ORGANIZATIONAL STRESS AND INDIVIDUAL STRAIN: A SOCIAL-PSYCHOLOGICAL STUDY OF RISK FACTORS IN CORONARY HEART DISEASE AMONG ADMINISTRATORS, ENGINEERS, AND SCIENTISTS

by

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Research Center for Group Dynamics
Institute for Social Research
The University of Michigan
November 1971

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A B S T R A C T

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Chairman: John R. P. French Jr.

The reviewed literature suggests that coronary heart disease as well as occupational differences in the disease may be associated with job stresses and personality traits. This study hypothesized that organizational stresses, such as high quantitative work load, responsibility for persons, poor relations with role senders, and contact with alien organizational territories, may be associated with high levels of psychological and physiological strain which are risk factors in coronary heart disease. It was further hypothesized that persons with coronary-prone Type A personality characteristics would be the most likely to exhibit strain under conditions of organizational stress.

Measures of these stresses, personality traits, and strains were obtained from 205 male, NASA administrators, engineers, and scientists. Type A personality measures included Sense of Time Urgency, Persistence, Involved Striving, Leadership, and preference for competitive and environmentally overburdening situations. Measures of flexibility, denial, overconformity to norms, and emotional dependency were also obtained. Measures of strain included pulse rate, systolic and diastolic blood pressure, and determinations of cholesterol, glucose, uric acid, and cortisol sera levels. Smoking behavior, job satisfaction, job-related threat, and self-esteem were also measured.

In some instances job stress was found to be directly related to risk factors in coronary heart disease. For example, reponsibility for persons, but not for things, is associated with heavy cigarette smoking, high pulse rate, and high diastolic blood pressure. Low participation is the key correlate of low job satisfaction, a probable psychological risk factor in coronary heart disease.

The most frequent relationships between stress and strain involve the interaction effects of characteristics of the persons and job stress on strain. For example, when the <u>needs</u> of the person for responsibility for the work of others is taken into account along with the actual amount of responsibility the person reports as part of his job, persons with either too little or too much responsibility have higher serum cholesterol levels than persons with perfect fit between their needs and the amount of reponsibility present. Similarly, Type A persons who report heavy responsibility for persons (such as for their work, careers, and well-being) are the most likely to show elevated systolic blood pressure, serum cholesterol, serum glucose, and heavy cigarette smoking. No such findings occur for responsibility for things (such as for budget, equipment, and projects).

Supportive relations, like personality, also interact with organizational stress to determine individual strain. For example, persons under heavy work load show elevated blood pressure, pulse rate, and glucose only when nonsupportive relations exist in their role set.

In the population under study, administrators, compared to engineers and scientists, report the most organizational stress (heavy work load, responsibility for persons, and excessive time in alien organizational territories). Administrators also have the highest Type A personality scores and the highest mean systolic blood pressure. They are also the heaviest smokers. These occupational differences in blood pressure and smoking appear due, in part, to the effects of the heavy stress and personality traits characteristic of the administrators.

This research suggests that understanding the underlying causes of coronary heart disease and the steps toward its prevention must extend beyond a simple examination of either job stress or personality independent of one another. Consideration must be given to the joint interaction of person and organization characteristics as predictors of the disease.

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by
Robert Dennis Caplan

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Doctoral Committee:

Professor John R. P. French, Jr., Chairman
Professor Frederick H. Epstein
Professor Floyd C. Mann
Professor Donald C. Pelz

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The work of George Brooks, is also acknowledged for his supervision of the biochemical analyses carried out at the Institute for Social Research. He was assisted by Howard Eichenbaum, Judy Hrushka Coon, and Terry Roth. Judy Coon also spent several weeks at Goddard Space Flight Center administering the medical interviews. The rapport which she maintained between the research team and the volunteers was excellent. Walter D. Block is also to be thanked for providing some supplementary biochemical analyses for this study.

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The typing of the final manuscript has proved to be a significant task. The major responsibility for the typing belongs to Thelma Eskin who, besides being typist, has also been a welcome source of editorial knowledge. She certainly deserves at least the "." in Ph.D. for her careful efforts. Pamela Deasy has also carried out a large portion of the typing. In addition, Faye Burton and Anne Jenne occasionally aided in the task.

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PART 1

Introduction

CHAPTER 1

Introduction and Review of the Literature

Modern organizations, like other settings, exert their own unique forces on the individual. These forces channel behavior towards certain goals, activities, and people and away from others, and this conformity exacts its price from the individual. The price, seen from the point of view of the organization, is usually thought of in terms of wages or salary, equipment investment, and scrap loss. These are the easily measurable costs. But there are other costs which are incurred for this conformity--costs to the individual in terms of job-related pathologies in the form of losses of mental and physical well-being and costs to the organization in terms of a loss of human resources. These costs, however, are often not obvious; indeed, techniques for human resource accounting are only just being developed (Brummet, Pyle, & Flamholtz, 1968).

Such job-related pathologies manifest themselves in a number of ways ranging from passive apathy, job dissatisfaction, depression, and anxiety to violent acting out against the organization in the form of property destruction and the sabotage of organizational goals. In some cases, the individual may even suffer a heart attack which will force him to withdraw from active life in the organization before his full value as a human asset has been realized. Thus, continual organizational pressures can result in a tragedy for both the organization and the individual. The tragedy can be particularly great for the organizational member who sees work as an important, valued, and creative aspect of his life.

A few years ago, the National Aeronautics and Space Administration (NASA) became interested in the problem of preventing coronary heart disease in its organizational members. In this organization the value of life is particularly salient since the survival of astronauts in space depends, ultimately, on the performance and creativity of other human beings. NASA decided that it wanted to identify those factors in coronary heart disease which lay within its organizational realm. Thus, programs of research, including the one to be described here, were started in an attempt to discover the links between social and psychological stresses in organizations and their effect on psychological and physiological strains. Of particular interest were those strains which may serve as risk factors in coronary heart disease.

This, then, is a study of the relationship between stress and strain in a modern organization. While it is a study of a particular organization, hopefully the research will provide organizational theorists and practitioners with some insight into the relationships between organizational stress, individual strain, and coronary heart disease.

As Ostfeld (1967) has observed, there is little need to justify the importance of studying coronary heart disease; over 900,000 persons in the United States alone die yearly of heart disease and primarily coronary heart disease. In 1967, coronary heart disease caused 31% of all deaths in the United States (U.S. Public Health Service, 1968). Indeed, heart disease is so widespread that a quarter of the persons in the population between the ages of 18 and 79 in 1967 had definite or suspected heart disease. In terms of financial costs (the sum of direct costs for medical care plus losses of output by members of the labor force due to heart disease), the nation's loss amounted to $22.4 billion, or 4% of the Gross National Product in 1963 (The President's Commission on Heart Disease, Cancer, and Stroke, 1964). In light of ~~this~~ these data on the prevalence of coronary heart disease, it is not surprising to find out that the disease is also the major cause of death among NASA's employees.

In carrying out the research about to be described here, we have focused on the social-psychological determinants of coronary heart disease. These determinants include the nature of the work environment and of the person (such as his traits or personality). A theoretical framework for mapping out the role of these determinants in coronary heart disease will be elaborated on shortly.

NASA has been particularly interested in trying to explain certain occupational differences in the incidence of coronary heart disease in the organization. Understanding these job differences may allow us to get a better grasp of the effects of work on the disease. Table 1 presents some data which suggests that such occupational differences in cardiovascular disease occur at NASA. These data were gathered from three NASA installations by Jean Mockbee, a statistician from the Occupational Medicine Division at NASA Headquarters.

The data are prevalence rather than incidence figures for persons who participated in NASA's yearly health examinations, and thus indicate how widespread the disease is in that sample rather than how often it occurs. While the data do show occupational differences in prevalence,

TABLE 1

OCCUPATIONAL DIFFERENCES IN DISEASE AT THREE NASA INSTALLATIONS COMBINED

Prevalence of Disease	Age 35-44		Age 45-54	
	Manager	Engineer, Scientist	Manager	Engineer, Scientist
Size of sample	272.0	598.0	350.0	537.0
% with cardiovascular disease	2.9	0.5	5.7	2.2
	p = .01		p = .02	
% with hypertension	8.8	7.9	13.1	12.7
	n.s.		n.s.	

the scientific validity of the findings may be questionable since the figures were obtained by a NASA medical statistician (Mrs. Jean Mockbee) who had only the medical records of the employees at her disposal. She coded these records for the presence of cardiovascular disease by examining the written diagnosis of the examining physician (who varied from one NASA installation to another) and by then matching this diagnosis with descriptions included under rubrics 410 through 429 of the International Classification of Diseases (World Health Organization, 1955). Thus, the extent to which uniform diagnoses were made or could be made is questionable.

Persons who had only hypertension were excluded from the cardiovascular disease category. To be classified as hypertensive, the person either had to have blood pressure in excess of 150/94 mm Hg or be previously diagnosed as hypertensive and be currently on hypertensive therapy.

Since the data are based on records obtained in the course of voluntary yearly medical examinations and, in some cases, in the course of compulsory health certification examinations for certain jobs, they represent a nonrandom sample of the total NASA population of administrators and engineers and scientists. Therefore, the data on coronary heart disease in Table 1 should be interpreted as only suggestive of occupational differences in coronary heart disease. At any rate, there is no implication that the research about to be described rests heavily on the above findings.

Looking at the 35- to 44-year-old age group we see that managers have a prevalence rate almost six times as high as it is for the engineers and scientists (2.9% versus .5%). The engineers and scientists have a significantly lower rate of cardiovascular disease ($p < .01$). In the 45- to 54-year-old age group, engineers and scientists again have a lower prevalence rate (2.2%) when compared with the managers (5.7%). Mrs. Mockbee has informed us that when the data are broken down into five-year rather than ten-year intervals, the findings remain essentially unchanged.

Table 1 also presents the prevalence of hypertension for each of these three occupational groups. While the differences between the groups is non-significant, it is interesting to note the trend in both age ranges. The managers have the highest prevalence (8.8% and 13.1%) compared to the scientists and engineers (7.9% and 12.7%). The current study will consider differences in stress and strain between administrators, engineers, and scientists in an attempt to see whether there is any support for the occupational differences in coronary heart disease suggested by these findings. It will also consider more general relationships between organizational stress and individual strain related to coronary heart disease.

The Epidemiology of Coronary Heart Disease in Organizations: The Sociological Versus the Social-Psychological Approach

Occupational Differences

For the most part, occupations which have been compared in the literature have differed with regard to physical activity as well as other task requirements (for example, see research by Bainton & Peterson, 1963; Breslow & Buell, 1960; Kahn, 1963; McDonough, Hames, Stulb, & Garrison, 1965; Morris & Crawford, 1958; Mortensen, Stevenson, & Whitney, 1959; Syme, Hyman, & Enterline, 1964b, 1965a; and Taylor, Klepetar, Keys, Parlin, Blackburn, & Puchner, 1967). More than one form of job stress has been confounded in these studies.

In the current study, our interest is in three occupational groups which would not be expected to differ markedly in the degree of their physical activity. These groups--administrators, engineers, and scientists--are all white collar professionals. Thus, it seems appropriate here to review epidemiological literature which compares groups similar to these three occupations. Table 1, of course, presented data which allowed us to compare managers against a combined group of engineers and scientists. In the epidemiological literature, the best comparisons available have contrasted managerial persons with "professionals" which includes scientists and engineers as well as persons in law and the medical professions.

The earliest study we can present was conducted by Whitney (1934). It was based on the 1930 census of all gainfully employed males 15-64 years of age in the United States. It showed that proprietors, managers, and public officials had higher age-standardized death rates for cardiovascular diseases than did professional men. The study included 79% of all employed males in ten states. These ten states were selected on the basis of the reliability of the occupational information provided by each state on its death certificates. Proprietors, managers, and officials had a death rate of 184 compared to professional men who had a rate of 177. These findings received additional support from census data drawn twenty years later by Guralnick (1963). Using the 1950 census data, she found that proprietors, managers, and officials had higher age-standardized mortality ratios (SMR = 99) than professional, technical, and kindred workers (SMR = 96) for all cardiovascular diseases. She also found similar findings for arteriosclerotic heart disease, myocardial degeneration, and rheumatic fever and chronic rheumatic heart disease when these were considered separately. Vascular lesions of the central nervous system showed the reverse pattern.

Similarly, Tsuji (1962) in a study of death rates per 100,000 people from vascular lesions of the central nervous system, heart disease, hypertension, and "decrepitness" between 1954 and 1956 in Japan found professionals and engineers had lower rates than managerial persons. Professionals and engineers had a death rate of 74 while managerial personnel had a rate of 86 per 100,000. No indication is given that these data are age-adjusted, however.

