. Socioeconomic status is unrelated to Variance in Work Load, Role Ambiguity, and Work Load Fit. On the other hand, Socioeconomic Status correlates between .55 and .60 with the measures of Supervisor and Other (others at work)

Social Support. Jobs with high socioeconomic status tend to be occupied by Type A persons ($r = .55$) and by persons who prefer or desire high levels of work load ($r = .44$). Turning to the strains, Socioeconomic Status correlates -.76 with Boredom, -.69 with Job Dissatisfaction, -.51 with Somatic Complaints, and .68 with quitting smoking (the quit rate in the occupation). (For $N = 23$, $r \geq .41$, $p \leq .05$.) The insights obtained from these data are not too profound but they are an important reflection of perceived job conditions, mental health, and health related behavior in our society; low status jobs have high perceived job stress, high psychological strain, and few people who have been able to give up smoking.

One should keep in mind that socioeconomic status is not causally related to stress or strain. Jobs with high levels of stress and strain (e.g., underutilization of abilities, insufficient rewards, dissatisfaction) are typically considered to have low socioeconomic status; jobs with low levels of stress and strain are typically considered to have high socioeconomic status. When socioeconomic status is related to mental and physical health strain, the cause(s) of the strain should be sought among the job stresses and cultural practices associated with socioeconomic status.

Predictors of Psychological Strains

The findings relating stresses to psychological strains are presented in Figure IV-1. To simplify the figure and to highlight the major trends in the data, as has been done in Figure III-1, only the strongest relationships have been depicted. In this case stress-strain relationships of .60 or higher and strain-strain relationships of .40 or higher are presented. The measures of the Person (P) indices for Job Complexity and Quantitative Work Load are missing from Figure IV-1. The P measures are hypothesized to influence strain through their Fit scores, and since strong relationships between P measures and strains at the ecological level generally have correspondingly strong relationships between Fit and strains, the relationships between P indices and strain have been omitted from the figure.

In general the findings in Figure IV-1 parallel the data from analyses at the individual level which were presented in Figure III-1. Consequently, there is reason to believe that these ecological findings do, in part, reflect psychological relationships. As expected, the magnitudes of the ecological relationships are much larger than the corresponding correlation coefficients at the individual level.

Dissatisfactions with the job. Since we conceive of Boredom and Work Load Dissatisfaction as components of overall Job Dissatisfaction, we are not surprised to find that these three show positive relationships parallel to, but stronger than, those at the individual level (see the large rectangle in Figure IV-1).

As is the case at the individual level, high levels of Boredom are associated with low utilization of skills and abilities, low complexity jobs, poor fit between the job and the person on complexity, low participation, low concentration, and high future ambiguity (the mean $r = .84$). These stresses characterize the simple, repetitive, unchallenging work which one would expect to lead to high boredom. Boredom associated with this type of work is also associated with low social support from a supervisor ($r = -.73$) and from others at work ($r = -.72$). Other factors associated with boredom include little change in work load ($r = -.64$) and poor fit between the person and the job on role ambiguity ($r = .66$). Finally, Type A personality is negatively related to boredom ($r = -.63$). We have already suggested that certain types of people would select certain jobs which fit their needs; the achievement oriented Type A person should select challenging jobs and avoid simple, boring jobs. We found that people in jobs such as the family physician and the administrative professor scored high on Type A while workers on the assembly line scored low. We suspect that it is this process of self-selection which produces the strong negative correlation between the measures of Type A and Boredom.

The one predictor of Work Load Dissatisfaction common to both the individual and ecological levels is Work Load-Fit. The more work load persons have relative to the amount they want, the more dissatisfied they are with their work load.

Many of the stresses which predict Boredom at both the ecological and individual levels also predict general Job Dissatisfaction at both levels. The magnitude of the average correlation between Job Dissatisfaction and the measures of Underutilization, Job Future Ambiguity, Complexity-Poor Fit, low Complexity-E, low Participation, and low Concentration is .71. Additionally, low social support is also associated with high job dissatisfaction at both levels of analyses. Since work which utilizes skills and the abilities is highly correlated with social support ($r = .70$), both these measures of subjective job environment probably contribute to one another's association with low job dissatisfaction.

Affective states and somatic complaints. Anxiety, Depression, Irritation, and Somatic Complaints generally tend to correlate with each other at the ecological level, paralleling many of their relationships at the individual level. The correlations among these strains do not show the dramatic increase in strength from the individual level to the ecological level that is found for many of the other relationships between stresses and strains. The fact that occupational scores on strains do not vary nearly so much as

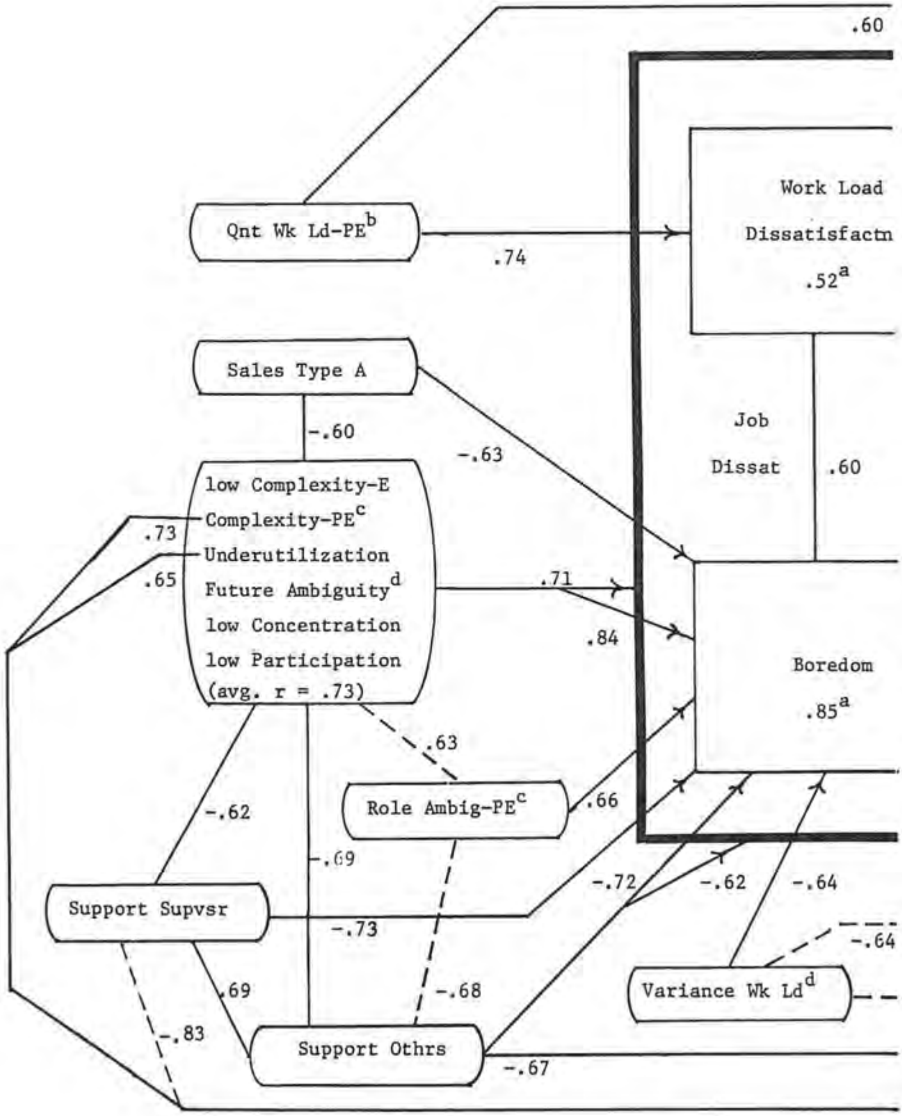

Figure IV-1. An interpretation of major correlations between stresses

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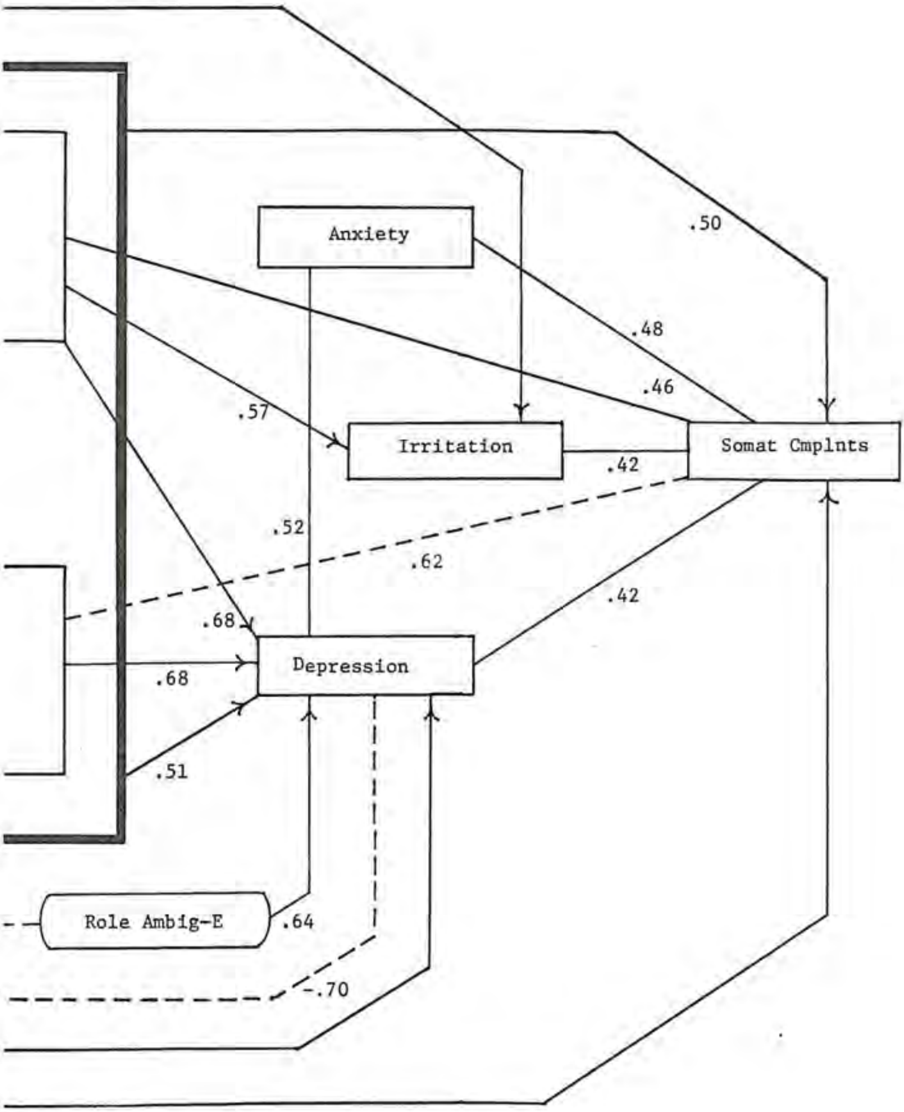
Note. These ecological correlations are based on the means for the 23 occupations. Stress-stress and stress-strain correlations ≥ .60 and strain-strain correlations ≥ .40 are presented. Arrows indicate suspected causal relationships; lines without arrow heads represent non-causal relationships. Broken lines indicate that the relationship does not parallel individual level findings of Chapter III. Correlations with the cluster of variables (Complexity-E, etc.) are averages.

[a]Correlations with the overall Job Dissatisfaction index.



and psychological strains at the ecological level.

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[b]High score indicates greater work load than desired; low score indicates less than desired.

[c]High score indicates poor fit (either more or less than desired).

[d]Not depicted are the correlations between Variance in Work Load and Future Ambiguity (r = -.65) and between Variance in Work Load and Concentration (r = .81).

the occupational scores on many stresses partially accounts for the smaller increment among the strain measures.

At the ecological level no stress has correlations of .60 or higher with Anxiety, nor do any of the dissatisfactions have correlations of .40 or higher with it.

Stresses which are associated with high scores on Depression at both the ecological and individual levels include low Concentration ($r = -.71$, ecological level), low Social Support from others at work ($r = -.67$), and high Role Ambiguity-E ($r = .64$). Depression is also related to low Variance in Work Load ($r = -.70$) at the ecological level only. All three dissatisfaction measures are also associated with Depression at both levels of analysis.

The stress of Quantitative Work Load-Fit (overload) and the feeling of Work Load Dissatisfaction are both associated with Irritation. Both of these relationships and the association between Quantitative Work Load-Fit and Work Load Dissatisfaction are paralleled by relationships at the individual level (r's - .27, .29, and .52, respectively--see Appendix G). These relationships suggest that one important source of irritation and aggravation is work overload and the associated feelings of dissatisfaction with work load.

Somatic Complaints are associated with the stresses of low support from one's supervisor, Job Complexity-Poor Fit, and Underutilization and all three dissatisfactions at the ecological level. At the individual level, however, none of the relationships between Somatic Complaints and these other measures is very strong ($.11 \leq |r| \leq .18$). This discrepancy suggests that although these variables do not have a direct psychological relationship with somatic complaints, they tend to covary with Somatic Complaints across occupations. Multivariate analyses will be necessary to explore reasons for this covariation.

Predictors of Behavioral Strains

Several relationships exist at the ecological level between behavioral strains and measures of stress and personality. Few of these relationships, however, were found at the individual level. Consequently, the results at the ecological level are largely a function of the patterning of occupational means rather than a reflection of causal relationships between stress, personality, and strain relationships at the individual level.

Smoking (the percentage of individuals who smoke) is highly correlated with several stresses at the ecological level: Underutilization (.71), Social Support from Supervisor (-.66), Job Complexity-Poor Fit (.70), Flexibility (-.78), Assert Good Self (.72), and Somatic Complaints (.78). None of these relationships is replicated at the individual level, however, ($|r| \leq .16$). Since there are no relationships to smoking at the individual level it is likely that the decision to smoke is not caused by individual job stress or strain. At the ecological level smoking and all of the stresses associated with it also covary with education. McKennel (1969) indicates that the decision to become a smoker is usually made in late adolescence. The relationship between education and smoking most likely reflects the social class norms for smoking during the individual's adolescence: smoking is more prevelant among lower socioeconomic status individuals (see U.S. Public Health Service, 1964). The stresses which covary with smoking at the occupational level are also more prevalent among jobs with lower socioeconomic status. Consequently, the ecological covariation between smoking and these stresses should not be interpreted as a causal relationship.

The quit rate for cigarette smoking for individuals in various occupations is related to Job Complexity-Poor Fit (-.67), Underutilization (-.67), and Social Support from Supervisor (.68). No such relationship occurs at the individual level of analysis ($|r| \leq .10$). Again, it appears that the ecological relationship between social support and quitting smoking may be largely a function of the social group with which a worker associates since both education and socioeconomic status are highly related to quit rate (r's of .65 and .68 respectively) and its correlates. Quit rate is of course related to overall rate of smoking ($r = -.84$), thus explaining the similarity of the findings for these variables.

The average number of cigarettes smoked by the smokers of each occupational group is not related to the occupational quit rate or to the percent of smokers in the occupation ($r = -.07$ and .21, respectively). Nor is it related to education ($r = .22$, N.S.). The number of cigarettes smoked among smokers is correlated .63 with Type A personality at the ecological level. We do not find a relationship between the two variables at the individual level ($r = -.14$), although a positive association between Type A and number of cigarettes smoked has been reported by Jenkins, Rosenman, and Zyzanski (1968).

Coffee drinking is related to Variance in Work Load (.68), Concentration (.60), and Depression (-.61) at the ecological level only (individual level $r \leq .10$). These relationships are probably due to the opportunity to drink coffee covarying with the other variables across occupations. For example, machine paced assembly line work has the lowest scores on Variance in Work Load, Concentration, and on coffee consumption, and one of the highest scores on Depression. The assembly line is believed to have relatively low rates of coffee consumption because the nature of the job does not provide many opportunities for taking coffee breaks. By comparison, the occupations with the highest levels of variation in work load and of concentration and relatively low levels of depression, the air traffic controllers and train dispatchers have coffee available all the time.

The dispensary visit variables are not strongly associated with any other variable at the ecological level. Because the availability of a dispensary changes for workers at different locations, relationships to dispensary visits are more appropriately examined across individuals and occupations with similar dispensary availability.

Obesity is correlated .60 with Deny Bad Self at the ecological level but not at the individual level ($r = -.01$). The ecological level relationship between Obesity and Deny Bad Self is probably due to covariation of these two variables with some third variable across the occupations and not to a causal relationship between this personality characteristic and obesity in individuals.

Discussion of Ecological Relationships

Most of the major relationships between stress and strain at the ecological level are paralleled by those at the individual level of analysis. This suggests that the covariations of the occupational means for stress and strain reflect psychological processes. There are also some instances where a finding at the occupational level of analysis is not paralleled by the individual level analysis. In these cases the explanation of the discrepancy between an ecological correlation and one at the individual level will require further analysis.

Data at the individual level of analysis appear to be more appropriate for determining the effects of job stresses on worker health than are data at the occupational level. The data at the occupational level may be used most profitably to generate occupational means as a way of locating jobs where people are experiencing unusually high levels of job stresses and psychological and physiological strains.

Summary

This chapter reports the results of the two predictions made in Chapter I about stress and strain at the ecological (i.e., occupational) level.

Prediction 1 states that among different jobs there will be significant differences in the mean stress, the mean strain, and in personality. The average levels of the demographic characteristics, personality, stress, psychological strain, behavioral strain, physiological strain, and reported illnesses for each of the occupations in the study were presented and discussed. Differences among occupations were found for the mean scores on most measures. Generally, men in occupations requiring few special skills reported the highest levels of strains. Several comparisons were made between sets of jobs which were of particular interest (machine paced versus nonmachine paced assembly work, large versus small air traffic control towers, etc.).

Prediction 2 states that at the ecological level there will be positive correlations between a variety of job stresses and a variety of psychological and behavioral strains. Correlations between the set of occupational mean scores on stress, personality and psychological and behavioral strains were computed and several of the stronger relationships were presented in Figure IV-1. Many of the ecological level relationships parallel those at the individual level. Relationships occurring at both levels are generally considered to reflect psychological processes operating across occupations. Ecological relationships which are not replicated at the individual level may suggest other processes which reflect differences between occupations or they may simply result from artifactual covariations of variables across occupations. Multivariate analyses will be necessary to interpret the interrelationships between various job demands and personality traits affecting strains.

CHAPTER V. SUMMARY AND IMPLICATIONS

This study has taken us on a journey into the world of psychological job hazards. Although they are not as easily measured as noise, heat, and noxious gases, these psychological hazards are just as real to any person who has experienced the pressure of an impending deadline or the monotony of a boring and repetitive job. These psychological stresses, we have seen, can have an important impact on the well-being of the worker.

In this chapter we will retrace our steps and point out the highlights of the journey. For those readers who have not read the full report we will summarize all the main findings, but we will describe only very briefly the background of previous research and the methods employed in our study. Two main sections of findings will be presented: occupational differences in job stresses and strains and the effects of these variables on various kinds of strain and illness. Then we will consider how these findings might be applied to reduce strain and to improve the well-being of the worker. Finally, we will point out a few of the more important research tasks which still lie ahead.

The Purposes of the Study

The purpose of this project is to develop dependable scientific knowledge about the effects of job stresses on psychological and physiological strains and on the health of the worker. Our ultimate aim is to find ways of preventing job stresses from impacting upon the worker. Before we started this project, it was already known that the rates of illness and the death rates varied greatly from one occupation to another even when there were no known differences in physical hazards. The causes of these differences in occupational health, however, were not known. Therefore, a more specific purpose of this project was to identify the patterns of environmental stresses and of employee strains in a wide variety of jobs including especially some jobs which were known to be high on rates of illness. The second purpose was to discover the effects of job demands (stresses) on workers' mental and physical health by testing four hypotheses about these effects.

These four hypotheses are presented in Figure V-1 as arrows running from cause to effect. In this figure, two kinds of environmental psychosocial stresses are represented: the "Global Objective Environment" refers to the real environment as it would be reported by an objective observer; the "Subjective Environment" is the person's perception of the objective environment. A basic assumption, which is untested in this particular

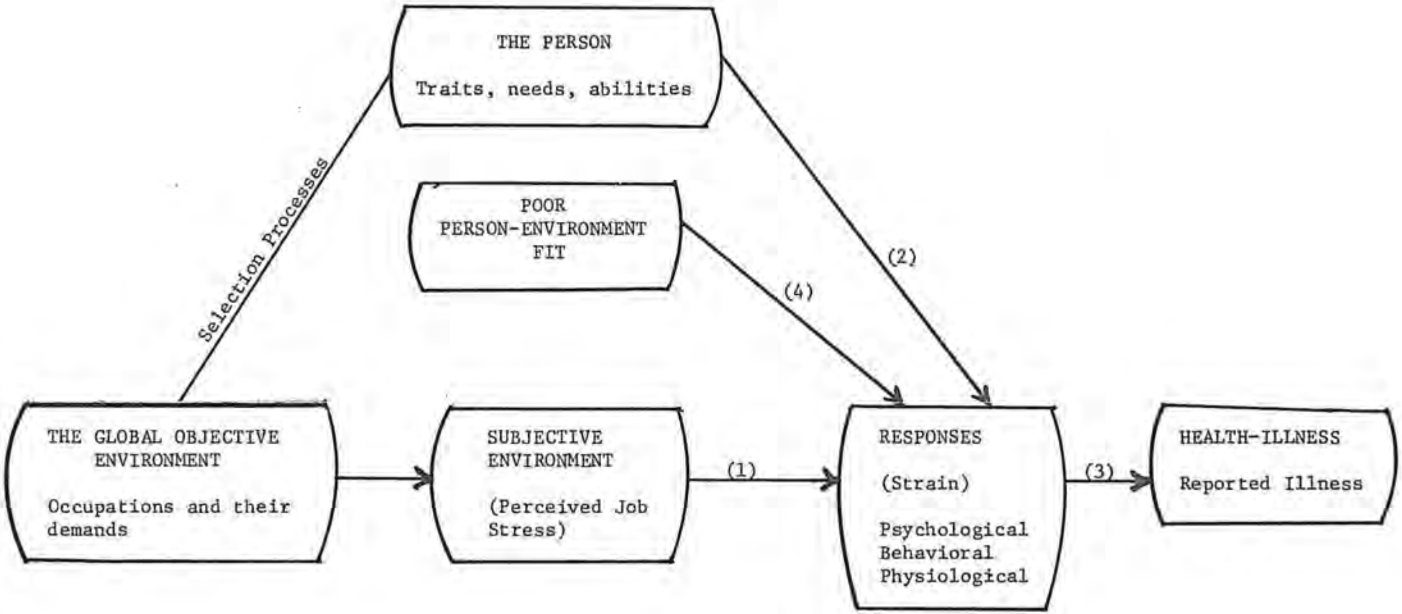

Figure V-1. A diagram of how stresses in the objective and subjective environment influence strains (responses) in the person which in turn influence the health of the person. The four numbered arrows running from one panel of variables (the cause) to another (the effect) represent the four main hypotheses of the study.

study, states that the effects of psychosocial stresses in the objective environment on the response of the person take place by means of their effects on the subjective environment as it appears to the worker. A sarcastic remark by a supervisor will cause anxiety or irritation in his subordinate only if the latter hears the remark and interprets is as sarcasm; but a physical stress such as carbon monoxide in the air may have lethal effects without any subjective awareness.

Hypothesis 1 (See arrow 1 in Figure V-1): Subjective job stresses, including job demands and poor person-environment fit, will produce psychological (e.g., job dissatisfaction and depression), behavioral (e.g., smoking), and physiological (e.g., blood pressure) strains in the person.

Hypothesis 2 (Arrow 2): Personality variables will also influence these same types of strain.

Hypothesis 3 (Arrow 3): Greater strains in the worker will cause higher rates of reported illness.

Hypothesis 4 (Arrow 4): A poor fit between the desired job environment and the perceived job environment will produce stronger effects on strains than will either of these components (desired or perceived environment) alone.

Figure V-1 also shows another kind of mutual relation between occupations and the person: there are selective processes whereby certain kinds of persons tend to choose certain occupations, and conversely whereby occupations select applicants in accordance with their knowledge, skill and education. A meticulous person who enjoys working with numbers may decide to become an accountant, and just such a person may be selected by the employer. This warns us that some of the obtained differences between persons in different occupations may be due to such selective processes while other occupational differences may reflect the effects of different occupational stresses.

The Research Methods

In order to accomplish our first purpose of identifying the patterns of job stresses and strains which pose potential threats to the health of workers we carefully selected a relatively large sample of 23 occupations. We were careful to include occupations known to have high rates of disease, particularly psychosomatic diseases such as peptic ulcer, hypertension (high blood pressure), and coronary heart disease. Occupations at high risk of one or more such diseases included air traffic controllers, train dispatchers, family physicians, and administrators in large organizations. We selected additional occupations to give us a wide range on each of a number of job stresses such as work load, responsibility for people, conflicting job demands, underutilization of abilities, and the complexity of the work. For example, we selected some very complex jobs like that of the physician and some very simple jobs like the automobile assembly line. Finally, we selected jobs which, on the basis of past research, might provide especially illuminating comparisons. In a previous study, for example, we discovered that air traffic controllers at large airports had more psychosomatic diseases than controllers at small airports, so we drew our sample from both large and small airports. The 23 occupations and the number of men in each are presented in Table V-1. In each of these occupations we chose men from several different organizations so that our sample would not be unduly influenced by the pecularities of any particular organizations.

We hoped that this heterogeneous selection of jobs and of job stresses would also provide us with a broad range of psychological strains such as boredom, dissatisfaction with work, anxiety, and depression. An inspection of the average scores for each occupation (see Table V-2) shows that we were successful in getting this broad range of strains. The mean age of the sample is about 39 years. The respondents, on the average, have a high school education (in some jobs, such as university professor, a Ph.D. is common), have been in the same occupational position between one and five years, work about 45 hours per week, earn $17,379 (in 1973 when the data were gathered), and support about three dependents in addition to themselves. All the respondents are males and practically all are white.

The information on job stresses, on psychological strains, and on behavioral strains (such as smoking) was obtained by means of confidential and voluntary responses on a questionnaire. In general each of these stresses and strains was measured by several carefully pretested questions, so the reliability of the measures was generally high (the reliability coefficients were typically in the .70's and .80's; see Chapter II).

In order to test our four hypotheses, correlational methods were used. For example, the first hypothesis that job stresses will produce strains within the person was tested by correlating each questionnaire measure of job stress with each measure of strain. It should be noted that such a correlational test of a hypothesis does not tell us which of the two variables is cause and which is effect; such conclusions have been drawn on the basis of previous research findings and plausibility.

Occupational Differences in Stress and Strain

The major findings concerning occupational difference in stress and

Table V-1

Occupational Groups and Their Sample Sizes

Occupational Groups	N
Blue Collar[a]	
Forklift driver	46
Assembler, machine paced	79
Assembler, machine paced relief	27
Assembler, nonmachine paced	69
Machine tender	34
Continuous flow monitor	101
Delivery service courier	20
Tool and die maker	77
Blue/White Collar	
Electronic technician	93
Policeman	111
Train dispatcher	86
Blue collar supervisor	178
White collar supervisor	42
White Collar	
Air traffic controller, large airports	82
Air traffic controller, small airports	43
Programmer	90
Accountant	92
Engineer	110
Scientist	117
Professor	74
Administrative professor	25
Administrator	253
Family physiican	104
Miscellaneous, gathered incidentally	57
Total	2010

[a]This ordering of occupational groups is approximately from lowest to highest Duncan SES score and therefore from lowest to highest occupational socioeconomic status.

strain are presented in Table V-2. In this table the average level of each variable is presented for each of the 23 occupations. When a variable is measured in commonly used units (e.g., age in years, income in dollars, coffee in cups), the occupational averages for the variable are presented using the units. For other variables the pattern of average, high, and low scores is presented using zero, plus, and minus signs. A zero means that the particular score for the variable is about average, one or more pluses mean higher than average, while one or more minuses mean lower than average scores.

Differences in Age, Length of Service, and Personality

Physicians, administrative professors, tool and die makers, continuous flow monitors, and train dispatchers tend to be the oldest groups (about 45 years or older). Air traffic controllers, police, and workers on machine paced assembly lines tend to be the youngest (under 35).

The groups with the oldest persons also tend to be the groups with the longest service. Length of service is a potentially important consideration in the study of job stress and health. The longer the service, the greater the exposure to stresses particular to the job. A long service could also mean that some of these people have remained in their jobs because they have learned how to cope adequately with job demands. In future analyses we shall be considering length of service as well as age as factors which may play a role in determining how job stress affects job-related strains.

In our present data we have found significant occupational differences in the Type A coronary-prone personality. The Type A person is characterized as hard driving, involved in the work, competitive, persistent, and tending to seek out high stress environments. Previous research has shown that such persons are high in risk factors and have a very high incidence of coronary heart disease. The professors in administrative posts in universities and the family physicians have the highest scores on Type A. French *et al.* (1965) and Mueller and French (1970) report that university administrators are more Type A than professors, particularly on achievement orientation, a component of Type A. Russek (1960, 1962) reports that general practitioners (family physicians), compared to specialists in medicine, have a much greater risk of coronary heart disease. Perhaps some of this risk is due to the Type A traits of the general practitioners.

Among blue collar employees, tool and die makers have the highest score on Type A, although their score is not nearly as high as the above mentioned occupational groups.

Occupational Differences in Job Stress and Strain

The reader should keep the following three points in mind when thinking

Table V-2. Occupational Differences in Demography, Personality,

	Number of men	Age (years)	Schooling (years)	Duncan SES (percentile)	Income ($)	Length of service
FORKLIFT DRIVER	46	40	11	17	10271	+
ASSEMB MACH-PACED	79	30	12	21	9790	---
ASSEMB M-P RELIEF	27	33	11	21	10140	0
ASSEMB NON-M-PACD	69	39	12	21	11260	-
MACHINE TENDER	34	34	12	22	11548	0
CONTINUOUS FLOW	101	45	12	23	12556	+
COURIER	20	45	11	32	8747	0
TOOL AND DIE	77	45	12	50	12889	+
ELECTRONIC TECH	93	39	13	62	14725	0
POLICEMAN	111	30	14	40	12530	-
SUPVISOR BLUE COLL	178	42	13	53	14779	0
SUPVISOR WHTE COLL	42	40	15	78	18494	0
TRAIN DISPATCHER	86	45	13	40	13801	++
ATC, LARGE AIRPORT	82	35	13	69	20754	+
ATC, SMALL AIRPORT	43	33	13	69	15764	0
PROGRAMMER	90	33	16	65	14269	-
ACCOUNTANT	92	39	15	78	10802	-
ENGINEER	110	38	17	87	17321	-
SCIENTIST	118	40	18	80	20011	0
PROFESSOR	74	44	19	84	23827	0
ADMIN. PROFESSOR	25	50	19	84	32076	0
ADMINISTRATOR	253	42	16	62	26317	-
PHYSICIAN	104	47	19	92	50813	++

Note. Variables described by pluses, zeros, and minuses indicate occupational standings relative to the mean of the random stratified sample:

+++ at least one standard deviation above the random sample mean,
++ at least two-thirds of a s.d. above the random sample mean,

Stresses, Psychological Strains, and Health-Related Behaviors

Type A	Flexibility	Assert Good	Deny Bad	Hrs Worked/Wk (hours)	Hrs Overtim/Wk (hours)	Unwanted Over-time (hours)	Quantitative Work Load-E	Combined Qnt Work Load	Variance in Work Load	Responsibility for Persons-E
0	--	+	0	40.4	3.5	1.2	0	0	0	0
-	0	0	0	41.1	4.0	1.1	0	0	--	-
0	0	0	0	40.5	3.0	0.2	0	0	-	-
0	-	0	0	41.9	5.7	1.9	0	-	-	-
0	-	0	0	42.9	4.3	0.5	0	0	0	0
-	0	0	0	40.8	4.4	0.4	-	--	0	0
0	-	+	0	39.1	1.7	0.5	0	0	0	0
+	-	0	0	46.9	4.3	2.1	0	0	0	-
0	0	0	0	40.2	2.2	0.7	0	0	0	-
0	0	0	0	46.1	6.4	1.5	0	0	+	+
0	0	0	0	47.6	6.8	3.3	0	0	0	+
0	0	0	0	43.7	3.8	2.0	0	0	0	+
0	-	0	0	41.7	2.8	1.6	+	++	+	+
0	0	0	0	38.1	0.4	0.5	0	0	++	0
0	0	0	0	38.7	0.9	0.0	0	0	++	0
-	+	-	0	42.2	3.2	1.2	-	-	0	--
0	0	0	0	40.6	1.9	1.2	0	0	0	--
0	+	0	0	43.3	3.6	1.4	0	0	0	--
0	++	0	0	46.6	5.0	1.1	0	0	-	-
0	+++	-	-	51.6	3.6	1.5	0	0	0	0
++	+++	-	-	56.4	11.4	3.6	++	++	0	++
0	0	0	0	48.7	6.4	1.5	0	0	0	+
+	+	0	0	58.4	6.7	3.2	++	+++	0	+++

+ at least one-third of a s.d. above the random sample mean,
0 within one-third of a s.d. of the random sample mean,
- at least one-third of a s.d. below the random sample mean,
-- at least two-thirds of a s.d. below the random sample mean,
--- at least one standard deviation below the random sample mean.