The four mortality studies which we have presented show that managers have higher mortality rates compared to professionals. Two other mortality studies, however, show the reverse findings. One of these studies is based on a United States sample and the other is from a sample in Japan. The first of these studies, by Hedley (1939), was based on all cases of white male deaths from acute coronary occlusion in Philadelphia between 1933 and 1937. Only ages from 35 to 64 were included. His findings show that the standardized mortality ratio for professionals was 100 while the ratio for proprietors, managers, and officials was 91. Hedley, interestingly enough, warns the reader to use caution in interpreting the findings drawn from state vital statistics, noting that it is possible that higher status groups (i.e., professionals) may have had higher rates affected by better diagnosis.

Tsuchiya (1965), in his study of males 15-years-old or older in Japan, also reports that professional and technical persons have higher age-standardized mortality ratios than do managers. These occupational differences are found for "diseases of the heart" (rubrics 410-434), a rather general category, where professionals have a ratio of 106 and managers a ratio of 65, for arteriosclerotic and degenerative heart disease (rubrics 420-422) where professionals have a SMR of 119 and managers have an SMR of 75, and for vascular lesions of the central nervous system (rubrics 330-334) where professionals have an SMR of 88 and managers an SMR of 46.

The final study on occupational differences we will review here is by Marks (1967). The data, unpublished, are summarized in Antonovsky (1968). Marks reports on 2,281 males, 18 years or older in the Tecumseh Community Health Study. The data were gathered from medical examinations taken between 1959 and 1960. The findings show that for the age range 18 to 39, managers, proprietors (non-farm), and officials have a ratio of observed to expected cases of coronary heart disease of 300 compared to professional, technical and kindred people who have a ratio of 118. On the other hand, the pattern reverses for age groups 40 to 59 and 60 and over where the professional, technical and kindred have ratios of 149 and 175 for the two age groups respectively and the managers, proprietors, and officials have ratios of 124 and 83 respectively for the two age groups.

In summary, out of the six studies which we have just reviewed, three find death rates highest for administrators and managerial personnel (as is the case at NASA), two find just the opposite, and one study suggests that the pattern may reverse for persons 40 years or older. This research, because of its purely sociological approach, leaves us with a set of equivocal results.[1] With these data we cannot explain why administrators at NASA are at highest risk; we can only identify which occupations may be at highest risk. Thus, a more fruitful and productive approach to understanding the social etiology of coronary heart disease has to be taken. It must begin with an examination of the nature of social and psychological stresses which a person encounters in his occupational environment.

The Relative Contribution of Job Stress to Heart Disease

There are some studies which suggest that the psychological stresses of the job, apart from other competing causes of coronary heart disease, such as diet and exercise, play a significant role in coronary heart disease etiology. Russek and Zohman (1958), in a study of 100 coronary

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[1] Reviews of the literature which have examined similar sociological characteristics have come up with parallel conclusions. Recent reviews by Marks (1967) and Antonovsky (1968) find little support for a social class gradient in coronary heart disease. Antonovsky, after reviewing 35 studies using mortality data and 21 using morbidity data concludes that, in general

> In terms of sheer number of studies, no fewer studies report inverse class gradients than direct gradients, and both are outnumbered by the number of studies showing no clear gradient. [P. 102]

patients and an equal number of controls, found that stress associated with work accounted for greater differences between the two groups than differences associated with diet, heredity, obesity, smoking, or exercise. As Russek (1965) notes

> Prolonged emotional strain associated with job responsibility . . . preceded the attack in 91% of the patients as compared with an occurrence of similar strain in only 20% of the normal control subjects. [P. 189]

Similar data are reported by Weiss, Dlin, Rollin, Fischer, and Bepler (1957) and by Van Der Valk and Groen (1967).

In another similar study, Pearson and Joseph (1963) compared 20 myocardial infarct patients with age-matched controls who were out-patients in the gastrointestinal unit of a hospital. Interviews were conducted with these patients in which the intensity and frequency of stresses from work, travel to and from work, home life, and leisure were graded. Sixteen out of 20 coronary patients reported greater overall stress than their matched controls. Pearson and Joseph note that these stresses centered around the work situation and focused more on the nature of interpersonal relationships in the job as compared to the more structural, task demands of the work.

Finally, a study from Sweden also provides similar findings. Theorell and Rahe (1970) studied 64 myocardial infarct patients (average age equaled 56) and 109 healthy subjects (average age equaled 53). The sample was made up of white collar professionals and managers and skilled workers and lower level managers. No breakdown of the data by occupation is given, however. Infarct patients compared to controls reported (a) more excessive overtime work, (b) dissatisfaction with their jobs, (c) hostility toward others who slowed them down. On the other hand, controls were more likely to (a) take work home with them, (b) supervise others, (c) have more responsibility at work, (d) take strict steps to insure opportunity for relaxation, and (e) be more worried about their financial states. Both groups, according to the authors showed a good deal of time urgency.

The methodology of these studies, unfortunately, is far from outstanding. For one thing, they deal with preselected populations--the survivors of coronary attacks. Surviving an attack may, in itself, be a function of certain special characteristics of the person. A recent study (Gordon & Kannel, 1971) indicates that half of all new coronary attacks are fatal. This means half of the sample is lost through some non-random process. The studies rely entirely on retrospective reports by the patients. Both the passage of time and the experience of an attack could conceivably alter the patient's perception of what his work environment was like. Nevertheless, the findings are consistent and in the expected direction. Job stress seems to play a relatively important role in the lives of people who have coronary heart disease.

Recently, there has been some indication that the stresses of the job, compared to factors of genetic origin, play a significant role in the etiology of coronary heart disease. Liljefors (1970) and Liljefors and Rahe (1970) examined pairs of monozygotic and dizygotic male twins, ranging from 42- to 67-years-old, obtained through the Swedish Twin Registry. In each of these pairs, one member had a more severe history of coronary heart disease than the other. Psychosocial satisfaction scores based on interviews by "blind" interviewers differentiated significantly between the coronary heart disease twin with an infarction and the less severe coronary heart disease brother. For all four categories of satisfaction --with work, lack of leisure, home problems, and life dissatisfactions in general--these differentiations were significant. However,

> In contrast, correlations run between the subjects' various medical history and physical examination data (smoking, obesity, cholesterol, and so forth) and their CHD severity were inconsistent and of low orders (insignificant) of magnitude. [Abstract]

This suggests that, irrespective of heredity, life and work stresses play a significant role in coronary heart disease. We shall shortly consider additional findings on the role of job dissatisfaction as a risk factor in coronary heart disease.

In addition to studies which compare the relative contribution of various domains of stress to coronary disease (like the ones mentioned above), there are a number of papers which have dealt with the effect of different degrees of job stress per se on individuals. Job characteristics such as overload and deadlines in their own right, for example, have been shown to be associated with heart disease and related physiological risk factors in studies of a number of occupational groups. These include tax accountants (Friedman, Rosenman, & Carroll, 1958), medical students (Czaczkes & Dreyfuss, 1959; Grundy & Griffin, 1959; Horwitz & Bronte-Stewart, 1962; Thomas & Murphy, 1958; and Wertlake, Wilcox, Haley, & Peterson, 1958), white collar workers administering contracts and handling personnel transactions (Caplan & French, 1968), and professions which are typified by general rather than specialist responsibilities (Russek, 1960, 1962, 1965). We shall return to some of these studies in more detail in a coming section when we examine research dealing with specific types of job stresses and their effect on the individual.

A Programmatic Model

In 1962 French and Kahn presented a theoretical model of behavior which represented the research approach of the Social Environment and Mental Health Program at the Institute for Social Research. This model has since been modified and elaborated to the form presented in Figure 1. The current model will serve as the theoretical orientation for the research presented here.

The purpose of the model is to identify major domains of variables which play a social-psychological role in the etiology of coronary heart disease and to indicate how they relate to one another in some theoretical system. In this section the reader will be oriented to the various aspects of the model. Then, relevant literature will be reviewed which deals with research on these variables.

A major assumption of the model is that there is an objective environment which exists somewhat independently of that environment as represented in the person's psyche. For purposes of the study the scope of that objective environment will be limited so that only aspects of the work domain are sampled. This restriction, of course, means that other important facets of the person's life must be ignored including the family, and the community and society with their attendant benefits and problems.[2]

The objective environment is represented by the box on the left in the figure. It includes the actual work load the person experiences, as well as, at a broader level, the occupation of the person (administrator, engineer, or scientist).

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[2] We have limited the focus here for reasons of expediency--that is, neither the researcher or the subjects would have been able to tolerate a more intensive investigation.

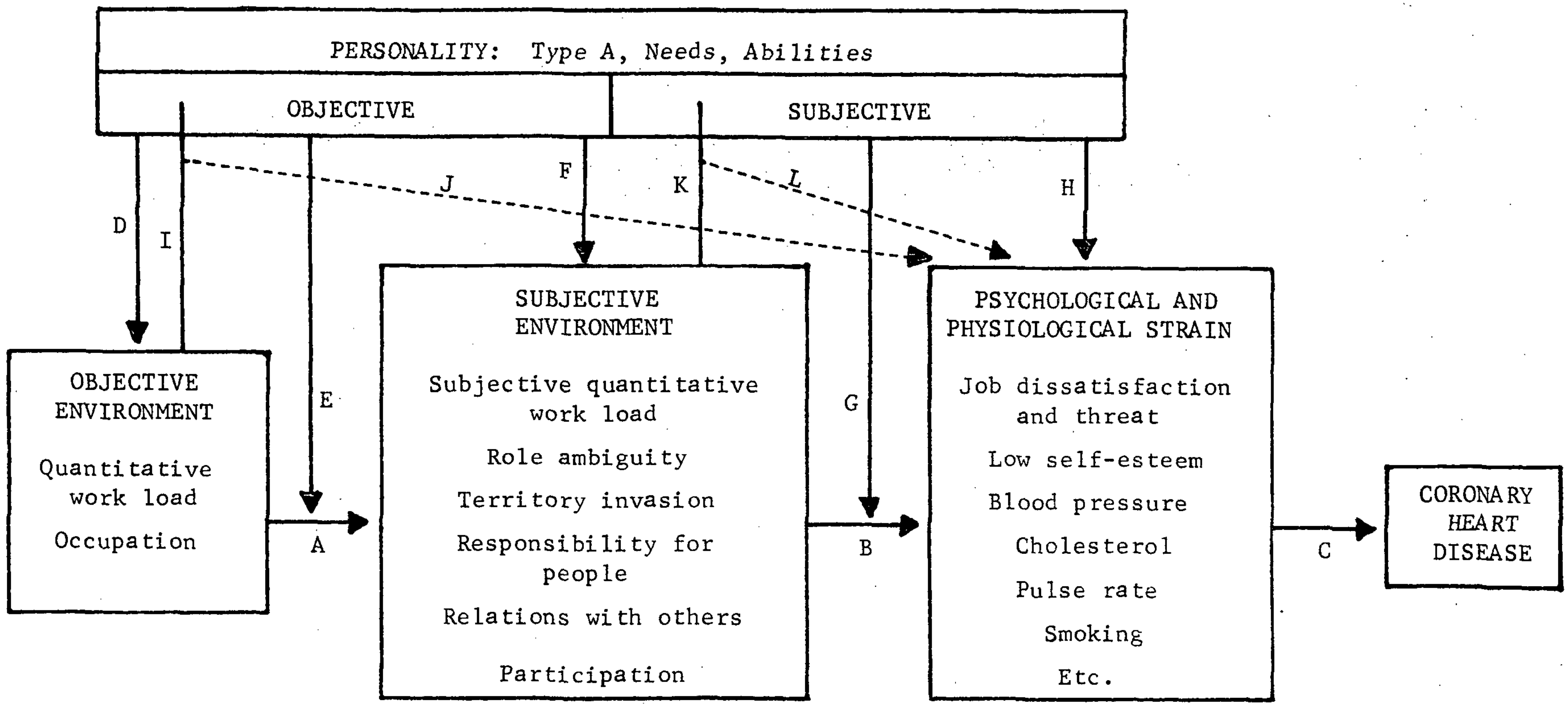

Figure 1. A theoretical model of how organizational stresses affect individual strains which are related to coronary heart disease. The vertical Arrows D and F indicate self-selection into high or low stress environments. The vertical Arrows E and G represent the conditioning effects of personality. The vertical Arrow H indicates the possibility that certain personality types are constitutionally different with regard to risk factors. The vertical Lines I and K represent objective and subjective person-environment fit, and the Dotted Lines J and L represent the effects of fit on strain.

Arrow A points from the objective work environment to the subjective work environment. This arrow indicates that the person's perception of his environment is, in part, determined by the actual setting he resides in. One would expect some, but not complete, overlap between objective and subjective environments. In fact, research by Kraut (1965) and Caplan and French (1968) have demonstrated that the two types of environment have different effects. These studies will be further discussed in an up-coming section.

Continuing to move from left to right across Figure 1, one can see that Arrow B links the subjective work environment with a set of responses of the person. These responses are defined as indicators of strain. There are two types of strain--psychological and physiological. Psychological strain includes affective discomfort such as job-related dissatisfaction, tension, and threat. Physiological strain is indicated by elevations in risk factors in coronary heart disease such as blood pressure, pulse rate, and serum cholesterol. The relevance of these risk factors will be discussed later.

Not all of the possible arrows are shown in the model. For example, one could have arrows running directly from objective stress to strain. However, the arrows which are drawn indicate assumptions at this point about the major channels through which stress-strain reactions take place. Thus, according to the model, the effects of the objective environment operate on strain primarily through the subjective environment.

Moving again to the right, one can see that the risk factors are linked by Arrow C to the disease state, coronary heart disease. In the current study, the incidence of coronary heart disease is not large enough to easily be studied in a cross-sectional research design at NASA--even though the disease, as noted earlier, is a widespread problem in the United States. Therefore, this study limits itself to only risk factors in coronary heart disease rather than the manifestation of the malady itself.

Earlier it was mentioned that one would expect an imperfect overlap between the objective and subjective environments. There are a number of reasons why such a discrepancy might occur. First of all, people may accurately observe their environment, but feel that it is not in their self-interest to divulge to others what they observe. This says nothing about the accuracy of the person as an observer; it does say something about the importance of a trust relationship between the "subject" and the social scientist. Second, people may "inaccurately" observe their environment because more accurate observation serves no apparent purpose in helping them survive. Thus, while the social scientist may prefer to think of social conflict on a seven-point scale, the person filling out the questionnaire may find that his accuracy of observation is limited to only three-point scales (unlike the organizational psychologist, neither his professional growth nor his prestige is enhanced by adding more intervals to his implicit observation scheme). Finally, the person may actually perceive the environment correctly, but may repress from consciousness or distort the perception because it threatens the person too much to admit the perception to consciousness.

The factor, which is of most interest to us here in accounting for such discrepancies between objective and subjective environment, is the personality of the individual. It is suggested that personality can modify and alter the perception of the external environment by introducing perceptual biases which lead to enhancement, simplification, or denial of what is occurring in the objective environment.

This influence of personality, as a variable conditioning how external inputs are perceived, is represented in Figure 1 by Arrow E. Arrow E runs from the box labeled personality to Arrow A linking the objective with the subjective environment. As a hypothetical example of the influence of personality, persons who have a disposition to always worry about whether there is enough time or not, that is, have a sense of time urgency, may over-estimate their objective work load, while persons who are medium on this trait may accurately report their work load, and finally, persons who are low on the trait may under-estimate their objective work load since they may perceive the time span in which it has to be completed as relatively unlimited.

Note that needs are included in Figure 1 as part of the personality. Where needs or motives are discussed, they shall be referred to as traits rather than as relatively impermanent states of the individual. In other words, motive and personality shall be treated as similar concepts--relatively enduring aspects of the person.

In discussing personality, a distinction is made between the objective and the subjective just as is the case for environment. Objective aspects of the person may refer to traits which can be measured objectively such as typing ability, mathematical and verbal ability, and so on. The subjective counterparts to these may be the person's own self-report about the same abilities. In the research reported on here we shall be primarily concerned with subjective personality--namely, self-reported judgments by the person about how he typically behaves and functions in a given setting --although we shall examine some measures which may be associated with objective personality such as age. Traits relating to the coronary-prone personality, often referred to in the literature as Type A, will be examined. These traits will be discussed at greater length later in this chapter.

The Arrows D and F, which run from personality to objective and subjective environment respectively, refer to self-selection and organizational-selection processes. The hypotheses for these arrows suggest that persons with a particular set of personality traits may choose certain types of jobs and not others (Holland, 1963; Roe, 1956) and that the organization may also choose certain types of persons. Furthermore, such persons may perceive their environments as more stressful thus indicating that they perceptually select and are aware of those aspects of their environment which are most stressful. Arrow H suggests that such persons may enter their jobs in states of high strain either because of constitutional make up or because they were in other highly stressful organizational environments prior to entering their present job.

Our failure to determine how much of the person's present level of strain is due to either constitutional make up or to stresses experienced in previous work environments could lead us to falsely conclude that all of the strain is due to characteristics of the person's current job.

This last point raises the issue of causality. In Figure 1 arrows rather than lines have been drawn between the panels of variables. The arrows indicate assumptions about the major directions in which events succeed one another over time. Because the study to be described here is cross-sectional rather than longitudinal, the findings will be primarily correlational. Thus, if links between variables in the model are demonstrated, it will take additional research to say more about the antecedent nature of the links or the direction of the arrows.

To return to the contribution of personality in the model, Arrows E and G represent the conditioning effects of personality. In this study, the term "conditioning variable" will be distinguished from the term "mediating variable." To illustrate the difference, consider three variables: X, Y, and Z. Y serves as a conditioning variable when it <u>intereacts</u> with X to yield Z. Y serves as a mediating variable when X effects Y, and Y, changed by X, in turn effects Z. In both cases Y and X are linked to produce Z, but in the first case, the linkage occurs jointly, bi-directionally from X to Y and Y to X, and instantaneously; in the second case, there is a definite order in time with linkage only occurring <u>from</u> X <u>to</u> Y.

Arrow E suggests that the effect of the objective environment on the person's subjective environment will differ according to personality of the individual. In this case, personality conditions the effect of the objective environment on the subjective environment by introducing the presence of perceptual bias. One type of person, faced with an objectively defined quantity of work, may exaggerate his reports of how much needs to be done. Another person may under-estimate the amount of work before him.

Arrow G indicates that some types of individuals may react to perceived stress in the environment by showing a great deal of strain. Other individuals with different personality types may show no such strain reaction. For example, two persons might subjectively believe that their work environment is overloading them, but perhaps only the one who is high on Need for Social Approval (who consequently feels that overload may cause him to do a poor job and lose the approval of other organizational members) will show an increase in blood pressure.

Closely related to the notion that personality conditions the environment's effect on strain, is the hypothesis that the fit between the person and the environment (P-E fit) also produces strain. This hypothesis will be elaborated on in a later section of this chapter. For now, however, one should note that it is theoretically possible to measure the relatively stable aspects of the person and either objective or subjective environment on commensurate dimensions. Thus, as a measure of the person we could measure the person's ability to type in terms of words per minute. As a measure of environment, we could find out the number of words per minute which are demanded by the job.

Again, a distinction between subjective and objective P-E fit is made. Subjective fit, unlike objective fit, relies on measures of the person and the environment which are based on self-reports. In Figure 1 vertical Lines I and K represent objective and subjective P-E fit respectively. Dotted Arrow J represents the effect of objective P-E fit on the person in terms of strain, and Dotted Arrow L represents a similarly hypothesized effect of subjective P-E fit on the person. In general, we assume that poor fit leads to strain.

This completes a brief and general overview of the theoretical model from which the current study is derived. It is a model of the social-psychological etiology of coronary heart disease. In the immediate sections which follow, previous research which bears on the relationships between the major panels in the model will be described. Following those sections, the major hypotheses which will be tested in this study will be described.

Environmental Stresses and Their Related Strains

In this section stresses which may have an effect on coronary heart disease will be considered. Stress will be defined as an external force applied to the individual while strain will be defined as the reaction of the person to stress or its effect on the person.

Role Theory Concepts

In discussing some major forms of organizational stress we shall be using terms such as "role overload" and "role ambiguity." As Biddle and Thomas (1966) have noted, attempts to create a uniform language of role have suffered from a basic difficulty--a lack of clarity which would allow one to develop mutually exclusive technical meanings. That being the case, we will at least communicate to the reader the manner in which we shall be using concepts from role theory.

Role has been defined from a variety of perspectives. Linton (1936), in one of the earliest definitions of role, defined the concept as normative behavior standards stemming from the culture (or, for our purposes, from the organization) of which the person is a member. This definition refers to standards for behavior rather than actual behavior. Parsons (1951), on the other hand, defines role as the individual's orientation to the situation irrespective of what cultural norms might already be in place. The person anticipates what role he should play to avoid certain sanctions and gain certain rewards. This is the role, not yet enacted, as the person defines it for himself. A third perspective, noted by Gross, Mason, and McEachern (1964), defines role as what the actor actually does rather than what he thinks he should do.

Despite the various ways of defining role, there is some commonality of agreement about the behavior of individuals. This is that "individuals in social locations behave with reference to expectations" (Gross et al., 1964). We shall use these three underlined terms as modifiers of the concept "role."

First, we shall speak of the role location or office as the person's position in the organization. Thus, when we refer to a person as an administrator, engineer, scientist, superior, peer, or subordinate, we will be describing a particular location in the set of positions in the organizational structure.

A set of expectations about the behavior of the person occupying the office will be assumed to accompany each office or location. These expectations can be defined in terms of formal descriptions of the duties, rights, and obligations of the person occupying the office. They may also be defined in terms of a set of expectations which are produced more informally by the rewards and sanctions of other persons with whom the office holder must interact.

All of the other persons in the organization who hold such expectations about the office holder's behavior and who communicate these expectations are called members of the person's role set (Merton, 1957). The members of the role set have expectations and provide rewards and sanction for the office holder because they are functionally dependent on that individual for the rewards and sanctions which they receive. When we talk about the office holder who is the target of these expectations, we shall refer to that individual as the focal person (Kahn, Wolfe, Quinn, Snoek, & Rosenthal, 1964). The other members of the role set will be referred to as role senders (Rommetveit, 1954), and their expectations, when communicated, will be known as the sent role.

When there is a perfect match between the desired and received prescriptions, evaluations, and resource allocations (Kahn & Quinn, 1968) which make up role expectations, then we say there is a perfect fit between the needs of the focal person and the demands of his environment. Bringing about this fit is an intricate task. In reality, the process of expectation formation becomes an unending process of reciprocation and expectation about expectations. It is much like the game of chess in which each focal piece moves in anticipation of what future moves will be made by other pieces on the board--both in terms of their formally prescribed behaviors and in terms of their less predictable rights to move when and where they wish within those limitations. Parsons and Shils (1951) have aptly described the nature of this interactive-reactive process in terms of such a double contingency model of behavior. When this process breaks down, poor fit results, which we would predict is apt to produce various forms of strain in the individual.

Why should the process break down? For one thing, role senders may differ in their ability to transmit and interpret expectations clearly. These circumstances can produce a set of incorrect expectations in the system. Second, the expectations may be transmitted with adequate clarity, but they may demand too much of the focal person. When expectations are inadequately transmitted, they can produce role ambiguity. When too many expectations are transmitted, role overload may be produced. We shall shortly see that role ambiguity, itself, may also lead to role overload.

Role Ambiguity

Under conditions of role ambiguity, the person is uncertain of the role expectations which all or some subset of his role set hold with regard to his office. Under conditions of role ambiguity, one cannot predict contingencies with which rewards and punishments will be administered for behaviors enacted as part of one's role. While there is some evidence of individual differences in tolerance for ambiguity (Cohen, Stotland, & Wolfe, 1955; Frenkel-Brunswik, 1949; Katz & Sarnoff, 1954; Maslow, 1943), there are a number of studies which show that, in general, ambiguity has strain-producing properties.

One of the most well-known of these studies is an intensive study of role ambiguity by Kahn, Wolfe, Quinn, Snoek, and Rosenthal (1964). On the basis of lengthy interviews with 53 focal persons in American companies, they found that role ambiguity was usually accompanied by low job-satisfaction (we shall soon report on research by Sales and House, 1970, linking low job-satisfaction and coronary heart disease), low self-confidence, a high sense of futility, and high job-related tension.

A number of studies have also reported high anxiety as a product of ambiguous situations. In the laboratory, the introduction of ambiguous situations produced tension and anxiety in students (Cohen, 1959, Raven & Rietsema, 1957) and in neuropsychiatric patients (Dibner, 1958). In Dibner's study, 20 neuropsychiatric patients were exposed to a controlled interview which was unstructured to the extent that no cues were given as to the nature of what the patient should discuss. Twenty other patients were told, at the onset of the interview, what topics they should talk about in a general manner. Four out of five of the anxiety measures including GSR were higher for patients in the more ambiguous interview condition. In another study (Smith, 1957) experimentally-produced ambiguity about role expectations was introduced in five-man work groups. This was accomplished by having accomplices in the experimental groups be silent members.

Compared to control groups, the introduction of ambiguity yielded lower productivity, dissatisfaction with the task, and increased member defensiveness about their behavior.

A number of field studies (in addition to Kahn et al., 1964) have also demonstrated similar effects of role ambiguity. Neel (1955) found that employees who described their foreman as one who does not check on them, does not let them know "where they stand with him," reported more nervousness on the job than workers whose foremen provided them with this information. Similarly, Mann and Hoffman (1956) reported that utility workers who felt they were insufficiently trained for their new jobs (that is, they had no clear ideas about what they should do or how they should do it) were more anxious than workers who felt their training had been adequate.

Part of our interest in role ambiguity stems from its widespread prevalence in the United States. Data obtained from a national survey of 725 male, wage and salary workers (Kahn et al., 1964), shows that 35% of the employees indicated a lack of clarity about the scope and responsibilities of their jobs; 29% were bothered by not knowing what their co-workers expected of them; 31% were under tension because of uncertainty as to how their superiors evaluated them; 31% were disturbed about the lack of information regarding opportunities for advancement in the organization; and 32% of them were distressed because they couldn't get information required to perform their jobs adequately. In other words, these findings suggest that almost a third of the work force experiences one or more of these various forms of ambiguity. Thus, we include ambiguity here not only because of its negative effects on psychological health, but also because of its pervasiveness in organizations.