Table V-2 (continued). Occupational Differences in Demography,

	Job Complexity-E	Concentration	Role Conflict	Role Ambiguity-E	Job Future Ambiguity	Underutilization of Abilities	Inequity of Pay	Income as % of Deserved Income
FORKLIFT DRIVER	--	--	+	0	+	++	0	0
ASSEMB MACH-PACED	---	---	0	0	++	+++	-	0
ASSEMB M-P RELIEF	--	--	+	0	0	++	-	--
ASSEMB NON-M-PACD	--	--	0	0	+	++	0	0
MACHINE TENDER	--	0	0	0	++	++	0	0
CONTINUOUS FLOW	0	0	0	0	0	+	-	0
COURIER	--	0	0	-	0	+	0	0
TOOL AND DIE	0	0	0	0	+	-	+	-
ELECTRONIC TECH	0	0	0	0	0	-	+	0
POLICEMAN	++	0	0	0	-	-	0	-
SUPVISOR BLUE COLL	+	0	0	0	0	0	0	0
SUPVISOR WHTE COLL	+	0	0	0	0	0	0	0
TRAIN DISPATCHER	+	++	+	-	0	0	0	0
ATC, LARGE AIRPORT	0	++	0	-	-	0	0	-
ATC, SMALL AIRPORT	0	++	-	--	--	0	0	0
PROGRAMMER	0	0	0	+	0	0	0	0
ACCOUNTANT	0	0	0	0	0	0	+	0
ENGINEER	0	0	0	+	0	0	0	0
SCIENTIST	0	0	0	+	0	-	0	0
PROFESSOR	+	0	-	0	0	---	0	0
ADMIN. PROFESSOR	++	0	0	0	-	--	0	0
ADMINISTRATOR	++	0	0	0	0	-	0	0
PHYSICIAN	+++	++	-	-	--	---	0	0

Personality, Stresses, Psychological Strains, and Health-Related Behaviors

Participation	Social Support from Supervisor	Social Suprt from Others at Work	Social Support from Home	Quantitative Work Load-Fit	Responsibility for Persons-Poor Fit	Job Complexity-Poor Fit	Role Ambiguity-Poor Fit	Job Dissatis-faction	Boredom	Work Load Dissat-isfaction
-	-	-	0	0	+	+	+	+	++	+
-	-	-	0	0	+	+++	0	++	+++	++
-	-	--	-	0	0	0	0	+	++	+
-	-	0	-	0	+	++	+	+	++	0
--	-	--	0	+	0	++	++	++	++	++
0	+	+	0	-	0	0	0	++	0	0
-	0	0	0	0	++	0	+	-	0	-
0	0	0	-	0	+	0	0	0	0	0
0	0	0	-	0	+	0	0	0	0	0
0	0	0	0	0	-	-	0	-	-	0
0	0	0	0	0	0	0	0	0	0	0
+	0	0	0	0	-	-	0	-	-	0
0	0	0	0	+	0	0	0	0	-	0
0	0	0	0	-	0	0	0	0	-	-
0	0	+	0	-	0	0	-	-	-	0
0	0	0	-	-	0	0	0	0	0	0
0	0	0	0	0	+	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	-	0
0	+	0	0	+	-	-	0	-	-	0
++	+	++	+	++	0	-	0	-	-	+
+	0	0	0	0	-	-	0	0	-	0
0	+	+	0	+	-	-	0	-	-	+

Table V-2 (continued). Occupational Differences in Demography,

	Somatic Complaints	Anxiety	Depression	Irritation	Percent who Smoke (%)	Percent of Smokers Who Have Quit (%)
FORKLIFT DRIVER	0	0	0	0	69	24
ASSEMB MACH-PACED	++	+	+	0	60	14
ASSEMB M-P RELIEF	++	0	+	0	70	14
ASSEMB NON-M-PACD	+	0	0	0	61	25
MACHINE TENDER	+	+	+	+	62	22
CONTINUOUS FLOW	0	0	-	0	50	38
COURIER	-	0	0	0	47	40
TOOL AND DIE	0	0	0	0	48	42
ELECTRONIC TECH	0	+	0	0	51	30
POLICEMAN	0	0	0	0	50	20
SUPVISOR BLUE COLL	0	0	0	0	60	30
SUPVISOR WHTE COLL	0	0	-	0	40	49
TRAIN DISPATCHER	0	0	0	+	59	29
ATC, LARGE AIRPORT	+	0	0	0	59	25
ATC, SMALL AIRPORT	+	0	-	0	65	22
PROGRAMMER	0	0	0	0	31	40
ACCOUNTANT	0	0	0	0	46	35
ENGINEER	0	0	0	0	34	47
SCIENTIST	0	0	0	0	28	41
PROFESSOR	-	0	0	0	34	43
ADMIN. PROFESSOR	0	0	0	+	43	41
ADMINISTRATOR	0	0	0	0	42	37
PHYSICIAN	0	-	0	0	32	46

Personality, Stresses, Psychological Strains, and Health-Related Behaviors

Avg Nmbr of Cigarettes Smoked (#)	Avg Number of cups of Coffee (#)	Avg Number of Caffeine Drinks (#)	Recency of Dispensary Visit	Recency of Staffed Dispensary Visit	Obesity
17.0	2.3	4.0	0	0	0
24.6	1.9	4.6	0	+	0
25.7	2.5	4.9	+	+	-
28.0	3.3	5.1	0	0	0
19.1	2.4	3.7	0	0	0
16.4	4.3	5.6	0	-	0
25.9	2.7	4.0	+	+	0
32.2	3.6	4.3	+	0	0
25.1	4.0	5.3	-	0	0
23.9	2.9	4.4	0	+	0
27.2	4.0	5.2	0	0	0
27.2	3.0	4.0	0	0	0
28.3	4.1	5.5	-	-	0
25.5	4.2	5.8	0	0	0
24.9	4.0	5.4	++	0	0
21.7	3.1	4.1	0	0	0
23.9	2.9	3.9	-	0	0
24.0	3.1	4.1	0	-	0
17.7	2.5	3.5	-	-	0
27.6	2.9	3.9	-	0	-
33.7	3.5	4.7	-	-	0
28.7	3.4	4.2	0	0	0
27.8	3.0	4.0	0	0	0

about the findings presented below. (1) The ratings are based on the reports of people within each occupation--we did not do the ratings for them. (2) Lest one conclude that some people were giving biased answers (either upwards or downwards) with regard to their work load and other measures of job stress, the measures were only slightly related to measures of response bias (such as social desirability effects) included in the questionnaire. (3) Perhaps most important, the sheer quantity of a person's work load (or of any other single job aspect) is only part of the story. We have also considered the qualitative aspects of the job demands. For example, air traffic controllers do not have as high (nor as low) a quantitative work load, per se, as other occupations. However, the controllers have the highest variation in the work load and the highest demands for concentration on what they are doing. A consideration of the interaction of these factors may tell us more about the effect of stress on health than a consideration of each factor separately. Such interactions will be studied in the next year. For now, we present each stress separately and ask the reader to keep the above three points in mind.

Who works the most hours per week? Family physicians and administrative professors head the list (over 56 hours per week) followed by university professors, blue collar supervisors, scientists, and police. Air traffic controllers have their hours sharply regulated for safety reasons (they average 38 to 39 hours per week). Our index of subjective quantitative work load yields somewhat similar results: family physicians and administrative professors are highest and train dispatchers are next; scientists, professors and police are about average.

The most unwanted overtime is put in by the administrative professors, blue collar supervisors, physicians, tool and die makers, and white collar supervisors.

With regard to variation in the amount of work load, the air traffic controllers and train dispatchers have the most variation whereas assemblers, especially on machine-paced lines, have the least variation. The busy professors, administrative professors, and family physicians fall close to the mean of the 23 occupations.

With regard to the demand for mental concentration on the job, air traffic controllers, train dispatchers, and family physicians all report the highest levels. Administrative professors, despite their high work load, do not report such high demands for concentration. Consequently, it is clear that high work load does not always reflect large variation in the amount of work load nor high demands for concentration. The group which reports the least demands for mental concentration are the assemblers on machine paced lines.

Low utilization of one's abilities, low participation, low job complexity are stresses which tend to be found in the same jobs. University professors, family physicians, and other professional occupations in the sample all report very little of these stresses. On the other hand, high levels of these stresses are found in machine paced and other assembly workers, fork lift drivers, and machine tenders. The jobs which are least complex and have the least utilization of people's abilities are also the jobs with high levels of future ambiguity and the lowest levels of social support. Other stresses with similar patterns include the extent to which levels of various characteristics of the job environment do not fit the preferences of the person. Professional occupations generally report good person-environment fit on job complexity, responsibility for persons, and role ambiguity while several blue collar occupations report poor person-environment fit on these variables. Consequently, if one were to pick out the most stressed occupational groups, they would tend to be the machine paced assembly line workers. Even the relief workers on the assembly line who switch from one job to another report relatively high levels of job stress.

When psychological strains are examined, the assemblers and the relief men on the machine paced assembly lines are the most bored and the most dissatisfied with their work load. Our sample of machine tenders also has very high scores on boredom, dissatisfaction with the work load, and dissatisfaction with the job as a whole. The most satisfied occupational groups in our study are university professors, family physicians, white collar supervisors, police, and the air traffic controllers at the small sites.

When one examines the psychological strains of anxiety, depression, and irritation, a similar picture presents itself. These strains seem to be highest among the machine tenders and the assemblers and the relief men on the machine-paced lines. The family physicians and the continuous flow workers have the lowest scores on these strains.

Somatic complaints, such as difficulty sleeping, loss of appetite, heart beating fast, and other symptoms of physiological strain have no relationship to the age of the person in this study. In fact, the occupation with the highest report of somatic complaints, assemblers on machine paced lines, is one of the youngest groups studied. The relief men on the machine paced lines also have relatively high levels of somatic complaints. University professors, family physicians, and scientists, by comparison, have the lowest scores on somatic complaints.

The percentage of smokers, the percentage of ex-smokers, and the number of cigarettes smoked (by those who smoke) all vary from one occupation to another. The percentage of smokers is lower and the percentage of ex-smokers is higher among the more highly educated occupations. The percentage of ex-smokers is also higher among older workers. No evidence in this sample relates any of the three measures of smoking behavior to job stress.

Visits to the medical dispensary at the work place occur most frequently for police, machine paced assemblers, and their relief men (about once every two months). We do not know the extent to which these differences may be due to accidents, physical hazards, or the easy availability of the dispensary.

Caffeine consumption (from coffee, colas, and tea) may reflect the easy access to a beverage machine; but it is interesting that high rates of caffeine ingestion occur for air traffic controllers at large airports (5.8 cups per day), train dispatchers (5.5 cups), and air traffic controllers at small airports (5.4 cups), the three jobs demanding the most alertness and concentration.

An index of obesity reveals that foremen, electronic technicians, and tool and die makers are most overweight while university professors and relief men on the assembly line are least overweight; but neither job stresses nor age is related to this measure of obesity.

Occupational Differences in Physiological Strain

The measures of physiological strain are limited to a subset of the occupations: administrators, scientists, air traffic controllers, electronic technicians, and supervisors (blue plus white collar). We examined the blood pressures, cholesterol, pulse rates, measures of thyroid hormones (T-3 and T-4I),uric acid, and cortisol of these persons. The occupations were compared by age groups to control for any effects of aging. Significant occupational differences were found for blood pressure and for serum uric acid levels. The scientists have significantly lower blood pressure levels compared to the other six occupations. This is not surprising because our findings show that the scientists are a relatively low stress occupation. However, the links between the stresses we have studied and these occupational differences in blood pressure and uric acid are not apparent in this first look at the results.

Special Comparisons of Related Occupations

The assembly line. The assemblers and the relief workers on the machine paced lines clearly stand out as being high in stress (underutilization, low participation, lack of adequate job complexity). Other jobs have high scores on other types of stress (administrative professors and physicians have high work load and responsibility for other's well-being). However, the high levels of psychological strain and somatic complaints among persons on the machine paced assembly lines suggests that attention ought to be directed toward improving their work conditions.

There have been some experiments at improving assembly line work by putting people in work teams and by getting away from the highly simplified machine paced line. Popular accounts of the success of some of these "sociotechnical" experiments in Scandinavia have appeared in magazines and newspapers. We are fortunate in our study to have samples of assemblers working in both machine paced and nonmachine paced assembly environments. In the nonmachine paced settings the employees work in small teams. Each team assembles a variety of components on trucks and then moves them down the line to the team at the next station.

Our findings show that the nonmachine paced line can be a psychologically more healthy environment. Compared to the machine paced assembly workers, the men who work in the teams report more utilization of their skills and abilities, more complexity, better fit on complexity, more participation in decision making, and more of a demand for concentration (in this case a desirable aspect of the work--using one's mind). The employees in the nonmachine paced work teams have significantly lower scores on boredom, anxiety, and depression. These findings suggest that particularly among the most stressful occupations there is the potential for significant improvement in the psychological health of the employees.

Air traffic controllers versus train dispatchers. Both of these jobs require the monitoring and dispatching of major conveyances in our nation's transportation system. This study has provided the opportunity to make some comparisons of the job demands and health of these occupational groups.

As the first step in the comparison, we examined air traffic controllers at airports with high and low traffic density. Cobb and Rose (1973) had previously found that the controllers at the high traffic towers, compared to those at the low traffic towers, had significantly higher prevalence rates for hypertension and peptic ulcer. In this study, we attempted to look for differences in job stress which might explain these differences in disease rates.

We find no significant differences in the amount of work load reported by the men at the large and small sites. Nor do we find any significant difference in the amount of responsibility reported by the men at the two types of sites. We do find, however, that the men at the large sites report significantly higher levels of role (job) ambiguity and role conflict (conflicting demands in the work environment). Persons at the large sites also report significantly lower levels of social support from others at work; there is no difference in the amount of support received from the immediate superior at the two types of sites, however. There is only one finding suggesting that there is more stress at the smaller sites--mean scores on anger-irritation are higher at the smaller sites.

Whether or not these differences in stress at the large and small sites can account for the differences in high blood pressure and peptic ulcer reported by Cobb and Rose will require further study.

Now let us turn to the train dispatchers. Although the air traffic controllers at the large sites report high levels of role conflict, the train dispatchers report significantly higher levels. In fact, in most areas of job demands, the dispatchers appear to be the more stressed occupation. The dispatchers report more quantitative work load (and poorer fit on this variable), more responsibility for other persons, more complexity in their work, more inequity in their pay, and less social support from others at work. Both occupations report about the same levels of demands for concentration in their work. On the good side for dispatchers, they report more social support from their immediate superior.

With regard to strains,the dispatchers also have generally higher scores. They report more job dissatisfaction and somewhat more boredom. On the other hand, they report fewer somatic complaints.

There has never been a study which compared controllers and train dispatchers until now. Consequently we cannot rely on past research to help us understand these differences. It is possible that dispatchers do have objectively more stressful jobs. It is also possible that air traffic controllers may be selected more carefully on their ability to handle stress. In such a case, they might experience their jobs as less stressful than the jobs of the dispatchers regardless of whether or not the two types of jobs differed from one another in objective stress. Obviously these questions have to be anwered in order to draw further conclusions from the findings.

Administrators, engineers, and scientists. In 1968 we compared the stresses and strains of these three occupations at one of NASA's bases because the medical records showed that the administrators had more than five times as much cardiovascular disease as the engineers and scientists in the age range 35-44 (Caplan, 1971). In that study we found the administrators to have the highest levels of quantitative work load and responsiblity for other persons. The administrators also reported the highest amounts of participation in decision making and the most social support from their immediate superior. The scientists were usually the opposite--lower work load and responsibility for persons, less participation, less social support. The engineers fell in the middle.

The findings from the current study are very similar particularly with regard to the differences between the administrators and the scientists. On the other hand, in this study the engineers are usually very similar to the administrators with regard to their job stresses. Perhaps the roles of engineering and administration are more separated in the sample at NASA than they are in the current sample in which we drew employees from private industry rather than from a governmental organization.

All three groups fall near the middle of the 23 occupations on job dissatisfaction. The engineers in the current study were also the most depressed and bored of the three groups. Again, all three groups fell near the middle on these strains among the 23 jobs studied. Although the NASA study found no differences in the level of satisfaction with work among the three occupational groups, the current study found that administrators were the most satisfied, scientists were the next most satisfied, and the engineers had the lowest satisfaction scores of the three groups.

In the NASA study, for those who smoked, administrators were found to smoke more cigarettes compared to the engineers and scientists. The findings are similar in this study. In both studies we can compare the blood pressure levels of the administrators and scientists. In both studies the systolic blood pressure levels of the administrators are significantly higher than the levels for the scientists regardless of age group. There are nonsignificant tendencies for the diastolic blood pressures also to be higher for the administrators.

The data from the current study suggest that the scientists, compared to the administrators and engineers, are the least stressed and the least strained. They are the least strained both with regard to psychological strains, behavioral indicators of strain (smoking), and physiological strain (blood pressure). Since we have not uncovered any simple relationships between job demands and either cigarette smoking or blood pressure in this study, other causal factors may be involved. One of these factors may be personality--the scientists have the highest scores on Flexibility of the three groups. Future analyses of the data will attempt to look at the interaction between job demands and personality as predictors of cigarette smoking and blood pressure. The low levels of psychological strain among the scientists may stem from their high levels of reported utilization of skills and abilities.

Major Findings on the Effects of Stress

The Effects of Stress on Psychological Strain

Figure V-1 presents a diagram of how various aspects of work and of the employee are related to health and illness. Arrow 1 has received a good deal of attention in our study because of previous studies (Kraut, 1966; French &

Caplan, 1972) which suggest that the subjective stress environment is more important than the objective environment as a predictor of strain. Another way of stating this hypothesis is "it is what the person perceives in his work environment which counts more than the actual objective stress." More will be said about the implications of this type of hypothesis later. For now, let us turn to the relationships between subjective (or reported) job stress and strain.

Boredom, dissatisfaction with work load, and overall job dissatisfaction form a cluster of related strains which tend to be associated with one another from job to job. As we shall see, many of the stresses of work are related to more than one of these psychological strains.

We have found a number of job characteristics which tend to be associated with one another and also tend to be associated with relatively low status jobs. Job status was measured by the Duncan Socioeconomic Status Index (Scheffler, Rice, & Kaplan, 1971). These characteristics include underutilization of one's skills and abilities, low participation, and high ambiguity about one's future job security. Two measures of the goodness of fit between the employee and the employee's job environment are also associated with these characteristics. These two measures are poor person-environment fit with regard to job complexity and with regard to responsibility for other persons (their work, their futures, their welfare). This entire set of characteristics tend to be found in the same jobs. Each of these characteristics is positively correlated with boredom (the correlations range between .31 and .59, all highly significant).[1]

Boredom and all of these related characteristics, except for poor fit on

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[1] A correlation is a measure of association between two variables; it tells how much they vary together. Correlations can range from 1.00 (the two variables show a perfect positive association) through 0.00 (the two variables are unrelated) to -1.00 (the two variables show a perfect inverse relation, i.e., when one is high, the other is low). In this type of research it is very rare to find a correlation which approaches 1.00. The following table may help to interpret these correlations:

.30-.39 is a weak relation
.40-.49 is a moderate relation
.50-.59 is a substantial relation
.60-.69 is a strong relation
.70 and above is a very strong relation

All correlations presented here are statistically significant at the 1% level or better, which means that they could have occurred by chance at most only one time out of a hundred. Many very weak correlations in this study were statistically significant, but we have adopted the conservative policy of generally <u>not</u> reporting significant correlations unless they are .30 or larger.

responsibility for persons, are also associated with high job dissatisfaction. Furthermore, poor social support from one's immediate superior and from others at work are also associated with high job dissatisfaction. All of the relationships have correlations ranging between .34 and .63.

Involuntary overtime has been a topic of discussion in union-management contract negotiations in recent years. It must be distinguished from voluntary overtime which people seek because they want to earn more money or because they are caught up in a task and want to complete it by a certain deadline. In this study we measure unwanted overtime (number of hours of overtime minus number of hours of overtime the person wanted to work) and find it associated (correlation =.39) with high dissatisfaction with the work load. Boredom and poor person-environment fit with regard to job complexity are also positively correlated with high levels of work load dissatisfaction. Dissatisfaction with work load is one of the major components of dissatisfaction with the job in general (correlation = .48).

We measured a number of other psychological strains besides job dissatisfaction and boredom. These strains include depression, anxiety, irritation, and somatic or bodily complaints usually thought to be associated with social and psychological stresses (for example, difficulty sleeping, loss of appetite, and sweaty palms). Both poor social support from the immediate superior and from others at work are associated with high levels of depression (correlations = .30 and .36, respectively). Conflicting demands from others at work (role conflict) is positively correlated (.33) with irritation. For the most part, however, levels of anxiety, irritation, depression, and somatic complaints are largely interrelated to one another (correlations range from .25 to .51) and <u>appear</u> to be influenced by dissatisfaction with the work rather than by the actual characteristics of the work itself. We emphasize "appear" because the findings from this study are cross-sectional rather than longitudinal. Although the findings do support Arrow 1, it is possible that some of the relationship between job stress and psychological strain could reflect a process where anxious (depressed, irritated, etc.) persons selected themselves into highly stressful jobs.

These findings on stress and psychological strain are supported by the results of a national random sample survey of the work force of the United States recently conducted by Quinn <u>et al</u>. (1971). In that study indicators of low participation in decision making, ambiguity about one's future job security, poor utilization of skills and abilities, and a lack of social support from persons at work were associated with high levels of psychological strain (job-related tension, job dissatisfaction, and so forth). We have also found similar relationships in a study of NASA professionals (French

& Caplan, 1972). Furthermore, Likert (1961) and Argyris (1964) cite a number of studies relating the utilization of people's talents and abilities to good mental health (and to productivity). In this study we have documented these relationships on a broader sample made up of 23 occupations.

Job Stress and Behavioral Strain

Figure V-1 refers to a second type of strain--behavioral. By behavioral indicators of strain, we mean activities such as smoking, drinking coffee or caffeinated beverages, and eating. We did not measure eating directly, but instead used an index of obesity based on the ratio of weight to the square of the height as a very rough substitute. We find that smokers, compared to those who have quit and those who never smoked, drink more coffee and more caffeinated drinks such as coca cola. However, none of these behavioral strains show any direct relationship with job stress or with affective strain. Again, we believe that future analyses which examine the moderating role of personality traits and social support may uncover some links between these behavioral indicators of strain and perceived job stress. For example, the relationship of Type A personality, subjective work load, and social support to the cessation of cigarette smoking have been reported by Caplan et al. (forthcoming) in a study of white collar professionals.

Job Stress and Physiological Strain

Physiological measures were obtained on a subsample of the occupations under study (administrators, scientists, supervisors, air traffic controllers at large and small airports, machine-paced assembly line workers, and electronic technicians at air traffic control towers. This sample constitutes 390 persons. Pulse rate, systolic and diastolic blood pressures, cortisol, cholesterol, thyroid hormones (T-3 and T-4I), and serum uric acid were the variables measured. Most values were found to be within normal ranges (in those cases where unusually high values were found, a letter documenting the analysis was sent to the participant's physician if the employee so requested).

In first-order analyses of the relationship between perceived job stresses and the physiological factors, there are no significant findings. This is a common, not unexpected, result. Our previous research (Caplan & Jones, 1974; Cobb, 1974b); French, 1973) has shown that one has to examine the interaction between job stress and other factors in order to find a relationship between subjective job stress and physiological responses. These previous studies have shown instances when job stresses related to physiological strain but only among persons who reported poor social support or only among those low on psychological defenses. They also have shown that some stress-strain relationships hold for Type A persons but not for others.

The Effects of Person-Environment Fit on Strain

Our theory predicts that the goodness of fit between a person and his job environment will have a stronger effect on strain than will either the perceived job environment or the desires about the environment (see Arrow 4 in Figure V-1). We measured the goodness of fit for five characteristics of the job (complexity of the work, quantitative work load, responsibility for persons, role ambiguity, and hours of overtime work) by subtracting the perceived environment from the desired environment. The resulting difference score measures the extent to which the worker has too much or too little overtime, too complex or too simple work, etc. A sixth measure of "perceived fit" was based on questions about the extent to which the worker was unable to utilize his best abilities on the job.

Each of these six measures of goodness of fit is correlated with each of the three measures of job dissatisfaction (overall job dissatisfaction, dissatisfaction with work load, boredom). This yields 18 correlations of stress with strain; 8 of these correlations are above .30. The average of these 8 correlations is .45; these effects of goodness of fit on these strains are stronger than the effects of any other job stresses.

Personality and Strain

There was no clear support for Hypothesis 2 that personality variables would directly affect psychological, physiological, and behavioral strains. We had expected these direct effects to be weaker than the interactive effects of personality and job stress, so later analysis may reveal significant conditioning (i.e., modifying) effects of personality on the stress-strain relation.

The Relationship of Job Stress and Strain to Health-Illness

This study did not set out to study disease entities because several thousand persons are required to obtain a large enough sample of persons with each disease. Instead, we concentrated on risk factors in disease such as blood pressure and cholesterol since these are health-related indicators which can be studied in much smaller samples. Respondents, however, were asked to indicate (a) whether or not they were under current treatment for disease and (b) what was the medical problem for which they last sought the advice of a physician. Although such data provide only a second-hand report of the diagnosis of the physician, they were easy to obtain and consequently we decided to see whether, as predicted by Hypothesis 3, persons with and without various reported illnesses differed from one another with regard to job stresses, personality, and measures of psychological and behavioral strain. (The relationship between physiological measures of strain and reported illnesses could not be reliably examined because of the small sample on which physiological data are available.)

Several findings provide some support for Hypothesis 3 that strain will produce illness. One strain, obesity, is strongly related to cardiovascular disease; and this finding is supported in many other studies. Another strain, anxiety, is higher in men with gastrointestinal problems than in healthy men. Anxiety is also higher in men under 40 who report having peptic ulcer than in men the same age who do not report an ulcer. Though anxiety may be a cause of illness as asserted by Hypothesis 3, it is also possible that illness causes anxiety.

Several measures of low social status are associated with respiratory infections, but we cannot be sure that the stresses of low status, for example, low income, is the causal factor; it may be that men in low status jobs are exposed to more physical hazards. There are additional instances in the present data where a stress or a strain tends to be associated with an illness but where further analysis is required.

Summary of Main Findings

Occupational Differences

1. The occupations in this study differ considerably in age and length of service.
2. University professors in administrative posts and family physicians score highest on a measure of the coronary-prone personality; tool and die makers are somewhat high on this measure.
3. The number of hours worked per week is highest for family physicians and administrative professors (over 55 hours per week), followed by professors, blue collar supervisors, scientists, and police. At the low end, air traffic controllers (whose hours are regulated for reasons of safety), average 38 to 39 hours per week.
4. The most <u>unwanted</u> overtime is put in by the administrative professors, blue collar supervisors, physicians, tool and die makers, and white collar supervisors.
5. A measure of quantitative work load shows high scores for family physicians, administrative professors and train dispatchers.
6. The greatest variation in work load occurs for air traffic controllers and train dispatchers; the least variation is found in assemblers,

expecially on machine paced lines.

7. A demand for high concentration on the job is typical for air traffic controllers, train dispatchers, and family physicians; the lowest concentration is required on the machine-paced assembly line.
8. Several job stresses (low utilization of one's abilities, low participation, low complexity of the work, poor person-environment fit on job complexity, poor fit on responsibility for persons, and poor fit in role ambiguity) tend to have similar levels in any given job. Occupations which are high on these stresses include assembly line workers, fork lift drivers, and machine tenders. The occupations which are low on these stresses are professors, family physicians, and other professions.
9. The men in high stress jobs in 8 above also suffer from low social support, whereas the men in low stress jobs report high support from their supervisors and others at work.
10. The occupations where the workers report both the most boredom and the greatest dissatisfaction with the work load are the assemblers and the relief men on the machine paced assembly line. Our small sample of machine tenders is also high on these strains. The most satisfied with their jobs are university professors, family physicians, white collar supervisors, police, and air traffic controllers at small sites.
11. The results for anxiety, depression and irritation present a picture similar to the above results for job dissatisfactions. These psychological strains are highest among the machine tenders and the assemblers and relief men on the machine paced assembly line. The least such affective strain is found among physicians and continuous flow workers.
12. Somatic complaints were most frequent in assemblers and relief men on machine paced assembly lines. Such complaints were least common among university professors, family physicians, and scientists.
13. Scientists had the lowest blood pressure of the seven occupations measured.
14. The assemblers and relief workers on the machine paced assembly lines have the highest stress and strain of any of the 23 occupations (see 6, 7, 8, 9, 10, 11, and 12 above).
15. Air traffic controllers at large sites have been shown previously to have more psychosomatic disease than those at small sites. The findings of this study suggest that the former may have more disease because they have more job ambiguity, more conflicting demands in their work, and less social support from others at work.

Effects of Stress on Strain and Illness

16. Three measures of dissatisfaction in work (boredom, dissatisfaction with work load, and job dissatisfaction) tend to occur together. The major environmental characteristics which appear to cause two or more of these dissatisfactions are: underutilization of one's skills and abilities, low participation, high uncertainty about the future (job insecurity), and poor social support from one's immediate superior and from others at work (see Hypothesis 1).
17. These three measures of dissatisfaction in work were even more strongly affected by the goodness of fit between the demands of the job and the desires of the worker (see Hypothesis 4). Poor fit with respect to the complexity of the work, the work load, responsibility for persons, and overtime hours lowered job satisfaction.
18. High levels of depression were influenced by poor social support from one's immediate superior and from others at work.
19. Role conflict caused irritation.
20. There was no significant relation of job stress to physiological or behavioral strains in the first order analyses.
21. There was no clear evidence that personality variables directly affect psychological, physiological, and behavioral strains (see Hypothesis 2).
22. The hypothesis that strain influences illnesses is supported by several findings: (a) obesity is related to cardiovascular disease, (b) anxiety is associated with gastrointestinal problems, (c) young men with peptic ulcer have more anxiety than young men without ulcer, and (d) low social status is associated with respiratory infections.

Applications of the Findings

In dicussing the application of the findings, we will first consider some of their limitations and some problems associated with attempts to reduce strain and illness due to job stress. We will then discuss several ways and situations in which the findings can be applied.

Limitations of the Findings

In this study, all of our measures of the job environment were obtained from subjective reports by workers rather than by objective measurements of job demands and job stresses. It is likely that these subjective reports contain some bias, but the fact that they correspond pretty well to generally known differences among the occupations and are generally unrelated to measures of response bias leads us to believe that this is not a serious source of error. Similarly, all of our data on illnesses come from the reports of workers rather than from the reports of doctors. It is known that under-reporting of illnesses commonly occurs in surveys; such under-reporting would be expected to influence some but not all of the analyses in this study.

Many refinements in the analysis of our data have not yet been completed, and it is well to review these refinements here because they have implications for the actions one might take based on our findings. First of all, we have examined the effects of a large number of job stresses on a variety of strains within the worker; but we have not examined how these effects of stresses on strains might vary: (a) for different types of personality; (b) for different levels of social support from other people; (c) depending on the catalytic effects of other job stresses such as low participation, role ambiguity, and job complexity. From past research we know that the coronary-prone personality is more susceptible to job stress and that social support often acts as a buffer between job stress and physiological strain. Such refinements in knowledge might greatly increase our ability to alleviate strain.

Our major analysis of the data has shown that there are significant effects of stress on strain which hold for a representative sample of all occupations; but a few pilot analyses have shown that these general relations also may vary from one occupation to another, within different age groups, and for groups with different levels of schooling. These pilot analyses suggest that a program of prevention which might work well in one occupation might have relatively little effect in another occupation.

Finally, we note that we have analyzed the effects of each job stress singly. However, certain job stressès tend to go together; for example, high participation is associated with high utilization of one's best abilities. Accordingly our analysis of the effects of participation may be also reflecting effects of self-utilization and vice-versa. Until we have disentangled these effects, it will be prudent to suggest programs of prevention which deal simultaneously with participation and self-utilization.

Problems of Application

A doctor who knows the cure for a great many ills still cannot prescribe the cure for a particular patient until he has made a diagnosis based on a careful examination. So, too, we must beware of universal cures for all strains in working life. Instead we must examine each occupation, each specific work place, and even each individual in order to identify the patterns of job stress which are operating and the types of strains and illness which are appearing; only then would it be reasonable to suggest some cure.

Given the imperfect state of our knowledge of stress and strain and assuming that we have a good diagnosis of a particular job situation, how much success could be expected from radical changes in the pattern of job stresses? We do not know the answer to this question, but our research suggests that job stress is one of several factors affecting strain and illness. For some people under some circumstances, however, it may be very strong. According to our findings it should be possible to control psychological strain more successfully than physiological strain and illness.

Can we produce a radical alteration in the pattern of job stresses? And what techniques might be successful. These questions are completely beyond the scope of the present study; and indeed there has been almost no systematic research aimed at the invention and the perfection of techniques for altering job stresses. Thus our suggestions for preventing strain and illness are based not only on the data from this project, but also on our experience in action research projects dealing with job stress and on an extensive literature on techniques of organizational development, supervisory training, and human relations in industry. Wherever the literature describes relevant techniques we will refer to these descriptions rather than repeating them here. Two general suggestions may be useful to the interested reader: (1) most of the current research on organizational development can be found in Applied Behavioral Science, and (2) a review and annotated bibliography on organizational development is presented by Franklin (1973).

Finally, we wish to note that there is a whole series of constraints which face anyone designing a preventive program to improve health. The program must not cost too much, it must not conflict with other goals, it must be feasible to carry out with available or obtainable personnel, etc. In large American organizations one must be especially concerned about whether the program of prevention will interfere with productivity and profits. Without arguing the pros and cons of this complex question, we will merely assert that we believe the kinds of prevention programs to be discussed will, if successful, increase productivity and reduce costs.

Having considered some of the limitations and problems associated with applying the findings, we will now discuss several procedures for reducing job strain. Our tentative suggestions fall into three classes: (1) the early identification of problems of stress, strain, and health; (2) the diagnosis of the problems revealed; (3) some possible prescriptions for a cure.

The Early Identification of Problems of Stress, Strain, and Health

The early identification of problems of stress, strain, and health is desirable because it presents the opportunity for prevention. Many of the health effects of stress are due to the cumulative effects, often over many years, of chronic conditions. We believe that the occupational differences in stress and strain which we have found in our sample of 23 occupations represent such chronic conditions, for we have eliminated from the sample those workers who have been employed only a short time. The findings helped to identify within this sample those occupations which are generally high in stress, the particular stresses which are high in specific occupations, and the strains and the reported illnesses associated with each occupation. We believe that this study provides the best data available on the occupational differences in stress and strain, but we recognized the need to collect similar data on an even wider sample of occupation.

In any large organization with adequate medical records, it is possible to utilize these records to check on suspected occupational differences in health or to examine differences among organizational units. Especially if the records are computerized, it is possible to detect changes over time which may be associated with changing conditions of stress in the organization. In one large organization, an analysis of this sort suggested that stressful events were followed rather quickly by substantial rises in blood pressure but that rises in morbidity and mortality occurred six months later. Such findings might be very useful if they permitted the early prediction of morbidity and mortality.

It seems likely that measures of job stress and of psychological strain might identify even more quickly than medical data those conditions in the organization which pose a threat to health. Some of the questionnaire measures of stress and strain which have been developed in this project might be profitably used in combination with medical records in large organizations to identify the occupations and organizational units at high risks, to determine the particular kinds of job stresses which exist, and to suggest possible targets for preventive actions.