Role Overload

When a system is unable to handle all of the inputs to it we say that it is in a state of overload. Overload can be broken down into two major types: quantitative and qualitative. Quantitative overload occurs when the individual finds that his role senders have given him more work than he can perform in a given period of time (work load refers to how much work there is; overload refers to whether it is excessive or not). He may have the skills required to perform the work, given enough time, but it is the lack of time which is crucial to the definition. On the other hand, qualitative overload is said to occur when the person finds that his role senders have made demands on him for performance which is beyond his ability irrespective of how much time he might have available. Thus, a person who was asked to design a new telecommunications system for a satellite within six months might find he had the engineering skills to do the job but had too many competing projects which also had to be finished; such a person would be labeled "quantitatively overloaded." On the other hand, if we gave the same assignment to a person with no engineering background, that individual would be qualitatively overloaded, because he lacked the necessary formal training and intellectual skills needed to carry out the task. In some instances, it is very difficult to separate out the extent to which overload is purely quantitative versus purely qualitative. In fact, it is probably not unrealistic to assume that most instances of overload in organizations involves mixtures of both types. Both work load and overload may be either objective or subjective depending on whether or not an independent observer or the focal person is asked to report on the state of the work environment.

Katz and Kahn (1966) note that overload in organizations is likely to occur precisely because "the coordination of many cycles of interrelated behavior is necessarily geared to a time schedule" (p. 230). In the interest of efficiency, little or no time is allowed to handle unanticipated inputs into the system. Thus, fluctuations in input produce overload at some points in time and underload at other points in time.

Closely related to the concept of overload is the term "role conflict." Kahn et al. (1964) note four major types of such conflict: (a) intra-sender conflict, where two or more conflicting demands come from a single role sender; (b) inter-sender conflict, where demands from one role sender oppose demands from one or more other role senders; (c) inter-role conflict, where role pressures associated with membership in one organization (such as the job organization) are in conflict with pressures from membership in another organization (such as the family); and (d) person-role conflict, such as when the role requirements violate the person's moral values. The first two types of conflict can easily provide a person with role overload. The third type could also provide overload particularly where a person held membership on multiple committees in some organization which were making competing demands on the individual. Thus, we would prefer to think of the first three types of conflict as forms of overload and to think of the fourth from, person-role conflict, as value conflict in the sense that it refers to more than just quantitative and qualitative overload. We would like to use value conflict to refer to the notion of more psychological and interpersonal conflicts, collisions of motives, and clashes of "personalities." Unfortunately, the distinction between conflict and role overload is not drawn this sharply in the research literature. Therefore, for our purposes, it will serve us well to refer to studies of role conflict as examples of role overload because these studies have focused on conflicts dealing with the allocation of time and talent and not with value conflicts.

In keeping with the definitions of overload which we have given, we shall use the terms quantitative and qualitative overload when it is possible to make such distinctions. Otherwise, we shall talk about "role overload." Finally, we shall also maintain the distinction made earlier in Figure 1 between subjective and objective forms of job stress. Thus, self-reports of quantitative overload will be referred to as "subjective quantitative overload," and independent reports will be referred to as "objective quantitative work load."

Earlier we suggested that role ambiguity can lead to role overload. This is likely to occur when the expectations sent to the focal person either are vague and ambiguous or are too few and too infrequent. Under such conditions, some people may "cover all fronts" by attempting to do more than is expected, and thus, de facto, satisfy all role senders (this is sometimes referred to as the "shot gun approach" by students trying to write essay answers on final examinations). Of course, under such conditions of uncertainty, the person can never be sure he or she has done everything required. The focal person then may begin to work overtime or speed up, and, of course, it is at that point that indicators of overload may begin to appear in the individual's performance.

Under conditions of overload, there is likely to be both adaptive and maladaptive attempts to deal with the situation. Miller (1960) has broken these responses to information input overload down into seven categories: (a) omission, failing to process some of the information; (b) error, processing information incorrectly; (c) queuing, delaying during periods of peak load in the hope of catching up during lulls; (d) filtering, neglecting to process certain types of information, according to some scheme of priorities; (e) approximation, or cutting categories of discrimination, making global and nonprecise responses; (f) employing multiple channels, such as in decentralization and delegation of work to others; and (g) escaping from the field. These types of responses, according to Miller, tend to typify the behavior of systems under stress at all levels of function in the universe ranging from the behavior of biological cells, to persons, organizations, and states--all living systems.

Terreberry (1968) looks at such system breakdown in an interesting form of overload which she calls over-complexification. Complexification is defined as the rate at which things become complex in the environment. When the rate exceeds the organism's ability to cope with the changes, breakdowns occur. As support for her major thesis, Terreberry relates data on rapid social changes to data showing increased incidences of bankruptcy, suicide, alcoholism, and other indicators of social disintegration.

A number of studies supporting Terreberry's hypothesis also deal, interestingly enough, with the effects of complexification on the incidence of coronary heart disease. For example, Tyroler and Cassel (1964) studied the effect of urbanization on coronary heart disease mortality rates of white male rural residents, ages 55-64. These people were exposed to different degrees of "urban influence" over a ten-year period. Size of the largest city in the county was used as an ecologic index of the degree of urban influence in each county examined. Rural residents showed a marked increase in coronary heart disease mortality as the index of urbanization increased. The authors noted

> . . . whatever changes rapid urbanization imposes on the way of life of people, these [changes] are likely to be most deleterious to the segment of the population that has the least time to adapt to them. [P. 175]

Syme, Hyman, and Enterline (1964) studied an instance of even more extreme complexification--namely, the presence of rural background people in white collar jobs. For these individuals the incidence of coronary heart disease was 3.14 times as great as would be expected by chance for nonrural white collar workers. Job mobility, which could also be interpreted as an instance where a person's environment would be in rapid flux, also served as a stress. Persons with four or more major job changes since age 18 had three times the incidence of heart disease as persons with none or one job change and four times the incidence of hypertension. Similar findings are reported by Syme, Borhani, and Buechley (1966) in a study of 80 California males, aged 45-64 with verified coronary heart disease and 80 age-, sex-, and race-matched controls. In that study, men who held three or more jobs in their lifetimes, and who held none of these jobs for extended periods of time, had a ratio of over four times higher coronary heart disease than their controls. This finding was independent of other factors such as weight, cigarette smoking, physical activity, and parental longevity. Lanese, Gresham, and Keller (1969) in a study of 210 white, male state employees, similarly found that elevated serum uric acid, a disputed risk factor in coronary heart disease, is associated with low job stability and more life situation changes in addition to other factors. Unfortunately, in all of these studies, and others (a number of which have been reviewed by Smith, 1967), the nature of the independent variable is quite global, so that many other factors besides complexification are probably being manipulated. Nevertheless, the findings are in the expected direction, and are, thus, suggestive.

A number of less global studies, however, also support the relationship between overload and concomitant strains and breakdowns in the individual. Under overload, primitive closure processes have been shown to take over during problem solving so that the individual makes decisions based on what was the first rather than the best solution considered (Dittes, 1961; Smock, 1955). The threat of failure under overload may become so strong that it produces disabling anxiety. Easterbrook (1959), Korchin (1962), and Janis (1962) all suggest that the effect of such anxiety under threat is to deteriorate the cognitive functioning of the individual. He may then have trouble discriminating between the safe and unsafe aspects of his environment and his time perspective may become short so that the person ignores long-range consequences of his behavior.

Over the past few years a number of studies of work overload and its effects on job-related strain have been conducted by members of the Institute for Social Research. The earliest of these studies cited here was the Kahn et al. (1964) national study of organizational stress which we have already described. In that study 45% of the 725 employed males reported that they encountered work overload in their jobs. In other words, work overload was found to be widespread in our society.

Sales (1969a), in a re-analysis of the Kahn et al. intensive study data on 43 subjects, found that subjective quantitative role overload, that is, overload as reported by the person, was significantly correlated with a number of psychological variables. Sales re-analyzed the data because originally no separate measure of subjective quantitative overload had been extracted for reporting purposes. Role overload correlated .60 with an index of "job-related tension" developed by Kahn et al., -.19 with the respondent's job satisfaction, -.35 with the respondent's trust in his role senders, -.28 with his degree of respect for his role senders, and -.24 with the goodness of interpersonal relations existing between the person and his role senders. Thus, overload, as represented by this set of findings, produces undesirable affects in the person and leads to a deterioration of relations with the individual's role senders perhaps because of mutual dissatisfactions with how they meet each other's demands.

Kraut (1965) obtained information regarding role conflict, from focal persons and role senders (their supervisors) in a computer manufacturing organization. We cite the study here because of the conceptual overlap of role conflict with role overload as we stated earlier. Again, the findings were similar to those from Kahn et al. The study showed that objective role conflict had little effect on the employee's satisfaction with his superior or with feelings of job-related tension; however, subjective role conflict, that is, conflict as perceived and reported by the employee, was significantly related to satisfaction with one's superior, $r = .54$, and with job-related tension, $r = -.39$.

In another study, this time of 92 university professors and 13 administrators by French, Tupper, and Mueller (1965), work overload was shown again to be negatively related to indicators of job-related well-being. In this study, a distinction was made between quantitative and qualitative overload. Interestingly enough, subjective quantitative overload and self-esteem were negatively and highly correlated (-.65) for administrators but were only correlated -.11 for professors. The difference between these two correlations is significant at $p < .05$. On the other hand, subjective qualitative overload showed just the opposite pattern. It correlated -.26 with self-esteem for the professors but only -.03 with self-esteem for the administrators. The difference between these two correlations is also significant at $p < .05$. Subsequent interview material from this study suggested that administrators were, indeed, more concerned with handling all of the quantity of work even if it meant sacrificing a bit on quality. On the other hand, the reverse impression seemed to be conveyed by the university professors--they felt that the esteem they won from colleagues was not so much a function of how fast they ran a study, but how well they did the job, even if that took some time. French et al. (1965), in a final report on the study, noted that administrators' desks were usually clean while professors' desks were generally cluttered and in disarray. Perhaps this attests to the relative amounts of respect each occupational group gave to handling quantitative work load--a messy desk would only serve to indicate that in terms of quantity, the focal person was way behind schedule. When we think about the administrators and non-administrators (engineers and scientists) at NASA, the reader might well be curious to know whether these occupational differences in the relationship between self-esteem and overload also hold up outside of the university setting.

By looking over the consistency of findings from the studies just cited, it seems fairly clear that overload does produce various sorts of psychological strain. What, however, is the evidence to suggest that overload also produces physiological strains linked with coronary heart disease? Again, we can cite a number of studies.

Perhaps the most classic and intriguing of all studies is the one of tax accountants under stress by Friedman, Rosenman, and Carroll (1957). Forty accountants were studied over a five-month period during which information about the nature of the tax deadlines, a major form of role overload, and other job-related stresses were obtained by interview. Blood samples were obtained during each interview and analyzed for serum cholesterol level and blood coagulation time. Serum cholesterol showed rises with peak periods of stress as judged by the accountants and showed a particularly marked increase just prior to the April 15 tax deadline. In the six weeks following this deadline, cholesterol again fell to earlier levels. Acceleration of blood coagulation time also showed the same relationship to deadlines. The authors further found that these changes in physiology could not be ascribed to changes in diet, exercise, or weight.

Interestingly enough, one of the participants in the study kept a weekly diary of his stresses in which he rated, on his own subjective scale, the degree of stress each week on a scale ranging from 1 to 100. The data, presented in Friedman et al., show a striking and significant correlation between the subject's ratings of stress and his serum cholesterol levels ($r = .88$; correlation as computed by Sales, 1969a).

This pattern of findings has also been repeated in a number of studies which studied the effects of medical school examinations on the cholesterol levels of medical students. In all of these studies, blood was drawn at some time prior to the examinations, that is, prior to the onset of overload, and just before or on the day of the examination. These studies include those by Dreyfuss and Czaczkes (1959), Grundy and Griffin (1959), Horwitz and Bronte-Stewart (1962), Thomas and Murphy (1958), and Wertlake, Wilcox, Haley, and Peterson (1958). In all of these studies there was a significant ($p < .001$) increase in cholesterol level just prior to or at the time of the overloading condition--the medical examination. Sales (1969a), in reviewing these studies, computed the overall difference across all studies in cholesterol value in the absence of the examination pressures and in their presence. The weighted mean for the samples drawn in the absence of examination pressure was 205 mg/100 ml, while the mean cholesterol for samples drawn during examination periods was 236 mg/100 ml. As Sales points out, even though there are a number of other factors besides role overload which are potential forces present during an examination, it is certainly possible that the difference in work load makes a major contribution to the difference in cholesterol which is observed.

Caplan and French (1968) provide additional support for these findings in a recent study which examined the relationship between work load and physiological strain in 22 white collar employees at the Headquarters of NASA. These men, contract negotiators, accountants, and people in personnel, were observed during three two-hour periods. Observers recorded their phone calls and the number of office visits that they had, and this constituted a measure of the objective quantitative work load of the subjects. During the two-hour period, and as these men worked at their desks, pulse rate was recorded using a telemetry unit. At the end of each two-hour period, blood samples were obtained from each of the men for later serum cholesterol analysis. During the third observation period, each man filled out a questionnaire which contained a subjective quantitative overload factor derived as part of the previously cited study of work load in university professors (French, Tupper, & Mueller, 1965). The factor includes items such as:

> 1. Overwhelming work load. Too many things need to be done.
> 2. Being torn by conflicting demands.
> 3. The feeling of never having any time.
>
> [Caplan & French, 1968, P. 2]

Serum cholesterol and pulse rate were uncorrelated at all three observation periods (average r = -.07) indicating that two mutually independent response variables were being dealt with here.

The measures of objective and subjective work load were found to be somewhat highly correlated ($r = .68$, $p < .01$), however, analysis of the relationship between these forms of overload and the physiological measures subsequently indicated that the distinction between objective and subjective quantitative overload is a fruitful one. Specifically, serum cholesterol was found to be a function of both objective quantitative work load (the correlations for the three observation periods are .40, .33, and .33) and subjective quantitative overload ($r = .41$). Partialling out the influence of either form of overload when correlating the other form with serum cholesterol level produced nonsignificant and small drops in these correlations. On the other hand, similar analyses showed that pulse rate was primarily a function of <u>subjective</u> rather than objective quantitative overload ($r = .68$). These results are summarized in Figure 2. The results

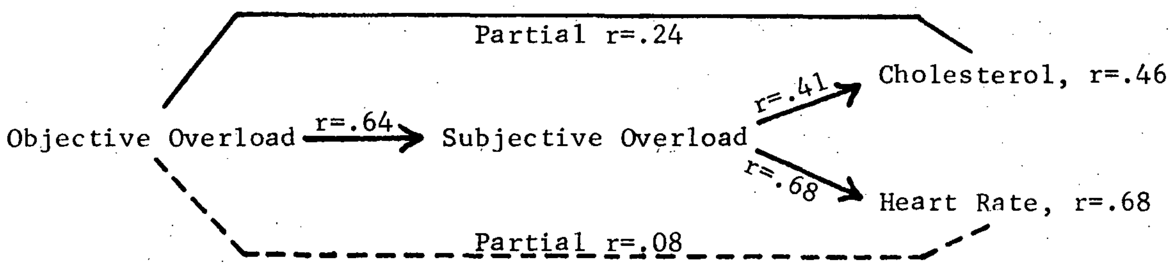

Figure 2. An interpretation of the relationship between overload and cholesterol and heart rate.

indicate that it is the person's subjective perception of how much work he has to do, irrespective of how much he actually is given to do, which effects pulse rate. This study, along with the Kraut study, demonstrates the importance of distinguishing between the objective and subjective environments.

Shortly after the completion of the above study, Sales (1969b) attempted to examine the relationship between work overload and risk factors in coronary heart disease in a more controlled laboratory study at the Institute for Social Research. Seventy-three undergraduates at The University of Michigan served as subjects. In one condition, subjects were deliberately overloaded by being given 35% more anagrams than they were able to solve in a five-minute time period (this rate was established by observing the rate of productivity of each subject on some initial trials). In the underload condition, the subjects were given 35% less work than they were able to complete so that they were always left with extra time on their hands. These procedures were followed for an hour.

Subjects in the overload condition showed an increase in serum cholesterol of 5.56 mg/100 ml during the experimental hour while subjects in the underload condition showed a slight decrease of .46 mg/100 ml. The F ratio for this difference in means was 2.35 ($p < .10$). As Sales notes:

> The changes involved in this effect may appear small, but the increase in cholesterol elicited by the objective overload condition represents a change of approximately 5% from the subjects' mean initial cholesterol levels. Considering the brief time period used and the relatively peripheral nature of the task (compared, say, to tasks used in organizational settings), the effect is reasonably striking. [P. 332]

Sales also found an interesting interaction effect between objective and subjective overload and serum cholesterol. Overall, people who were objectively overloaded showed increases in serum cholesterol level during the one-hour period regardless of how subjectively overloaded they felt. Persons who were exposed to underload and also felt underloaded also showed an increase in serum cholesterol level which Sales suggests is due to the stress of monotony. Subjects who were objectively underloaded but felt subjectively overloaded surprisingly showed an increase in cholesterol level. The author suggests as a tentative, and untested, explanation of this finding that perhaps these latter "subjects saw themselves as performing extremely well <u>on a task which seemed to them to be quite difficult</u>" (p. 333).

Finally, Sales found a significant and inverse correlation ($r = -.24$, $p < .05$) between the subjects' reported enjoyment of the task, which we might think of as "job satisfaction" and changes in serum cholesterol level. Dissatisfied subjects tended to show increases in cholesterol level and satisfied subjects tended to show decreases in cholesterol. This finding goes hand in hand with clinical impressions in the medical literature regarding satisfaction with one's work and the incidence of coronary heart disease. Wolf (1961) writes about men who strive in their work "without joy" as the ones who are most prone to coronary heart disease. This, Wolf has labeled the "Sisyphus Complex."

Interestingly enough, the relationship between job satisfaction and coronary heart disease has been further followed up in a study by Sales and House (1970) which adds support to the last finding. In a study using group correlations between the job satisfaction scores for various occupations (gathered from the psychological literature) and standardized mortality ratios for the same occupations (using data from the National Vital Statistics), these researchers found that job dissatisfaction and heart disease correlated .49. These findings hold for both blue collar and white collar occupational groups.

<u>Role Underload</u>

The study by Sales (1969b) is the only one that this writer knows of which has examined the effects of underload as well as overload on risk factors in coronary heart disease. This, in a way, is a pity, for there is a wealth of psychological literature pointing to the relationship between underload and stress. Underload has been written about under a number of headings including under-utilization (French & Kahn, 1962) and low self-actualization (Argyris, 1957, 1964; Maslow, 1965). Most of these studies of underload emphasize qualitative rather than quantitative underload. It appears that people have enough to do in terms of filling up their time quantitatively, but qualitatively their work lacks as much challenge and opportunity for growth as they might like.

Adam Smith, writing as early as 1776, felt that job simplification, which attempts to reduce the number of skills utilized in a role and increase the repetitive nature of the job, had undesirable consequences for the well-being and health of the worker. He wrote:

> It [division of labor] corrupts even the activity of his body, and renders him incapable of exerting his strength with vigor and perseverance, in any other employment than that to which he has been bred. His dexterity at his own particular trade seems, in this manner, to be acquired at the expense of his intellectual, social, and marital virtues. [Reported in Lewis, 1963, P. 237]

In modern times, writers (Argyris, 1957, 1964; Kornhauser, 1965; Likert, 1961, 1967; McGregor, 1957; Whyte, 1955) likewise argued that division of labor leads to dissatisfaction (a new risk factor in coronary heart disease), boredom, and monotony.

The studies which have been done on under-utilization or underload in organizational settings fall into two categories: field interviews or surveys and field experiments. Let us consider some of the survey studies first.

Perhaps one of the best known is the Walker and Guest (1952) study of life on the assembly lines. As a result of intensive interviews with assembly line workers and persons in other roles in a factory, they concluded that the assembly line was the most stressful of all types of jobs producing increased dissatisfaction, absences, and turnover. While there are a number of other undesirable aspects of the assembly line, we are probably safe in assuming that low utilization or qualitative underload contributed significantly to the job stresses.

Similar findings on the relationship between under-utilization, as a form of qualitative underload, and low job satisfaction have been reported by Morse (1953) and Mann (1953). Kornhauser (1965), in an interview study of 655 blue collar male workers in the Detroit metropolitan area, also found low use of abilities to be related to poor mental health. Mental health, in that study, was measured by paper-and-pencil instruments, and consisted of indices of anxiety, self-esteem, freedom from worry, and satisfaction with the job. Kornhauser describes the under-utilized respondents as having a very fatalistic, passive, and resigned attitude toward their environment, and concludes that this shows poor mental health. Although Hulin and Blood (1968) criticize this conclusion on the basis that Kornhauser is applying a "middle-class" definition of what mental health is to a group of people who may be correctly perceiving their chances for changing their surroundings, the finding nevertheless holds that persons occupying these low skill jobs do, for real or unreal reasons, feel like pawns.

In support of these findings, Kasl and French (1962), in a study of 33 male employees in a variety of jobs in a company concerned with the installation, repair, and maintenance of communication equipment, find that monotony and mental health are negatively correlated. As an indicator of low mental health they measured the number of visits a person made to the company medical dispensary for reasons other than physical injuries on the job. Perceived monotony and dullness of one's job and the frequency of dispensary visits correlated .59. Interestingly enough, dispensary visits and self-esteem correlated -.47. Roessler and Greenfield (1958) have noted that dispensary visits, at least in a university setting, are related to low self-acceptance.

When we put these findings together, it appears that under-utilization at work is seen by the person as a blow to his self-esteem. This would be particularly the case if we assume that people form idealized self-concepts which include the notion that they should be utilized (see French & Sherwood, 1963 for an exposition of this model of self theory). Since the esteem others in a group hold for a focal person determines, in part, the self-esteem of that person (Sherwood, 1962), we might suggest that going to a dispensary is an attempt to gain the self-acceptance of sympathetic others (such as the physician) and thereby raise the individual's self-esteem. It would be interesting, therefore, to know whether visitors to the dispensary, under these circumstances, actively try to seek out high esteem-content comments from the physician such as "Of course you don't feel good, but <u>look at how hard you've been working</u> (for the good of the organization) these past few days."

One of the earliest field experiments on under-utilization is the Trist and Bamforth (1951) study of a change from the shortwall to longwall method of coal mining in Wales. The conversion to the longwall method was a step toward job simplification and reduced the complexity of each role. This change produced a marked drop in job satisfaction, increased absenteeism, and increased psychosomatic illness (unfortunately, the types of illness are not specified further).

Nine years later, Mann and Hoffman (1960), in a study of the effects of job enlargement resulting from the automation of a midwestern electric power company, concluded that the effect of job enlargement produced significant increases in worker satisfaction with their jobs. They reported a correlation of .68 between the perception that one had a chance to do the things one was best at, a measure of self-utilization, and liking for one's job. The results must be interpreted with caution, however, since the change to automated working conditions included a number of other changes not related to increased job complexity (there was more of a group atmosphere in the automated plants, newer and better physical working conditions, and more opportunity for privacy) which may have effected feelings of job satisfaction. Another unfortunate complication in the study, was that the company selected employees with the best records in the old plants to work in the new, automated plants. Thus, the experimental group was probably the group which had the most involvement to begin with.

Several studies from the industrial and organizational psychology literature have manipulated participation by employees in the work process. While participation has certain psychological aspects to it which include greater psychological feelings of control over one's environment, more information about the function of one's environment, and more commitment to one's group, it can also be seen as a way of increasing utilization--or a movement away from under-utilization. People who participate in decision-making in their work devote more of their energy and skills to their work. The evidence from field experiments on participation (Coch & French, 1948; French, Israel, & Aas, 1960; French, Kay, & Meyer, 1966; Morse & Reimer, 1956) has shown that it produces lower rates of turnover, lower absenteeism, in many cases, higher productivity, and increased job satisfaction.

These findings on participation seem to hold across a very wide range of organizations. In Yugoslavian factories, operated under a system of Workers' Councils, we still find that participation is associated with job satisfaction (Obradovic, French, & Rodgers, 1970). Even more different from our large American organizations are the very small factories and poultry branches on the kibbutz in Israel. A study of 44 such organizations reveals that high participation is associated with high satisfaction with the job and with the organization, high self-esteem, low alienation, high commitment to work and to the organization, more innovation of better ways of doing the job, doing more extra work, reading more books and magazines related to one's work, a higher performance evaluation by one's manager, and lower absenteeism (Levitan, 1970).

Do these studies mean that everyone wants job enlargement? According to two recent studies, this may not necessarily be the case. Turner and Lawrence (1965) studied 470 workers in 11 industries on 47 different jobs. They found that workers from factories located in small towns responded quite differently than workers who came from more urban settings. Workers from the cities showed no relationship between the extent to which their jobs were enlarged ones, that is, had more complexity, responsibility, authority, and variety, and work attendance, for example. If anything, they indicated high satisfaction with such undesirable task attributes as repetitiveness and low responsibility. On the other hand, workers from small towns showed greater turnover and dissatisfaction in jobs with less variety and other such undesirable attributes. Turner and Lawrence concluded that city workers were "normless."