Diagnosis of the Problem

Once indicators of strain and illness have located a problem, then the diagnosis of the problem could be facilitated by the use of the measures and of the methods of analysis employed in this project. The possible effects of job stresses on strain and health could be determined; and this diagnostic information could be utilized in the design of programs of prevention and therapy. It is obvious that such diagnostic information would be better if it contained measures of physical and chemical stresses as well as measures of psychological and social stresses.

Preventive Actions

Our ultimate goal is the primary prevention of strain and illness by altering job stresses and improving the job environment. Although our measures of the environment are subjective, we shall assume that they correspond sufficiently with the objective characteristics of the environment so that the distinction need not be maintained in this discussion. If the objective environment is improved, we assume that the workers will perceive the improvements and respond to them accordingly.

Preventive actions will be discussed in the context of two situations: (1) when there is evidence that strain and illness are associated with the job, but nothing is known about the stresses producing the strain, and (2) when there is evidence of strain and illness and the pattern of stresses associated with the job are known.

Dealing with unknown patterns of job stresses. If our identification of problems occurs through the discovery of occupational differences in strain and in illness, then we do not know what aspects of a high stress job is producing the strain. With this limited information, there is a very limited number of preventive actions that might be taken. One such action is job rotation. For example, two workers could be assigned to a particularly stressful job during an eight-hour shift; each worker would have to endure the stressful job for only four hours, and would be shifted to a different job for the remaining four hours. There is some evidence for the possible success of such a procedure in our findings--relief workers on the assembly lines show less strain than do the regular machine paced assembly line workers.

There is a second procedure for dealing with jobs known to be high in the level of strain and illness but where we do not know the specific stresses that are producing the ill-effects. One could plan for a high level of mobility in high stress occupations so that no worker spends more than a few years in the job before moving on to a different job. Of course, a high level of turnover is not uncommon in entering jobs which are low on complexity and high on boredom and can be learned in a few days or weeks. But if we knew that a particular entering job was producing cumulative affects which began to show up as serious illnesses after ten years, then we could better plan for a more orderly progression of workers through such jobs, while avoiding the possible stress of too rapid job changes.

Dealing with known patterns of job stresses. We turn now to the more hopeful case where we not only know that there is strain and illness in a particular job, but we also know the particular pattern of stresses in this job. Now we are able to suggest specific changes in the job environment which ought to prevent strain and illness. Given our limited knowledge about the effects of stress on strain and especially the dearth of dependable knowledge about how to alter job stress in large organizations, it is desirable that the following programs of prevention should be set up as field experiments which carefully evaluate the effects of the program in reducing stress, controlling strain, and reducing the levels of illness. Such experiments could use the economical and reliable measures of stress and strain which have been developed for this project.

First, let us consider a set of findings about a cluster of job stresses which are particularly prevalent among low-status jobs. The following job stresses form a cluster in the sense that they tend to occur together in a job and also in the sense that they have similar effects on psychological strains like boredom and job dissatisfaction: low responsibility for other people, low complexity of the work, underutilization of one's skills and ability, low participation, and insecurity and ambiguity with respect to one's occupational future. All of these job stresses can be reduced through programs of job enlargement, job enrichment, and increased participation.

Especially during the past fifteen years, there have been many attempts at the humanization of work. Thirty-four such "experiments" are summarized in the appendix to Work in America, the report of a special task force to the Secretary of Health, Education and Welfare, 1973. Most of these attempts to improve the quality of work have been carried out in small groups or departments rather than in whole factories or companies. Most have been complex programs which attempted to improve several aspects of the work environment simultaneously. Commonly they involve some way of ameliorating simple, boring, repetitive work by means of job rotation and by the elimination of greatly fractionated and simplified jobs, often replacing them with work teams with the division of labor left up to the team itself. Sometimes the jobs were enlarged by making the work teams responsible for support functions such as maintenance, quality control, custodial and personnel functions. Most of the attempts to increase participation by employees dealt with the immediate work situation such as having workers participate in job redesign, training first-line supervisors to use more participative techniques of supervision, delegating authority downward in the organization, and reducing the number of supervisors or the number of levels of supervision.

Compared to the typical American efforts, the experiments with industrial democracy in Norway, in Yugoslavia, and on the Kibbutz in Israel more often dealt with the larger social structure for decision making and with the processes of political power. For example, the unions were more heavily involved in the Norwegian studies, the government and the political party took more initiative in the setting up and the design of the workers councils in Yugoslavia, and the total community was involved in the democratic management of Kibbutz factories.

Quite generally these efforts to humanize work, both in America and in Europe, have reported success in increasing morale, improving job satisfaction, stimulating cooperation and communication, and reducing grievances and conflicts. Somewhat less often they have been successful in increasing production, improving quality, and raising efficiency. In no case has there been any good evidence that they reduce illness or improve the physical health of the employees. The health effects, however, have never been adequately examined, the reports of improved satisfaction and human relations are often suspected of bias, and the evaluation of productivity and efficiency rarely includes an adequate control group. In short, there are many widely publicized and hopeful attempts to improve the quality of working life, but there is no sound scientific evidence that they are successful (or unsuccessful), especially in improving the health of workers.

Since every case tried out a different pattern for improving the work environment, and since no two cases were adequately evaluated by the same measures, there is no way of determining whether one program worked better than another. Even for a particular program, there is no way of determining which of the many changes introduced were in fact responsible for any success that was achieved. There is a great need for the comparative evaluation of a variety of programs for job redesign utilizing common measures of job satisfaction, common measures of the quality of human relations, common measures of productivity, and, especially, common measures of health and illness.

Many of the American efforts to alleviate the strains of excessively simple and boring work have focused on changing the style of supervision, the social structure and the delegation of authority, the training of supervisors and managers, and changes in the division of labor which do not involve a radical change in the technology of work, that is, they do not involve new machinery, new buildings, and new equipment. Such limited attempts do not seem to offer much hope for a fundamental improvement of the strains and stresses which we have identified in the machine paced assembly line. More radical changes in the technology for assembling automobiles by means of autonomous work groups rather than machine paced assembly lines have apparently been successful at the Saab and Volvo plants in Sweden. Again it is unfortunate that there is no adequate and objective evaluation of these important social experiments.

The stress of job insecurity, which is especially strong in lower blue collar jobs such as the assembly line, could be partly alleviated by unemployment insurance. It could be more completely controlled by the more difficult means of reducing unemployment and the threat of unemployment.

The previously described programs on the "humanization" of work have usually neglected individual differences; they have assumed, for example, that all workers on the same job suffer the same stress from the low complexity of the work. So the programs of job enrichment have attempted to increase the complexity of the job for everyone. Our research raises questions about applying this assumption to all jobs (though there may be some jobs where everybody's work is too simple). We therefore want to take into account individual differences and specifically consider the problems of changing the environment to fit the person and changing the person to fit the environment.

Changing the environment to fit the person. In this project we have studied the goodness of fit between the person and his environment with respect to five variables: the complexity of the work, the amount of responsibility for other people, the amount of work load, the degree of role ambiguity, and the amount of overtime worked. We have also measured the underutilization of the workers skills and abilities, that is, his perception of the fit between the job demands and his own abilities. Typically, we have found that not everyone suffers the same environmental stress; for example, many workers say that their job is too simple while others doing the same work report it is too complex. As reported earlier, these stresses due to misfit were generally the strongest predictors of job satisfaction, of dissatisfaction with one's work load, and of boredom; and the misfit predicted better to these variables than did either of their component parts (for example, poor fit on job complexity predicted strain better than either the perceived complexity of the job or the desired complexity of the job).

Therefore, it is inappropriate in some jobs to introduce the same environmental changes for all workers. For example, job enlargement which increases the complexity of the job would decrease stress for some workers while increasing stress for others. What is needed is an individualized program to improve person-environment fit.

Our results suggest that dissatisfaction with the work load can be improved by avoiding involuntary overtime. Then each individual has some chance to adjust the amount of actual overtime to fit his own needs.

The problem of poor fit between the worker and his job is more difficult to solve when we deal with other job demands such as the complexity of the work or the amount of work to be done in an eight-hour day. We will describe one program which was designed to improve person-environment fit in a variety of office jobs in NASA (Campbell, 1973). The study included eleven work groups, typically composed of eight to ten men and their first-line supervisor.

In the six experimental groups the person-environment fit of each member was measured by a questionnaire similar to the one used in the current study. Nine dimensions of fit were assessed including quantitative work load, responsibility for persons, role ambiguity, and participation. These data revealed substantial individual differences within a group; for example, some men had too much work to do but others had too little. It was possible, therefore, that the amount of work could be reallocated in such a way as to improve the fit for most workers without reducing production.

The design called for the feedback to the group of the scores on fit for each individual on each of the nine dimensions. Katz and Kahn (1966) describe the feedback procedure as, "Group discussion of facts and figures in a task oriented atmosphere where people are seeking to analyze the problem, identify possible causes as objectively as possible and agree upon possible solutions" (p. 419). In this program average scores on fit were fed back to the group and ten meetings were held to discuss how to solve the problems of stress and strain which were revealed by the data.

The feedback of data was generally successful in identifying a variety of job stresses, many of which varied from one group to another. The solution of the problems, however, depended on the leadership and cooperation within the group, external constraints upon the freedom of action enjoyed by the group, the support from higher level supervisors, etc. Because of these constraints and perhaps because the feedback used average scores instead of individualized scores on fit, there was little change in person-environment fit during the limited time of this experiment. Because of the faulty execution of the design for improving fit there was no test of its effects on strain and illness.

A final type of environmental change which may be used to promote psychological well-being is the provision of social support from one's supervisor and from one's co-workers. Such support may prove to be an important key to successful programs of affirmative action and equal opportunity employment in the American work place. Our findings indicate that social support can reduce job dissatisfaction and depression.

Supervisory training in the area of human relations is one approach to providing more such emotional support from supervisors. The Survey Research Center findings on supportive supervision (Likert, 1961) as well as the Ohio State Leadership Studies on the effects of "consideration" have been utilized in supervisory training programs (Fleishman, 1974). It is a common finding that it is easier to change a supervisor's belief in supportive practices than it is to change his actual behavior back on the job. Even his new belief in the desirability of a more considerate and supportive type of supervision may regress markedly a few months after the completion of the training course when he discovers that his own boss does not approve of that style of supervision (Fleishman, 1974; Hariton, 1951). These findings have had two consequences. First, there has been a good deal of experimentation with more experiential types of human relations training such as role playing, T-groups, and sensitivity training. Kurt Back (1973) lists in his bibliography 141 research studies evaluating the effectiveness of sensitivity training and encounter groups. Nevertheless, there is a wide diversity in the kinds of groups studied and much disagreement about their effects, especially about their long-range effects. A second consequence has been an interest in training organizations or vertical slices of organizations rather than isolated individuals. Here a supervisor and his boss and his boss' boss may all receive similar training at the same time. Under such favorable circumstances it is possible to produce substantial changes in supervisory practices (Marrow, Bowers, & Seashore, 1967). Although none of these studies of training has concentrated exclusively on the provision of social support from supervisors, many of them have had a very considerable emphasis on supportive human relations, so there is a good deal of descriptive literature on how such training can be done.

Much of the same literature also deals extensively with team building and how to create a cohesive and supportive work group. Within the field of organizational development, those writers who have been influenced by the National Training Laboratory have dealt with this topic (see, for example, Beckhard, 1972; Beckhard & Lake, 1971; Bowers, Franklin, & Pecorella, 1973; Davis, 1970).

Changing the person to fit the environment. Our research on the Type A coronary-prone personality shows that these people are especially susceptible to certain kinds of job stress. It seems obvious that strain and illness in these people might be prevented by enlarging the ordinary personnel procedures of selection and placement. One could add new measures of susceptibility to stress such as the Type A personality. We do not believe that our current measures of personality are adequate for this purpose, but we do believe that useful measures could be developed for use in the selection and placement of individuals who are highly susceptible to job stresses.

A better basis for judging an employee's susceptibility to stress is his reaction to past stress on the job. Observations of these responses, including the utilization of medical records and measures of psychological strains such as we have employed in this project, can form a useful basis for judging the potential person-environment fit when considering individuals for promotion to higher jobs.

In cases where job stresses cannot be altered, there is always the possibility that the individual could be helped to cope more effectively with job stresses by means of training or counseling. Personnel departments and medical departments have occasionally provided such services but little is known of their effectiveness.

Implications for Further Research

It is not infrequent that a research project raises more questions than it answers. From the many suggestions for further research we select six that are especially important. (1) The relation between objective job stresses and the subjective perception of them should be further studied. (2) More knowledge is needed about individual differences in susceptibility to stress and strain and about successful methods by which individuals cope with stress. (3) There should be comparative evaluations of the many different attempts to improve job design in such a way as to humanize work. (4) There should be more research on how to change job stresses, how to improve the fit between the person and his job, and how to increase participation and social support. (5) The current study was confined to white males, and we believe similar research should focus on the special occupational stresses of blacks and of women. (6) The linkage of job stress and strain to actual disease should be more thoroughly explored in studies involving complete medical examinations.

APPENDIX A

Questionnaire Cover Letter

This letter appeared as the front cover of each questionnaire.

INSTITUTE FOR SOCIAL RESEARCH / THE UNIVERSITY OF MICHIGAN / ANN ARBOR, MICHIGAN 48106

JOB DEMANDS AND WORKER HEALTH STUDY

To Respondents:

The Institute for Social Research at The University of Michigan, in collaboration with the National Institute for Occupational Safety and Health, is studying job stress and its relationship to coronary heart disease. We are concerned with all aspects of people's work in the American labor force: the type of work they do, the pay they get, the problems they face, their satisfaction with work, and the effect of work on their physical and economic well-being. The aim of this study is to obtain information which will help improve the conditions of work.

As members of various occupations and professions in the labor force, only persons like yourself can give the information needed to further this research. Answers to all questions on the attached questionnaire are *voluntary*, *anonymous*, and completely *confidential*. Your name will never be associated with this data.

Feel free to add comments or qualifications in the margins as you go along. Space has also been provided at the end for suggestions about matters not covered in specific questions.

We are very grateful for your assistance.

Sincerely,

Sidney Cobb, M.D.
Program Director

Bruce Margolis, Ph.D.
Project Officer, NIOSH

APPENDIX B

Occupational Categories and the Jobs They Represent

Presented below are groups of job titles which were combined under one occupational label. For example, when asked for their job title some respondents reported "forklift driver", some reported "hilo driver", and others reported "selector". In the coding process all of these job titles, which represent the same occupation, were included under the label "forklift driver".

Blue Collar

Forklift driver
  hilo driver
  selector

Assembler, machine paced

Assembler, machine paced relief
  utility man
  relief man
  extra man

Assembler, nonmachine paced
  nonmachine paced team
  nonmachine paced nonteam
  assembly line-nonmachine paced
    repairman

Machine tender
  line tender

Continuous flow monitor
  operator
  relief operator
  chief operator
  operating engineer

Delivery service courier

Tool and die maker
  tool and die leader

Blue/White Collar

Electronic technician
  field engineer

Policeman
  patrolman
  police officer

Train dispatcher

- Blue collar supervisor
  - forklift driver supervisor
    - warehouse foreman
  - assembler, machine paced supervisor
  - assembler, nonmachine paced supervisor
  - continuous flow monitor supervisor
    - shift production supervisor
  - delivery service courier supervisor
  - tool and die supervisor
    - machine foreman
  - electronic technician supervisor
    - field engineering group manager
  - train dispatcher supervisor
    - chief dispatcher
    - assistant chief dispatcher
  - foreman (of occupations not included in the study)

- White collar supervisor
  - ATC, large airports, supervisor
  - ATC, small airports, supervisor
  - supervisor of computer programmers
  - accountant supervisor
  - engineer supervisor

White Collar

- Air traffic controller, large airports

- Air traffic controller, small airports

- Programmer
  - systems analyst
  - systems programmer

- Accountant
  - cost analyst
  - financial analyst

- Engineer

- Scientist

- Professor
  - economics
  - public health
  - sociology
  - medicine

Administrative professor
- economics
- public health
- sociology

Administrator
- manager
- superintendent
- administrative assistant
- vice president
- division president
- executive
- general foreman
- policeman/administrator

Family physician

APPENDIX C

Subsetting Procedure for the Sales Type A Personality Index: A Short Measure of the Type A Personality

Ross Vickers

The measures of Type A personality that we have been using in studies of the relationship between job stresses and coronary heart disease risk factors are self-report personality inventories. The development of these measures began in Stephen M. Sales doctoral dissertation, "Differences among Individuals in Affective, Behavioral, Biochemical and Physiological Responses to Variations in Workload" (1969). In this dissertation, Sales began with a large set of items designed to tap various aspects of the Type A syndrome. The result, using data from both a sample of students and a sample of workers at a National Aeronautics and Space Administration base, was a set of 72 items that formed 14 distinct clusters or variables. These 14 clusters of items were found, generally, to be positively related to serum cholesterol levels, but negatively related to serum uric acid. They were not related to performance on a laboratory task of solving anagrams.

The next major study using these Type A indices was Robert D. Caplan's doctoral thesis, "Organizational Stress and Individual Strain: A Social-Psychological Study of Risk Factors in Coronary Heart Disease Among Administrators, Engineers, and Scientists" (1971). The respondents in this study were once again workers at the National Aeronautics and Space Administration. In this case only the nine variables which Sales had found to have the most effect were employed. The results here indicate that under conditions of high workload, people who are high on the Type A measures are also high on serum cholesterol, serum uric acid, glucose, and so on. This relation does not hold for each Type A measure paired with each risk factor, but, with more than chance frequency, there are effects in the direction indicated.

In a study which is currently in the design stage, we have attempted to shorten the measure because of space limitations. Even the set of nine variables that Robert Caplan used involves 49 items and we had not sufficient room for that many. As a result, we employed a three step process to reduce the number of items while still maintaining as much of the flavor of the larger set as possible. First, using data from Caplan's dissertation sample, we did a factor analysis of the responses to the 49 items. This yielded eleven factors, six of which closely resembled previously used clusters of items. Second, we used a computer program which is designed to select subsets of items from a larger number which comprise a total scale in such a fashion that it maximizes the correlation between the subset and the overall scale score. To do this, the sample that we were dealing with was split in half and the same procedure run on each half of the sample. The results showed that there were six items which served as good predictors for both of the halves of the sample.

To get three more items, we turned to the findings of the factor analysis along with Robert Caplan's results. Caplan had found that one of the strongest variables of the nine that he employed was one labelled "Involved Striving", which tapped essentially the extent to which the person got wound up in his work. The factor analysis showed that this cluster of items did not hold together well. There was one factor composed of items from this scale, but several items from the scale were missing and showed up in other factors. Along with the factor loadings themselves, all of this suggested that "Involved Striving" probably represented a general factor within the overall Type A measure. As a result, we decided to select, for our three remaining items, those three items from "Involved Striving" which best represented that variable. This was determined by taking the three items in the scale with the highest average inter-item correlation.

When these were included with the six items previously determined by the subsetting procedure, we found that we had a scale with good internal consistency (estimated alpha coefficient is roughly .80) and which showed a respectable correlation with the total of the person's responses to all 49 items (a correlation of .90). So we decided that this would be an acceptable short form to represent the long form of the test.

The items that are included in this subset of nine are presented to the respondent with a 7-point response scale ranging from "Very true of me" to "Not at all true of me." The items that we have retained for our present study are:

I hate giving up before I'm absolutely sure that I'm licked.
I've often been asked to be an officer of some group or groups.
Sometimes I feel like I shouldn't be working so hard, but something drives me on.
I thrive on challenging situations. The more challenges I have, the better.
In comparison to most people I know, I'm very involved in my work.
It seems as if I need thirty hours a day to finish all the things I'm faced with.
In general, I approach my work much more seriously than most of the people I know.
I guess there are people who can be nonchalant or easy going about their work, but I am not one of them.
My achievements are considered to be significantly higher than those of most people I know.

Appendix D

Selection of P-E Fit Indices

Investigators have found that the relationship between Person-Environment (P-E) fit variables and strains may have a U-shape or, in other words, the relationship may be curvilinear (Caplan, 1971; French, 1973; French et al, 1974; Vickers, forthcoming). It is expected, however, that most measures of job demands (E) will be linearly related to strain in first-order analyses. Consequently, the relationships of job demands to strains can be compared with the relationships of P-E fit to strains if the P-E fit indices are transformed so that their relationships to strains are also linear. This appendix details the development of P-E fit indices with the necessary linear relationships to strain. First, the theoretical shape of relationships between P-E fit variables and strains are briefly reviewed. Next, transformations are developed to produce a P-E fit index with linear relationships to strain from a P-E fit index with curvilinear relationships to strain. Finally, the shapes of the relationships between P-E fit variables and strains in this study are identified and the strength of the linearity of relationships between strains and transformed P-E fit indices is determined. P-E fit indices with linear relationships to strains are then selected for use in this report.

Shapes of Relationships between P-E Fit Variables and Strains

P-E fit is a measure of the discrepancy between the rewards and demands in the environment and the motives and abilities of the person. Both the environment and the person are measured on a commensurate dimension (e.g. "How much are you paid?" and "How much do you want to be paid?"). The amount of the characteristic desired by the person (P) is subtracted from the amount on the job (E) to produce a score representing the person environment (P-E) fit. A score of zero represents perfect fit (i.e., no discrepancy). A negative discrepancy (E<P) occurs when the environment provides less of the characteristic than the person wants. A positive discrepancy (E>P) score occurs when the environment requires more of the characteristic than the person wants.

Three different shapes have been suggested for the relationship between P-E fit and strain, depending on the variables involved (see Figure D-1).[1] House (1972) suggests that fit on extrinsic supplies can be linearly related to strains. For example, if a person receives less money than he desires, several needs may not be fulfilled and strains will increase. On the other hand, even if additional money were not particularly desired, it can always be used and should tend to increase satisfaction and decrease strains. (See the solid line in Figure D-1).

House (1972) points out that fit on intrinsic supplies can be logarithmically related to strains. If the environment provides fewer opportunities for a person to use his training and abilities than he would prefer, higher

[1]The theoretical shapes to be discussed assume that P-E fit is measured with equal interval scales. Measuring P-E fit with ordinal scales may introduce or eliminate curvilinearity in the relationship between P-E fit and strains.

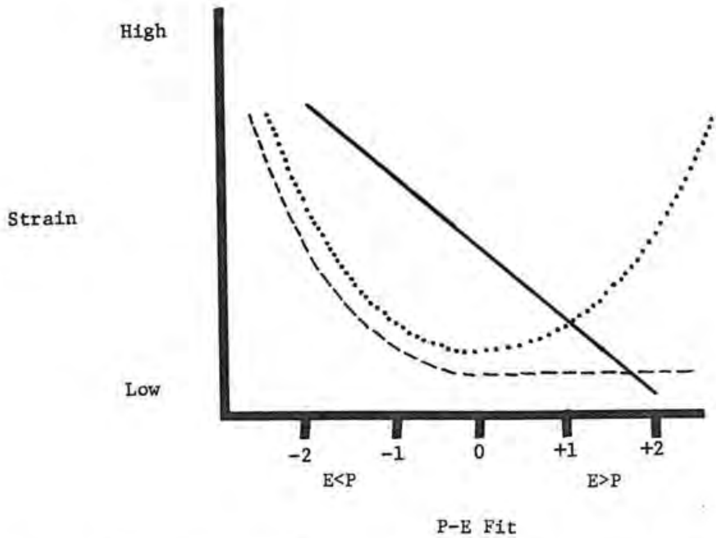

Figure D-1. Hypothesized relationships between P-E fit and strain.

strains should result. As the environment provides more opportunities for a person to use his training and abilities, then his dissatisfactions and other strains decrease until the point is reached at which he can no longer utilize all of the opportunities he is given. As the number of opportunities (not demands) to use training and abilities increases beyond this point, little change in strains will occur. (See the broken line in Figure D-1).

French et al (1974) suggest that when two different motives are associated with a P-E fit dimension, a measure of the P-E fit dimension may have a U-shaped relationship with strains. The U-shaped relationship occurs when frustration of another motive is associated with a negative P-E fit discrepancy.[2] The quality of strain may differ along the continuum of the P-E fit measure. The following example illustrates a shift in strain from boredom to threat of failure as fit on responsibility shifts from a discrepancy of too little (E<P) to a discrepancy of too much (E>P). If a person has much less responsibility on his job than he would like, the lack of opportunity to use his abilities may result in his feeling bored. If, however, a person has more responsibility on his job than he wants , the possibility of making a wrong decision may result in his feeling a constant threat of failure. (See the dotted line in Figure D-1).

The arguments for the linear, logarithmic, and U-shaped relationships suggest that the relationships between the four P-E fit variables (Quantitative Work Load, Responsibility for Persons, Job Complexity, and Role Ambiguity) and strains in this study will be U-shaped. Both positive and negative discrepancies on each variable can affect environmental supplies and demands leading to higher strain.

Poor fit from underload (E<P) on Quantitative Work Load can result in high strain because of underutilization and frustration of one's need to achieve and to perform at a maximum level. Poor P-E fit on Quantitative Work Load can also result from the pressures of overload (E>P) which result in high strain. For P-E fit on Responsibility for Persons, not enough responsibility (E<P) suggests the job is uninteresting and that feelings of underutilization will result in higher strain. Too much Responsibility for Persons (E>P) may threaten the individual with failure. For P-E fit on Job Complexity, too little complexity on the job (E<P) may reflect overly simplified, routine job activities which can result in boredom. On the other hand, an individual may not be able to perform satisfactorily a job which is too complex (E>P). The individual's failures can result in higher strain levels. Similarly, too little Job Ambiguity (E<P) can reflect excessively close supervision or technological control of the worker resulting in monotony, boredom, and higher levels of other strains. An overly ambiguous job (E>P) can increase the individual's feelings of uncertainty, and insecurity, and inability to control his fate, resulting in higher strain.

Since the preceding discussion suggests that it is very likely that the four P-E fit variables have U-shaped relationships with strains, a transformation to produce P-E indices with linear relationships to strains will be developed.

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[2] P-E fit theory makes no theoretical prediction as to whether curvilinear relationships will be U-shaped or V-shaped. Analyses to determine more exactly the shape of curvilinear relationships will be performed during the second phase of this project. For the present, references to U-shaped relationships will refer to both U- and V-shaped relationships unless otherwise noted.

Developing P-E fit Transformations with Linear Relationships to Strains.

The simplest P-E fit measure is a single P-E fit item score. Using this simple measure a procedure will be developed for transforming a P-E fit item with U-shaped relations to strains into a P-E fit variable with linear relationships to strains. This simple case will then be elaborated to include multiple item measures of P-E fit.

Single item measures of P-E fit discrepancy. A P-E fit item score equals the score on the environment item minus the score on the commensurate person item (i.e., P-E fit = (E - P)). The U-shaped relationship between strains and P-E fit results when strain is lowest when the E and P scores are equal (i.e., E - P = 0) and strain increases as the magnitude of the difference between E and P scores (i.e., either E<P or E>P) becomes larger. With strains increasing as the magnitude of the discrepancy between E and P increases, a simple way to make the U-shaped relationship approximately linear would be to ignore the sign of the discrepancy and use the absolute value of the P-E fit score. This transformation produces a P-E fit discrepancy measure which has a minimum score of perfect fit (i.e., 0) and increases as the amount of misfit increases in either direction. Figure D-2a illustrates the change this transformation would produce.

The relationship between the P-E fit discrepancy and strain is not perfectly linear. To have a truly linear relationship result from the transformation, strains should have a V-shaped relationship to the original P-E fit measure as in Figure D-2b. Nunnally (1967) suggests, however, that the difference between the relationships involving the P-E fit discrepancy measure in Figures D-2a and D-2b will not greatly affect the strength of their correlations with strains. The correlation between P-E fit discrepancy and strains is robust enough to measure the strength of the relationship as long as the variables have a monotonically increasing or monotonically decreasing relationship. The P-E fit discrepancy transformation should therefore produce an adequatley linear relationship regardless of whether the P-E fit relationships with strains are U- or V-shaped.

The preceding discussion has assumed that the relationship between the original P-E fit measure and strain was U- or V-shaped. The absolute value transformation of P-E fit scores to produce P-E fit discrepancy scores is appropriate only when this assumption is met. For example, when the relationship between an original P-E fit measure and strain is linear, the absolute value transformation will produce the pattern of P-E fit discrepancy scores illustrated by the dotted lines in Figure D-2c. A linear analysis of this pattern of scores would describe little, if any, relationship between the P-E fit discrepancy measure and strain (see the solid line in the graph to the right in Figure D-2c). The relationship between the P-E fit measure and strain must be determined to be U-shaped (or V-shaped) before the absolute value transformation of P-E fit scores can be appropriately used to produce P-E fit discrepancy scores with linear relationships to strain.

Multiple item measures of P-E fit discrepancy. When a multiple item index of P-E fit that has curvilinear relationships with measures of strain is transformed to a discrepancy index of P-E fit, the nature of the expected relationship between the items of the P-E fit index and strain needs to be considered. Two different types of relationships between P-E fit items in a P-E fit index are discussed below. In light of these relationships, two transformations of multi-item indices of P-E fit discrepancy will be considered. Finally, the comparative usefulness (i.e., the ability to account for variance in measures of strain) of the two transformations will be examined.

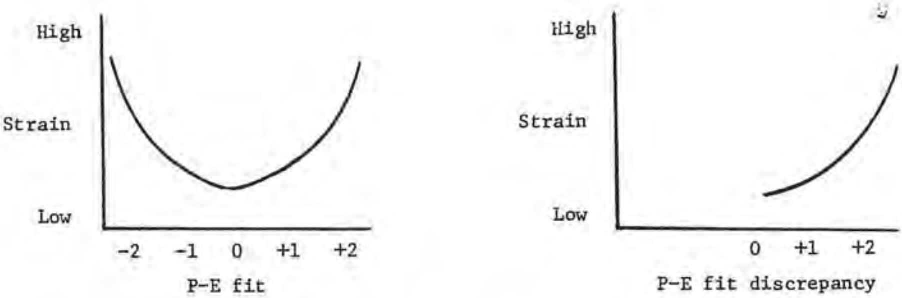

Figure D-2a. Illustration of the absolute value transformation of P-E fit scores on a U-shaped relationship between P-E fit and strains.

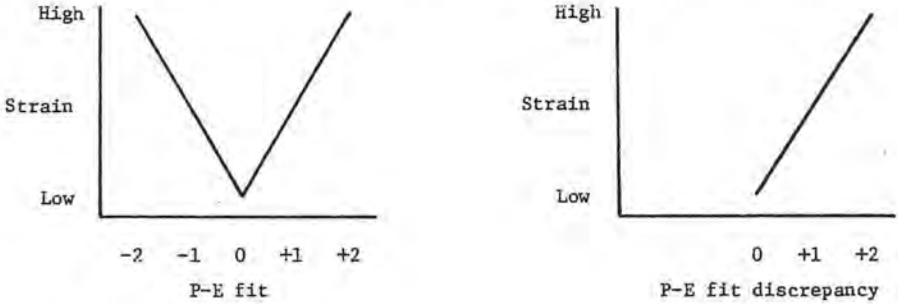

Figure D-2b. Illustration of the absolute value transformation of P-E fit scores on a V-shaped relationship between P-E fit and strains.

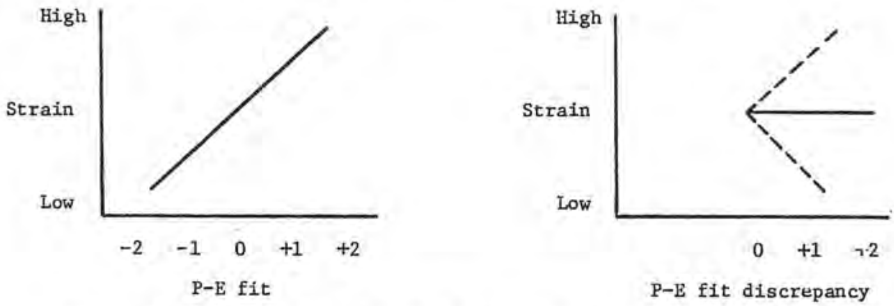

Figure D-2c. Illustration of the absolute value transformation of P-E fit scores on a linear relationship between P-E fit and strains.

A unitary P-E fit index is defined as follows. When several items are used to form a unitary P-E fit index, the items combine to increase the reliability of the measure. Each item attempts to measure the same conceptual entity. Such items are expected to correlate highly and have the same relationship to strain. A unitary P-E fit index, therefore, has a single relationship with strain. The P-E fit items in the index of quantitative work load are an example. The items ask about the amount of time the person has to complete work, the amount of work there is to do, and so on. The content of the items is essentially overlapping in the sense that asking about a person's time to complete work is simply another way of asking about how much work a person has to do, and so on. The indices of P-E fit which measure responsibility for persons and role ambiguity also appear to have this unitary quality to them. The inter-item correlations of these three indices will be discussed shortly.

An aggregate P-E fit index is defined as follows. For an aggregate P-E index each item measures a different variable having its own relationship with strain. Such items are not necessarily expected to correlate with each other since the variables which they measure can operate independently of one another. The several items combine to produce an index measuring the total (i.e. aggregate) effect of the several variables on strain. An aggregate P-E fit index, therefore, represents the effect of several relationships with strain. The index of P-E fit on job complexity is an aggregate index. Working with people, having tasks which change from day to day, and working with people across one's organizational boundaries are some of the items from this index. Each of these variables has been suggested by some theorist or researcher as a quality of a complex job. but there is no requirement that all of these characteristics be present in a job for it to be considered complex.

In producing a multi-item index score, the P-E fit item scores measuring a unitary P-E fit index may simply be added to obtain a score representing the overall fit on the construct. One can perform such an operation based on the assumption that the index score is an additive function of its items. The P-E fit items constituting an aggregate P-E fit index might also be assumed to have additive effects in producing variation in strains. (This assumption will be tested for the P-E fit indices under consideration during the second phase of the study.) Both kinds of P-E fit indices can be represented by the formula:

$$\text{P-E fit index score} = \sum_{i=1}^{N} (E_i - P_i) \qquad [1]$$

where

E_i = the ith environment item score

P_i = the commensurate ith person item score

N = the number of pairs of E and P items in the index

This formula was used by Caplan (1971), French et al (1974), and Vickers (forthcoming) to produce P-E fit indices.