This, however, was not the interpretation which Blood and Hulin (1967) gave to the above study. They, instead, suggested that urban populations of workers did have norms, but these norms were not middle class ones. In a reanalysis of some data gathered by Patricia C. Smith on 1,300 blue collar workers employed in 21 plants in the eastern half of the United States, Blood and Hulin found further confirmation of their interpretation. First, they divided the respondent population in terms of the extent to which the community from which the respondent came from was integrated or alienated from middle class work norms. The criteria for integrated and alienated communities was based on a principle component analysis by Kendall (1963) which defined an integrated community as one which had few slums, low population density, small size, and a low standard of living among other demographic data. Next, satisfaction was related to job level (taken as an indicator of the extent to which the job was an enlarged or simplified one--high level jobs being more enlarged) in each type of community. Satisfaction was inversely related to job level in the most alienated community (r = -.50), yet it was positively related to job level in the most integrated community (r = .40). Thus, for blue collar workers, the community setting is an important conditioner of the relationship between utilization and job satisfaction. On the other hand, Hulin and Blood do find that the relationship between job enlargement and satisfaction does hold, in general, for white collar workers. Interestingly enough, the Coch and French study, which did use blue collar employees, and did show a positive association between increased participation and job satisfaction, among other dependent variables, was carried out in a "small town." The cross-cultural replication in Norway (French, Israel, and Aas, 1960) also took place "in a small town in southern Norway with about 6,000 inhabitants" (p. 7). The same might be noted for previously cited research by Levitan on the Israeli kibbutzim.

It is clear from the studies on underload and under-utilization which have been reviewed that there is a consistent negative relationship between low utilization and job satisfaction. In light of Sales' laboratory findings on the inverse relationship between satisfaction and serum cholesterol and the recent findings by Sales and House on an inverse relationship between job satisfaction and the standardized mortality ratios for coronary heart disease, it seems that much more research is warranted to further examine the relationship between qualitative underload and coronary heart disease in organizational settings.

Responsibility

In the introduction to the language and concepts of role theory, it was noted that certain expectations are directed by role senders to the focal person. The focal person may or may not comply with these expectations depending on whether he has the rights and privileges to ignore or meet them or the obligation to ignore or meet them as part of his role.

One way of characterizing the obligations is in terms of the responsibilities a person has for certain aspects of his job. One can divide these responsibilities into two major classes: responsibilities for person-related aspects of the job, and responsibilities for impersonal aspects. Person-related aspects include responsibilities for the futures and careers of others, responsibilities for the intellectual and psychological growth of others, responsibilities for their well-being (both mental and physical), and responsibilities for supervising the work of others (such as seeing that they can do the job as expected). Impersonal responsibilities refer to responsibilities for aspects of a job such as the equipment, budget, and the projects or tasks. This division is similar to the division between task and process maintenance that is believed to go on in small groups (for example, see Bales, 1950; Benne & Sheats, 1948).

Morris, Kagan, Pattison, and Gardner (1966), in a study of heart disease in London busmen, provide some of the data which suggest that responsibility for persons may be an important risk factor. They studied 687 male drivers and conductors in a five-year longitudinal study. The men were selected in 1956 on the basis of having shown no evidence of ischemic heart disease. The study showed, at the end of the five years, that it was the bus drivers and not the conductors who had the highest incidence of ischemic heart disease. This finding essentially replicated findings on busmen from an earlier study (Morris, 1959; Morris, Heady, Raffle, Robert, & Parks, 1953). Morris et al. (1966) further found that the drivers had "substantially higher blood-lipid levels than conductors of the same age" (p. 7). Furthermore, drivers also had higher systolic blood pressure than conductors among those busmen 50 years of age or older.

Morris et al. (1953) in their initial study of these differences between the two occupational roles, suggest that differences in health are probably due to differences in physical activity. They suggest that the conductor, being constantly on his feet, stays in better condition than the driver. Marks (1966), in reviewing the initial 1953 study, suggests, however, that the Morris et al. interpretation may be somewhat of an oversimplification. Marks writes that

> One might speculate, however, on the relative stress of driving a bus compared with the seemingly lesser vicissitudes of serving passengers. [P. 64]

These studies, as a set, suggest that bus drivers may have higher incidence of coronary heart disease because they have more direct responsibility for the safety and well-being of people (the passengers) than do the conductors who have more impersonal responsibility.

The other studies that we wish to cite here do not refer to which class of responsibility is being considered, but only suggest that responsibility, in general or unspecified as to type, may play some role in coronary heart disease. There are two such studies which the author encountered. The first of these, by Stanowski, Cisek, Gutwinski, and Wilkon (1954) studied the occupations of 193 patients with confirmed myocardial infarction and 880 patients with various forms of coronary insufficiency but no myocardial infarction. The authors noted that half of the patients in the two diseased groups were in occupations involving mental work and half the patients were either in groups demanding physical work or a mixture of mental and physical work. Thus, mental work was most frequently represented in the disease groups. The authors further found that the jobs with mental work required, in addition, "a good deal of concentration and <u>responsibility</u> [emphasis added]." The study, unfortunately, suffers from a complete lack of adequate control groups, although the data are suggestive of the role of responsibility in coronary heart disease.

The second study, by Caffrey (1969), compared monks from 10 Trappist and 17 Benedictine monasteries in North America in terms of certain behavior characteristics and coronary heart disease prevalence. Benedictine monks have the highest rates of myocardial infarction and are omnivorous, compared to the Trappists who are lacto-vegetarian. Furthermore, the Benedictine monks lead the most sedentary life of the two groups. Interestingly enough, a discriminant function analysis differentiated between the two groups of monks in terms of a Responsibility Factor. The factor includes items such as "the interviewer's estimate of responsibility of the duties expressed by the subject" and "subject's own opinion of the level of responsibility of his duties." Benedictine monks had the highest score on the factor.

These studies provide only a fragile tie-in to any hypothesis that responsibility, and particularly responsibility for persons, leads to coronary heart disease. In the research to be described here, however, we shall specifically see whether responsibilities for persons constitute more of a stress than impersonal responsibilities and examine how these forms of responsibility relate to risk factors in coronary heart disease.

Organizational Territoriality

Robert Ardrey's (1968) excursion, from a safe distance, into the world of The Territorial Imperative has brought to many people's attention the potential importance which personal space and territory may play in the everyday activities of men and women in organizations. Certainly people develop feelings of ownership with regard to their roles and the physical office space or work space they occupy (Felipe & Sommer, 1966; Hall, 1961, 1966; Sommer, 1959). Might it be reasonable to expect that strains, such as feelings of insecurity, might crop up when people cross the boundary between their own section of the organization and enter other sections--or cross the organizational boundary and move out from their organization altogether (as salesmen do everyday)? It would seem that crossing boundaries is stressful for more than just the crosser; indeed, every time a person moves out of his territory, he invades the territory of someone else, potentially putting the other person, as well as himself, under stress.

But, why should we be concerned with the crossing of organizational boundaries, both internal and external, in a study of risk factors in coronary heart disease? Indeed, there has been virtually no research performed which has linked these two sets of variables. The exceptions are research on people changing jobs where entering a new job might be seen as entering unknown territories. Such studies indicate that the more jobs a person holds, the higher the incidence of coronary heart disease (for example, Syme, Borhani, & Buechley, 1966; Syme, Hyman, & Enterline, 1964a).

There is some research which suggests that territoriality may be an important factor in job stress. First of all, the stresses attendant with the violation of territory have been noted in a number of settings including a national survey of business and industrial organizations in the United States (Kahn et al., 1964), in mental institutions (Esser, Chamberlain, Chapple, & Kline, 1965; Goffman, 1961), and on board a warship (Roos, 1968). Second, territory invasion is pervasive in organizations. Kahn et al.'s (1964) study shows that 43% of their respondents in a nation-wide survey have roles which require them to at least sometimes have contacts outside of their organization--that is, to cross a boundary and move into other territory. They further find that such increased contacts beyond company boundaries are associated with higher levels of role conflict and job-related tension (both findings are significant at $p < .001$). Forty-six percent report they at least sometimes have contacts with other persons across departmental boundaries within the organization. Virtually identical findings are reported for the relationship between the number of contacts people have across departmental boundaries within the organization and role conflict.

Thus, we find it tempting to include territorial invasion as a major organizational stress variable in our NASA research both because of its prevalence in organizations and because of its potential ability to provoke strain. In an up-coming section on person-environment fit we shall again refer to territoriality when we talk about persons who work in "hostile" environments which are not their home grounds.

Relations with Others

While we can think of the stresses on an individual in terms of some input of impersonal work load units, such as the number of projects assigned or the number of deadlines presented, we do a great disservice to reality if we ignore the interpersonal context in which these role demands are made. What may be an organizational emergency for one person may merely be a small "brush fire" for another individual if the latter person knows that he can count on the people around him for support in trying times.

Psychologists and students of organizational behavior have paid a good deal of attention over the last 20 years to the quality of working relations which people have with one another. Many organizational theorists, in fact, have suggested that good relations between organizational members can be a key factor in improving organizational health (for example, Argyris, 1964; Likert, 1961, 1967; McGregor, 1964). Research has shown that the loyalty that peers have toward one another can increase member satisfaction with their work (Cartwright & Zander, 1960; Mann & Baumgartel, 1953; Mayo, 1960; Zaleznick, Christenson, & Roethlisberger, 1958; for example) and protect the members from job-related worry and anxiety (Seashore, 1954).

Laboratory research in this area has suggested that people actually seek out other individuals when stress increases (Schacter, 1959). A study by Kissel (1965) further suggests that people are not likely to seek out just any individual under stress, but those persons who are likely to provide them with some sort of psychological support. Kissel, using palmar skin conductance as a measure of strain, found that the presence of a friend in the room while the subject was involved in a stressful task reduced palmar conductance; the presence of a stranger had no such effect. The implication is that the strain-reducing properties of other persons related to the focal person are a function of the past history of some enduring and supportive relationships between the focal person and his role senders. Interestingly enough, if others can share the stress, that is, if others visibly endure similar role demands as the focal person, then feelings of psychological strain are reduced (Burlingham & Freud, 1943; Maier, 1965; Titmuss, 1950).

While we have cited studies on the importance of relations with one's peers, there are other studies which demonstrate that relations with one's superior are equally as important. These will not be reviewed here, but there are excellent programs of such research such as reported in Likert's New Patterns of Management, which summarizes much of the work at the Institute for Social Research and in the Ohio State Leadership Studies which began in 1945 (for example, Halpin & Winer, 1957).

The bulk of these studies, when examined, lead one to characterize good relations between the focal person and his role senders as ones in which there exist high trust, high supportiveness, and high interest in listening to and trying to deal with the problems that confront the focal person. These studies are particularly relevant here because they address themselves to the dependent variable, job satisfaction, which we now have reason to believe is an important risk factor in coronary heart disease. If we assume that a sample of people have approximately equal job stresses, then it is not unreasonable to predict that those who also have the poorest relations with the people they work with should experience the most strain.

While there have been no published studies on the relationship between how organizational members get along with one another and coronary heart disease, there is at least one relevant work in progress. In a prospective study in Israel, Medalie (personal communication, 1971) finds that men who like their immediate superior develop less heart disease than men who do not like their superior.

Personality

At this point we turn to a rather different class of variables--traits which are a relatively stable part of the individual, traits which the person brings into the job with him. Laymen have frequently been heard to remark that Mr. Smith is a "coronary *type*" or that "he has *all the makings* of a heart attack." These "clinical" observations have not gone unnoticed by persons studying coronary heart disease. In fact, a fair amount of research has been generated to see whether or not there is a coronary personality. As we noted before we are interested in personality because it is conceivable (a) that people self-select themselves into high overload and high stress jobs, and (b) that persons with certain personality characteristics may react differently to stress than persons without these traits.

The research on personality and its relationship to coronary heart disease, like the research on overload and coronary heart disease, can be divided into two major types: studies of patient populations and studies of normal populations. The studies of patient populations tend to employ retrospective designs and/or measures of the patient which are assumed to be stable and therefore would have produced identical results had the patient been measured before the onset of disease. The studies of normal populations tend to be prospective.

Before the studies utilizing patient populations are reviewed, two potential weaknesses of such research should be pointed out. In dealing with patient populations it is possible that one may end up measuring (a) survivors of coronary attack (the already cited Framingham research shows that up to 50% of all coronary attacks result in [redacted] death), and (b) post-attack impressions which might not be the same as responses the person would have given before he knew he had heart disease.

To return to the research itself, it was pointed out above that people often form their own clinical impressions regarding which of their acquaintances may be a "coronary type." Some of the earliest work in this area has, in fact, been based on clinical impressions. Dunbar (1948) constructed personality profiles for each of her patients. She reported that these patients were hard workers, showing compulsive striving, an urge to succeed in life, and a good deal of self-discipline. The never-ending nature of this psychological mandate for their lives was later described by Wolf (1961) as a "Sysiphus Complex"--the goals set were somewhat unrealistic or unattainable, according to Wolf's clinical impressions of patients he worked with.

If one traces the history of what followed, two currents of research occurred. On the one hand, several studies were carried out attempting to confirm Dunbar's description of the coronary personality which used, as the major methodological thrust, the comparison of coronary heart disease patients and noncoronary controls. A second current of research utilized nonpatients examining the relationship between risk factors and personality and often utilizing prospective designs to predict to coronary heart disease. Let us take up the studies utilizing patients first.