Although no distinction is made between a unitary and an aggregate index in formula [1], the distinction becomes important when transforming a P-E fit index into a P-E fit discrepancy index. The amount of strain associated with poor P-E fit on a unitary index is a function of the magnitude of the discrepancy between the P-E fit index score and perfect fit. Therefore, when transforming a unitary P-E fit index to produce a P-E fit discrepancy index, the absolute value of the index score should be used. Taking the absolute value of the index score in formula [1] produces the following formula:

$$\text{P-E fit discrepancy score for a unitary construct} = \left| \sum_{i=1}^{N} (E_i - P_i) \right| \qquad [2]$$

The amount of strain associated with poor P-E fit on an aggregate index is a function of the magnitude of the discrepancy between each P-E fit item score and perfect fit. Therefore, when transforming an aggregate P-E fit index to produce a P-E fit discrepancy index, the absolute value of each item score should be used. Taking the absolute value of the P-E fit scores in formula [1] produces the following formula:

$$\text{P-E discrepancy index score for an aggregate construct} = \sum_{i=1}^{N} \left| (E_i - P_i) \right| \qquad [3]$$

When all of the item scores have the same sign, formulas [2] and [3] produce the same P-E fit discrepancy index scores. However, when items having positive P-E fit scores are combined with items having negative P-E fit scores formulas [2] and [3] produce different results. For example, assume that four items measuring P-E fit on quantitative work load (a unitary index) have scores of -4, -2, +1, and +2 and that four items measuring P-E fit on job complexity (an aggregate index) have the same scores. The P-E fit index scores (formula [1]) would be -3 for both responsibility for persons and job complexity. The P-E fit discrepancy score for responsibility for persons (formula [2]) would be +3 while the P-E fit discrepancy score for job complexity (formula [3]) would be +9. When items have different signs, formula [2] operates as though only the combined effect of the items contributes to the discrepancy while formula [3] operates as though each item contributes separately to the discrepancy.

The likelihood that some items in a P-E fit measure have negative scores while other items have positive scores is lower for a unitary index than for an aggregate index. Since all of the items in a unitary index are attempting to measure the same entity, the item scores tend to be similar both in magnitude and in sign. The items constituting an aggregate index each measure a different entity. If the entities occur independently of one another, the scores of these items should vary more in magnitude and in sign than items in a unitary index. In support of these expectations, the similarity of the item scores for each of the unitary indices of P-E fit on responsibility for persons, on quantitative work load, and on role ambiguity is reflected in their fairly high inter-item reliabilities of .83, .71, and .82 respectively. The higher variance in the item scores for the aggregate index of P-E fit on job complexity is reflected in its comparatively low inter-item reliability of .54.

Before turning to the tests of the two transformation formulas, one final point might be noted. If one had to choose between formulas [2] and [3] and had no knowledge of whether or not one's measures of P-E fit represented unitary or aggregate indices, one should choose formula [3]. The reasoning behind this choice is as follows. For a unitary index, all of the P-E fit item scores will typically have the same sign. In this situation both formulas perform equally well. For an aggregate index, some of the P-E fit item scores are more likely to have different signs. In this situation the formula [3] index should perform better. Consequently, formula [3] should work for all situations.

Testing the Shape of the Relationships of P-E Fit and P-E Discrepancy to Strains

The preceding two sections have generated two hypotheses to be tested First, strains will have a U-shaped relationship with the original P-E fit indices. Second, when these U-shaped relationships occur, the transformed P-E fit discrepancy scores will have a linear relationship with strains. The discrepancy scores produced by formula [3] should have correlations with strains which are equal to or somewhat higher than those produced by formula [2].

A direct test of the hypothesis that the relationship between the P-E fit variables and strains is U-shaped can be performed using multiple regression techniques. The presence of a U or parabolic shaped relationship between P-E fit indices and strains can be determined by comparing the variance predicted by a linear relationship (r^2) between the variables (i.e., $Y = a + bx$) with the variance predicted by a parabolic relationship (R^2) between the variables (i.e., $Y = a + bx + cx^2$). If R^2 accounts for a significant amount of variance beyond that accounted for by r^2, the relationship is U-shaped.

This analysis was performed using the MIDAS Polynomial Regression program (Fox and Guire, 1973). Table D-1 presents the relationships between P-E fit variables and psychological strains for the stratified random sample. Since the relationships between P-E fit variables and both the health behavior variables (e.g., coffee drinking, dispensary visits) and physiological strains (e.g., blood pressure, serum uric acid) are low and uninformative, they are not included in Table D-1. The first two columns under each P-E fit variable present the R and r values for the relationship between the P-E fit index constructed according to formula [1] and the psychological strains. The remaining two columns under each P-E fit variable present the r values for the relationships between P-E discrepancy indices constructed according to formulas [2] and [3]. They will be discussed shortly.

The increase in variance predicted by the curvilinear relationship is equal to R^2-r^2. Therefore, with a larger difference between R and r, it is more likely that the relationship is U-shaped. Relationships which are significantly U-shaped ($F > 3.87$, $p < .05$)--i.e., where R^2 accounts for a significant amount of variance beyond r^2--are noted with an asterisk next to the R value on Table D-1.

In discussing the relationships presented in Table D-1 only the significant multiple correlations (R's) and correlations (r's) will be considered. To determine whether a relationship is linear or curvilinear, it must first be determined that a relationship exists--i.e., that the relationship is significant. Therefore, relationships which fail to meet the $p < .05$ criterion (i.e., $R < .15$ or $r < .12$) will be excluded from discussion.

The relationships between the P-E fit index (formula [1]) for Quantitative Work Load and the psychological strains are linear. None of the four significant R values (ranging from .21 to .53) has a statistically significant U-shaped tendency. This linear relationship cannot be due to a poor distribution of fit scores since a third of the fit scores on Quantitative Work Load had negative values while over half of the fit scores had positive values. The linear relationship may be an artifact of patterns across occupational groups in the stratified random sample. This possibility will be checked in the second phase of this project when the shape of the relationships between P-E fit variables and strains will be analyzed within occupations. For the present, it is reasonable to conclude that P-E fit on Quantitative Work Load is linearly related to strains.

The other three P-E fit indices (Responsibility for Persons, Job Complexity, and Role Ambiguity) have U-shaped relationships with psychological strains. For each of these indices every significant R value also has a significant U-shaped relationship with the psychological strain. Caplan (1971) and Vickers (forthcoming) also found the same U-shaped relationship between strains and P-E fit on responsibility for persons and role ambiguity in more homogeneous samples, suggesting that the shape of the relationships of these variables to strains is not an artifact of differences across occupations in the sample. The relationship between the three fit variables and strains will be tested within occupations to be sure the U-shaped relationship is replicated.

Another possibility which must be considered is that the P-E fit variables relate to strains in patterns which are neither linear nor U-shaped. In order to be sure that the linear and U-shaped relationships represented by R^2 fully describe the relationships between P-E fit and strains, the R^2 values were compared to the eta^2 (E^2) values of the relationships. Eta is a measure of the strength of all patterns of relationship between the variables. The comparisons of the R^2 and E^2 values followed a procedure presented by Blalock (1960, pp. 311-316). In only two of 27 comparisons did the difference between E^2 and R^2 reach the .05 level of significance. Considering the number of comparisons which were made, these two instances can be considered to be chance occurrences. This lack of a significant difference between the E^2 and R^2 values suggests that R^2 does account for all of the relationships between the P-E fit variables and psychological strains.

The second hypothesis to be tested is that when strains have U-shaped relationships with P-E fit measures, strains will have linear relationships to the transformed P-E fit discrepancy measures. Correlation coefficients (r's) measure the strength of the linear relationship between two variables. Therefore, correlations between strains and the three P-E indices (the P-E fit index produced by formula [1] and the two P-E discrepancy indices produced by formulas [2] and [3]) can be compared to determine which index has the strongest correlations with strains.

Indices of P-E fit discrepancy were constructed for each of the four P-E fit variables using formulas [2] and [3]. The correlations between the discrepancy indices for each P-E fit variable and strains were computed. Table D-1 presents the correlations between the formula [2] and [3] indices and psychological strains for each P-E fit variable to the right of the correlations between the original P-E fit indices (formula [1]) and psychological strains. Again, since the correlations between P-E fit discrepancy indices and both health behaviors and physiological strains are low and uninformative, they are not included in Table D-1.

It was noted that P-E fit on Quantitative Work Load has linear relationships to the psychological strains. Therefore, formula [1] should produce an index for P-E fit with stronger correlations to strains than either formula using an absolute value transformation. Table D-1 shows that formula [1] does indeed produce higher correlations to psychological strains than does either of the other two indices. Six strains have significant correlations to one or more of the three Quantitative Work Load P-E indices. The formula [1] index produced the highest correlations to five of these strains. The formula [1] index did

Table D-1

Linear and U-shaped Relationships between P-E Fit Variable Indices
and Psychological Strains

Psychological Strain Variables	P-E Fit Variables															
	Quantitative Work Load				Responsibility for Persons				Job Complexity				Role Ambiguity			
	R^{ab}	r^{c}			R	r			R	r			R	r		
	[1] $\Sigma(E-P)$	[1] $\Sigma(E-P)$	[2] $\lvert\Sigma(E-P)\rvert$	[3] $\Sigma\lvert E-P\rvert$	[1] $\Sigma(E-P)$	[1] $\Sigma(E-P)$	[2] $\lvert\Sigma(E-P)\rvert$	[3] $\Sigma\lvert E-P\rvert$	[1] $\Sigma(E-P)$	[1] $\Sigma(E-P)$	[2] $\lvert\Sigma(E-P)\rvert$	[3] $\Sigma\lvert E-P\rvert$	[1] $\Sigma(E-P)$	[1] $\Sigma(E-P)$	[2] $\lvert\Sigma(E-P)\rvert$	[3] $\Sigma\lvert E-P\rvert$
Job Dissat	.21	.19	.19	.22	.20*	-.14	.21	.23	.23*	-.03	.31	.47	.14*	.07	.13	.19
Boredom	.05	.05	.05	.13	.31*	-.24	.30	.32	.35*	-.25	.36	.51	.15*	.03	.12	.17
Wk Ld Dissat	.53	.52	.44	.36	.20*	.06	.09	.07	.30*	.15	.26	.36	.11	.03	.09	.13
Somat Cmplnts	.05	.05	.06	.06	.09	-.09	.07	.07	.18*	-.11	.20	.16	.04	.03	-.02	.02
Anxiety	.14	.13	.13	.09	.11	.05	.06	.05	.21*	.06	.22	.21	.09	.09	-.02	.01
Depression	.27	.27	.20	.24	.10	.01	.06	.05	.17*	.03	.20	.22	.09	.06	.07	.11
Irritation	.28	.27	.24	.17	.08	.06	.01	.00	.14	.09	.15	.15	.14	.12	.02	.06

Note. These analyses were performed using data from the stratified random sample, n=318.

[a]For $R \geq .15$, $p < .05$. For $R \geq .18$, $p < .01$.

[b]The multiple correlation coefficient (R) in this table is derived from the prediction of the psychological strain score from the fit score and it's square, i.e., $Y = a + bx + cx^2$.

[c]For $r \geq .12$, $p < .05$. For $r \geq .15$, $p < .01$.

*Adding the x^2 term to produce R accounts for significantly ($p < .05$) more variance than does the linear correlation (r) alone. The psychological strain therefore has a U-shaped relationship to the fit variable.

reasonably well in the remaining case (.19 versus .22). Consequently, no transformation of the P-E fit index on quantitative work load was necessary to produce an index with linear relationships to strains. The P-E fit index, labeled Quantitative Work Load-Fit, is used for the analyses involving P-E fit on Quantitative Work Load in the accompanying report.

It was noted above that the psychological strains had U-shaped relationships to the formula [1] indices for the remaining three P-E fit variables (Responsibility for Persons, Job Complexity, and Role Ambiguity). As expected, Table D-1 shows that for these three variables formulas [2] and [3] produce indices which have consistently higher correlations with psychological strains than do the formula [1] indices. Also, the correlations between the formula [3] indices and strains are generally higher than the comparable correlation between the formula [2] indices and strains.

For P-E fit on Responsibility for Persons, two psychological strains have significant correlations with one or more of the three P-E indices. The formula [3] index has higher correlations with both of these strains (i.e., it accounts for more of the variance in these strains) than does either of the other two indices.

Regarding P-E fit on Job Complexity, all seven of the strain variables have significant correlations with one or more of the P-E indices. The formula [3] index has the highest correlation with four strain variables, ties with the formula [2] index for the highest correlation with one strain variable, and has correlations only slightly lower than those of the formula [2] index for the remaining two strains.

Finally, for P-E fit on Role Ambiguity, three psychological strains have significant correlations to either or both the formula [2] and the formula [3] indices. The formula [3] index has higher correlations to all three strains than does the formula [2] index.

Considering each of three these P-E fit variables, when a linear relationship between strains and a P-E index is significant, the formula [3] discrepancy index almost always produces a higher correlation than does either of the other two P-E indices. Consequently, the formula [3] index of each variable--labeled Responsibility for Persons-Poor Fit, Job Complexity-Poor Fit, and Role Ambiguity-Poor Fit--is used for the analyses in the report.

Summary

A P-E index with linear relationships to psychological strains was developed for each of the four P-E fit variables in this study. First, it was necessary to determine whether indices constructed according to a previously used formula (Caplan, 1971; French, et al, 1974) had linear relationships to strains. An index was constructed for each P-E fit variable by summing the discrepancies between its P and E item scores (i.e., formula [1]). The relationships between each P-E fit index and strains was tested to see if it was linear or U-shaped. It was found that the psychological strains were linearly related to P-E fit on Quantitative Work Load and that they had a U-shaped relationship to P-E fit on Responsibility for Persons, Job Complexity, and Role Ambiguity.

In order to transform the P-E fit indices with U-shaped relations to strains into P-E indices with linear relations to strains, two formulas for P-E discrepancy indices were developed. Formula [2] produced an index by taking the absolute value of the sum of the P-E fit item scores. Formula [3] produced an index by taking the sum of the absolute values of the P-E fit item scores. The correlations between strains and the three indices for P-E fit variables were compared to determine which index had the highest correlations to strain. For P-E fit on Quantitative Work Load the formula [1] index had the highest correlations to strains. This index was used to construct the Quantitative Work Load-Fit index used for the analyses in this study. For the other three P-E fit variables, formula [3] produced the index which generally had the highest correlations with psychological strains. This formula was used to construct the Responsibility for Persons-Poor Fit, Job Complexity-Poor Fit, and Role Ambiguity-Poor Fit indices used for the analyses in this study.

APPENDIX E

Description of Measures of Demographic Characteristics, Subjective Environment (Stress), Personality, P-E Fit, Psychological Strain, Health Behavior, and Illnesses

Note. The introduction (if any), content, and response scale of each measure is presented. The interitem correlations are included for multiple item measures. The measures are presented in the order in which they are listed in Table II-7. The source of each measure is also presented in Table II-7.

MEASURES OF DEMOGRAPHIC CHARACTERISTICS

Occupation

Item Content and Format:

Regarding your current job, what is your main occupation? My main occupation is:

____

(Please Print Full Job Title)

What is the name of the section or part of the company or organization in which you work?

____

(Please Print; Fill In)

Briefly describe the things you do as part of your job. *(Please Print)*

____

____

____

____

Note. The responses to all three items were considered in determining the respondent's occupation.

Age

Item Content and Format:

How old are you? *Check One Box. (Ignore numbers in brackets [ ]).*

☐	Under 20 years	[1]	☐	Between 40–44	[6]
☐	Between 20–24	[2]	☐	Between 45–49	[7]
☐	Between 25–29	[3]	☐	Between 50–54	[8]
☐	Between 30–34	[4]	☐	Between 55–59	[9]
☐	Between 35–39	[5]	☐	60 or older	[10]

Note. The numbers in brackets were recoded to the approximate mid-point value of the interval of years to give a measure of approximate age in years. They were recoded so that 1 = 18 years, 2 = 22, 3 = 27, 4 = 32, 5 = 37, 6 =42, 7 = 47, 8 = 52, 9 = 57 and 10 = 62 years of age.

Years of Schooling

Item Content and Format:

How much schooling have you had? *Check One Box. (Ignore numbers in brackets [ ]).*

- ☐ None [1]
- ☐ Grades 1–4 [2]
- ☐ Grades 5–6 [3]
- ☐ Grades 7–8 [4]
- ☐ Grades 9–11 [5]
- ☐ Grade 12 (completed high school) [6]
- ☐ Completed high school plus other non-college training (technical or trade school) [7]
- ☐ Some college [8]
- ☐ Completed college with bachelor's degree [9]
- ☐ Completed college with advanced or professional degree (M.A., M.S., PH.D., M.D., etc.) [10]

Note. The numbers in brackets were recoded so that the nominal scale became an interval scale approximating the number of years of schooling, as follows: 1 = 1 year, 2 = 3, 3 = 6, 4 = 8, 5 = 10, 6 = 12, 7 = 13, 8 = 14, 9 = 16, 10 = 19 years of schooling.

Income

Item Content and Format:

How much did you earn on this job in 1972 before any deductions for taxes or other things?

$ ____________ in 1972
(Fill In Amount)

Length of Service

Item Content and Format:

How long have you been in your present position, that is your particular job, where you work? *Check One Box.*

☐ Less than one month [1]	☐ Between 1 and 5 years [4]
☐ 1 to 6 months [2]	☐ Between 6 and 10 years [5]
☐ 7 months to 1 year [3]	☐ More than 10 years [6]

MEASURES OF SUBJECTIVE ENVIRONMENT (STRESS)

Hours Worked per Week

Item Content and Format:

The "forty-hour week" is a very common term. However, when people count up the hours they work, they sometimes find they work somewhat more or somewhat less than forty hours. During the **average** week, how many hours do you work, not counting the time you take off for meals?

_______ HOURS PER WEEK
(Fill In)

Hours of Overtime per Week

Item Content and Format:

In the last **month**, how many hours of what you consider "overtime" did you put in?

_______ HOURS OVERTIME
(Fill In)

Note. The response was divided by 4 to produce the per week score.

Unwanted Overtime

Item Content and Format:

How many of these overtime hours did you actually **want** to work either for the money or to get something done?

_______ HOURS
(Fill In)

Note. The response from this question was divided by four and subtracted from the Hours of Overtime per Week to produce the Unwanted Overtime score.

Quantitative Work Load (Quinn)
Quantitative Work Load-E
Combined Quantitative Work Load

A. Intercorrelation Matrix

Item	2:21	2:22	2:23	2:24	2:25	2:26	2:27	2:28	2:29	2:30
2:22	.59									
2:23	.47	.49								
2:24	.47	.54	.59							
2:25	.13	.13	.16	.27						
2:26	.31	.30	.23	.30	.22					
2:27	.42	.48	.50	.62	.29	.34				
2:28	.32	.28	.32	.39	.19	.21	.54			
2:29	.23	.23	.29	.26	.22	.30	.28	.24		
2:30	.21	.21	.38	.37	.19	.13	.51	.33	.25	
2:31	.16	.21	.31	.35	.39	.28	.39	.28	.28	.26

B. Introduction: These questions deal with different aspects of work. Please indicate how often these aspects appear in your job.

C. Index	Item	Content
Quantitative Work Load (Quinn)[1]	2:21	How often does your job require you to work very fast?
	2:22	How often does your job require you to work very hard?
	2:23	How often does your job leave you with little time to get things done?
	2:24	How often is there a great deal to be done?
Quantitative Work Load - E[2]	2:25[3]	How much slowdown in the work load do you experience?
	2:26	How much time do you have to think and contemplate?
	2:27	How much work load do you have?
	2:28	What quantity of work do others expect you to do?
	2:29	How much time do you have to do all your work?
	2:30	How many projects, assignments, or tasks do you have?
	2:31	How many lulls between heavy work load periods do you have?

(continued)

Work Load, Continued

Index	Item	Content
Combined Quantitative Work Load	-[4]	________

[1]These items were taken from a national survey by Quinn _et al_ (1971). They were used separately as an index to compare results of this study with those of the national sample.

[2]The items in this index parallel those of the Quantitative Work Load - P Index.

[3]The underlined items were reverse scored.

[4]This index was produced by combining the items from the Quantitative Work Load (Quinn) and the Quantitative Work Load - E Indices.

D. Response Scales:

Items 2:21-2:24	Very Often	Fairly Often	Some-times	Occa-sionally	Rarely
	5	4	3	2	1
Items 2:25-2:31	A Great Deal	A Lot	Some	A Little	Hardly Any
	5	4	3	2	1

Variance in Work Load

A. Intercorrelation Matrix

Item	2:32	2:33
2:33	.49	
2:34	.44	.73

B. Introduction: Now indicate how often you experience each of the following changes on your job.

C. Item	Content
2:32	A marked increase in the work load.
2:33	A marked increase in the amount of concentration required on your job.
2:34	A marked increase in how fast you have to think.

D. Response Scale:

	Hardly or Never	A Little of the Time	Some of the Time	Very Often
Items 2:32-2:34	1	2	3	4

Responsibility for Persons-E

A. Intercorrelation Matrix

Item	2:35	2:36	2:37
2:36	.77		
2:37	.66	.69	
2:38	.65	.63	.64

B. Introduction: How much of each of the following types of responsibility do you have?

C. Item	Content
2:35	How much responsibility do you have for the future of others?
2:36	How much responsibility do you have for the job security of others?
2:37	How much responsibility do you have for the morale of others?
2:38	How much responsibility do you have for the welfare and lives of others?

D. Response Scale:

	Very Little	A Little	Some	A Lot	A Great Deal
Items 2:35-2:38	1	2	3	4	5

Job Complexity-E

A. Intercorrelation Matrix

Item	2:14	2:16	2:40	2:42	2:44
2:16	.45				
2:40	-.09	.09			
2:42	.30	.42	.35		
2:44	.31	.35	.30	.43	
2:46	.06	.34	.32	.40	.42

B. Introduction: Please read what Pete's job is like and what Dan's job is like. Then circle the number which describes the job you would prefer if you were looking for a new job. Next circle the number which describes the job you have now.* Follow the same procedure for each item in this section. (Note: The Job Complexity - E Index and the Job Complexity - P Index use the same content but ask for different responses. This statement introduces the items of both indices.)

*This sentence was inadvertently omitted from the introduction.

C. Item	Content	
2:13 & 2:14	Van's job is defined and described in almost every detail. Nothing is left to chance. There is a procedure for every type of task.	On Ed's job, a person has some idea of the purpose of the job-but no exact instructions are given on how to do the work. There is often no set procedure.
2:15 & 2:16	Jack works on the same tasks every day. He uses the same procedures or equipment all of the time. Each task is like the one he just finished.	Almost each day things change in Alan's job. Each task is rarely the same as the previous one. He is likely to use different procedures or equipment from case to case.
2:39[1] & 2:40	Tom's job requires him to be around people constantly. He works or talks with people most of the time.	Bob's job does not require him to work with anyone else. In his job Bob works alone. He rarely deals with other people.
2:41 & 2:42	In Rich's job he works with people from several different groups. He has to handle each group differently because they have different needs and want to get different things done.	Don's contact at work is strictly with the people in his own work group or department. He does not need to deal with several differe groups or departments or organiza tions.

(continued)

Item	Content	
2:43 & 2:44	In Tom's job he works on many different tasks which are all in different stages of completion. Some things are just being started while others are halfway finished, and others may be finished by someone else.	Jim's job requires him to work on one job at a time. When that work unit is completed, he starts to work on another unit or task. Two or more units are never worked on at the same time. He always finishes one unit before starting another.
<u>2:45</u> & <u>2:46</u>	Don's job has changes in work load; every once in a while Don has to work to his absolute maximum. When that happens, he has to concentrate as hard as he can and be as careful as he can.	Dick's job goes along evenly from hour to hour and from day to day. The pace of the work stays about the same. He rarely, if ever, has to suddenly change the pace of his work and work even faster and harder.

[1]The underlined items were reverse scored.

<u>D. Response Scale</u>: The items constituting the Job Complexity-E Index (items 2:14, 2:16, 2:40, 2:42, 2:44, 2:46) use response scale "B" (MY JOB IS...) from the item format below. The proper names are changed to fit each item. (See the Job Complexity-P Index for information concerning the odd numbered items.)

<u>E. Item Format</u>:

<u>Van's Job</u>	<u>Ed's Job</u>
Van's job is defined and described in almost every detail. Nothing is left to chance. There is a procedure for every type of task.	On Ed's job, a person has some idea of the purpose of the job—but no exact instructions are given on how to do the work. There is often no set procedure.

A) I WOULD PREFER A JOB . . . . . *(Circle One Number)*

Exactly Like Van's	A Lot Like Van's	Somewhat Like Van's	Halfway Between Van's/Ed's	Somewhat Like Ed's	A Lot Like Ed's	Exactly Like Ed's	
1	2	3	4	5	6	7	[2:13]

B) MY JOB IS . . . . . *(Circle One Number)*

Exactly Like Van's	A Lot Like Van's	Somewhat Like Van's	Halfway Between Van's/Ed's	Somewhat Like Ed's	A Lot Like Ed's	Exactly Like Ed's	
1	2	3	4	5	6	7	[2:14]

Concentration

Item Content and Format:

Pete's Job	Dan's Job
This job requires that Pete pay close attention to what he is doing. Pete must concentrate and his mind cannot wander from the work.	No concentration is required on this job. Dan can let his mind wander and still do the work. It is unnecessary to pay close attention to what is going on.

A) I WOULD PREFER A JOB . . . . . *(Circle One Number)*

Exactly Like Pete's	A Lot Like Pete's	Somewhat Like Pete's	Halfway Between Pete's/Dan's	Somewhat Like Dan's	A Lot Like Dan's	Exactly Like Dan's
1	2	3	4	5	6	7

B) MY JOB IS . . . . . *(Circle One Number)*

Exactly Like Pete's	A Lot Like Pete's	Somewhat Like Pete's	Halfway Between Pete's/Dan's	Somewhat Like Dan's	A Lot Like Dan's	Exactly Like Dan's
1	2	3	4	5	6	7

Note. Response B is the subjective environment score on concentration. This measure was presented with the Job Complexity-E items and is described in the introductory statement for the Job Complexity-E measure.

Role Conflict

A. Intercorrelation Matrix

Item	2:47	2:48
2:48	.59	
2:49	.52	.62

B. Introduction: Conflicts can occur in any job. For example, someone may ask you to do your work in a way which is different from what you think is best or you may find that it is difficult to satisfy everyone. How often do you face problems in your work like the ones listed below?

C. Item	Content
2:47	Persons equal in rank and authority over you ask you to do do things which conflict.
2:48	People in a good position to see if you do what they ask give you things to do which conflict with one another.
2:49	People whose requests should be met give you things which conflict with other work you have to do.

D. Response Scale:

Items 2:47-2:49	Rarely or Never	Sometimes	Fairly Often	Very Often
	1	2	3	4

Role Ambiguity-E

A. Intercorrelation Matrix

Item	2:17	2:18	2:19
2:18	.52		
2:19	.57	.48	
2:20	.55	.71	.61

B. Introduction: These questions deal with different aspects of work. Please indicate how often these aspects appear in your job.

C. Item[1]	Content
2:17	How often are you clear on what your job responsibilities are?
2:18	How often can you predict what others will expect of you on on the job?
2:19	How much of the time are your work objectives well defined?
2:20	How often are you clear about what others expect of you on the job?

[1]All items were reverse scored.

D. Response Scale:

	Very Often	Fairly Often	Some-times	Occa-sionally	Rarely
Items 2:17-2:20	5	4	3	2	1

Job Future Ambiguity

A. Intercorrelation Matrix

Item	1:65	1:66	1:67
1:66	.58		
1:67	.39	.45	
1:68	.52	.46	.41

B. Introduction: In the future some jobs will be changing while others will be staying the same. Here are some questions which deal with this topic.

C. Item[1]	Content
1:65	How certain are you about what your future career picture looks like?
1:66	How certain are you of the opportunities for promotion and advancement which will exist in the next few years?
1:67	How certain are you about whether your job skills will be of use and value five years from now?
1:68	How certain are you about what your responsibilities will be six months from now?

[1]All items were reversed scored.

D. Response Scale:

	Somewhat Uncertain	A Little Uncertain	Somewhat Certain	Fairly Certain	Very Certain
Items 1:65-1:68	1	2	3	4	5

Underutilization of Abilities

[illegible] [illegible]

Item	2:62	2:63
2:63	.67	
2:64	.61	.67

B. Introduction: This next set of items deals with the use of your skills and abilities. Indicate how often you use each type.

C.

Item[1]	Content
2:62	How often does your job let you use the skills and knowledge you learned in school?
2:63	How often are you given a chance to do the things you do best?
2:64	How often can you use skills from your previous experience and training?

[1]All items were reverse scored.

D. Response Scale:

Items 2:62-2:64	Hardly, Rarely	Occa-sionally	Some-times	Fairly Often	Very Ofte
	1	2	3	4	5

Inequity of Pay

A. Intercorrelation Matrix

Item	4:38	4:39
4:39	.67	
4:40	.55	.50

B. Index[1]	Content
4:38	Compared to other people where you work who do a job similar to yours, how fair is your pay?
4:39	Compared to other people where you work who do a job different from yours, how fair is your pay?
4:40	Compared to other people who do not work where you work but who have similar skills to yours how fair is your pay?

[1]All items were reverse scored.

C. Response Scale:

I GET...

Items 4:38-4:40	Very Much Less Than I Ought To Get	Somewhat Less Than I Ought To Get	A Little Less Than I Ought To Get	About The Same As I Ought To Get	More Than I Ought To Get
	1	2	3	4	5

Equity: Income as % of Deserved Income

Item Content and Format:

Considering your education, knowledge, ability, experience, your overtime work, and how hard your work is, how much do you think you should have been paid in 1972?

$ ____________ in 1972
(Fill In Amount)

Note. The response to the Income measure (presented in the Demographic Characteristics section of this Appendix) was divided by the response to this item to produce the Equity: Income as % of Deserved Income score.

Participation

A. Intercorrelation Matrix

Item	2:50	2:51
2:51	.66	
2:52	.58	.68

B. Introduction: The following items deal with different aspects of work. Indicate how much of each aspect you have on your job.

C. Item	Content
2:50	How much do you take part with others in making decisions that affect you?
2:51	How much do you participate with others in helping set the way things are done on your job?
2:52	How much do you decide with others what part of a task you will do?

D. Response Scale:

	Very Little	A Little	Some	A Lot	A Great Deal
Items 2:50-2:52	1	2	3	4	5

Social Support from Supervisor
Social Support from Others at Work
Social Support from Wife, Friends, and Relatives

A. Intercorrelation Matrix

Item	3:11	3:14	3:17	3:20	3:12	3:15	3:18	3:21	3:13	3:16	3:19
3:14	.50										
3:17	.61	.54									
3:20	.53	.48	.60								
3:12	.39	.02	.18	.20							
3:15	.05	.22	.13	.05	.22						
3:18	.28	.11	.38	.27	.53	.32					
3:21	.29	.04	.33	.51	.49	.30	.54				
3:13	.11	-.02	.01	.02	.29	.15	.13	.25			
3:16	-.02	.04	.06	.02	.11	.31	.14	.20	.42		
3:19	.07	.03	.13	.10	.15	.11	.22	.23	.54	.44	
3:22	.02	-.01	.07	.12	.14	.20	.13	.32	.49	.49	.67

B. Item / Content

Item	Content
	How much does each of these people go out of their way to do things to make your work life easier for you?
3:11	A. Your immediate supervisor (boss)...
3:12	B. Other people at work...
3:13	C. Your wife, friends and relatives...
	How easy is it to talk with each of the following people?
3:14	A. Your immediate supervisor...
3:15	B. Other people at work...
3:16	C. Your wife, friends and relatives...

(continued)

Item	Content
	How much can each of these people be relied on when things get tough at work?
3:17	A. Your immediate supervisor...
3:18	B. Other people at work...
3:19	C. Your wife, friends and relatives...
	How much is each of the following people willing to listen to your personal problems?
3:20	A. Your immediate supervisor...
3:21	B. Other people at work...
3:22	C. Your wife, friends and relatives...

[1] The items labeled A (3:11, 3:14, 3:17, 3:20) constitute the Social Support from Supervisor Index. Similarly, the items labeled B and C constitute the Social Support from Others at Work Index and the Social Support from Wife, Friends and Relatives Index, respectively.

C. Response Scale:

Items 3:11-3:22	Very Much	Somewhat	A Little	Not At All	Don't Have Any Such Person
	4	3	2	1	0

Note: The '0' category response was assigned a missing data value.

MEASURES OF PERSONALITY

Sales Type A Personality

A. Intercorrelation Matrix

Item	2:53	2:54	2:55	2:56	2:57	2:58	2:59	2:60
2:54	.18							
2:55	.15	.09						
2:56	.13	.29	.26					
2:57	.24	.28	.17	.22				
2:58	.17	.25	.17	.54	.20			
2:59	.15	.26	.15	.40	.26	.48		
2:60	.32	.15	.26	.34	.25	.34	.24	
2:61	.23	.11	.21	.22	.28	.21	.18	.35

B. Introduction: Here are 9 self-description questions. Any answer which describes the way you feel or act is the right one to give. Remember that you may use any of the seven response categories.

Answer quickly rather than making a long decision on each question. Of course, if you want to think out some answer, feel free to do so. However, it's your first impressions which are the most important. Remember you will not be identified with your answers.

C. Item[1]	Content
2:53	I hate giving up before I'm absolutely sure that I'm licked.
2:54	Sometimes I feel that I shouldn't be working so hard, but something drives me on.
2:55	I thrive on challenging situations. The more challenges I have, the better.
2:56[2]	In comparison to most people I know, I'm very involved in my work.
2:57	It seems as if I need thirty hours a day to finish all the things I'm faced with.

(continued)

Type A Personality, continued

Item	Content
2:58[2]	In general, I approach my work more seriously than most people I know.
2:59[2]	I guess there are some people who can be nonchalant about their work, but I'm not one of them.
2:60	My achievements are considered to be significantly higher than those of most people I know.
2:61	I've often been asked to be an officer of some group or groups.

[1]All items were reverse scored.

[2]These items were also used to build an index of Involved Striving (a component of Type A personality).