Perhaps the most often quoted study is one by Miles, Waldfogel, Barrabee, and Cobb (1954). They studied a portion of 100 young male coronary patients previously investigated by Gertler and White (1954). Tests including the Cattell 16 PF and the Rorschach, as well as a social history, were administered to these men and a group of controls who were slightly younger (41.7 years versus 39.0 years), slightly more educated, and who had a smaller proportion of Jews among them (Jews, at least in the New York clothing industry, have a higher prevalence of atherosclerosis (Epstein, Boas, & Simpson, 1957)). There were virtually no personality differences on the tests mentioned. However, 50% of the coronary group compared to 12% of the controls reported working <u>longer hours</u> and taking <u>fewer vacations</u> (in addition to reporting greater stress and strain). The authors, perhaps rather harshly, concluded that they could find no support for Dunbar's coronary personality. Indeed, the hours a person chooses to work and the vacation time he chooses to take would seem to be more valid as an indicator of personality traits than a questionnaire for the former relies on reports of actual occupational behavior which are directly relevant to Dunbar's characterizations. Consistently enough, Miles et al. also found that 24% of the respondents showed a personality pattern which indicated compulsive striving, hard work, self-discipline and so on, compared to 10% of the controls. While this difference is not statistically significant, it is in the expected direction.

In the other studies of patients which followed, there has been a lack of support for Dunbar's personality type. Cleveland and Johnson (1962) administered the Rorschach and TAT to 25 coronary patients, average age 35, and found that their patients had lower achievement motives than the non-coronary patient controls. The TAT data suggested that the coronary subjects showed "a generally despondent, hopeless, and 'what's the use' attitude." O'Connell and Lundy (1961) compared arteriosclerotic heart disease patients with a group of hypertensives. The coronary disease patients set very low goals in a level of aspiration task--again hardly in keeping with the Dunbar characterization. Interestingly enough, the hypertensives set "unrealistically high goals."

Some epidemiologists were disturbed with the fact that these studies had been dealing with patient populations where post-attack impressions might have been biased by knowledge of their disease state. Ibrahim, Jenkins, Cassel, McDonough, and Hames (1964) set out to tackle this problem. They isolated various groups of nonpatients who, on the basis of scores on serum cholesterol level and systolic blood pressure, could be separated into high, moderate, and low risk groups. The high risk groups were high on both cholesterol and systolic blood pressure, the low risk groups low on both, and so on. Then they compared these groups with coronary patients groups using the Anxiety, Repression, and Lie scales of the MMPI. They found, as hypothesized, that a pattern of low hostility, and high anxiety and repression were present in 67% of the coronary patient group, 24% of the high risk group, 23% of the moderate risk group, and 24% of the low risk group. Thus, they concluded that this set of traits occurs after the onset of the disease. Further research has suggested that the impact of a coronary attack can produce lowered achievement orientations (Miller, 1965) and depression (Klein, 1964).

Thus, the studies utilizing patients, are at best confounded by the interaction of the experienced attack and the personality of the individual. Let us turn, then, to the other set of studies--ones which utilize non-patients.

The most ambitious set of these studies are the longitudinal studies by Friedman, Rosenman, and their colleagues who make up the Western Collaborative Group. This longitudinal research was preceded by a number of studies in which a specific overt behavior pattern known as Type A was statistically examined in relationship to certain risk factors in coronary heart disease. Type A, in the words of Friedman, Rosenman et al., can be characterized as:

> excessive drive, aggressiveness, and ambition, frequently in association with relatively greater preoccupation with competitive activity, vocational deadlines, and similar pressures. An enhanced sense of time urgency is usually also exhibited by subjects possessing this interplay of endogenous behavioral factors and exogenous pressures, with various resulting characteristic motor mannerisms and stylistics. The relative absence of this interplay has been designated as characterizing the subject with behavior pattern Type B. [Rosenman, Friedman, Straus, Wurm, Jenkins, Messinger, Kositchek, Hahn, & Werthessen, 1966]

In these studies the Type A pattern is a behavior pattern. The assessment of Types A and B is performed by trained interviewers who observe the manner and style as well as the content of answers to interview questions. Explosive speech, anticipating the nature of the question before it is fully answered, and rapid speech are examples of some of the behaviors which are coded.

Behavior pattern A has now been shown to be associated with a variety of risk factors in coronary heart disease. These risk factors include elevated serum cholesterol, triglycerides, and beta-lipoproteins (Friedman

& Rosenman, 1959, 1960; Friedman, St. George, Byers, & Rosenman, 1960; Rosenman & Friedman, 1961; Rosenman, Friedman, Straus, Jenkins, Zyzanski, & Wurm, 1970; Rosenman, Friedman, Straus, Wurm, Kositchek, Hahn, & Werthessen, 1964), decreases in blood-clotting time and increased incidence of arcus senilis (Friedman & Rosenman, 1959; Rosen & Friedman, 1961), elevated daytime secretion of norepinephrine (Friedman, St. George, Byers, & Rosenman, 1960), capillary ischemia in conjunctival tissue (Friedman, Byers, & Rosenman, 1965; Friedman, Rosenman, & Byers, 1964), and hyperinsulemic response to glucose challenge (Friedman, Byers, Rosenman, & Elevitch, 1970). In addition, Type A has also been found to be associated with the incidence of coronary heart disease (Friedman & Rosenman, 1959, 1960; Rosenman & Friedman, 1961; Rosenman et al., 1966, 1970).

Similar findings relating serum cholesterol level and Type A have also been reported by other investigators not associated with the Friedman-Rosenman Western Collaborative Group. Thus, Sloane, Habib, Eveson, and Payne (1961) compared 13 student volunteers free of coronary heart disease but with abnormally high fasting cholesterol levels (greater than 165.5 mg percent) with 13 subjects with abnormally low cholesterol levels (less than 107 mg percent). In blind psychiatric interviews with both groups it was noted that the high cholesterol students were more aggressive and outgoing. Furthermore, they were more competitive in a group situation. On self-ratings they showed significantly greater mean scores on indices of physical and verbal hostility and hostile attitudes.

Because all of these studies are static rather than dynamic over time, Friedman and Rosenman et al. set out to perform a longitudinal study in an attempt to predict from behavior pattern A to coronary heart disease. Three thousand five hundred twenty-four male participants, ages

39-59, employed in 11 large private organizations in California were observed beginning in 1960. The subjects were matched on age and occupation. Comprehensive data was obtained at intake and at annual intervals thereafter. In a follow-up report at two years (Rosenman et al., 1966), subjects classified as Type A in 1960 had already incurred coronary heart disease at a rate three times as great as the Type B subjects ($p < .01$). Comparing all other differences between the Type A and B groups at that time, the authors concluded that the behavior pattern "furnished the most important single prognostic entity" (p. 86). These findings held up for the groups if they were further broken down into decades--in which case the 39- to 49-year-old Type A group had six times the incidence of coronary heart disease as the Type B group ($p < .01$). In the 50- to 59-year-old groups, Type As had almost twice the incidence of coronary heart disease as Type Bs ($p < .05$).

The most recent follow-up has occurred four and one half years after the start of the study (Rosenman et al., 1970). Again, a significantly higher incidence of coronary heart disease has been found in groups which had initially been high on risk factors such as parental history of coronary heart disease, systolic and diastolic blood pressure, cigarette smoking, serum cholesterol level, serum triglycerides, and beta-lipoproteins. A positive association between Type A and coronary heart disease was again present in this follow-up. Furthermore, in the 39- to 49-year-old group, the Type A men have over twice the incidence of coronary heart disease as do the Type B men, <u>even when all of the above physiological correlates of coronary heart disease are statistically held constant</u> ($p < .002$). Among the 50- to 59-year-old group there is a nonsignificant trend in the same direction.

In an attempt to further validate the Friedman and Rosenman Type A pattern, Keith, Lown, and Stare (1965) have compared three groups of hospital patients: coronary, peptic ulcer, and those having neither disease. Subjects were rated in blind interviews on a four-point scale, using the Friedman and Rosenman interviewing technique, which ranged from fully developed Type A to fully developed Type B with two intermediate groups. In the 35- to 44-year-old group, Keith et al. were able to identify correctly two-thirds of the coronary group as Type A with less than one-third of the noncoronary group as false positives. In the 45- to 49-year-old group, however, a reverse association occurred where two-thirds of the coronary group were found related to Type B. The authors concluded that

> The findings of the present study show that such behavior characteristics are not specifically associated with coronary artery disease. [P. 430]

This is surprising in light of a number of methodological problems with the study which would have, at best, suggested that any such conclusion should be withheld. First of all, Keith et al. noted that the interview reliability was "not very high." Second, only seven persons were assigned to the fully developed Type A category and only 16 to the fully developed Type B category. Sixty-four subjects fell into the intermediate categories. Since Keith et al. dealt primarily with partially developed behavior patterns of Types A and B, one might question whether Keith et al. had an adequate sample of Types A and B on which to test their hypothesis. Furthermore, the behavior pattern interview was designed for <u>predictive</u> purposes, and the study reported on here examined patients who already had knowledge of their disease state (we have already commented on the weaknesses inherent in such studies).

In the wake of this "failure to replicate," it was noticed that 25 of the subjects under age 50 at the time of the beginning of the Western Collaborative Group Study had, unknown to the investigators and unknown to the subjects, suffered a silent myocardial infarction. This provided an excellent opportunity to study personality differences in persons with coronary heart disease who, unlike the subjects in the patient studies already reported on, had no knowledge of their disease state. The study, carried out by Jenkins (1966), showed that the silent infarct group scored significantly higher on the behavior pattern Type A than age and occupation-matched controls.

While the interview procedures for classifying behavior type seem to have been very productive in producing a consistent set of results, the procedure itself is costly in that interviewers have to be trained and their reliability checked on. Therefore, attempts have been made to develop paper-and-pencil measures of Type A. The Jenkins Activity Scale (Jenkins, 1967) has been one attempt which has shown a high degree of concurrent validity with the interviews. It has also been shown to discriminate between persons with high and low serum uric acid (Jenkins & Hames, forthcoming), a disputed risk factor in coronary heart disease. Sales (1969a) has also attempted to develop a questionnaire measure of the coronary personality. Additional information on the Sales measure will be presented in a later section of this report. For now, we should point out that research on the measure is still in a preliminary stage.

As we noted earlier, one of our major interests in personality concerns its role as a conditioner of the effects of stress on strain.

There are some, but not many, examples of this type of research. For example, Fishman (1965) studied the mediating effects of the need for social approval, measured by the Crowne-Marlowe test, on the relationship between being able to aggress at some frustrator and consequent tension reduction. Sixty females from a teachers college served as subjects in a laboratory experiment in which the experimenter introduced frustration by preventing the subjects from successfully completing a task. Some of the subjects were allowed to aggress against the experimenter by filling out a post-experiment questionnaire in which they were asked to state how they felt about the experimenter. Tension reduction was measured by drops in systolic blood pressure. High need for social approval subjects who were frustrated showed less aggression than low need approval subjects. Furthermore, following aggression there was a significant drop in systolic blood pressure, but only if the person was low on social approval ($p < .01$). Subjects high on need for social approval showed no such drop.

In a second study, also using the Crowne-Marlowe measure of need for social approval, this writer performed an analysis of some of the data gathered by Kasl, Cobb, and Brooks (1968). In this study data were gathered on 28 blue collar employees concerning their report of person-environment fit on a number of dimensions of their work; the relationship between amount of fit and serum cholesterol as a function of their need for social approval was examined. The results are presented in Table 2. Subjects who reported poor person-environment fit, that is, the aspects of their job they reported on were not present in amounts commensurate with their needs, tended to show high cholesterol values (inverse correlations between person-environment fit and serum cholesterol)--but only if they were also high on need for social approval. Subjects low on need for social approval showed correlations between poor person-environment fit and serum cholesterol level which were much lower in magnitude.

TABLE 2

CORRELATION OF PERSON-ENVIRONMENT FIT MEASURES WITH CHOLESTEROL FOR HIGH AND LOW CROWNE-MARLOWE RESPONDENTS

P-E Fit Dimension	Crowne-Marlowe Low	Crowne-Marlowe High
Interesting things to do on job	.25	-.35*
Opportunities to learn new things and skills	.03	-.22
Time filled with enough things to do to keep busy	-.14	-.46
Adequate authority and responsibility	.15	-.26

*N = 28; each dimension is a single item pair asking the subject "how much is there?" and "how much would you like?" A difference score is then computed for the pair. A low score on person-environment (P-E) fit indicates poor reported fit.

The findings of this study suggest that maintaining good person-environment fit, particularly on the dimensions described in the table, which include keeping one's time filled with things to do and having interesting things to do, is a socially desirable thing for some people. For others, who are low on the need for social approval, poor person-environment fit apparently has no such meaning. Thus, poor fit for the high need for social approval subjects may constitute a threat to their ability to satisfy that need, and consequently, these stresses, when confronted, are most likely to elevate their serum cholesterol levels.