D. Response Scale:

Items 2:53-2:61	1 Very true of me	2	3	4 Neither very true nor very untrue of me	5	6	7 Not at all true of me

Flexibility

A. Intercorrelation Matrix

Item	4:11	4:12	4:13	4:14	4:15	4:16
4:12	.19					
4:13	.27	.31				
4:14	.22	.18	.31			
4:15	.24	.23	.18	.29		
4:16	.29	.35	.30	.20	.30	
4:17	.36	.14	.27	.21	.29	.37

B. Introduction: In this section, we have listed a few more things that describe the way some people feel about life. Please read each sentence in the list below, and see how true it is of the way you feel about things.

C.

Item[1]	Content
4:11	Our thinking would be a lot better off if we would just forget words like "probably," "approximately," and "perhaps."
4:12	I like to have a place for everything, and everything in its place.
4:13	I don't like to work on a problem unless there is the possibility of coming out with a clear cut-answer.
4:14	Once I have my mind made up I seldom change it.
4:15	I think I am stricter about right and wrong than most people.
4:16	The trouble with many people is that they don't take things seriously enough.
4:17	People who seem unsure and uncertain about things make me me feel uncomfortable.

[1]All items were reverse scored.

D. Response Scale:

	Very True	Fairly True	Not Very True	Not True At All
Items 4:11-4:17	4	3	2	1

Assert Good Self
Deny Bad Self

A. Intercorrelation Matrix

Item	3:53	3:55	3:57	3:58	3:59	3:62	3:64	3:54	3:56	3:60	3:61	3:63	3:65
3:55	.17												
3:57	.08	.01											
3:58	.21	.13	.29										
3:59	.13	.20	.13	.15									
3:62	.07	.10	.08	.15	.16								
3:64	.22	.11	.24	.36	.13	.19							
3:54	-.24	-.09	-.19	-.37	-.17	-.19	-.27						
3:56	-.09	-.06	-.07	-.23	-.04	.03	-.14	.18					
3:60	-.10	-.04	-.18	-.19	-.13	-.14	-.18	.21	.22				
3:61	-.17	-.12	-.23	-.24	-.06	-.13	-.24	.22	.26	.35			
3:63	-.16	-.07	-.20	-.20	-.05	-.11	-.15	.12	.10	.27	.32		
3:65	-.15	-.08	-.23	-.19	-.22	-.23	-.29	.22	.03	.22	.24	.17	
3:66	-.01	-.09	-.07	-.06	-.02	-.07	-.02	-.01	.05	.22	.24	.15	.12

B. Introduction: Please read each item. If you agree with it or if it is true of you, place a mark in the box under the word TRUE. If you disagree with an item or it is untrue of you, place a mark in the box under the word FALSE. Work rapidly. Do not skip any items. Please recheck to make sure you have answered all the questions.

C.

Index	Item	Content
Assert Good[1]	3:53	I never hesitate to go out of my way to help someone in trouble.
	3:55	Before voting I thoroughly investigate the qualifications of all the candidates.
	3:57	I have never deliberately said something that hurt someone's feelings.
	3:58	I am always courteous, even to people who are disagreeable.
	3:59	I am always careful about my manner of dress.
	3:62	My table manners at home are as good as when I eat out in a restaurant.
	3:64	No matter who I am talking to, I am always a good listener.

(continued)

Assert Good, Deny Bad, continued

Index	Item	Content
Deny Bad	3:54	I sometimes try to get even, rather than forgive and forget.
	3:56	At times I have really insisted on having things my own way.
	3:60	There have been occasions when I felt like smashing things.
	3:61	I sometimes feel resentful when I do not get my way.
	3:63	There have been times when I was quite jealous of the good fortune of others.
	3:65	I am sometimes irritated by people who ask favors of me.
	3:66	On occasion I have had doubts about my ability to succeed in life.

[1]All items in the Assert Good index were reverse scored.

D. Response Scale:

Items 3:53-3:66	True	False
	☐	☐
	[1]	[2]

Quantitative Work Load-P

A. Intercorrelation Matrix

Item	1:58	1:59	1:60	1:61	1:62	1:63
1:59	-.18					
1:60	.25	.08				
1:61	.03	.31	.12			
1:62	.46	-.09	.15	.13		
1:63	.52	-.05	.22	.05	.34	
1:64	.31	.15	.33	.22	.13	.19

B. Introduction: Again, if you were designing a job for yourself, how much of each of the following would you like to have in such a job?

C. Item	Content
1:58	How much work load would you like to have?
1:59[1]	How much time would you like to have to do all your work?
1:60	How much slowdown in the work load would you prefer?
1:61	How much time to think and contemplate would you like?
1:62	What quantity of work would you prefer others to expect of you?
1:63	How many projects, assignments, or tasks would you like to have?
1:64	How many lulls between heavy work load periods would you like to have?

[1]The underlined items were reverse scored.

D. Response Scales:

Items 1:58-1:62

Very Little	A Little	Some	A Lot	A Great Deal
1	2	3	4	5

Items 1:63-1:64

Hardly Any	A Few	Some	A Lot	A Great Number
1	2	3	4	5

Responsibility for Persons-P

A. Intercorrelation Matrix

Item	1:54	1:55	1:56
1:55	.67		
1:56	.59	.60	
1:57	.65	.61	.59

B. Introduction: If you could have your own way about designing a job for yourself, how would you like each of the following to be?

C. Item	Content
1:54	How much responsibility would you like to have for the the futures of others?
1:55	How much responsibility would you like for the job security of others?
1:56	How much would you like for the morale of others?
1:57	How much would you like for the welfare and lives of others?

D. Response Scale:

Items 1:54-1:57

Very Little	A Little	Some	A Lot	A Great Deal
1	2	3	4	5

Job Complexity-P

A. Intercorrelation Matrix

Item	2:13	2:15	2:39	2:41	2:43
2:15	.43				
2:39	-.14	.00			
2:41	.26	.33	.30		
2:43	.36	.31	.25	.47	
2:45	.27	.36	.20	.48	.46

B. Introduction: See Job Complexity-E Index, part B.

C. Item Content: See Job Complexity-E Index, part C.

D. Response Scales*

I WOULD PREFER A JOB

Exactly Like Van's	A Lot Like Van's	Somewhat Like Van's	Halfway Between Van's/Ed's	Somewhat Like Ed's	A Like Ed's	Exactly Like Ed's
1	2	3	4	5	6	7

* Proper names were changed to fit each item.

E. Item Format: See Job Complexity-E Index, part E

Role Ambiguity-P

A. Intercorrelation Matrix

Item	1:50	1:51	1:52
1:51	.61		
1:52	.47	.67	
1:53	.48	.72	.63

B. Introduction: If you could have your own way about designing a job for yourself, how would you like each of the following to be?

C. Item[1]	Content
1:50	How much of the time would you like your work objectives to be well defined?
1:51	How often would you like to be clear on what others expect of you?
1:52	How often would you like to be able to predict what others will expect of you on the job?
1:53	How often would you like to be clear on what your job responsibilities are?

[1]All items were reverse scored.

D. Response Scale:

Items 1:50-1:53

Very Often	Fairly Often	Sometimes	Occa-sionally	Rarely
1	2	3	4	5

Quantitative Work Load-Fit

A. Intercorrelation Matrix

Variable	E P	2:27- 1:58	2:29- 1:59	2:25- 1:60	2:26- 1:61	2:28- 1:62	2:30- 1:63
E P							
2:29-1:59		.18					
2:25-1:60		.31	.18				
2:26-1:61		.29	.24	.23			
2:28-1:62		.46	.15	.18	.15		
2:30-1:63		.49	.24	.21	.12	.27	
2:31-1:64		.39	.21	.37	.27	.15	.30

B. Variable description

Each variable is the difference between the scores on the P and E items (E-P). See the documentation on the Work Load-P Index for information concerning the introduction, content, and response scales of items 1:58 to 1:64. See the documentation on the Work Load-E Index for similar information about items 2:25 to 2:31.

Responsibility for Persons-Poor Fit

A. Intercorrelation Matrix

Variable	E / P	|2:35-1:54|	|2:36-1:55|	|2:37-1:56|
E P				
|2:36-1:55|		.43		
|2:37-1:56|		.43	.47	
|2:38-1:57|		.39	.31	.46

B. Variable description

Each variable is the absolute value of the difference between the scores on the P and E items. See the documentation on Responsibility for Persons-P Index for the information concerning the introduction, content, and response scales of items 1:54 to 1:57. See the documentation on the Responsibility for Persons-E Index for similar information about items 2:35 to 2.38.

Job Complexity-Poor Fit

A. Intercorrelation Matrix

Variable (E P)	|2:14-2:13|	|2:16-2:15|	|2:40-2:39|	|2:42-2:41|	|2:44-2:43|
|2:16-2:15|	.39				
|2:49-2:39|	.15	.33			
|2:42-2:41|	.39	.40	.33		
|2:44-2:43|	.22	.24	.25	.31	
|2:46-2:45|	.28	.26	.22	.29	.42

B. Variable description

Each variable is the absolute value of the difference between the scores on the P and E items. See the documentation on the Job Complexity-P Index for information concerning the introduction, content, and response scales of items 2:13, 2:15, 2:39, 2:41, and 2:43. See the documentation on the Job Complexity-E Index for similar information about 2:14, 2:16, 2:40, 2:42, and 2:44.

Role Ambiguity-Poor Fit

A. Intercorrelation Matrix

Variable E / P	|2:19-1:50|	|2:20-1:51|	|2:18-1:52|
E P			
|2:20-1:51|	.28		
|2:18-1:52|	.23	.55	
|2:17-1:53|	.32	.56	.52

B. Variable description

Each variable is the absolute value of the difference between the scores on the P and E items. See the documentation on the Role Ambiguity-P Index for information concerning the introduction, content, and response scales of items 1:50 to 1:53. See the documentation on the Role Ambiguity-E Index for similar information about items 2:17 to 2:20.

MEASURES OF PSYCHOLOGICAL STRAIN

Job Dissatisfaction
Work Load Dissatisfaction
Boredom

A. Intercorrelation Matrix

Item	3:42	3:43	3:44	3:45	3:46	3:48	3:50	3:52	3:47	3:49
3:43	.32									
3:44	.24	.54								
3:45	.34	.60	.51							
3:46	.41	.63	.62	.63						
3:48	.18	.31	.27	.31	.32					
3:50	.16	.41	.35	.41	.40	.56				
3:52	.18	.39	.31	.31	.38	.60	.66			
3:47	.26	.50	.55	.46	.52	.24	.30	.22		
3:49	.13	.41	.45	.37	.42	.22	.48	.31	.57	
3:51	.20	.44	.49	.42	.50	.21	.44	.31	.68	.78

B. Introduction:

Item 3:42 — This question deals with the type of company you work for.

Items 3:43-3:46 — Now we would like you to think about the type of work you do in your job in this company.

Items 3:47-3:52 — How often do you feel the following things about your job?

C. Index	Item	Content
_1	3:42	All in all is this company a good one to work for?
Job Dissatisfaction	3:43	Knowing what you know now, if you had to decide all over again whether to take the type of job you now have, what would you decide?
	3:44[3]	If you were free right now to go into any type of job you wanted, what would your choice be?
	3:45	If a friend of yours told you he was interested in working in a job like yours, what would you tell him?
	3:46	All in all, how satisfied would you say you are with your job?

(continued)

Dissatisfaction, continued

Index	Item	Content
Work Load Dissatisfaction	3:48	I dislike the amount of work I'm expected to do.
	3:50	I am dissatisfied with the pace of my work.
	3:52	I am unhappy about my current work load.
Boredom	3:47[4]	My work is interesting to do.
	3:49	I feel bored with the work I have to do.
	3:51	The work on my job feels dull.

[1]Because it alone refers specifically to the company, this item was excluded from the job satisfaction indices.

[2]Before this index was computed, its four items were standardized (Z scores) to equalize the widely differing means and variances due to the different lengths of the response scales used in the items.

[3]Subjects answering this item with response 3 ("Not Want to Work") were assigned a missing data code before computation of inter-item correlations and before index construction.

[4]This item was reverse scored.

D. Response Scales:

	1	2	3	4	5
Item 3:42	Extremely Good	Very Good	Average	Somewhat Poor	Very Bad

(continued)

Dissatisfaction, continued

Item 3:43	1	2	3
	Decide Without Hesitation To Take The Same Type of Job	Have Some Second Thoughts	Decide Definitely Not to Take This Type of Job
Item 3:44	1	2	3
	Take The Same Type of Job As Now Have	Take A Different Type of Job	Not Want To Work
Item 3:45	1	2	3
	Strongly Recommend It	Have Doubts About Recommending It	Advise Him Against It

Item 3:46	1	2	3	4
	Very Satisfied	Somewhat Satisfied	Not Too Satisfied	Not At All Satisfied

Items 3:47-3:52	Very <u>Often</u>	Fairly <u>Often</u>	Some- <u>times</u>	Occa- <u>sionally</u>	Rarely, <u>Never</u>
	5	4	3	2	1

Somatic Complaints

A. Intercorrelation Matrix

Index	5:11	5:12	5:13	5:14	5:15	5:16	5:17	5:18	5:19
5:12	.09								
5:13	.22	.47							
5:14	.34	.20	.23						
5:15	.11	.33	.37	.23					
5:16	.18	.22	.23	.25	.17				
5:17	.23	.34	.70	.24	.36	.24			
5:18	.15	.26	.26	.19	.41	.26	.28		
5:19	.20	.27	.20	.17	.16	.35	.18	.33	
5:20	.22	.10	.21	.15	.13	.20	.22	.22	.24

B. Introduction: Have you experienced any of the following during the past month on the job?

C.

Item	Content
5:11	Your hands trembled enough to bother you.
5:12	You were bothered by shortness of breath when you were not working hard or exercising.
5:13	You were bothered by your heart beating hard.
5:14	Your hands sweated so that you felt damp and clammy.
5:15	You had spells of dizziness.
5:16	You were bothered by having an upset stomach or stomach ache.
5:17	You were bothered by your heart beating faster than usual.
5:18	You were in ill health which affected your work.
5:19	You had a loss of appetite.
5:20	You had trouble sleeping at night.

D. Response Scale:

Items 5:11-5:18 — Have you experienced any of the following during the past month on the job?

Items 5:19-5:20 — In addition, did you experience either one of the following during the past month?

Never	Once Or Twice	Three Or More Times
1	2	3

Depression
Anxiety
Irritation

A. Intercorrelation Matrix

Item	3:24	3:28	3:33	3:34	3:38	3:40	3:23	3:25	3:27	3:37	3:35	3:39	3:41	3:26	3:29	3:30	3:31	3:32
3:28	.60																	
3:33	.33	.42																
3:34	.49	.62	.37															
3:38	.49	.52	.32	.55														
3:40	.29	.38	.67	.33	.31													
3:23	.27	.27	.20	.25	.19	.19												
3:25	.30	.30	.22	.29	.28	.19	.59											
3:27	.24	.23	.52	.27	.25	.40	.36	.36										
3:37	.25	.29	.17	.33	.44	.23	.40	.43	.26									
3:35	.32	.31	.13	.30	.34	.16	.16	.18	.22	.27								
3:39	.33	.40	.18	.35	.33	.23	.21	.30	.26	.32	.55							
3:41	.42	.43	.27	.38	.36	.29	.23	.27	.31	.30	.53	.62						
3:26	.04	.09	.31	.09	.06	.30	.04	.11	.28	.08	.01	-.01	.08					
3:29	.30	.30	.10	.34	.36	.10	.20	.31	.24	.29	.21	.30	.23	.16				
3:30	.37	.40	.27	.35	.36	.26	.39	.38	.38	.41	.32	.46	.47	.04	.25			
3:31	.34	.47	.20	.42	.37	.20	.16	.22	.22	.33	.34	.47	.43	.07	.37	.48		
3:32	.43	.31	.22	.33	.36	.15	.11	.09	.09	.16	.09	.19	.23	.11	.23	.19	.26	
3:36	.25	.38	.23	.41	.37	.19	.23	.26	.30	.38	.29	.37	.33	.18	.36	.31	.34	.21

B. Introduction: Here are some items about how people may feel. When you think about yourself and your job nowadays, how much of the time do you feel this way?

C. Index

Index	Item	Content
Depression	3:24	I feel sad.
	3:28	I feel unhappy.
	3:33[1]	I feel good.
	3:34	I feel depressed.
	3:38	I feel blue.
	3:40	I feel cheerful.
Anxiety	3:23	I feel nervous.
	3:25	I feel jittery.
	3:27	I feel calm.
	3:37	I feel fidgety.
Irritation	3:35	I get angry.
	3:39	I get aggravated.
	3:41	I get irritated or annoyed.
_[2]	3:26	I feel useful and needed at work.
	3:29	I feel confused.
	3:30	I feel tense.
	3:31	I feel frustrated.
	3:32	I feel lonesome.
	3:36	I feel tired for no reason.

[1]These items were reverse scored.

[2]These items were not included in any index because their correlations were not consistently higher with one index that with the other two indices.

D. Response Scale:

	Never Or A Little Of The Time	Some Of The Time	A Good Part Of The Time	Most Of The Time
Items 3:23-3:41	1	2	3	4

MEASURES OF HEALTH RELATED BEHAVIOR

Smoker-non-Smoker

Ex-Smoker

Item Content and Format:

Do you smoke? *Circle One Number.*

1. I smoke.

2. I used to smoke but have stopped.

3. I have never smoked as a habit.

Note. For the Smoker-non-Smoker variable respondents who circled the first response were classified as smokers (coded '2'); respondents who circled the other responses were classified as non-smokers (coded '1'). For the Ex-Smoker variable, respondents circling the second response were classified as ex-smokers (coded '2'), while those circling the first response were coded as still smoking ('1'). Respondents who reported never having smoked were given missing data values for the Ex-Smoker variable.

Number of Cigarettes Smoked (if>0)

Item Content and Format:

If you smoke, how much do you smoke per day on the average? *Fill In The Blanks.*

	Enter Number
A) How many cigarettes per day?	________
B) How many cigars per day?	________
C) How many pipes of tobacco per day?	________

Note. Only response A was used as the score on this measure. If the respondent indicated that he smoked zero cigarettes per day he was considered a non-smoker and assigned a missing data code for this variable.

Cups of Coffee

Caffeinated Drinks

Item Content and Format:

How much of each of the following beverages do you drink per day? *Fill In The Blanks.*

		Enter Number
A)	How many cups of caffeine-free coffee such as Sanka or Decaf?	_____ cups
B)	How many cups of regular coffee (instant, freeze-dried, or ground)?	_____ cups
C)	How many cups of tea?	_____ cups
D)	How many cups of cola (coke, pepsi)	_____ cups

Note. Response B was used as the score for Cups of Coffee. The sum of responses B, C, and D was used as the score for Caffeinated Drinks.

Obesity Index

Item Content and Format:

What is your height (stocking feet)?

_____ feet, and _____ inches

What is your weight (office clothes or work clothes, no heavy coat, and without shoes)?

_____ pounds

Note. The Obesity Index score equals weight in pounds divided by height squared in inches time 100 ((weight/height^2) x 100). See Florey (1970) for an evaluation of this index.

Recency of Dispensary Visit

Staffed Dispensary Visit

Item Content and Format:

When was the last time you made use of the medical or health services where you work **other than for a routine physical exam** (for example, to get an aspirin for a headache, to take care of a sore muscle, injury or other discomfort)? *Check One Box. (Ignore numbers in brackets [ ]).*

☐ Within the past week [1]

☐ 2 weeks ago [2]

☐ 3 weeks ago [3]

☐ 1 month ago [4]

☐ 2 months ago [5]

☐ 3 months ago [6]

☐ 4 months ago [7]

☐ 5 months ago [8]

☐ 6 months ago or longer [9]

☐ There is no medical dispensary where I work [10]

☐ There is a medical dispensary but I have never used it [11]

Note. This item was reverse scored by subtracting the value in brackets from 12. Thus a higher value represents a more recent visit to the dispensary. Subjects who indicated that there was no dispensary at the workplace (response '10') were given a missing data code. The procedures for coding the Staffed Dispensary Visit measure were like those for the Recency of Dispensary Visit variable, except that missing data codes were assigned to respondents whose medical services at work were known to be non-staffed (e.g., only a stock of medical supplies).

MEASURES OF ILLNESSES

Cardiovascular Disease

Peptic Ulcer

Gastrointestinal Problems

Respiratory Infection

Item Content and Format:

Are you under regular treatment for any condition at the present time? *Circle One Number.*

1. No.

2. Yes. I am receiving treatment for ______________________
(Condition Being Treated)
____

What was your reason for going to your private doctor, medical service, or clinic away from the work place the last time you went? Be as specific as possible. *(Fill In: Please Print)*

Reason: ______________________

____

____

Note. Each man's response to these two medical questions was coded according to the rules in Appendix F, indicating which conditions, if any, appeared as a reason for regular medical treatment or for his last visit to a doctor. For each of the illness/injury codes 01 through 32 in Appendix F a variable was constructed indicating whether an individual did or did not report being treated for that condition. These variables are dichotomous, indicating treatment or no treatment, and do not reflect the number of times (if more than one) the condition was listed.

Only the four illnesses listed at the top of this page had both frequencies high enough to be suitable for analysis and likely susceptibility to stress. Of these four the Cardiovascular Disease variable differs from the listing in Appendix F in that it is a composite of two codes (01 for cardiovascular disease and 02 for hypertension). A subject received the same score for reporting both categories (01 and 02) as he would have for reporting either one alone.

APPENDIX F

Medical Coding:

Illness and Injury Categories

These codes were used in coding the responses given in the questions requesting reasons for visiting the medical dispensary at work, reasons for seeing a private doctor, and conditions for which the respondent was under regular treatment. The following rules were followed in using these codes:

1) Only 1 code should be used per illness encountered. If you need to make a decision on which code to use for a particular illness, a more specific category takes precedence over a more general one. Codes 01-16 are considered more specific codes. Codes 20-32, and 40 are considered more general codes. 'Other' code is 50. As examples, if "surgery to remove a tumor" is given, it should be coded 07 Growths, cancer, etc., rather than 26 General Surgery. If "pulled a muscle shoveling snow" is given, it should be coded 06 Neuromuscular, rather than 20 Injury.

2) Do not double-code. If two different illnesses which fall into the same illness category are given for any particular question, code this code number only once. For example, if "heart attack and stroke" are given in question 20, code 01,00,00.

Specific codes:

Code	Disease
01	Cardiovascular disease (heart attack, heart failure, angina pectoris, stroke, arteriosclerosis, any mention of heart, circulatory problems)
02	Hypertension, high blood pressure.
03	Diabetes (sugar diabetes, diabetes mellitus)
04	Dizziness, lack of energy, tiredness, faint, fatigue, etc.
05	Nervous and mental disorders, psychological problems, alcoholism, drugs, tension
06	Neuromuscular (back pain, back sprain, arthritis, bursitis, pulled muscles, neuritis, tendonitis, rheumatism)
07	Growths, benign or malignant, cancer, carcinoma, tumor (any location)
08	Allergy (respiratory, gastrointestinal or skin symptoms), asthma
09	Respiratory infection (colds, coughs, flu, sinus, sore throat, tonsillitis)
10	Peptic ulcer (duodenal ulcer, gastric ulcer)

11	Gastrointestinal disease (diarrhea, constipation, colitis, gall bladder, nervous stomach, stomach trouble, etc.)
12	Hyperventilation
13	Cleaning of ears
14	Headache
15	Hemorrhoids
16	Gout

General codes:

Code	Disease
20	Injury, chemical exposure, occupational cause
21	Injury, non-occupational cause
22	Injury, cause not specified
23	Skin disease and infections (psoriasis, eczema, boils, hives, warts, sty, pimples, fungus, insect bites), occupational cause
24	Skin disease, etc., non-occupational cause
25	Skin disease, etc., cause not specified
26	General surgery (surgery and post-operative check-ups, therapy, vasectomy)
27	Chest pain, not otherwise specified
28	Thyroid (other than injury, surgery, or diagnosis)
29	GU (urinary-genital, bladder, prostate) (other than injury, surgery, or diagnosis)
30	Eye, ear, nose (infections, inflammations, problems) (other than injury, surgery, or diagnosis)
31	Hernia (other than injury, surgery, or diagnosis)
32	Extremities (infections, soreness, pain, swelling, tiredness) (other than injury, surgery, or diagnosis or mentions of 06.)

40 Routine medical procedures such as physical exams, eye exams, getting glasses, X-rays, immunizations, shots, dental work, blood test, advice, return to work papers

50 Other

98 Not applicable

99 No answer, missing data

APPENDIX G

Intercorrelations among the Questionnaire Measures for the Random Stratified Sample

(1) Correlations between the Psychological and Behavioral Strains and Their Predictors

(2) Correlations among the Psychological and Behavioral Strains

(3) Correlations among the Predictor Variables

Appendix G (Random Stratified Sample): (1) Correlations between

	JOB DISSAT	WK LD DISSAT	BOREDOM	SOMAT CMPLNTS	DEPRESSION	ANXIETY
AGE	-.1114 (315)	-.0275 (315)	-.2829 (315)	-.0880 (315)	-.0652 (315)	-.0769 (315)
SCHOOLING	-.1968 (315)	-.0766 (315)	-.3145 (315)	-.2115 (315)	-.0814 (315)	-.0341 (315)
DUNCAN SES	-.3424 (317)	-.1309 (316)	-.5029 (316)	-.1371 (316)	-.1194 (317)	-.0070 (317)
INCOME	-.2547 (295)	-.0500 (295)	-.3203 (295)	-.1564 (295)	-.1438 (296)	-.0515 (296)
LENGTH SERV	-.0855 (314)	.0214 (313)	-.2158 (313)	-.0653 (313)	.0409 (315)	-.0037 (315)
HRS WKD/WK	-.1369 (312)	.1510 (311)	-.1923 (311)	-.0618 (311)	-.0501 (312)	-.0289 (312)
HRS OVRTIM/WK	.0905 (308)	.1982 (307)	.0069 (307)	.0601 (306)	.1347 (307)	.0952 (307)
UNWNTD OVRTIM	.1989 (208)	.3920 (207)	.0440 (207)	.1352 (206)	.0910 (208)	.2103 (208)
QNT WK LD-E	.0075 (316)	.3264 (315)	-.1862 (315)	.0031 (315)	.0510 (316)	.0457 (316)
COMB QNT WKLD	-.0425 (316)	.3520 (315)	-.2098 (315)	.0083 (315)	.0480 (316)	.0715 (316)
VARINCE WK LD	-.0867 (316)	.1044 (315)	-.2579 (315)	.1064 (315)	.0095 (316)	.0645 (316)
RESP PERSON-E	-.2615 (317)	-.0516 (316)	-.3003 (316)	-.1272 (316)	-.1277 (317)	-.0433 (317)
COMPLEXITY-E	-.3115 (310)	-.0434 (309)	-.5129 (309)	-.1097 (309)	-.0890 (310)	.0026 (310)
ROLE CONFLICT	.1371 (315)	.2646 (314)	.0360 (314)	.2509 (314)	.2174 (316)	.2595 (316)
ROLE AMBIG-E	.1698 (316)	.1591 (315)	.1021 (315)	.1105 (315)	.1880 (316)	.1659 (316)
FUTURE AMBIG	.3865 (314)	.1384 (313)	.3603 (313)	.0802 (313)	.2351 (315)	.1150 (315)
UNDERUTILIZAT	.4221 (311)	.2151 (310)	.5909 (310)	.1802 (310)	.1734 (311)	.0911 (311)

the Psychological and Behavioral Strains and Their Predictors

IRRITATION	CIG SMOKED >0	COFFEE	CAFFEIN DRNKS	OBESITY	DISP VISIT	STFFD DIS VIS
-.0191 (315)	.0802 (126)	.1003 (313)	.0048 (313)	-.0273 (311)	-.0572 (231)	-.1307 (100)
-.0492 (315)	-.1645 (126)	-.0351 (313)	-.0795 (313)	-.0720 (311)	-.1093 (231)	-.1703 (100)
-.0777 (317)	-.0989 (126)	.0167 (314)	-.0675 (314)	-.0534 (312)	-.1301 (232)	-.1486 (100)
-.0355 (296)	-.0513 (119)	-.0244 (295)	-.0401 (295)	.0323 (293)	-.0204 (216)	-.1035 (97)
.0226 (315)	-.0014 (126)	-.0275 (312)	-.0722 (312)	.0946 (310)	-.0374 (231)	-.1943 (100)
.0101 (312)	.1308 (124)	.0627 (310)	.0797 (310)	.0349 (307)	-.0271 (227)	.0589 (98)
.0257 (307)	.0833 (126)	.0682 (304)	.1020 (304)	.0482 (302)	.0079 (222)	.0674 (94)
.1976 (208)	.1980 (79)	-.0651 (206)	-.0641 (206)	.0979 (204)	-.0525 (154)	-.0530 (65)
.2061 (316)	-.0117 (126)	.0314 (313)	.0094 (313)	.0405 (311)	-.0766 (232)	-.0329 (100)
.2084 (316)	.0714 (126)	.0643 (313)	.0611 (313)	.0343 (311)	-.0838 (232)	.0044 (100)
.0812 (316)	-.0824 (125)	.1024 (313)	.0757 (313)	.0243 (311)	-.1137 (231)	-.0378 (99)
-.0210 (317)	-.1134 (126)	-.0466 (314)	-.0391 (314)	-.0455 (312)	-.1010 (232)	-.1004 (100)
.0026 (310)	-.0824 (120)	.0565 (307)	.0126 (307)	.0165 (305)	-.1407 (226)	-.0448 (97)
.3278 (316)	.0333 (125)	.1557 (313)	.1339 (313)	.0479 (311)	.0331 (231)	.0446 (99)
.0939 (316)	.0205 (126)	.0522 (313)	.0208 (313)	.0728 (311)	-.0715 (232)	.0609 (100)
.0570 (315)	.1165 (124)	-.0795 (312)	-.1019 (312)	.0825 (310)	.0121 (231)	-.0720 (99)
.0647 (311)	.1130 (125)	-.0532 (308)	.0120 (308)	.0376 (306)	.0526 (226)	.1377 (99)

Appendix G (Random Stratified Sample): (1) Correlations between

	JOB DISSAT	WK LD DISSAT	BOREDOM	SOMAT CMPLNTS	DEPRESSION	ANXIETY
INEQTY OF PAY	.0705 (315)	.1346 (315)	-.0926 (315)	.0835 (315)	.0539 (315)	.0542 (315)
EQUITY % INCME	-.1185 (285)	-.2560 (285)	-.1158 (285)	-.1808 (285)	-.1110 (286)	-.0538 (286)
PARTICIPATION	-.3568 (316)	-.1203 (315)	-.3116 (315)	-.1340 (315)	-.1731 (316)	-.0897 (316)
SUPPORT SUP	-.3431 (298)	-.2858 (297)	-.2191 (297)	-.1071 (296)	-.3004 (298)	-.1041 (298)
SUPPORT OTHRS	-.3540 (317)	-.2178 (316)	-.2862 (316)	-.1643 (316)	-.3570 (317)	-.2414 (317)
SUPPORT HOME	-.1511 (310)	-.0720 (309)	-.1169 (309)	-.0797 (309)	-.1974 (311)	-.0532 (311)
SALES TYPE A	-.1258 (317)	.0666 (316)	-.2687 (316)	-.0566 (316)	-.0569 (317)	.0296 (317)
FLEXIBILITY	-.1263 (315)	-.0315 (315)	-.1433 (315)	-.0108 (315)	-.0266 (315)	-.0103 (315)
ASSERT GOOD	-.1384 (315)	-.1375 (315)	-.1402 (315)	-.1057 (315)	-.2345 (315)	-.1967 (315)
DENY BAD	-.2687 (315)	-.2291 (315)	-.2412 (315)	-.2525 (315)	-.2579 (315)	-.3008 (315)
QNT WK LD-P	-.2631 (314)	-.3380 (313)	-.2771 (313)	-.0573 (313)	-.2866 (314)	-.1054 (314)
RESP PERSON-P	-.1485 (312)	-.1466 (311)	-.0720 (311)	-.0305 (311)	-.1554 (312)	-.1116 (312)
COMPLEXITY-P	-.3047 (310)	-.1747 (309)	-.3372 (309)	-.0247 (309)	-.1216 (310)	-.0492 (310)
ROLE AMBIG-P	.0435 (312)	.0870 (311)	.0289 (311)	.0526 (311)	.0746 (312)	.0211 (312)
QNT WK LD-PE	.1896 (300)	.5173 (299)	.0504 (299)	.0464 (299)	.2651 (301)	.1348 (301)
RESP PERSON-PE	.2272 (309)	.0735 (308)	.3237 (308)	.0661 (308)	.0493 (310)	.0510 (310)
COMPLEXITY-PE	.4718 (309)	.3581 (308)	.5106 (308)	.1608 (308)	.2167 (309)	.2138 (309)
ROLE AMBIG-PE	.1911 (307)	.1274 (306)	.1683 (306)	.0213 (306)	.1163 (307)	.0149 (307)

the Psychological and Behavioral Strains and Their Predictors (continued)

IRRITATION	CIG SMOKED	COFFEE >0	CAFFEIN DRNKS	OBESITY	DISP VISIT	STFFD DIS VIS
.0478 (315)	-.1017 (125)	.0952 (313)	.0370 (313)	.0748 (311)	.0218 (231)	.0452 (100)
-.0713 (286)	.1046 (114)	.0042 (285)	-.0077 (285)	-.0649 (283)	-.0624 (208)	-.1098 (91)
-.0454 (316)	-.1985 (125)	-.0144 (313)	.0074 (313)	-.0034 (311)	-.0792 (231)	-.0296 (99)
-.2111 (298)	-.0027 (122)	.0536 (295)	.0190 (295)	-.0167 (293)	-.1177 (216)	-.1298 (90)
-.2208 (317)	-.0363 (126)	-.0257 (314)	-.0147 (314)	-.0329 (312)	-.0806 (232)	-.0986 (100)
-.0759 (311)	-.0871 (124)	-.0222 (308)	.0248 (308)	-.0765 (306)	-.0845 (227)	-.1048 (98)
.0983 (317)	-.1426 (126)	.0450 (314)	.0114 (314)	.0883 (312)	-.0821 (232)	-.2066 (100)
-.0888 (315)	.0526 (125)	.0592 (313)	.0628 (313)	-.0657 (311)	.0217 (231)	.0194 (100)
-.2291 (315)	-.2013 (125)	-.0691 (313)	-.0846 (313)	-.0315 (311)	.0593 (231)	-.0028 (100)
-.3507 (315)	-.0477 (125)	-.0785 (313)	-.0789 (313)	-.0129 (311)	.0130 (231)	.1378 (100)
-.1488 (314)	-.0697 (125)	.1061 (311)	.0695 (311)	.1254 (309)	-.1608 (230)	-.2397 (99)
-.0900 (312)	-.0757 (124)	-.0147 (309)	.0102 (309)	.0297 (307)	-.1103 (228)	-.1837 (99)
-.0755 (310)	.0219 (120)	.0915 (307)	.0262 (307)	.0734 (305)	-.0434 (225)	-.0288 (97)
-.0619 (312)	-.1332 (124)	.0321 (309)	-.0244 (309)	.0170 (307)	-.0350 (228)	.0124 (99)
.2749 (301)	.0137 (121)	-.0525 (298)	-.0454 (298)	-.0565 (296)	.0674 (222)	.1641 (96)
.0017 (310)	.0348 (123)	.0319 (307)	-.0034 (307)	-.0098 (305)	.0188 (226)	-.1067 (98)
.1529 (309)	.1442 (119)	.0445 (306)	.0949 (306)	.0445 (304)	-.0193 (225)	-.0818 (97)
.0616 (307)	-.0293 (123)	-.0155 (304)	-.0564 (304)	.0199 (302)	-.0059 (227)	.0290 (98)

Appendix G (Random Stratified Sample): (2) Correlations

	JOB DISSAT	WK LD DISSAT	BOREDOM	SOMAT CMPLNTS	DEPRESSION	ANXIETY
JOB DISSAT	1.0000					
WK LD DISSAT	.4825 (316)	1.0000				
BOREDOM	.6262 (316)	.3945 (316)	1.0000			
SOMAT CMPLNTS	.1692 (315)	.1644 (315)	.1235 (315)	1.0000		
DEPRESSION	.3661 (316)	.3755 (315)	.2701 (315)	.3405 (315)	1.0000	
ANXIETY	.2041 (316)	.3166 (315)	.1182 (315)	.4212 (315)	.5080 (317)	1.0000
IRRITATION	.1350 (316)	.2929 (315)	.0947 (315)	.2467 (315)	.4730 (317)	.4035 (317)
CIG SMOKED >0	.0826 (126)	.2053 (126)	.1252 (126)	.0871 (125)	.0785 (126)	.0023 (126)
COFFEE	.0409 (313)	.0247 (313)	-.0427 (313)	.0613 (313)	.0145 (314)	.1037 (314)
CAFFEIN DRNKS	.0481 (313)	.0789 (313)	-.0155 (313)	.0828 (313)	.0201 (314)	.0876 (314)
OBESITY	-.0100 (311)	-.0332 (311)	-.0203 (311)	-.0219 (311)	.0446 (312)	.0457 (312)
DISP VISIT	.0212 (231)	.0741 (231)	.1392 (231)	.1733 (231)	.0208 (232)	-.0377 (232)
STFFD DIS VIS	-.0853 (100)	.1178 (100)	.0578 (100)	.0554 (100)	-.0285 (100)	-.2442 (100)

among the Psychological and Behavioral Strains

1.0000						
.0405	1.0000					
(126)						
.1627	.3799	1.0000				
(314)	(125)					
.1623	.3891	.8774	1.0000			
(314)	(125)	(314)				
.1074	.0235	.0299	.0306	1.0000		
(312)	(124)	(310)	(310)			
-.0191	.0768	-.0709	-.0391	-.1032	1.0000	
(232)	(95)	(230)	(230)	(228)		
-.2183	.0588	-.1606	-.0691	-.1242	1.0000	1.0000
(100)	(46)	(98)	(98)	(99)	(100)	
IRRITATION	CIG SMOKED >0	COFFEE	CAFFEIN DRNKS	OBESITY	DISP VISIT	STEED DIS VIS

Appendix G (Random Stratified Sample): (3) Correlations among the Predictor Variables

AGE	1.0000									
SCHOOLING	.1386 (316)	1.0000								
DUNCAN SES	.2887 (316)	.7244 (316)	1.0000							
INCOME	.3247 (295)	.5531 (295)	.5261 (296)	1.0000						
LENGTH SERV	.4399 (314)	.0057 (314)	.1913 (315)	.1590 (294)	1.0000					
HRS WKD/WK	.1780 (312)	.4345 (312)	.3112 (313)	.4407 (292)	.0946 (311)	1.0000				
HRS OVRTIM/WK	.0266 (307)	.1101 (307)	-.0472 (308)	.0618 (287)	-.1125 (306)	.5647 (304)	1.0000			
UNWNTD OVRTIM	.0515 (207)	.1524 (207)	.1049 (208)	.1531 (193)	.1022 (207)	.2501 (204)	.2676 (208)	1.0000		
QNT WK LD-E	.2569 (315)	.2064 (315)	.2148 (317)	.2532 (295)	.1647 (314)	.3600 (312)	.2639 (307)	.2457 (208)	1.0000	
COMB QNT WKLD	.2156 (315)	.1832 (315)	.2477 (317)	.2802 (295)	.1722 (314)	.3936 (312)	.2646 (307)	.2143 (208)	.8957 (317)	1.0000

	AGE	SCHOOLING	DUNCAN SES	INCOME	LENGTH SERV	HRS WKD/WEEK	HRS OVRTIM/WK	UNWNTD OVRTIM	QNT WK LD-E	COMB QNT WKLD
VARINCE WK LD	.1625 (315)	-.0196 (315)	.1590 (317)	.1018 (295)	.1401 (314)	.0525 (312)	-.0002 (307)	.1621 (207)	.2539 (316)	.3588 (316)
RESP PERSON-E	.1839 (316)	.1425 (316)	.1433 (318)	.3414 (296)	.1622 (315)	.2668 (313)	.1464 (308)	.0538 (208)	.2969 (317)	.3085 (317)
COMPLEXITY-E	.1694 (309)	.4597 (309)	.5423 (311)	.3572 (290)	.1265 (308)	.3468 (306)	.1542 (301)	.0310 (204)	.3885 (310)	.4348 (310)
ROLE CONFLICT	.0555 (314)	-.1144 (314)	-.0950 (316)	-.1399 (295)	.0270 (314)	-.0009 (311)	.0888 (306)	.2297 (207)	.2524 (315)	.2529 (315)
ROLE AMBIG-E	-.0328 (315)	.1359 (315)	.0363 (317)	-.1121 (295)	-.1360 (314)	.0315 (312)	.0442 (307)	.2404 (208)	-.0261 (317)	-.0921 (317)
FUTURE AMBIG	-.0583 (313)	-.2272 (313)	-.3717 (315)	-.2693 (294)	-.1231 (313)	-.2306 (310)	-.0234 (305)	.0706 (208)	-.1074 (314)	-.1836 (314)
UNDERUTILIZAT	-.2680 (310)	-.4595 (310)	-.6086 (312)	-.4176 (291)	-.2677 (309)	-.2878 (307)	.0028 (302)	.0042 (205)	-.2463 (311)	-.2819 (311)
INEQTY OF PAY	.0450 (315)	.1496 (315)	.2161 (316)	-.0303 (295)	.0698 (313)	.0355 (311)	.0515 (306)	.0660 (206)	.1446 (315)	.1581 (315)
EQUITY % OF INCME	.1306 (285)	.0894 (285)	.0845 (286)	.2401 (286)	-.0440 (284)	-.0193 (282)	-.1177 (278)	-.1134 (188)	-.0603 (285)	-.1190 (285)

Appendix G (Random Stratified Sample): (3) Correlations among the Predictor Variables (continued)

	AGE	SCHOOLING	DUNCAN SES	INCOME	LENGTH SERV	HRS WKD/WEEK	HRS OVRTIM/WK	UNWNTD OVRTIM	QNT WK LD-E	COMB QNT WKLD
PARTICIPATION	.1088 (315)	.2172 (315)	.3529 (317)	.2301 (295)	.1154 (314)	.0738 (312)	.0173 (307)	-.0006 (207)	.1648 (316)	.1801 (316)
SUPPORT SUP	.1065 (296)	.1218 (296)	.1801 (298)	.1299 (278)	.0402 (296)	-.0253 (293)	-.0699 (293)	-.0809 (202)	-.0989 (297)	-.0763 (297)
SUPPORT OTHRS	.1633 (316)	.2186 (316)	.2993 (318)	.2831 (296)	.0520 (315)	.1440 (313)	-.0146 (308)	-.0407 (208)	.0741 (317)	.1319 (317)
SUPPORT HOME	.1341 (309)	.1047 (309)	.0791 (311)	.1453 (291)	.0878 (309)	.0490 (306)	.0179 (301)	-.0715 (203)	.0862 (310)	.0646 (310)
SALES TYPE A	.2073 (316)	.1602 (316)	.2517 (318)	.2136 (296)	.1054 (315)	.3449 (313)	.2667 (308)	.0924 (208)	.3907 (317)	.3440 (317)
FLEXIBILITY	-.0241 (315)	.4716 (315)	.3603 (316)	.2234 (295)	-.1013 (313)	.2068 (311)	.1278 (306)	.1373 (207)	-.0018 (315)	.0536 (315)
ASSERT GOOD	.0930 (315)	-.1511 (315)	-.0531 (316)	-.0383 (295)	.0698 (313)	.0541 (311)	-.0049 (306)	-.0596 (207)	.0803 (315)	.0786 (315)
DENY BAD	.0633 (315)	.0400 (315)	.0645 (316)	.0104 (295)	.0513 (313)	.0771 (311)	-.0012 (306)	-.1039 (207)	.0282 (315)	.1015 (315)

	AGE	SCHOOLING	DUNCAN SES	INCOME	LENGTH SERV	HRS WKD/WEEK	HRS OVRTIM/WK	UNWNTD OVRTIM	QNT WK LD-E	COMB QNT WKLD
QNT WK LD-P	.0136 (313)	.0701 (313)	.1612 (315)	.0605 (293)	.0247 (312)	.0261 (310)	-.0578 (305)	-.1249 (206)	.1347 (314)	.1270 (314)
RESP PERSON-P	.0198 (311)	-.1226 (311)	-.0471 (313)	.0522 (291)	.0618 (310)	-.0074 (308)	-.0382 (303)	-.1508 (205)	.1123 (312)	.1541 (312)
COMPLEXITY-P	.0679 (309)	.3947 (309)	.4167 (311)	.3202 (289)	.0572 (308)	.2638 (307)	.1116 (301)	-.0595 (203)	.1481 (310)	.1846 (310)
ROLE AMBIG-P	.0855 (311)	-.1090 (311)	-.1076 (313)	-.0815 (291)	.0371 (310)	.0770 (308)	.0479 (303)	.0204 (205)	.0072 (312)	-.0484 (312)
QNT WK LD-PE	.1830 (299)	.1360 (299)	.0730 (301)	.1678 (282)	.1072 (299)	.2862 (296)	.2688 (292)	.2797 (198)	.7118 (301)	.6239 (301)
RESP PERSON-PE	-.1146 (309)	-.1914 (309)	-.2081 (310)	-.2452 (289)	-.1087 (309)	-.1440 (306)	-.0289 (301)	.0509 (204)	-.1219 (309)	-.1529 (309)
COMPLEXITY-PE	-.1777 (308)	-.2089 (308)	-.3067 (310)	-.2442 (289)	-.1426 (307)	-.1528 (306)	-.0337 (300)	.0640 (203)	-.0534 (309)	-.0549 (309)
ROLE AMBIG-PE	.0858 (306)	-.1324 (306)	-.1858 (308)	-.1301 (286)	-.0289 (305)	.0019 (303)	-.0015 (298)	.0694 (203)	.0274 (308)	-.0318 (308)

Appendix G (Random Stratified Sample): (3) Correlations among the Predictor Variables (continued)

RESP PERSON-E	.3069	1.0000								
	(317)									
COMPLEXITY-E	.3309	.3599	1.0000							
	(310)	(311)								
ROLE CONFLICT	.1670	.0516	.1045	1.0000						
	(315)	(316)	(310)							
ROLE AMBIG-E	.0323	-.1836	.0991	.1732	1.0000					
	(316)	(317)	(310)	(315)						
FUTURE AMBIG	-.2577	-.2617	-.3488	.1206	.1919	1.0000				
	(314)	(315)	(309)	(314)	(314)					
UNDERUTILIZAT	-.2906	-.2977	-.5350	.0920	.0436	.4353	1.0000			
	(311)	(312)	(305)	(310)	(311)	(309)				
INEQTY OF PAY	.1624	.0379	.1053	.1811	.0252	-.0542	-.0750	1.0000		
	(315)	(316)	(309)	(314)	(315)	(313)	(310)			
EQUITY % INCME	-.0975	-.0232	-.0437	-.2030	-.0709	-.0240	-.1514	-.3455	1.0000	
	(285)	(286)	(280)	(285)	(285)	(284)	(281)	(285)		
PARTICIPATION	.2244	.3851	.4034	.0336	-.1776	-.3920	-.3873	.0179	-.0164	1.0000
	(316)	(317)	(311)	(316)	(316)	(314)	(311)	(315)	(285)	
SUPPORT SUP	.0140	.1697	.1282	-.2824	-.2546	-.2569	-.2311	-.1057	.1375	.2539
	(297)	(298)	(292)	(297)	(297)	(298)	(292)	(296)	(269)	(297)
SUPPORT OTHRS	.1637	.3175	.3123	-.1236	-.2005	-.2440	-.3250	-.0411	.0167	.3289
	(317)	(318)	(311)	(316)	(317)	(315)	(312)	(316)	(286)	(317)
SUPPORT HOME	.0094	.2170	.0923	-.0641	-.0830	-.1387	-.1079	-.1315	.0203	.0867
	(310)	(311)	(304)	(310)	(310)	(309)	(305)	(309)	(281)	(310)

	VARINCE WKLD	RESP PERSON-E	COMPLEXITY-E	ROLE CONFLICT	ROLE AMBIG-E	FUTURE AMBIG	UNDERUTILIZAT	INEQUITY OF PAY	EQUITY * INCOM	PARTICIPATION
SALES TYPE A	.1551 (317)	.2327 (318)	.2740 (311)	.1370 (316)	-.0773 (317)	-.2310 (315)	-.3075 (312)	.2016 (316)	-.0367 (286)	.1849 (317)
FLEXIBILITY	-.0284 (315)	-.0100 (316)	.2335 (309)	-.1322 (314)	.1451 (315)	-.0858 (313)	-.2189 (310)	-.0250 (315)	.0082 (285)	.0876 (315)
ASSERT GOOD	.0047 (315)	.1076 (316)	-.0038 (309)	-.0389 (314)	-.1065 (315)	.0065 (313)	-.0719 (310)	-.0629 (315)	.1186 (285)	.0634 (315)
DENY BAD	.0219 (315)	.1330 (316)	.0691 (309)	-.0730 (314)	-.0902 (315)	-.1542 (313)	-.1915 (310)	-.0645 (315)	.1435 (285)	.0486 (315)
QNT WK LD-P	.1406 (314)	.2324 (315)	.2243 (309)	-.0230 (313)	-.1469 (314)	-.1693 (313)	-.2198 (309)	.0247 (313)	.0951 (284)	.2059 (314)
RESP PERSONS-P	.1800 (312)	.4188 (313)	.1017 (307)	-.0052 (311)	-.1460 (312)	-.0646 (311)	-.0414 (307)	-.0671 (311)	-.0841 (282)	.1781 (312)
COMPLEXITY-P	.1406 (310)	.2500 (311)	.6833 (310)	-.0361 (310)	.0696 (310)	-.3012 (309)	-.3890 (305)	-.0080 (309)	.0274 (279)	.2780 (311)
ROLE AMBIG-P	.0492 (312)	.0257 (313)	.0142 (307)	.0286 (311)	.1762 (312)	.0403 (311)	-.0013 (307)	.0083 (311)	-.0239 (282)	-.0922 (312)
QNT WK LD-PE	.0986 (300)	.0851 (301)	.1575 (296)	.2362 (300)	.1122 (301)	.0207 (300)	-.0365 (296)	.1076 (300)	-.1193 (273)	-.0199 (300)
RESP PERSON-PE	-.2204 (309)	-.4278 (310)	-.3171 (304)	-.0789 (309)	.0421 (309)	.2287 (309)	.2796 (304)	-.0302 (308)	-.0664 (280)	-.3220 (309)
COMPLEXITY-PE	-.1796 (309)	-.2726 (310)	-.4100 (310)	.1309 (309)	.0285 (309)	.2710 (308)	.3982 (304)	.0149 (308)	-.1094 (279)	-.3119 (310)
ROLE AMBIG-PE	.0480 (307)	.0007 (308)	-.0547 (302)	.1224 (306)	.2739 (308)	.2629 (306)	.1290 (302)	.0732 (306)	-.0961 (277)	-.1975 (307)

Appendix G (Random Stratified Sample): (3) Correlations among the Predictor Variables (continued)

SUPPORT SUP	1.0000										
SUPPORT OTHRS	.3845 (298)	1.0000									
SUPPORT HOME	.0809 (294)	.3288 (311)	1.0000								
SALES TYPE A	-.0211 (298)	.1548 (318)	-.0331 (311)	1.0000							
FLEXIBILITY	.0518 (297)	.1712 (316)	.0552 (309)	-.1011 (316)	1.0000						
ASSERT GOOD	.0298 (297)	.1347 (316)	.0253 (309)	.1605 (316)	-.1592 (316)	1.0000					
DENY BAD	.0950 (297)	.2171 (316)	.0976 (309)	.0344 (316)	.0629 (316)	.4859 (316)	1.0000				
QNT WK LD-P	.1543 (296)	.2145 (315)	.0721 (308)	.1848 (315)	.0140 (313)	.1313 (313)	.2066 (313)	1.0000			
RESP PERSON-P	.0835 (295)	.2500 (313)	.2400 (307)	.1662 (313)	-.1333 (311)	.2165 (311)	.1388 (311)	.3576 (313)	1.0000		
COMPLEXITY-P	.1636 (292)	.2950 (311)	.0675 (304)	.2074 (311)	.2780 (309)	-.0198 (309)	.0523 (309)	.3589 (309)	.1855 (307)	1.0000	
ROLE AMBIG-P	-.0151 (295)	-.0714 (313)	-.0249 (307)	.0017 (313)	-.0399 (311)	.0414 (311)	.0769 (311)	-.0509 (313)	-.0652 (313)	-.0117 (307)	

	SUPPORT SUP	SUPPORT OTHRS	SUPPORT HOME	SALES TYPE A	FLEXIBILITY	ASSERT GOOD	DENY BAD	QNT WK LD-P	RESP PERSON-P	COMPLEXITY-P
QNT WK LD-PE	-.2274 (285)	-.1100 (301)	.0110 (296)	.1924 (301)	-.0103 (299)	-.0113 (299)	-.1186 (299)	-.5909 (301)	-.1628 (299)	-.1362 (295)
RESP PERSON-PE	-.0640 (293)	-.1310 (310)	-.0525 (305)	-.0359 (310)	-.1192 (308)	.0312 (308)	-.0314 (308)	-.0490 (310)	.2109 (310)	-.1556 (304)
COMPLEXITY-PE	-.2037 (291)	-.2466 (310)	-.0043 (303)	-.1011 (310)	-.0702 (308)	-.1266 (308)	-.2223 (308)	-.1866 (308)	-.0614 (306)	-.2937 (310)
ROLE AMBIG-PE	-.1974 (291)	-.1454 (308)	-.0076 (302)	-.0706 (308)	-.0906 (306)	.0414 (306)	.0155 (306)	-.1431 (308)	-.0323 (308)	-.1000 (302)

	ROLE AMBIG-P	QNT WK LD-PE	RESP PERSON-PE	COMPLEXITY-PE	ROLE AMBIG-PE
ROLE AMBIG-P	1.0000				
QNT WK LD-PE	.0802 (299)	1.0000			
RESP PERSON-PE	-.0299 (310)	-.0713 (297)	1.0000		
COMPLEXITY-PE	-.0586 (306)	.0908 (295)	.3149 (303)	1.0000	
ROLE AMBIG-PE	.6206 (308)	.1496 (295)	.0321 (305)	.0838 (301)	1.0000

APPENDIX H

Intercorrelations among Questionnaire and Physiological Measures for the Physiological Sample

(1) Correlations between the Physiological Strains and the Questionnaire Measures

(2) Correlations among the Physiological Strains

(3) Correlations between the Psychological and Behavioral Strains and their Predictors

(4) Correlations among the Psychological and Behavioral Strains

(5) Correlations among the Predictor Variables

Appendix H (Physiological Sample): (1) Correlations between the Physiological Strains and the Questionnaire Measures

	HEART RATE	SYSTOLIC BP	DIASTOLIC BP	CHOLESTEROL	T - 3	T - 4I	URIC ACID	CORTISOL	CIG 4 HOURS	CAFF 4 HOURS
AGE	.0651	.0562	.1414	.2669	-.1839	.0153	.0183	.1711	-.1261	-.0883
	(386)	(383)	(383)	(352)	(335)	(336)	(338)	(352)	(346)	(345)
SCHOOLING	-.0856	-.2700	-.2206	-.0158	.2832	.0987	-.1415	.1638	-.2536	-.1487
	(386)	(383)	(383)	(352)	(335)	(336)	(338)	(352)	(346)	(345)
DUNCAN SES	.0590	-.1120	-.0800	.1102	.0848	-.0750	.0735	.0304	-.0619	.0620
	(383)	(380)	(380)	(349)	(332)	(333)	(335)	(349)	(346)	(345)
INCOME	-.0187	-.0655	-.0098	.1166	.0836	-.0015	-.0537	.0334	-.1469	-.0294
	(366)	(362)	(362)	(335)	(322)	(323)	(320)	(334)	(327)	(327)
LENGTH SERV	.0944	.0720	.0714	.1030	-.1121	-.1222	.1836	-.0371	.0425	-.0074
	(383)	(380)	(380)	(349)	(332)	(333)	(335)	(349)	(343)	(342)
HRS WKD/WK	-.0252	-.1774	-.0849	.0170	.0964	.1220	-.0494	.1575	-.1020	-.1030
	(380)	(379)	(379)	(346)	(330)	(331)	(333)	(346)	(340)	(339)
HRS OVRTIM/WK	-.0334	-.1208	-.0594	.0123	.1262	.0236	.0070	.2031	-.1127	-.1451
	(384)	(381)	(381)	(350)	(333)	(334)	(336)	(350)	(344)	(343)
UNWNTD OVRTIM	-.0596	.0256	.0474	.0252	.1035	-.0327	.0483	.1255	-.0989	-.0450
	(212)	(209)	(209)	(196)	(182)	(182)	(188)	(198)	(177)	(177)
QNT WK LD-E	.0283	.0070	-.0200	.0679	.0633	.1088	.0045	.0672	-.0207	-.0303
	(386)	(383)	(383)	(352)	(335)	(336)	(338)	(352)	(346)	(345)
COMB QNT WKLD	.0432	.0152	-.0302	.0505	.0646	.0415	.0571	.0089	.0088	.0189
	(386)	(383)	(383)	(352)	(335)	(336)	(338)	(352)	(346)	(345)

	HEART RATE	SYSTOLIC BP	DIASTOLIC BP	CHOLESTEROL	T - 3	T - 4I	URIC ACID	CORTISOL	CIG 4 HOURS	CAFF 4 HOURS
VARINCE WK LD	.0005 (385)	.1323 (382)	.0544 (382)	.0120 (351)	-.0540 (334)	-.0385 (335)	.1184 (337)	-.1439 (351)	.0955 (345)	.1512 (344)
RESP PERSON-E	.0408 (385)	-.0109 (382)	-.0045 (382)	.1221 (351)	-.0723 (334)	.0296 (335)	.0875 (337)	.0912 (351)	.0378 (345)	.0668 (344)
COMPLEXITY-E	.0301 (378)	-.0934 (375)	-.1020 (375)	.0059 (345)	.0789 (329)	.0893 (330)	-.0056 (331)	.0521 (345)	.0036 (338)	.0092 (337)
ROLE CONFLICT	.0326 (383)	-.0066 (380)	-.0196 (380)	.0526 (349)	.0493 (332)	.0019 (333)	.0575 (335)	-.0721 (349)	-.0330 (343)	.0165 (342)
ROLE AMBIG-E	-.0701 (386)	-.1397 (383)	-.1118 (383)	.0084 (352)	.0883 (335)	.1647 (336)	-.0356 (338)	.0861 (352)	-.0883 (346)	-.1251 (345)
FUTURE AMBIG	-.0298 (386)	.0010 (383)	-.0001 (383)	-.0384 (352)	.0827 (335)	.1031 (336)	-.0477 (338)	.0920 (352)	-.1090 (346)	-.1661 (345)
UNDERUTILIZAT	-.0685 (384)	.0482 (381)	-.0201 (381)	-.1379 (351)	-.0512 (333)	.0113 (334)	-.0738 (336)	-.1038 (350)	.0102 (344)	-.0686 (343)
INEQTY OF PAY	.0337 (379)	-.0104 (376)	.0049 (376)	-.0345 (345)	.0018 (328)	-.0459 (329)	.0783 (332)	-.0894 (345)	.0939 (340)	.0625 (339)
EQUITY % INCME	-.0464 (353)	-.0018 (349)	-.0503 (349)	-.0152 (322)	-.0192 (310)	.0312 (311)	-.1387 (307)	.2103 (321)	-.1295 (315)	-.1161 (315)
PARTICIPATION	.0658 (384)	-.0033 (381)	-.0385 (381)	.0279 (350)	.0313 (333)	.0529 (334)	.0346 (336)	.0496 (350)	-.0011 (344)	.0198 (343)

Appendix H (Physiological Sample): (1) Correlations between the Physiological Strains and the Questionnaire Measures (cont'd)

	HEART RATE	SYSTOLIC BP	DIASTOLIC BP	CHOLESTEROL	T - 3	T - 4I	URIC ACID	CORTISOL	CIG 4 HOURS	CAFF 4 HOURS
SUPPORT SUP	-.0040 (385)	.0151 (382)	-.0351 (382)	.0363 (351)	.0310 (334)	-.0144 (335)	-.1067 (338)	.1304 (351)	-.0803 (345)	.0290 (344)
SUPPORT OTHRS	.1326 (384)	.1342 (381)	.0653 (381)	.0450 (350)	-.0725 (333)	-.0006 (334)	-.0134 (337)	.0749 (350)	.0703 (344)	.1661 (343)
SUPPORT HOME	.0419 (384)	.0458 (381)	.0066 (381)	-.0357 (351)	.1292 (333)	.0446 (334)	-.0066 (336)	.0807 (350)	.0025 (344)	.0551 (343)
SALES TYPE A	-.0083 (386)	-.0007 (383)	-.0085 (383)	.1172 (352)	-.0328 (335)	.0819 (336)	.0609 (338)	.0486 (352)	-.0085 (346)	.0464 (345)
FLEXIBILITY	-.0366 (385)	-.0805 (382)	-.0425 (382)	.0100 (352)	.1542 (334)	.0373 (335)	-.0047 (337)	.0219 (351)	-.1121 (345)	-.0298 (344)
ASSERT GOOD	.0937 (385)	.0780 (382)	.0686 (382)	-.0614 (352)	-.0305 (334)	-.0357 (335)	.0381 (337)	-.0467 (351)	.0108 (345)	.0207 (344)
DENY BAD	.0790 (385)	.0691 (382)	.1009 (382)	-.0940 (352)	-.0883 (334)	-.0797 (335)	.0079 (337)	-.0199 (351)	-.0324 (345)	.1151 (344)
QNT WK LD-P	-.0422 (382)	-.0521 (379)	-.0189 (379)	.0191 (348)	.0829 (331)	.0166 (332)	-.0641 (334)	.0136 (348)	.0348 (342)	-.0252 (341)
RESP PERSON-P	.0302 (382)	.0494 (379)	.0475 (379)	.0104 (348)	-.0391 (331)	-.0141 (332)	.0911 (334)	.0089 (348)	.0569 (342)	.0343 (341)

	HEART RATE	SYSTOLIC BP	DIASTOLIC BP	CHOLESTEROL	T - 3	T - 4I	URIC ACID	CORTISOL	CIG 4 HOURS	CAFF 4 HOURS
COMPLEXITY-P	.0342 (378)	-.0972 (375)	-.0941 (375)	.0111 (346)	.1199 (329)	.0851 (330)	.0046 (332)	.0424 (346)	-.0677 (338)	.0011 (337)
ROLE AMBIG-P	-.0628 (382)	-.0938 (379)	.0350 (379)	.0842 (348)	.0191 (331)	.0694 (332)	-.0739 (334)	.0885 (348)	-.1623 (342)	-.0537 (341)
QNT WK LD-PE	-.0316 (370)	-.0470 (367)	.0020 (367)	-.0305 (337)	-.0021 (320)	-.0739 (321)	-.0293 (323)	-.0428 (337)	.0393 (331)	.0090 (330)
RESP PERSON-PE	-.0555 (378)	.1054 (375)	.0551 (375)	-.0658 (344)	-.0412 (327)	-.0736 (328)	.0337 (330)	-.1086 (344)	-.0161 (338)	-.0239 (337)
COMPLEXITY-PE	-.0598 (375)	.0034 (372)	.0104 (372)	-.0410 (343)	.0412 (327)	-.0176 (328)	-.0124 (329)	-.1076 (343)	.0154 (335)	.0009 (334)
ROLE AMBIG-PE	-.0456 (380)	-.1082 (377)	-.0227 (377)	-.0076 (346)	.0802 (329)	.0722 (330)	-.0728 (332)	-.0019 (346)	-.0814 (340)	-.0430 (339)
JOB DISSAT	-.0972 (386)	-.0615 (383)	-.0527 (383)	-.0024 (352)	.0455 (335)	.0827 (336)	-.0701 (338)	-.0311 (352)	-.0318 (346)	-.0618 (345)
BOREDOM	-.1050 (386)	-.0097 (383)	-.0533 (383)	-.0905 (352)	.0092 (335)	.0490 (336)	-.0832 (338)	-.0247 (352)	-.0262 (346)	-.0781 (345)
WK LD DISSAT	-.0172 (386)	-.0307 (383)	-.0250 (383)	.0231 (352)	.0003 (335)	.0362 (336)	-.0138 (338)	-.0086 (352)	.0422 (346)	-.0404 (345)

Appendix H (Physiological Sample): (1) Correlations between the Physiological Strains and the Questionnaire Measures (cont'd)

	HEART RATE	SYSTOLIC BP	DIASTOLIC BP	CHOLESTEROL	T - 3	T - 4I	URIC ACID	CORTISOL	CIG 4 HOURS	CAFF 4 HOURS
SOMAT CMPLNTS	.0620	.1146	.0713	.0620	-.0452	-.0284	.0289	-.0089	.1334	.0674
	(386)	(383)	(383)	(352)	(335)	(336)	(338)	(352)	(346)	(345)
DEPRESSION	-.0860	-.0780	-.0312	.0632	.0908	-.0138	-.0749	-.0149	-.0539	-.1669
	(384)	(381)	(381)	(350)	(333)	(334)	(337)	(350)	(344)	(343)
ANXIETY	-.0272	.0531	-.0460	.0963	.0727	-.0216	-.0289	.0469	.0749	-.0052
	(385)	(382)	(382)	(351)	(334)	(335)	(338)	(351)	(345)	(344)
IRRITATION	-.0304	.0382	.0427	.0882	.0133	-.0503	.1345	.0559	-.0373	-.0545
	(384)	(381)	(381)	(350)	(333)	(334)	(337)	(350)	(344)	(343)
CIG SMOKED >0	.1495	.1547	.0208	.2075	-.0749	-.0265	-.1663	.1702	.5777	.0470
	(154)	(154)	(154)	(141)	(137)	(138)	(137)	(142)	(148)	(147)
COFFEE	.1263	.1735	.1122	.1386	-.0984	.0373	.0694	.0464	.2926	.5298
	(386)	(383)	(383)	(352)	(335)	(336)	(338)	(352)	(346)	(345)
CAFFEIN DRNKS	.0924	.1347	.0875	.0391	-.1075	.0495	.0768	-.0159	.2443	.5961
	(386)	(383)	(383)	(352)	(335)	(336)	(338)	(352)	(346)	(345)
OBESITY	.0513	.2979	.3187	.2178	-.1011	.0137	.2858	-.0235	.0143	.0592
	(385)	(382)	(382)	(351)	(334)	(335)	(337)	(351)	(345)	(344)
DISP VISIT	-.0489	-.0364	-.0160	-.0253	.1011	.0463	.0508	.1305	-.1626	-.0968
	(279)	(276)	(276)	(257)	(244)	(245)	(245)	(257)	(239)	(237)
STFFD DIS VIS	-.0449	-.0827	.0099	.0123	.0393	.0618	.0659	.0480	-.2469	-.0346
	(166)	(164)	(164)	(147)	(142)	(143)	(141)	(149)	(135)	(136)

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Appendix H (Physiological Sample): (2) Correlations among the Physiological Strains

	HEART RATE	SYSTOLIC BP	DIASTOLIC BP	CHOLESTEROL	T - 3	T - 4I	URIC ACID	CORTISOL	CIG 4 HOURS	CAFF 4 HOURS
HEART RATE	1.0000									
SYSTOLIC BP	.2026 (380)	1.0000								
DIASTOLIC BP	.1281 (380)	.6052 (383)	1.0000							
CHOLESTEROL	.1339 (351)	.1965 (346)	.2490 (346)	1.0000						
T - 3	-.0794 (334)	-.0111 (330)	-.0154 (330)	-.0504 (325)	1.0000					
T - 4I	-.0237 (335)	-.0391 (331)	-.0449 (331)	.0344 (326)	-.2766 (335)	1.0000				
URIC ACID	.0951 (338)	.1522 (335)	.2901 (335)	.0954 (330)	-.0639 (314)	-.0899 (315)	1.0000			
CORTISOL	.1002 (352)	.0456 (347)	.0551 (347)	.0206 (340)	-.0311 (326)	.1128 (327)	-.0227 (328)	1.0000		
CIG 4 HOURS	.4146 (344)	.1846 (340)	.0633 (340)	.0807 (313)	-.1517 (299)	.0707 (300)	-.0236 (302)	-.0003 (316)	1.0000	
CAFF 4 HOURS	.1338 (343)	.0891 (339)	.1105 (339)	.0153 (311)	-.1154 (296)	.0808 (297)	.0978 (299)	-.0264 (313)	.3132 (342)	1.0000

Appendix H (Physiological Sample): (3) Correlations between the

	JOB DISSAT	WK LD DISSAT	BOREDOM	SOMAT CMPLNTS	DEPRESSION	ANXIETY
AGE	-.0165 (390)	-.0317 (390)	-.0528 (390)	-.0368 (390)	.0322 (388)	.0104 (389)
SCHOOLING	-.0521 (390)	-.1290 (390)	-.1841 (390)	-.2374 (390)	.0121 (388)	-.0596 (389)
DUNCAN SES	-.2369 (387)	-.3311 (387)	-.4848 (387)	-.2144 (387)	-.1418 (385)	-.0820 (386)
INCOME	-.0865 (369)	-.1945 (369)	-.2205 (369)	-.2010 (369)	-.0597 (368)	-.0546 (368)
LENGTH SERV	-.0610 (387)	-.0764 (387)	-.1650 (387)	-.0200 (387)	-.0504 (385)	-.0389 (386)
HRS WKD/WK	-.0019 (384)	.0839 (384)	-.0910 (384)	-.0478 (384)	.0540 (382)	.0115 (383)
HRS OVRTIM/WK	.0374 (388)	.1235 (388)	.0147 (388)	-.0463 (388)	.0513 (386)	-.0009 (387)
UNWNTD OVRTIM	.0963 (214)	.1719 (214)	-.0001 (214)	.0297 (214)	-.0452 (214)	-.0414 (214)
QNT WK LD-E	.0668 (390)	.2038 (390)	-.1116 (390)	.1791 (390)	.0213 (388)	.0898 (389)
COMB QNT WKLD	.0748 (390)	.2349 (390)	-.1092 (390)	.2366 (390)	.0458 (388)	.1246 (389)
VARIANCE WK LD	-.0076 (389)	.0513 (389)	-.0959 (389)	.2169 (389)	.0037 (387)	.0833 (388)
RESP PERSON-E	-.2419 (389)	-.0746 (389)	-.2473 (389)	-.0237 (389)	-.1489 (387)	-.0846 (388)
COMPLEXITY-E	-.2502 (382)	-.1916 (382)	-.4292 (382)	-.1039 (382)	-.2325 (381)	-.0983 (381)
ROLE CONFLICT	.1934 (387)	.2747 (387)	.2043 (387)	.2023 (387)	.2708 (386)	.1967 (386)
ROLE AMBIG-E	.2488 (390)	.2603 (390)	.2486 (390)	-.0143 (390)	.2262 (388)	.2310 (389)
FUTURE AMBIG	.4216 (390)	.2920 (390)	.4400 (390)	.0974 (390)	.3506 (388)	.2556 (389)
UNDERUTILIZAT	.4389 (388)	.3917 (388)	.5438 (388)	.2311 (388)	.2581 (386)	.1864 (387)

Psychological and Behavioral Strains and their Predictors

IRRITATION	CIG SMOKED	COFFEE >0	CAFFEIN DRNKS	OBESITY	DISP VISIT	STFFD DIS VIS
-.0307 (388)	.0792 (155)	.1345 (390)	.0131 (390)	.1267 (389)	-.0867 (282)	-.1101 (167)
-.0183 (388)	-.0691 (155)	-.1383 (390)	-.1523 (390)	-.1499 (389)	-.2438 (282)	-.2241 (167)
-.0794 (385)	-.0220 (155)	.0824 (387)	-.0085 (387)	.0167 (386)	-.2378 (279)	-.3273 (165)
-.0495 (368)	.0627 (146)	.0674 (369)	.0279 (369)	.0077 (368)	-.2109 (264)	-.1462 (162)
-.0848 (385)	.0765 (155)	.1281 (387)	.0319 (387)	.0809 (386)	.0212 (281)	.0117 (166)
.0539 (382)	.0392 (154)	-.0250 (384)	-.0627 (384)	-.0900 (383)	-.1511 (277)	-.1275 (165)
.0830 (386)	.0196 (155)	-.0139 (388)	-.0476 (388)	-.0993 (387)	-.0432 (280)	-.0078 (165)
.0042 (214)	.0838 (73)	.0433 (214)	.0057 (214)	-.0155 (214)	-.0292 (169)	-.0420 (108)
.1288 (388)	.0148 (155)	.0020 (390)	-.0341 (390)	-.1105 (389)	-.0842 (282)	-.0910 (167)
.1768 (388)	.0162 (155)	.0070 (390)	-.0149 (390)	-.0891 (389)	-.0418 (282)	-.0520 (167)
.1083 (387)	.0717 (155)	.0962 (389)	.0624 (389)	.0025 (388)	.1487 (281)	.0959 (167)
.0153 (387)	.1624 (155)	.0684 (389)	.0228 (389)	-.0241 (388)	.0102 (281)	-.0564 (167)
.0015 (381)	.0395 (153)	.0185 (382)	-.0162 (382)	-.0215 (381)	-.0502 (275)	-.0310 (163)
.3082 (386)	.0475 (154)	.0619 (387)	.0357 (387)	.0206 (386)	.0665 (280)	-.0215 (166)
.0691 (388)	-.0332 (155)	-.0398 (390)	-.0665 (390)	-.0134 (389)	-.1047 (282)	-.0551 (167)
.1400 (388)	-.0212 (155)	-.1293 (390)	-.1253 (390)	.0200 (389)	.0158 (282)	.0536 (167)
.0616 (386)	-.0577 (155)	-.0980 (388)	-.0555 (388)	-.0155 (387)	.0985 (280)	.1632 (166)

Appendix H (Physiological Sample): (3) Correlations between the

	JOB DISSAT	WK LD DISSAT	BOREDOM	SOMAT CMPLNTS	DEPRESSION	ANXIETY
INEQTY OF PAY	.0646 (383)	.1346 (383)	-.0C07 (383)	.1141 (383)	.0118 (381)	.0883 (382)
EQUITY % INCME	-.0214 (356)	-.0445 (356)	.0430 (356)	-.0692 (356)	.0122 (355)	-.0170 (355)
PARTICIPATION	-.2525 (388)	-.1662 (388)	-.3445 (388)	-.0219 (388)	-.2296 (386)	-.1590 (387)
SUPPORT SUP	-.3168 (389)	-.2843 (389)	-.2884 (389)	-.1908 (389)	-.2910 (388)	-.2180 (389)
SUPPORT OTHRS	-.3007 (388)	-.2225 (388)	-.2727 (388)	-.0968 (388)	-.3693 (388)	-.2441 (388)
SUPPORT HOME	-.1413 (388)	-.2116 (388)	-.1654 (388)	-.1687 (388)	-.2524 (387)	-.1562 (387)
SALES TYPE A	-.0231 (390)	.0247 (390)	-.2076 (390)	.1150 (390)	-.0444 (388)	.0357 (389)
FLEXIBILITY	-.0238 (389)	-.0924 (389)	-.0523 (389)	-.1053 (389)	-.0362 (387)	-.0315 (388)
ASSERT GOOD	-.1162 (389)	-.1127 (389)	-.1222 (389)	.0337 (389)	-.1294 (387)	-.0914 (388)
DENY BAD	-.1464 (389)	-.2086 (389)	-.1925 (389)	-.1710 (389)	-.2491 (387)	-.2329 (388)
QNT WK LD-P	-.1903 (386)	-.3288 (386)	-.1962 (386)	-.1202 (386)	-.2159 (384)	-.1462 (385)
RESP PERSON-P	-.0662 (386)	-.0958 (386)	-.0853 (386)	.1601 (386)	-.0605 (384)	.0522 (385)
COMPLEXITY-P	-.1911 (382)	-.2582 (382)	-.2828 (382)	-.0264 (382)	-.1623 (380)	-.0629 (381)
ROLE AMBIG-P	.1459 (386)	.0070 (386)	.0812 (386)	-.0465 (386)	.0084 (384)	-.0577 (385)
QNT WK LD-PE	.1726 (374)	.3973 (374)	.0607 (374)	.2424 (374)	.1801 (372)	.1988 (373)
RESP PERSON-PE	.2023 (382)	.0778 (382)	.1772 (382)	.1887 (382)	.1252 (380)	.1504 (381)
COMPLEXITY-PE	.4641 (379)	.3987 (379)	.5203 (379)	.2354 (379)	.3632 (378)	.2447 (378)
ROLE AMBIG-PE	.1990 (384)	.0590 (384)	.1637 (384)	-.0096 (384)	.0643 (382)	.0251 (383)

Psychological and Behavioral Strains and their Predictors (continued)

IRRITATION	CIG SMOKED >0	COFFEE	CAFFEIN DRNKS	OBESITY	DISP VISIT	STFFD DIS VIS
.0454 (381)	.0249 (153)	.0786 (383)	.0636 (383)	-.0732 (382)	.0725 (275)	-.0329 (162)
-.0007 (355)	-.0732 (140)	-.0097 (356)	-.0817 (356)	.0032 (355)	-.1378 (252)	-.1754 (151)
-.0590 (386)	.1383 (155)	-.0141 (388)	-.0457 (388)	-.0215 (387)	-.0039 (280)	-.0727 (166)
-.2112 (388)	-.0124 (155)	-.0514 (389)	-.0654 (389)	-.0096 (388)	-.1496 (281)	-.1031 (167)
-.1678 (388)	-.0054 (154)	.1335 (388)	.1423 (388)	.0651 (387)	-.0107 (281)	.0308 (167)
-.1046 (387)	-.0497 (153)	.0213 (388)	.0106 (388)	-.0332 (387)	-.0684 (281)	.0482 (166)
.1137 (388)	-.0561 (155)	.0402 (390)	.0368 (390)	-.0232 (389)	-.0032 (282)	.0044 (167)
-.0470 (387)	-.0071 (155)	.0148 (389)	.0502 (389)	.0012 (388)	-.1039 (281)	-.1710 (166)
-.1303 (387)	-.1891 (155)	.0441 (389)	.0667 (389)	-.0234 (388)	-.0188 (281)	-.0296 (166)
-.2807 (387)	-.0369 (155)	.0414 (389)	.0985 (389)	.0498 (388)	-.0211 (281)	.0713 (166)
-.0294 (384)	.0233 (154)	.0825 (386)	.0543 (386)	-.0681 (385)	-.0929 (278)	-.0328 (165)
.0310 (384)	-.0727 (154)	.0404 (386)	.0292 (386)	-.0039 (385)	.0201 (278)	.1167 (165)
-.0447 (380)	.0015 (153)	.0469 (382)	.0134 (382)	-.0103 (381)	-.0690 (276)	-.0559 (164)
-.0464 (384)	-.1070 (154)	.0262 (386)	.0350 (386)	.0293 (385)	-.0109 (278)	-.0324 (165)
.1141 (372)	-.0282 (150)	-.0590 (374)	-.0766 (374)	-.0231 (373)	.0123 (270)	-.0174 (160)
.0293 (380)	-.1369 (152)	.0215 (382)	.0659 (382)	.0261 (381)	-.0323 (274)	.1060 (164)
.1724 (378)	.0060 (152)	-.0161 (379)	.0188 (379)	.0103 (378)	.0059 (274)	.0612 (163)
-.0012 (382)	-.0079 (153)	.0269 (384)	.0194 (384)	.0468 (383)	-.0239 (277)	-.0173 (164)

	JOB DISSAT	WK LD DISSAT	BOREDOM	SOMAT CMPLNTS	DEPRESSION	ANXIETY
JOB DISSAT	1.0000					
WK LD DISSAT	.4453 (390)	1.0000				
BOREDOM	.6134 (390)	.5407 (390)	1.0000			
SOMAT CMPLNTS	.1942 (390)	.2914 (390)	.1495 (390)	1.0000		
DEPRESSION	.4503 (388)	.4151 (388)	.4173 (388)	.3460 (388)	1.0000	
ANXIETY	.3370 (389)	.3719 (389)	.2627 (389)	.4705 (389)	.5598 (388)	1.0000
IRRITATION	.2020 (388)	.2663 (388)	.1980 (388)	.1802 (388)	.3473 (388)	.3025 (388)
CIG SMOKED >0	.0307 (155)	.0049 (155)	.0103 (155)	.0615 (155)	.1220 (154)	.0685 (155)
COFFEE	-.0269 (390)	-.0539 (390)	-.0661 (390)	-.0180 (390)	-.1431 (388)	-.0112 (389)
CAFFEIN DRINKS	-.0284 (390)	-.0639 (390)	-.0344 (390)	.0180 (390)	-.1259 (388)	-.0272 (389)
OBESITY	-.0209 (389)	.0025 (389)	-.0275 (389)	-.0015 (389)	-.0152 (387)	-.0006 (388)
DISP VISIT	.0311 (282)	.0983 (282)	.0446 (282)	.1379 (282)	.0356 (281)	.0553 (281)
STFFD DIS VIS	.0154 (167)	.0067 (167)	.0166 (167)	.1527 (167)	-.0801 (167)	-.0206 (167)

among the Psychological and Behavioral Strains

IRRITATION	CIG SMOKED >0	COFFEE	CAFFEIN DRNKS	OBESITY	DISP VISIT	STFFD DIS VIS
1.0000						
.0679 (154)	1.0000					
.0018 (388)	.2551 (155)	1.0000				
.0114 (388)	.2946 (155)	.8335 (390)	1.0000			
-.0472 (387)	-.0124 (155)	.1165 (389)	.0740 (389)	1.0000		
.0760 (281)	.1174 (96)	.0234 (282)	.0618 (282)	-.0589 (281)	1.0000	
-.1092 (167)	.2186 (51)	-.0893 (167)	-.0357 (167)	.0284 (166)	1.0000 (167)	1.0000

Appendix H (Physiological Sample): (5) Correlations among the Predictor Variables

	AGE	SCHOOLING	DUNCAN SES	INCOME	LENGTH SERV	HRS WKD/WEEK	HRS OVRTIM/WK	UNWNTD OVRTIM	QNT WK LD-E	COMB QNT WKLD
AGE	1.0000									
SCHOOLING	-.0189 (390)	1.0000								
DUNCAN SES	.1412 (387)	.4288 (387)	1.0000							
INCOME	.2989 (369)	.4206 (369)	.4165 (366)	1.0000						
LENGTH SERV	.4359 (387)	-.2472 (387)	.2772 (384)	.0583 (366)	1.0000					
HRS WKD/WK	.0566 (384)	.4820 (384)	.0743 (381)	.2505 (363)	-.1584 (383)	1.0000				
HRS OVRTIM/WK	.0176 (388)	.3728 (388)	-.0292 (385)	.1215 (367)	-.1056 (386)	.6067 (383)	1.0000			
UNWNTD OVRTIM	.0086 (214)	.1310 (214)	-.0117 (212)	.0581 (200)	.0000 (213)	.3241 (211)	.6553 (214)	1.0000		
QNT WK LD-E	.1131 (390)	.1545 (390)	.0559 (387)	.0887 (369)	.0361 (387)	.2970 (384)	.2876 (388)	.2014 (214)	1.0000	
COMB QNT WKLD	.0381 (390)	.1029 (390)	.0803 (387)	.1196 (369)	.0598 (387)	.2338 (384)	.2480 (388)	.1862 (214)	.8634 (390)	1.0000

	AGE	SCHOOLING	DUNCAN SES	INCOME	LENGTH SERV	HRS WKD/WEEK	HRS OVRTIM/WK	UNWNTD OVRTIM	QNT WK LD-E	COMB QNT WKLD
VARIANCE WK LD	-.0314 (389)	-.1949 (389)	.1121 (386)	.0901 (368)	.1625 (386)	-.1282 (383)	-.0608 (387)	.1425 (214)	.1081 (389)	.2871 (389)
RESP PERSON-E	.1286 (389)	.0173 (389)	.0576 (386)	.3155 (368)	.1255 (386)	.0653 (383)	.0896 (387)	.1016 (214)	.2308 (389)	.2879 (389)
COMPLEXITY-E	.0264 (382)	.4019 (382)	.3559 (379)	.4546 (364)	-.0260 (379)	.2939 (376)	.2157 (380)	.0834 (210)	.2747 (382)	.3003 (382)
ROLE CONFLICT	.1097 (387)	-.0427 (387)	-.1771 (384)	-.0124 (367)	.0137 (384)	.0398 (381)	.1002 (385)	.1556 (212)	.2280 (387)	.2294 (387)
ROLE AMBIG-E	.0430 (390)	.2631 (390)	-.1558 (387)	.0822 (369)	-.1783 (387)	.2952 (384)	.2465 (388)	.0913 (214)	.0811 (390)	-.0043 (390)
FUTURE AMBIG	.0542 (390)	.0444 (390)	-.2835 (387)	-.0540 (369)	-.1267 (387)	.1122 (384)	.1788 (388)	.1120 (214)	.0014 (390)	-.0604 (390)
UNDERUTILIZAT	-.2100 (388)	-.2979 (388)	-.5596 (385)	-.2803 (367)	-.1527 (385)	-.1621 (382)	-.0120 (386)	.0388 (213)	-.1409 (388)	-.1190 (388)
INEQTY OF PAY	-.1369 (383)	-.0542 (383)	.1232 (380)	-.1311 (362)	.0628 (380)	-.0247 (377)	-.0516 (382)	-.0527 (210)	.0540 (383)	.1252 (383)
EQUITY % OF INCME	.1458 (356)	.0888 (356)	-.0045 (353)	.0409 (356)	-.0428 (353)	-.0271 (350)	.0800 (355)	.0220 (194)	-.0274 (356)	-.1204 (356)

Appendix H (Physiological Sample): (5) Correlations among the Predictor Variables (continued)

	AGE	SCHOOLING	DUNCAN SES	INCOME	LENGTH SERV	HRS WKD/WEEK	HRS OVRTIM/WK	UNWNTD OVRTIM	QNT WK LD-E	COMB QNT WKLD
PARTICIPATION	-.0501 (388)	.2155 (388)	.2257 (385)	.2694 (367)	.0245 (385)	.1292 (382)	.0578 (386)	.0664 (212)	.1789 (388)	.2196 (388)
SUPPORT SUP	.1258 (389)	.1493 (389)	.1241 (386)	.0889 (368)	-.0076 (386)	.0552 (383)	-.0254 (387)	-.0966 (214)	-.0079 (389)	-.0498 (389)
SUPPORT OTHRS	.1333 (388)	-.0142 (388)	.1400 (385)	.0710 (368)	.1317 (385)	-.1287 (382)	-.0890 (386)	-.0199 (214)	-.0197 (388)	-.0050 (388)
SUPPORT HOME	.0201 (388)	.1061 (388)	.0597 (385)	.0844 (368)	.0123 (385)	.0232 (382)	.0003 (386)	-.1480 (214)	-.0088 (388)	-.0012 (388)
SALES TYPE A	.0199 (390)	.1713 (390)	.1526 (387)	.2269 (369)	.0044 (387)	.2525 (384)	.2266 (388)	.1632 (214)	.4159 (390)	.4300 (390)
FLEXIBILITY	-.0558 (389)	.3211 (389)	.1840 (386)	.1461 (368)	-.1138 (386)	.1050 (383)	.0258 (387)	.0122 (213)	-.0465 (389)	-.1199 (389)
ASSERT GOOD	.0824 (389)	-.1486 (389)	-.0334 (386)	-.0827 (368)	.0215 (386)	.0086 (383)	.0084 (387)	.0172 (213)	.0920 (389)	.0572 (389)
DENY BAD	.0007 (389)	-.1034 (389)	.0598 (386)	-.0522 (368)	-.0006 (386)	-.1218 (383)	-.1064 (387)	-.0281 (213)	-.0569 (389)	-.0687 (389)

	AGE	SCHOOLING	DUNCAN SES	INCOME	LENGTH SERV	HRS WKD/WEEK	HRS OVRTIM/WK	UNWNTD OVRTIM	QNT WK LD-E	COMP QNT WKLD
QNT WK LD-P	-.0459 (386)	.1436 (386)	.1487 (383)	.1350 (366)	-.1274 (383)	.0495 (380)	.0103 (384)	-.0654 (212)	.0545 (386)	.0141 (386)
RESP PERSON-P	.0090 (386)	-.0746 (386)	-.0142 (383)	.1822 (366)	.0067 (383)	.0005 (380)	-.0695 (384)	-.2253 (212)	.0863 (386)	.1718 (386)
COMPLEXITY-P	-.0032 (382)	.4089 (382)	.3240 (379)	.4040 (362)	-.0670 (379)	.1911 (376)	.0981 (380)	.0197 (210)	.1748 (382)	.1638 (382)
ROLE AMBIG-P	.1205 (386)	.1102 (386)	-.0724 (383)	.0650 (366)	-.0108 (383)	.1438 (380)	.0926 (384)	.0293 (212)	.0240 (386)	-.0290 (386)
QNT WK LD-PE	-.1228 (374)	.0082 (374)	.0908 (371)	.0516 (354)	-.1141 (371)	-.1552 (368)	-.2152 (372)	-.2189 (204)	-.7135 (374)	-.6388 (374)
RESP PERSON-PE	-.1207 (382)	-.1128 (382)	-.0444 (379)	-.1759 (362)	-.0877 (379)	.0195 (376)	.0266 (380)	.1656 (211)	-.1202 (382)	-.1013 (382)
COMPLEXITY-PE	-.1416 (379)	-.2306 (379)	-.2348 (376)	-.2192 (361)	-.0507 (376)	-.1256 (373)	-.0170 (377)	.0487 (209)	-.0527 (379)	.0128 (379)
ROLE AMBIG-PE	.0479 (384)	-.0005 (384)	-.1428 (381)	-.0160 (364)	-.0082 (381)	.0558 (378)	.0392 (382)	-.0275 (212)	-.0200 (384)	-.0246 (384)

Appendix H (Physiological Sample): (5) Correlations among the Predictor Variables (continued)

RESP PERSON-E	.2497 (389)	1.0000								
COMPLEXITY-E	.2088 (382)	.2931 (382)	1.0000							
ROLE CONFLICT	.1733 (386)	.1304 (386)	.0737 (382)	1.0000						
ROLE AMBIG-E	-.1545 (389)	-.1688 (389)	.0309 (382)	.2411 (387)	1.0000					
FUTURE AMBIG	-.1968 (389)	-.2612 (389)	-.2120 (382)	.1524 (387)	.4116 (390)	1.0000				
UNDERUTILIZAT	-.0656 (387)	-.1910 (387)	-.3974 (380)	.0774 (385)	.1510 (388)	.3478 (388)	1.0000			
INEQTY OF PAY	.1363 (382)	-.0406 (382)	.0204 (376)	.0009 (380)	-.0245 (383)	-.0726 (383)	.0404 (381)	1.0000		
EQUITY % INCME	-.0796 (355)	-.0641 (355)	.0112 (351)	.0076 (354)	.1121 (356)	-.0175 (356)	-.0140 (354)	-.4225 (350)	1.0000	
PARTICIPATION	.1818 (387)	.3448 (387)	.4385 (382)	.0536 (387)	-.1446 (388)	-.2214 (388)	-.3955 (386)	.0829 (381)	-.0475 (354)	1.0000
SUPPORT SUP	-.1257 (388)	.0779 (388)	.1424 (381)	-.3088 (386)	-.1629 (389)	-.1921 (389)	-.3098 (387)	-.1819 (382)	.2175 (355)	.1919 (387)
SUPPORT OTHRS	.0864 (387)	.2245 (387)	.1087 (381)	-.1157 (386)	-.2257 (388)	-.2507 (388)	-.2348 (386)	-.0787 (381)	.0538 (355)	.2678 (386)
SUPPORT HOME	.0259 (387)	.1035 (387)	.1228 (381)	-.1235 (386)	-.1221 (388)	-.1246 (388)	-.1404 (386)	-.0522 (381)	.0510 (355)	.1437 (386)

	VARINCE WKLD	RESP PERSON-E	COMPLEXITY-E	ROLE CONFLICT	ROLE AMBIG-E	FUTURE AMBIG	UNDERUTILIZAT	INEQUITY OF PAY	EQUITY % INCOM	PARTICIPATION
SALES TYPE A	.1307 (389)	.1886 (389)	.2854 (382)	.1099 (387)	.0044 (390)	-.0755 (390)	-.1954 (388)	.0982 (383)	-.0553 (356)	.2717 (388)
FLEXIBILITY	-.1577 (388)	-.0967 (388)	.1588 (381)	-.0430 (386)	.1502 (389)	.0162 (389)	-.1553 (387)	.0200 (382)	.0406 (355)	.0866 (387)
ASSERT GOOD	.0537 (388)	.0487 (388)	-.0605 (381)	.0551 (386)	-.1096 (389)	-.1311 (389)	-.0707 (387)	.0174 (382)	.0437 (355)	.0306 (387)
DENY BAD	.0305 (388)	.0335 (388)	-.0466 (381)	-.1407 (386)	-.1969 (389)	-.2292 (389)	-.0966 (387)	.0000 (382)	.0799 (355)	.0412 (387)
QNT WK LD-P	.0410 (385)	.1205 (385)	.2574 (378)	-.0463 (383)	-.0651 (386)	-.1735 (386)	-.1793 (384)	-.0374 (379)	.0777 (354)	.0946 (384)
RESP PERSONS-P	.2617 (385)	.3638 (385)	.1574 (378)	.0553 (383)	-.0967 (386)	-.1195 (386)	-.0611 (384)	.0150 (379)	-.0479 (354)	.1341 (384)
COMPLEXITY-P	.1287 (382)	.2360 (382)	.6759 (379)	.0307 (381)	.0150 (382)	-.2048 (382)	-.3253 (380)	.0216 (375)	.0617 (349)	.4041 (382)
ROLE AMBIG-P	-.1243 (385)	-.0563 (385)	.0048 (378)	.0158 (383)	.2729 (386)	.1116 (386)	.0685 (384)	-.0004 (379)	.0533 (354)	-.0903 (384)
QNT WK LD-PE	.0739 (373)	.0891 (373)	.0156 (368)	.2051 (372)	.0956 (374)	.1278 (374)	.0403 (372)	.0450 (368)	-.0406 (342)	.0374 (373)
RESP PERSON-PE	.0197 (382)	-.5777 (382)	-.1938 (375)	-.0222 (379)	.0367 (382)	.1934 (382)	.1432 (380)	.0716 (375)	-.0520 (350)	-.2631 (380)
COMPLEXITY-PE	.0701 (379)	-.2684 (379)	-.4868 (379)	.1175 (379)	.1208 (379)	.2569 (379)	.3992 (377)	.1431 (373)	-.0290 (348)	-.2723 (379)
ROLE AMBIG-PE	-.0027 (383)	-.0894 (383)	-.0343 (377)	-.0039 (381)	.3249 (384)	.1681 (384)	.1449 (382)	.0508 (378)	-.0131 (352)	-.1098 (382)

Appendix H (Physiological Sample): (5) Correlations among the Predictor Variables (continued)

SUPPORT SUP	1.0000									
SUPPORT OTHRS	.3211 (388)	1.0000								
SUPPORT HOME	.2389 (387)	.3050 (387)	1.0000							
SALES TYPE A	.0402 (389)	.0717 (388)	.1094 (388)	1.0000						
FLEXIBILITY	.0647 (388)	.0071 (387)	.0546 (387)	-.1901 (389)	1.0000					
ASSERT GOOD	.0313 (388)	.1230 (387)	.0360 (387)	.1137 (389)	-.2364 (389)	1.0000				
DENY BAD	.0961 (388)	.1949 (387)	.0988 (387)	-.0083 (389)	-.0455 (389)	.4547 (389)	1.0000			
QNT WK LD-P	.0756 (385)	.0507 (384)	.1159 (384)	.1167 (386)	.0248 (385)	.0570 (385)	.1266 (385)	1.0000		
RESP PERSON-P	-.0005 (385)	.1056 (384)	.1454 (384)	.2062 (386)	-.1935 (385)	.1316 (385)	.0683 (385)	.2325 (386)	1.0000	
COMPLEXITY-P	.1135 (381)	.1559 (380)	.2284 (380)	.3095 (382)	.2145 (381)	-.0742 (381)	-.0275 (381)	.3704 (378)	.3299 (378)	1.0000
ROLE AMBIG-P	.0323 (385)	-.0500 (384)	.0394 (384)	.0510 (386)	.1935 (385)	-.0740 (385)	.0448 (385)	.0410 (386)	-.0878 (386)	.1015 (378)

	SUPPORT SUP	SUPPORT OTHRS	SUPPORT HOME	SALES TYPE A	FLEXIBILITY	ASSERT GOOD	DENY BAD	QNT WK LD-P	RESP PERSON-P	COMPLEXITY-P
QNT WK LD-PE	-.0694 (373)	-.0619 (372)	-.1066 (372)	.2294 (374)	-.0936 (373)	.0278 (373)	-.1361 (373)	-.6552 (374)	-.0765 (374)	-.1510 (367)
RESP PERSON-PE	-.1336 (381)	-.1673 (380)	-.1147 (380)	.0109 (382)	-.1094 (381)	.0448 (381)	-.0143 (381)	-.0007 (382)	.2584 (382)	-.0407 (375)
COMPLEXITY-PE	-.2505 (378)	-.1450 (378)	-.1287 (378)	.0084 (379)	-.0633 (378)	-.0153 (378)	-.1155 (378)	-.1995 (375)	-.0804 (375)	-.3197 (379)
ROLE AMBIG-PE	-.1120 (383)	-.1726 (382)	-.0177 (382)	-.0438 (384)	.0423 (383)	-.0471 (383)	-.0887 (383)	.0059 (384)	-.0787 (384)	.0020 (376)

	ROLE AMBIG-P	QNT WK LD-PE	RESP PERSON-PE	COMPLEXITY-PE	ROLE AMBIG-PE
ROLE AMBIG-P	1.0000				
QNT WK LD-PE	-.0282 (374)	1.0000			
RESP PERSON-PE	-.0618 (382)	-.0698 (370)	1.0000		
COMPLEXITY-PE	-.0135 (375)	.1067 (365)	.2456 (372)	1.0000	
ROLE AMBIG-PE	.5060 (384)	-.0392 (373)	-.0295 (380)	.1537 (374)	1.0000

APPEN-

Raw Score Means and Standard

	Age (years)		Schooling (years)		Duncan SES (percentiles)		Income ($)	
FORKLIFT DRVR	39.7	10.5 (46)	11.0	2.2 (46)	17.	0. (46)	10271.	1842. (44)
ASSEMB MACH	29.8	10.9 (79)	11.9	2.0 (79)	21.	0. (79)	9790.	2076. (52)
ASSEMB RELIEF	33.1	10.7 (27)	11.5	2.2 (27)	21.	0. (27)	10140.	1229. (24)
ASSEMB NOMACH	38.9	10.5 (69)	12.2	1.7 (69)	21.	0. (69)	11260.	3107. (65)
MACH TENDER	34.2	9.2 (34)	12.0	1.5 (34)	22.	0. (34)	11548.	1493. (32)
CONTIN FLOW	45.3	8.9 (100)	12.5	1.5 (100)	23.	0. (101)	12556.	1402. (98)
COURIER	45.0	11.7 (20)	11.2	1.7 (20)	32.	0. (20)	8747.	3022. (14)
TOOL AND DIE	48.9	11.1 (77)	12.2	1.8 (77)	50.	0. (77)	12889.	2584. (69)
ELEC TECH	38.7	9.0 (92)	13.2	1.0 (92)	62.	0. (93)	14725.	3500. (89)
POLICEMAN	30.0	6.4 (109)	14.3	1.0 (109)	40.	0. (111)	12530.	3263. (102)
SUP BLUE COLL	41.9	9.2 (178)	13.0	1.6 (178)	53.	0. (178)	14779.	2603. (166)
SUP WHTE COLL	40.3	8.9 (42)	14.6	1.8 (42)	78.	7. (42)	18494.	5265. (41)
DISPATCHER	44.5	9.6 (86)	12.7	1.4 (86)	40.	0. (86)	13801.	1689. (82)
ATC, LARGE	34.6	5.8 (82)	13.1	1.0 (82)	69.	0. (82)	20754.	3093. (81)
ATC, SMALL	33.0	7.8 (43)	13.1	0.8 (43)	69.	0. (43)	15764.	1915. (43)
PROGRAMMER	33.1	8.1 (90)	16.5	2.1 (90)	65.	0. (90)	14269.	2987. (81)
ACCOUNTANT	38.9	12.5 (92)	15.1	1.8 (92)	78.	0. (92)	10802.	2933. (77)
ENGINEER	38.0	9.2 (110)	16.8	1.9 (110)	87.	0. (110)	17321.	3958. (102)
SCIENTIST	39.8	9.9 (116)	18.3	1.5 (116)	80.	0. (117)	20011.	4952. (112)
PROFESSOR	43.9	9.9 (74)	19.0	0.0 (74)	84.	0. (74)	23827.	8357. (72)
ADMIN PROF	49.6	8.4 (25)	19.0	0.0 (25)	84.	0. (25)	32076.	6901. (25)
ADMINISTRATOR	41.9	9.5 (253)	16.5	2.5 (253)	62.	0. (253)	26317.	18575. (245)
PHYSICIAN	47.0	8.0 (104)	19.0	0.0 (104)	92.	0. (104)	50813.	19610. (96)

Note. The form of the statistics is: Mean S.D.
(N)

DIX I

Deviations for 23 Occupations

Length of Service		Hours Worked per Week		Hours Overtime per Week		Hours Unwanted Overtime		Quantitative Work Load-E	
4.76	1.18 (46)	40.4	3.0 (46)	3.5	2.8 (46)	1.2	2.1 (40)	3.65	0.52 (46)
3.01	1.28 (79)	41.1	7.1 (77)	4.0	5.3 (78)	1.1	2.4 (55)	3.46	0.56 (79)
3.89	1.31 (27)	40.5	9.0 (26)	3.0	7.4 (27)	0.2	0.6 (12)	3.46	0.71 (27)
3.78	1.53 (69)	41.9	6.5 (66)	5.7	6.7 (68)	1.9	4.0 (45)	3.41	0.44 (69)
3.94	1.18 (34)	42.9	4.2 (33)	4.4	3.0 (34)	0.6	1.5 (32)	3.54	0.64 (34)
4.90	1.31 (100)	40.8	5.6 (95)	4.4	5.9 (100)	0.4	1.4 (65)	3.24	0.48 (100)
4.11	1.37 (19)	39.1	5.1 (20)	1.7	2.1 (20)	0.5	0.9 (14)	3.46	0.42 (20)
4.97	1.24 (76)	46.9	8.3 (77)	4.3	6.7 (75)	2.1	3.9 (43)	3.45	0.44 (77)
4.30	1.22 (92)	40.2	6.9 (91)	2.2	3.8 (93)	0.7	1.4 (54)	3.46	0.48 (93)
3.70	0.99 (108)	46.1	5.8 (107)	6.4	5.9 (110)	1.5	3.1 (101)	3.48	0.51 (109)
4.12	1.16 (177)	47.6	7.9 (177)	6.8	6.6 (176)	3.3	5.1 (146)	3.69	0.54 (177)
4.12	1.29 (42)	43.7	7.5 (42)	3.8	5.0 (41)	2.0	3.6 (28)	3.55	0.55 (42)
5.35	0.92 (86)	41.7	3.4 (86)	2.8	3.3 (86)	1.6	2.3 (48)	3.87	0.56 (85)
4.83	1.11 (82)	38.1	4.7 (82)	0.4	1.0 (82)	0.5	1.3 (16)	3.44	0.46 (82)
4.25	1.05 (43)	38.7	4.9 (42)	0.9	1.4 (43)	0.0	0.0 (17)	3.39	0.43 (43)
3.76	1.03 (89)	42.2	6.4 (89)	3.2	4.1 (88)	1.2	2.5 (58)	3.30	0.51 (90)
3.72	1.22 (92)	40.6	4.4 (90)	1.9	3.6 (91)	1.2	2.8 (40)	3.56	0.60 (92)
3.81	1.27 (110)	43.3	3.9 (109)	3.6	3.7 (108)	1.4	2.7 (76)	3.51	0.52 (110)
4.09	1.22 (116)	46.6	6.0 (116)	5.0	5.3 (112)	1.1	2.8 (91)	3.52	0.47 (116)
4.69	0.96 (74)	51.6	8.1 (74)	3.6	5.9 (59)	1.5	2.9 (29)	3.59	0.51 (74)
4.35	0.99 (25)	56.4	6.9 (25)	11.4	9.6 (21)	3.6	6.0 (15)	4.05	0.46 (25)
3.59	1.14 (251)	48.7	6.8 (250)	6.4	6.5 (247)	1.5	3.8 (208)	3.70	0.54 (253)
5.37	0.98 (103)	58.4	12.6 (103)	6.7	8.9 (84)	3.2	5.6 (55)	4.06	0.47 (104)

Appendix I: Raw Score Means and Standard

	Combined Qnt Work Load		Variance in Work Load		Responsibility for Persons-E		Job Complexity-E	
FORKLIFT DRVR	3.58	0.59 (46)	2.81	0.72 (46)	2.58	1.38 (46)	3.67	0.82 (46)
ASSEMB MACH	3.40	0.65 (79)	2.43	0.83 (79)	2.06	1.13 (79)	3.42	1.00 (77)
ASSEMB RELIEF	3.35	0.82 (27)	2.53	0.74 (26)	2.14	1.18 (27)	3.95	0.67 (25)
ASSEMB NONMACH	3.27	0.58 (69)	2.55	0.78 (69)	2.40	1.23 (69)	3.73	1.13 (68)
MACH TENDER	3.50	0.75 (34)	2.74	0.75 (33)	2.44	1.14 (33)	3.83	0.87 (32)
CONTIN FLOW	3.09	0.57 (100)	2.84	0.65 (100)	2.61	1.05 (100)	4.60	0.90 (97)
COURIER	3.39	0.56 (20)	2.76	0.68 (20)	2.49	1.16 (20)	3.94	1.28 (19)
TOOL AND DIE	3.36	0.51 (77)	2.77	0.68 (76)	2.24	1.09 (77)	4.51	0.99 (72)
ELEC TECH	3.40	0.51 (93)	3.00	0.61 (93)	2.17	0.99 (93)	4.64	1.00 (93)
POLICEMAN	3.52	0.54 (110)	3.22	0.59 (111)	3.64	0.98 (111)	5.63	0.63 (110)
SUP BLUE COLL	3.68	0.59 (178)	3.07	0.65 (173)	3.42	0.96 (176)	5.37	0.79 (174)
SUP WHTE COLL	3.57	0.57 (42)	3.04	0.68 (42)	3.55	1.07 (42)	5.45	0.62 (42)
DISPATCHER	3.96	0.57 (85)	3.33	0.68 (86)	3.67	0.99 (86)	5.21	0.77 (82)
ATC, LARGE	3.62	0.44 (82)	3.48	0.54 (82)	2.97	1.20 (82)	4.90	0.69 (82)
ATC, SMALL	3.50	0.47 (43)	3.51	0.59 (42)	2.91	1.03 (42)	4.82	0.78 (42)
PROGRAMMER	3.25	0.52 (90)	2.72	0.58 (90)	1.82	0.91 (90)	4.90	0.86 (89)
ACCOUNTANT	3.51	0.61 (92)	2.78	0.67 (92)	1.91	0.94 (92)	4.45	0.86 (92)
ENGINEER	3.48	0.55 (110)	2.78	0.56 (108)	1.96	0.84 (108)	5.06	0.70 (109)
SCIENTIST	3.43	0.50 (116)	2.60	0.69 (117)	2.30	0.99 (117)	4.89	0.91 (116)
PROFESSOR	3.61	0.53 (74)	2.70	0.73 (72)	2.87	1.03 (74)	5.41	0.71 (70)
ADMIN PROF	4.07	0.54 (25)	2.88	0.74 (25)	4.02	0.77 (25)	5.85	0.73 (24)
ADMINISTRATOR	3.70	0.58 (253)	2.97	0.60 (253)	3.55	1.00 (253)	5.78	0.67 (248)
PHYSICIAN	4.14	0.44 (104)	3.00	0.79 (102)	4.26	0.72 (101)	5.93	0.86 (100)

Note. The form of the statistics is: Mean S.D. (N)

Deviations for 23 Occupations (continued)

Concentration		Role Conflict		Role Ambiguity-E		Job Future Ambiguity		Underutilization of Abilities	
4.28	1.61 (46)	1.92	0.75 (46)	2.27	1.09 (46)	3.25	0.96 (46)	3.71	1.12 (45)
3.92	1.79 (79)	1.75	0.72 (79)	2.19	1.04 (79)	3.49	1.10 (79)	4.43	0.76 (78)
4.44	1.55 (27)	1.97	0.88 (26)	2.06	1.08 (27)	2.72	0.90 (27)	3.67	0.94 (26)
4.46	1.41 (69)	1.91	0.73 (69)	2.06	0.97 (69)	3.21	1.05 (69)	3.67	1.02 (69)
5.09	1.54 (34)	1.84	0.80 (33)	2.25	1.05 (34)	3.61	0.95 (34)	3.65	1.04 (34)
4.95	1.25 (101)	1.58	0.48 (100)	1.76	0.71 (100)	2.97	1.01 (101)	3.19	0.97 (97)
5.00	1.41 (20)	1.63	0.61 (19)	1.62	1.01 (20)	2.63	1.12 (19)	3.30	1.23 (20)
5.58	1.12 (76)	1.84	0.61 (75)	1.78	0.75 (77)	3.14	0.91 (76)	2.16	1.02 (77)
5.30	1.07 (93)	1.82	0.63 (93)	2.06	0.65 (93)	2.52	0.80 (93)	2.09	0.79 (93)
5.55	1.12 (111)	1.65	0.60 (110)	2.03	0.71 (110)	2.14	0.73 (111)	2.13	0.88 (110)
5.29	1.22 (178)	1.86	0.71 (178)	2.02	0.73 (178)	2.76	0.97 (178)	2.58	0.97 (178)
5.69	0.92 (42)	1.73	0.57 (42)	2.11	0.65 (42)	2.69	0.91 (42)	2.40	0.79 (42)
6.35	0.72 (86)	2.01	0.66 (86)	1.67	0.67 (85)	2.53	0.83 (86)	2.71	0.94 (86)
6.52	0.61 (82)	1.56	0.56 (82)	1.62	0.50 (82)	2.21	0.66 (82)	2.52	1.00 (82)
6.47	0.77 (43)	1.36	0.50 (43)	1.31	0.34 (43)	2.07	0.72 (43)	2.41	0.93 (43)
5.59	0.98 (90)	1.59	0.58 (90)	2.41	0.68 (90)	2.70	0.82 (90)	2.42	0.95 (88)
5.37	1.02 (92)	1.62	0.56 (92)	2.23	0.75 (92)	2.77	0.82 (92)	2.45	1.06 (92)
5.35	0.92 (110)	1.82	0.64 (110)	2.36	0.63 (110)	3.06	0.99 (110)	2.28	0.73 (109)
5.28	1.12 (114)	1.52	0.48 (117)	2.39	0.70 (116)	2.84	0.90 (117)	1.99	0.80 (115)
5.38	1.15 (71)	1.37	0.38 (72)	2.18	0.84 (73)	2.44	1.06 (74)	1.42	0.68 (74)
5.60	1.15 (25)	1.89	0.67 (25)	2.20	0.66 (25)	2.14	0.69 (25)	1.74	0.58 (25)
5.31	1.02 (251)	1.84	0.60 (249)	2.12	0.66 (253)	2.70	0.90 (253)	2.24	0.72 (251)
6.34	0.70 (100)	1.45	0.50 (101)	1.60	0.62 (103)	1.82	0.86 (102)	1.30	0.49 (102)

	Inequity of Pay		Equity as % of Deserved Income		Participation		Social Support from Supervisor	
FORKLIFT DRVR	2.67	1.04 (45)	91.4	12.2 (41)	2.34	1.09 (46)	2.63	0.88 (46)
ASSEMB MACH	2.40	0.76 (79)	86.5	15.3 (49)	2.19	1.12 (79)	2.48	0.81 (78)
ASSEMB RELIEF	2.45	0.69 (27)	78.6	24.2 (20)	2.33	1.19 (27)	2.40	0.73 (27)
ASSEMB NOMACH	2.67	0.78 (69)	86.3	13.3 (64)	2.52	1.17 (69)	2.59	0.76 (69)
MACH TENDER	2.65	0.99 (34)	87.3	9.2 (32)	2.06	1.01 (33)	2.62	0.84 (33)
CONTIN FLOW	2.42	0.71 (100)	90.1	12.0 (98)	2.97	1.02 (100)	3.29	0.64 (101)
COURIER	2.50	0.92 (20)	88.1	10.8 (14)	2.41	1.11 (20)	3.13	0.86 (19)
TOOL AND DIE	3.12	0.97 (75)	82.6	14.8 (67)	2.85	1.03 (74)	2.70	0.87 (75)
ELEC TECH	3.11	0.95 (92)	88.0	12.1 (89)	2.81	0.91 (93)	2.87	0.86 (93)
POLICEMAN	3.02	0.87 (109)	80.6	14.0 (100)	2.64	0.94 (110)	3.07	0.73 (110)
SUP BLUE COLL	2.93	0.90 (174)	89.7	10.0 (164)	3.18	0.97 (178)	3.10	0.76 (178)
SUP WHTE COLL	2.89	1.03 (41)	89.4	10.1 (41)	3.27	0.98 (42)	3.08	0.75 (42)
DISPATCHER	3.04	1.01 (86)	87.1	13.4 (81)	3.03	0.98 (86)	2.97	0.83 (86)
ATC, LARGE	2.87	0.74 (82)	81.4	15.9 (79)	3.14	0.99 (82)	2.69	0.72 (82)
ATC, SMALL	2.93	0.91 (43)	85.8	17.8 (42)	3.17	1.00 (43)	2.87	0.64 (43)
PROGRAMMER	2.91	0.90 (89)	87.1	11.0 (81)	3.13	0.93 (90)	3.04	0.70 (89)
ACCOUNTANT	3.31	0.92 (91)	86.4	10.7 (76)	2.73	0.96 (92)	3.10	0.76 (92)
ENGINEER	2.89	0.87 (106)	88.7	13.4 (101)	2.98	0.73 (110)	2.86	0.71 (110)
SCIENTIST	2.77	0.82 (108)	90.7	10.8 (106)	3.13	0.92 (117)	3.04	0.68 (117)
PROFESSOR	2.95	0.98 (74)	90.8	15.9 (70)	3.20	1.03 (73)	3.24	0.82 (60)
ADMIN PROF	2.75	0.80 (25)	89.9	10.0 (25)	3.79	0.65 (25)	3.17	0.77 (23)
ADMINISTRATOR	2.79	0.80 (246)	89.6	10.4 (240)	3.39	0.86 (249)	3.06	0.67 (252)
PHYSICIAN	2.75	0.80 (95)	90.9	14.6 (96)	2.94	1.18 (101)	3.16	0.80 (8)

Note. The form of the statistics is: Mean S.D. (N)

Deviations for 23 Occupations (continued)

Social Support from Others at Work		Social Support from Home		Type A		Flexibility		Assert Good Self	
2.84	0.58 (46)	3.43	0.64 (44)	5.06	0.90 (46)	1.87	0.50 (46)	1.69	0.20 (46)
2.82	0.60 (78)	3.32	0.62 (79)	4.79	0.98 (78)	2.11	0.57 (78)	1.55	0.26 (78)
2.66	0.62 (26)	3.26	0.74 (26)	4.91	0.93 (27)	2.13	0.51 (27)	1.65	0.25 (27)
2.91	0.59 (69)	3.20	0.73 (69)	5.03	1.00 (68)	2.03	0.53 (69)	1.62	0.26 (69)
2.63	0.70 (33)	3.46	0.63 (33)	5.00	1.03 (33)	2.01	0.54 (34)	1.63	0.25 (34)
3.36	0.49 (101)	3.50	0.66 (101)	4.83	1.00 (101)	2.23	0.48 (101)	1.60	0.24 (100)
2.96	0.61 (20)	3.45	0.51 (19)	5.04	0.89 (20)	2.01	0.54 (20)	1.66	0.23 (20)
3.01	0.57 (76)	3.23	0.71 (76)	5.52	1.00 (77)	2.04	0.50 (76)	1.65	0.25 (76)
3.08	0.51 (93)	3.24	0.72 (92)	5.14	0.94 (93)	2.30	0.38 (93)	1.60	0.25 (93)
3.17	0.48 (110)	3.53	0.56 (109)	5.09	0.88 (110)	2.18	0.49 (108)	1.55	0.26 (108)
2.97	0.56 (177)	3.44	0.61 (176)	5.31	0.94 (178)	2.15	0.51 (178)	1.63	0.26 (178)
3.10	0.48 (42)	3.55	0.60 (42)	5.16	0.83 (42)	2.29	0.37 (41)	1.59	0.24 (41)
2.93	0.64 (86)	3.44	0.68 (85)	5.19	0.83 (85)	1.98	0.45 (86)	1.62	0.24 (86)
3.12	0.54 (82)	3.43	0.60 (82)	5.24	0.71 (82)	2.23	0.42 (82)	1.57	0.23 (82)
3.37	0.46 (43)	3.58	0.51 (43)	5.15	0.80 (43)	2.18	0.47 (43)	1.58	0.26 (43)
3.01	0.59 (90)	3.26	0.68 (89)	4.86	0.94 (90)	2.56	0.42 (90)	1.47	0.23 (90)
3.03	0.58 (92)	3.44	0.58 (91)	4.91	0.96 (92)	2.27	0.46 (92)	1.59	0.29 (92)
2.98	0.45 (110)	3.31	0.69 (108)	5.01	0.91 (110)	2.49	0.45 (110)	1.54	0.26 (110)
3.08	0.51 (116)	3.36	0.61 (117)	5.29	0.77 (117)	2.65	0.46 (117)	1.49	0.25 (117)
3.14	0.61 (74)	3.61	0.44 (72)	5.29	0.86 (74)	2.91	0.46 (73)	1.47	0.29 (72)
3.50	0.49 (25)	3.76	0.33 (25)	5.86	0.90 (25)	2.78	0.42 (25)	1.48	0.24 (25)
3.08	0.51 (253)	3.46	0.63 (252)	5.34	0.81 (252)	2.42	0.45 (252)	1.53	0.25 (252)
3.41	0.49 (100)	3.45	0.64 (101)	5.78	0.74 (103)	2.45	0.50 (100)	1.56	0.27 (101)

	Deny Bad Self		Quantitative Work Load-P		Responsibility for Persons-P		Job Complexity-P	
FORKLIFT DRVR	1.52	0.25 (46)	3.26	0.33 (46)	3.66	1.02 (46)	3.87	0.98 (45)
ASSEMB MACH	1.41	0.28 (78)	3.09	0.46 (78)	3.45	1.17 (78)	3.92	1.14 (78)
ASSEMB RELIEF	1.36	0.26 (27)	3.12	0.48 (27)	3.13	1.21 (26)	4.26	0.80 (26)
ASSEMB NCMACH	1.42	0.26 (69)	3.24	0.37 (69)	3.59	1.02 (69)	4.26	0.94 (68)
MACH TENDER	1.42	0.29 (34)	3.05	0.55 (33)	3.48	1.00 (33)	3.98	0.76 (31)
CONTIN FLOW	1.48	0.27 (100)	3.32	0.42 (98)	3.57	0.95 (98)	4.67	0.85 (97)
COURIER	1.51	0.33 (20)	3.38	0.37 (20)	3.75	0.91 (20)	4.25	1.13 (19)
TOOL AND DIE	1.47	0.27 (76)	3.36	0.48 (74)	3.40	1.19 (74)	4.52	0.95 (70)
ELEC TECH	1.41	0.27 (93)	3.42	0.41 (93)	3.60	0.84 (93)	4.80	0.95 (92)
POLICEMAN	1.41	0.26 (108)	3.43	0.45 (111)	3.71	0.92 (111)	5.46	0.71 (110)
SUP BLUE COLL	1.49	0.27 (178)	3.45	0.43 (178)	3.91	0.84 (178)	5.02	0.93 (173)
SUP WHTE COLL	1.44	0.27 (41)	3.49	0.37 (42)	3.96	0.83 (42)	5.24	0.80 (42)
DISPATCHER	1.44	0.27 (86)	3.31	0.48 (86)	3.81	1.02 (86)	4.76	0.89 (83)
ATC, LARGE	1.47	0.24 (82)	3.42	0.40 (81)	3.94	0.83 (81)	4.95	0.80 (82)
ATC, SMALL	1.46	0.29 (43)	3.41	0.44 (43)	3.70	0.88 (43)	4.85	0.86 (41)
PROGRAMMER	1.39	0.25 (90)	3.33	0.35 (89)	2.80	1.06 (89)	5.11	0.81 (89)
ACCOUNTANT	1.45	0.26 (92)	3.37	0.44 (92)	3.36	0.90 (91)	4.63	0.94 (92)
ENGINEER	1.41	0.25 (110)	3.43	0.37 (109)	3.05	0.91 (108)	4.96	0.77 (109)
SCIENTIST	1.40	0.27 (117)	3.35	0.44 (112)	3.27	0.97 (111)	5.09	0.88 (117)
PROFESSOR	1.35	0.29 (72)	3.05	0.47 (72)	2.93	0.98 (73)	5.12	0.78 (70)
ADMIN PROF	1.35	0.29 (25)	3.29	0.38 (24)	3.36	0.90 (24)	5.53	0.82 (24)
ADMINISTRATOR	1.41	0.25 (252)	3.53	0.37 (253)	3.89	0.82 (253)	5.61	0.78 (248)
PHYSICIAN	1.44	0.27 (101)	3.39	0.37 (103)	3.99	0.88 (101)	5.62	0.91 (100)

<u>Note</u>. The form of the statistics is: Mean S.D.
(N)

Deviations for 23 Occupations (continued)

Role Ambiguity-P		Quantitative Work Load-Fit		Responsibility for Persons-Poor Fit		Job Complexity-Poor Fit		Role Ambiguity-Poor Fit	
2.74	1.29 (46)	0.42	0.59 (45)	1.62	1.05 (45)	1.40	0.91 (45)	1.46	0.90 (45)
2.34	1.22 (78)	0.38	0.75 (76)	1.70	1.10 (77)	1.85	1.17 (77)	1.12	0.92 (78)
2.01	1.02 (27)	0.34	0.88 (27)	1.14	0.85 (25)	1.22	0.95 (25)	1.24	0.85 (27)
2.18	1.18 (69)	0.16	0.63 (66)	1.54	0.98 (69)	1.53	1.10 (68)	1.44	1.02 (68)
2.83	1.17 (33)	0.50	0.91 (33)	1.35	0.87 (33)	1.59	1.24 (31)	1.84	1.04 (32)
2.08	1.09 (98)	-0.10	0.52 (95)	1.31	0.83 (96)	0.97	0.80 (97)	0.96	0.84 (95)
2.37	1.29 (20)	0.10	0.34 (19)	1.89	0.99 (18)	1.13	1.12 (19)	1.52	1.19 (20)
2.47	1.35 (72)	0.11	0.56 (65)	1.55	0.96 (73)	0.88	0.84 (70)	1.29	1.04 (70)
1.88	0.79 (92)	0.04	0.66 (91)	1.68	0.89 (92)	1.01	0.85 (92)	0.88	0.65 (92)
1.98	0.89 (111)	0.05	0.69 (109)	0.89	0.59 (111)	0.56	0.64 (110)	1.02	0.74 (110)
2.14	0.96 (178)	0.24	0.72 (175)	1.00	0.75 (176)	1.01	0.86 (173)	1.07	0.78 (177)
1.72	0.65 (42)	0.04	0.75 (39)	0.89	0.81 (42)	0.61	0.61 (42)	0.86	0.58 (42)
1.61	0.84 (86)	0.53	0.83 (83)	1.15	0.77 (86)	1.15	0.92 (82)	0.85	0.73 (84)
1.82	0.97 (81)	0.01	0.56 (80)	1.46	0.89 (80)	1.12	0.70 (82)	0.90	0.79 (80)
1.75	0.95 (43)	-0.02	0.52 (43)	1.23	0.87 (42)	0.90	0.68 (41)	0.73	0.80 (43)
2.08	0.90 (89)	-0.02	0.58 (86)	1.21	0.92 (89)	0.92	0.67 (89)	0.97	0.65 (89)
2.06	0.88 (91)	0.19	0.78 (92)	1.53	0.96 (90)	1.13	0.85 (92)	1.08	0.70 (91)
1.83	0.77 (109)	0.05	0.71 (103)	1.18	0.95 (106)	0.80	0.60 (109)	1.07	0.75 (107)
2.15	0.85 (112)	0.15	0.55 (103)	1.25	0.95 (110)	0.69	0.59 (116)	0.90	0.65 (111)
2.43	1.09 (72)	0.48	0.58 (60)	0.88	0.58 (73)	0.59	0.60 (70)	1.04	0.82 (70)
2.27	0.86 (24)	0.74	0.55 (20)	0.94	0.70 (24)	0.59	0.56 (24)	0.94	0.64 (24)
2.06	0.88 (253)	0.16	0.65 (239)	0.83	0.75 (253)	0.58	0.61 (248)	0.91	0.68 (251)
1.99	1.17 (100)	0.65	0.53 (97)	0.76	0.59 (98)	0.46	0.54 (100)	0.91	0.93 (99)

Appendix I: Raw Score Means and Standard

	Job Dissatisfaction		Boredom		Work Load Dissat-isfaction	
FORKLIFT DRVR	3.69	0.89 (46)	2.90	1.19 (46)	2.54	1.06 (46)
ASSEMB MACH	3.87	0.84 (79)	3.37	1.08 (79)	2.88	1.16 (79)
ASSEMB RELIEF	3.66	0.70 (26)	2.96	1.09 (27)	2.76	0.99 (27)
ASSEMB NCMACH	3.72	0.84 (69)	2.77	1.05 (69)	2.40	1.04 (69)
MACH TENDER	4.02	0.74 (34)	2.89	0.76 (34)	2.90	1.07 (34)
CONT IN FLOW	3.94	0.81 (100)	2.29	0.87 (100)	1.95	0.73 (100)
COURIER	2.94	0.78 (20)	1.83	0.93 (20)	1.66	0.74 (20)
TOOL AND DIE	3.58	0.81 (77)	1.96	0.79 (77)	2.08	0.81 (77)
ELEC TECH	3.19	0.84 (93)	1.84	0.87 (93)	2.13	0.87 (93)
POLICEMAN	2.93	0.70 (110)	1.53	0.66 (109)	1.94	0.77 (109)
SUP BLUE COLL	3.47	0.89 (178)	1.81	0.83 (178)	2.27	0.97 (178)
SUP WHTE COLL	2.90	0.71 (42)	1.65	0.72 (42)	2.09	0.95 (42)
DISPATCHER	3.41	0.90 (85)	1.55	0.72 (85)	2.39	1.19 (85)
ATC, LARGE	3.09	0.66 (82)	1.49	0.68 (82)	1.84	0.78 (82)
ATC, SMALL	2.85	0.69 (43)	1.40	0.65 (43)	1.87	0.63 (43)
PROGRAMMER	3.16	0.79 (89)	1.95	0.92 (89)	2.02	0.71 (89)
ACCOUNTANT	3.40	0.84 (92)	2.09	0.83 (92)	2.25	1.08 (92)
ENGINEER	3.59	0.84 (110)	2.00	0.87 (110)	2.25	0.87 (110)
SCIENTIST	3.16	0.79 (116)	1.57	0.64 (117)	1.98	0.80 (117)
PROFESSOR	2.85	0.59 (74)	1.36	0.41 (74)	2.06	0.88 (74)
ADMIN PROF	2.97	0.67 (25)	1.38	0.38 (25)	2.76	1.17 (25)
ADMINISTRATOR	3.10	0.75 (253)	1.57	0.73 (253)	2.01	0.78 (253)
PHYSICIAN	2.79	0.57 (101)	1.34	0.45 (101)	2.54	1.04 (101)

<u>Note</u>. The form of the statistics is: Mean S.D.
(N)

Deviations for 23 Occupations (continued)

Somatic Complaints		Anxiety		Depression		Irritation	
1.31	0.31 (46)	1.67	0.50 (46)	1.77	0.52 (46)	1.84	0.43 (46)
1.51	0.37 (79)	1.84	0.65 (78)	1.91	0.57 (78)	1.84	0.61 (78)
1.48	0.51 (27)	1.72	0.71 (27)	1.94	0.76 (26)	1.98	0.73 (26)
1.38	0.36 (69)	1.56	0.50 (69)	1.74	0.48 (69)	1.84	0.52 (69)
1.41	0.39 (33)	1.93	0.68 (34)	1.83	0.60 (34)	2.00	0.78 (34)
1.23	0.24 (101)	1.48	0.44 (101)	1.47	0.45 (101)	1.73	0.44 (101)
1.16	0.22 (20)	1.64	0.49 (19)	1.60	0.57 (19)	1.75	0.63 (19)
1.28	0.27 (75)	1.61	0.45 (76)	1.56	0.45 (76)	1.75	0.42 (76)
1.36	0.36 (93)	1.82	0.64 (93)	1.64	0.59 (93)	1.84	0.56 (93)
1.26	0.23 (109)	1.59	0.41 (111)	1.55	0.45 (111)	1.89	0.49 (111)
1.32	0.33 (178)	1.71	0.53 (177)	1.67	0.53 (177)	1.92	0.52 (177)
1.22	0.28 (42)	1.69	0.63 (42)	1.47	0.40 (42)	1.70	0.49 (42)
1.31	0.31 (85)	1.70	0.58 (86)	1.58	0.55 (85)	2.00	0.55 (86)
1.40	0.34 (82)	1.73	0.57 (82)	1.54	0.42 (82)	1.71	0.40 (82)
1.42	0.37 (43)	1.72	0.52 (43)	1.44	0.39 (43)	1.38	0.48 (43)
1.26	0.32 (88)	1.69	0.54 (90)	1.69	0.49 (90)	1.74	0.49 (90)
1.28	0.28 (91)	1.77	0.60 (92)	1.70	0.57 (92)	1.72	0.52 (92)
1.23	0.23 (110)	1.73	0.56 (110)	1.74	0.58 (110)	1.65	0.46 (110)
1.20	0.22 (116)	1.72	0.53 (117)	1.63	0.51 (117)	1.64	0.48 (117)
1.18	0.16 (74)	1.70	0.46 (74)	1.80	0.54 (74)	1.86	0.52 (74)
1.22	0.23 (25)	1.71	0.63 (25)	1.73	0.50 (25)	2.02	0.48 (25)
1.25	0.25 (253)	1.72	0.50 (253)	1.62	0.50 (253)	1.82	0.41 (253)
1.19	0.25 (102)	1.46	0.47 (103)	1.49	0.44 (103)	1.76	0.38 (103)

	Percent who Smoke		Percent of Smokers who Have Quit		Cigarettes Smoked per Day	
FORKLIFT DRVR	68.9	46.8 (45)	24.4	43.5 (41)	17.0	10.9 (28)
ASSEMB MACH	59.5	49.4 (79)	14.5	35.6 (55)	24.6	14.8 (43)
ASSEMB RELIEF	70.4	46.5 (27)	13.6	35.1 (22)	25.7	7.9 (18)
ASSEMB NOMACH	60.9	49.2 (69)	25.0	43.7 (56)	28.0	12.2 (39)
MACH TENDER	61.8	49.3 (34)	22.2	42.4 (27)	19.1	9.9 (21)
CONT IN FLOW	49.5	50.2 (101)	37.5	48.7 (80)	16.4	9.5 (39)
COURIER	47.4	51.3 (19)	40.0	50.7 (15)	25.9	9.4 (8)
TOOL AND DIE	48.1	50.3 (77)	42.2	49.8 (64)	32.2	13.7 (26)
ELEC TECH	50.5	50.3 (93)	29.9	46.1 (67)	25.1	11.3 (42)
POLICEMAN	49.5	50.2 (107)	19.7	40.1 (66)	23.9	8.8 (49)
SUP BLUE COLL	60.1	49.1 (178)	29.6	45.8 (152)	27.2	9.1 (87)
SUP WHTE COLL	40.5	49.7 (42)	48.5	50.8 (33)	27.2	11.8 (11)
DISPATCHER	59.3	49.4 (86)	29.2	45.6 (72)	28.3	15.3 (40)
ATC, LARGE	58.5	49.6 (82)	25.0	43.6 (64)	25.5	11.2 (42)
ATC, SMALL	65.1	48.2 (43)	22.2	42.2 (36)	24.9	10.1 (27)
PROGRAMMER	31.1	46.6 (90)	40.4	49.6 (47)	21.7	10.3 (18)
ACCOUNTANT	45.7	50.1 (92)	35.4	48.2 (65)	23.9	10.9 (33)
ENGINEER	33.6	47.5 (110)	47.1	50.3 (70)	24.0	10.2 (18)
SCIENTIST	27.6	44.9 (116)	40.7	49.6 (54)	17.7	12.7 (19)
PROFESSOR	33.8	47.6 (74)	43.2	50.1 (44)	27.6	17.6 (18)
ADMIN PROF	43.5	50.7 (23)	41.2	50.7 (17)	33.7	18.9 (4)
ADMINISTRATOR	42.0	49.5 (250)	37.1	48.5 (167)	28.7	14.2 (70)
PHYSICIAN	31.7	46.8 (104)	45.9	50.2 (61)	27.8	9.9 (24)

Note. The form of the statistics is: Mean S.D. (N)

Deviations for 23 Occupations (continued)

Number of Cups of Coffee		Number of Caffeine Drinks		Recency of Dispensary Visit		Recency of Staffed Dispensary Visit		Obesity	
2.3	3.5 (45)	4.0	3.5 (45)	4.6	3.4 (31)	4.3	2.3 (11)	3.60	0.48 (45)
1.9	2.1 (77)	4.6	2.8 (77)	5.3	3.2 (76)	6.3	2.8 (39)	3.50	0.52 (78)
2.5	2.8 (27)	4.9	3.6 (27)	6.4	2.9 (26)	6.2	2.9 (15)	3.43	0.45 (26)
3.3	3.1 (69)	5.1	3.5 (69)	4.5	3.1 (69)	4.3	3.0 (28)	3.64	0.56 (66)
2.4	2.4 (34)	3.7	2.8 (34)	3.9	2.4 (34)	4.3	2.4 (15)	3.64	0.50 (33)
4.3	3.2 (101)	5.6	3.5 (101)	3.2	2.6 (101)	3.4	2.7 (60)	3.66	0.48 (99)
2.7	2.6 (19)	4.0	2.5 (19)	6.2	3.4 (9)	6.7	4.2 (3)	3.67	0.50 (18)
3.6	2.9 (76)	4.3	3.1 (76)	5.9	3.3 (59)	5.1	2.7 (20)	3.69	0.46 (73)
4.0	3.3 (93)	5.3	3.1 (93)	2.8	3.3 (44)	4.1	3.1 (15)	3.68	0.48 (93)
2.9	2.9 (105)	4.4	3.3 (104)	4.8	3.7 (46)	6.4	3.3 (14)	3.64	0.34 (107)
4.0	2.9 (178)	5.2	3.0 (177)	3.8	3.0 (148)	4.0	2.4 (49)	3.70	0.40 (176)
3.0	2.2 (42)	4.0	2.0 (42)	3.8	3.3 (25)	4.8	3.7 (6)	3.63	0.32 (42)
4.1	3.9 (85)	5.5	3.8 (85)	3.0	3.4 (38)	3.7	2.6 (11)	3.64	0.45 (86)
4.2	3.7 (82)	5.8	4.0 (82)	3.3	3.4 (57)	4.0	2.9 (28)	3.61	0.44 (82)
4.0	3.8 (43)	5.4	4.0 (43)	7.1	3.4 (18)	4.0	2.8 (2)	3.51	0.32 (43)
3.1	2.9 (89)	4.1	3.1 (89)	3.8	3.6 (80)	4.6	2.8 (25)	3.50	0.56 (90)
2.9	2.7 (90)	3.9	3.1 (90)	2.9	3.2 (62)	3.8	2.5 (24)	3.55	0.50 (91)
3.1	2.5 (110)	4.1	2.4 (110)	4.3	3.4 (83)	3.4	2.1 (18)	3.48	0.35 (110)
2.5	3.0 (116)	3.5	3.3 (116)	2.9	2.7 (109)	3.0	2.1 (73)	3.46	0.39 (115)
2.9	2.5 (74)	3.9	2.4 (74)	2.8	2.9 (43)	4.3	2.8 (23)	3.40	0.38 (72)
3.5	3.1 (23)	4.7	2.8 (23)	2.5	3.3 (11)	3.4	1.9 (5)	3.60	0.48 (23)
3.4	2.7 (250)	4.2	2.8 (250)	3.3	3.0 (224)	4.0	2.7 (107)	3.60	0.41 (247)
3.0	2.9 (103)	4.0	2.8 (103)	4.6	3.9 (83)	4.8	3.3 (29)	3.59	0.38 (104)

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