Some support for the relevance of a need for social approval as an important personality trait associated with coronary heart disease comes from a recent study by Jenkins, Hames, Zyzanski, Rosenman, and Friedman (1969). They administered the California Personality Inventory (Gough, 1957) to 34 San Francisco firemen and 152 male supermarket employees in

Georgia. The socialization scale, which measures adherence to social norms, correlated .46 ($p < .05$) with serum cholesterol. Thus, there appears to be some set of traits having to do with the approval by others, being sensitive to the demands of others, or "other-directedness" to borrow the term from Riesman (1950), which is related to risk factors in coronary heart disease.

Other personality variables which may serve as mediators of the effects of stress on strain include flexibility-rigidity which is also from the California Personality Inventory, and the Emotional Dependence Scale (developed by Sampson, 1960). The importance of these latter two traits derives primarily from Kahn et al.'s (1964) research on role conflict. Persons who are flexible tend to engage in more role conflict situations and report greater job-related tension when they encounter conflicts. Furthermore, persons who are emotionally dependent on others in their role set may have difficulties in breaking off from the stressful interpersonal interactions; their dependence may lead to greater involvement in their psychological relations with colleagues, and they, therefore, may be more likely to experience strain under conflict.

Person-Environment Fit

Our essential notion here is that it is the lack of fit between the needs and abilities of the individual and the commensurate supplies and demands of the environment which constitute basic sources of stress for the individual (Arrows J and L in Figure 1). This characterization of the cause of strain is not new to the literature and has been developed and conceptualized by a number of theorists (for example, Barker, 1960; French, Rodgers, & Cobb, forthcoming; Jahoda, 1961; Lewin, 1951, Murray, 1938;

Pervin, 1968).

One of the concepts we have already discussed, overload, falls within the domain of person-environment fit--for overload implies that the person is faced with more work than he prefers to handle and/or has the ability to handle. Thus, the studies which we have presented on the relationship between overload and coronary heart disease can also be viewed as examples of the relationship between poor person-environment fit and disease.

In a sense, the use of personality variables as conditioners of relationships between stress and strain also follows the person-environment fit model. Essentially, personality represents qualities in the person, and the environment is characterized by the stresses of work load and conflicts. In cases where personality does condition the stress-strain relationship, we say that the fit between the personality and the environment is poor if it leads to strain and good if it leads to no strain.

To minimize method variance and to insure conceptual comparability it is usually typical to insist that the measures of the person and the measures of the environment be in quite commensurate terms. Thus, we could ask a person how many meetings per week the individual would prefer, as a measure of the person, and also ask how many meetings the person has, as a measure of the environment. These responses can then be compared for degree of fit.

We make the distinction between objective fit and subjective fit just as we have made the distinction between the objective and subjective environment. Unfortunately, it is very difficult to obtain objective measures of how many meetings a person <u>wants</u> or can adequately handle in relation to how many meetings the person actually has, since this requires an independent measure of the person's motive states. Therefore, most of the current research on person-environment fit has concentrated on subjective rather than objective fit.

Age: A Conditioning Variable

We view age as an important variable not merely because as people get older their blood pressure, cholesterol, and other risk factors may change, but because as people get older, the consequences of social and organizational stresses may increase. Older persons may find it difficult to find other jobs. Thus, they may feel their job security is more threatened by inabilities to do all their work than would be the case with younger people. For reasons such as these, age might act as a conditioning variable producing higher levels of psychological and physiological strain in older than in younger people given the same level of stress.

Risk Factors--The Dependent Variables

In this section the dependent variables used in the study will be briefly described providing some information about their "pedigree" as risk factors in coronary heart disease.

Psychological Strains

There are three main types of strain which will be examined: low job satisfaction, job-related threat, and low self-esteem. Research reviewed earlier in this chapter suggested that low job satisfaction is positively correlated with serum cholesterol (Sales, 1969a, 1969b) and with the incidence of coronary heart disease. The latter finding was particularly striking due to the magnitude of the relationship ($r = .67$). Less, however, has been said about job-related threat and low self-esteem, so some of the literature relevant to these two variables will be reviewed here.

Taking up the notion of threat first, we should distinguish between threat and noxious stimulation confrontation. Threat is produced by anticipating the onset of some particularly noxious stimuli (such as an examination or a visit to the dentist). On the other hand, confrontation deals with the actual occurrence of these stimuli (such as actually taking the examination or being in the dentist's chair). A number of studies now suggest that the strain reaction of people may be greater during threat than during actual confrontation with the stressor (Grinker & Spiegel, 1945; Lazarus, 1966; Mechanic, 1962; Shannon & Isbell, 1963).

Overload, such as cramming before examinations or working under a tight deadline, may be stressful merely because it immediately taxes the person's mental and physical capabilities to do the job at hand. However, overload may also generate strain because it may be threatening. The person may begin to worry about the possibility that he will be unable to complete the work in time and may, therefore, eventually have to confront dissatisfied role senders such as the boss and customers. The individual may feel that this possible confrontation will be very unpleasant because at that time people may express their dissatisfaction with the individual's performance; in other words, they will communicate low public esteem to the overloaded person. Thus, an overload at Time 1 can raise feelings of threat in the individual about what may happen at Time 2 if the overload cannot be adequately coped with.

There is little research relating threat to coronary heart disease, but one study by Kasl, Cobb, and Brooks (1968) is relevant. They carried out a longitudinal study of serum uric acid and serum cholesterol in married, employed men who eventually lost their jobs because of a permanent plant shutdown. The sample of 200 men was composed primarily of blue collar workers from three companies which were closing and two control companies. The study picked up these men prior to the job loss and at periods following the job loss. Thus, if threat of the loss was present in the anticipation period, high levels of strain should be manifested then with little or no increase in the post-job-loss period when the men were still unemployed. This, in fact, turned out to be the case. Anticipation of the impending plant shutdown was associated with a sharp increase in uric acid levels ($p < .005$) which remained high during the job-loss period. Serum cholesterol, however, remained unchanged during the anticipation period. Similar findings have been reported by Rahe and Arthur (1967) in a study of men awaiting the start of their underwater demolition training. Uric acid levels were initially high while cholesterol, if anything, was slightly below the normal mean of the men. In the Dreyfuss and Czaczkes (1959) study of medical students, cholesterol levels went up just prior to the examinations the students were scheduled to take. The meaning of the anticipation may have to be further understood before we can predict which physiological response variable will be most likely to react (Kasl et al., 1968).

A third measure of psychological strain which will be examined here is self-esteem. Little is known about the relationship of self-esteem to coronary heart disease but a few studies do appear to be germane. Research by Kasl and Cobb (1970) on approximately 150 men followed over a two-year period during which many of them lost their jobs in a plant shutdown shows that drops in diastolic blood pressure are associated with increases in reported self-esteem (gamma = .64, tau = .53, $p < .001$). These men were studied from a time just prior to the shutdown of plants they worked in until later periods when they entered stabilized re-employment. Eighty percent of the men showed higher diastolic blood pressures in the period just before they lost their jobs than they did in the succeeding periods of re-employment.

It appears that the loss of job was a blow to the person's self-esteem, and in turn, this loss of self-esteem may have raised diastolic blood pressure levels. The mean drop in diastolic blood pressure upon stable re-employment was 3.06 mm Hg (the mean drop for systolic blood pressure was 5.32 mm Hg). It is not unreasonable to suggest that the loss of self-esteem may be even greater (and hence the increase in blood pressure also greater) in situations where a person is fired from his job while others still retain their employment.

In a study of the same population, Kasl et al. (1968) found that while cholesterol level did not change in anticipation of the job loss, it did increase as the job loss occurred, and it subsequently decreased after the men got new jobs. Kasl et al. showed that nurses' ratings of the men on anxiety, sadness, and low self-esteem, ratings which were combined because of high intercorrelations between them, tended to have low serum uric acid ($r = -.45$, $p < .01$) and high serum cholesterol ($r = .41$, $p < .025$). However, these findings held only for men who were flexible (CPI rigidity scale) and low on defensiveness suggesting that for rigid, defensive persons the ratings may have been of dubious validity.

Nevertheless, there are other studies which suggest that measures of self-esteem might be included in a study of the relationship between job stress and related strains. Kasl and French (1962), for example, found that self-esteem and frequency of visits to medical dispensaries for reasons other than physical injuries were inversely related ($r = -.47$, $p < .01$). This finding was based on data gathered from 527 male nonsupervisory and 198 male supervisory employees in a nation-wide manufacturing company. Sloane et al. (1961), in a study of student volunteers described earlier, found that high cholesterol subjects had lower self-esteem, as measured by the discrepancy between real and ideal self regarding a self-assessment of anxiety, than subjects with low serum cholesterol levels.

Since self-esteem is essentially a measure of satisfaction with one's self, and since we now have evidence relating job satisfaction and life satisfaction to coronary heart disease, it will be interesting to see whether or not self-esteem relates to other risk factors in coronary heart disease and is affected by stresses such as work load.

With regard to overload, we know from the French et al. (1965) study of university administrators and professors, for example, that among administrators the more subjective quantitative overload they report, the lower is their self-esteem ($r = -.65$). On the other hand, subjective qualitative overload is unrelated to self-esteem among the administrators ($r = -.03$). Yet, among professors subjective quantitative overload is unrelated to self-esteem ($r = -.11$) while subjective qualitative overload is negatively related to self-esteem ($r = -.26$). Mott, Mann, McLoughlin, and Warwick (1965) in a study of over 600 shift workers in five industrial plants in the United States found that workers' difficulty in adjusting to and handling a variety of roles ranging from that of husband to that of employee were negatively associated with self-esteem (overall $r = -.17$).

Cigarette Smoking

Whether cigarette smoking is a cause or merely a noncausal correlate of coronary heart disease is a largely unresolved issue. Nevertheless, there is rather complete agreement with regard to the fact that smoking is associated with the disease.

Because the literature on this topic is so voluminous, a thorough review of it could not be given justice here. The conclusions of the 1971 Surgeon General's Report (U.S. Department of Health, Education, and Welfare, 1971), however, provide probably the most authoritative review to date of the literature on smoking and heart disease. The highlights of the report can be summarized as follows: (1) Both prospective and retrospective studies indicate that cigarette smoking is a significant risk factor contributing to the development of coronary heart disease. The risk for cigarette smokers is appreciably greater than that for pipe and cigar smokers. (2) Cigarette smoking operates independently of other risk factors as well as jointly with them to increase the risk of CHD appreciably. (3) Cigarette smoking may accelerate pathophysiological changes of coronary heart disease already present and may contribute to sudden death from CHD. (4) Autopsy studies suggest that cigarette smoking is associated with a significant increase in atherosclerosis of the aorta and coronary arteries. (5) Cessation of smoking is associated with decreased risk of death from CHD. (6) Experimental studies in animals and humans suggest that there are at least six different physiological mechanisms which have been identified by which cigarette smoking may contribute to CHD and/or its manifestations. (7) Numerous prospective studies indicate that cigarette smoking is associated with increased mortality from cerebrovascular disease. (The above seven points were freely quoted from P. 51-52 of the report.)

Smoking also remains as an important risk factor because of research which has suggested that it is associated with personality traits, which appear to be related to the Type A behavior pattern. McArthur, Waldron, and Dickinson (1958) provide an excellent illustration of this point.

They studied 252 Harvard alumni who participated in the Study on Adult Development. These men were selected during their sophomore years which fell between 1938 and 1940. At the time they were picked for their lack of physical abnormality. They were then followed up over a period of 15 years during which a wide range of medical, physiological, psychological, anthropological, and sociological data were collected. The results indicate that nonsmokers prefer "belonging to few societies" while smokers report "belonging to many societies ($p < .02$)." Of the nonsmoker they said that he is an

> Inner-directed person . . . and maybe an introvert . . . he approves scientific rather than business values and may often himself be a scientist or engineer. [P. 270]

On an administration of the Strong Vocational Interest Blank, the smokers were most like the profile for the occupation "sales manager" and least like the occupation "scientific researcher worker ($p < .01$)." On the basis of these findings we might expect to find populations of administrators permeated by significantly more smokers than populations of engineers and scientists. The finding on introversion is in keeping with Eysenck, Tarrant, and Woolf's (1960) finding that extroverts smoke more.

With regard to the heavy smoker, McArthur et al., concluded that:

> Most have had marital problems, some quite dramatic. All are given to impulsive acts, some to physical violence if only in the form of volunteering for dangerous missions. Several are <u>hard-driving</u>, <u>tough competitors</u>. None are usual for our group. As one observer phrased it, "they are men who live in overdrive."[3] [P. 271]

These characteristics certainly seem similar to Friedman and Rosenman's Type A person.

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[3]Emphases added.

The observation about volunteering noted above has also been documented by Schubert (1964, 1965). In studies of male and female college freshmen, he finds that smokers, compared to nonsmokers, are more likely to volunteer for psychology experiments, score higher on an MMPI measure of impulse expression (Impulsivity Scale), show a greater preference for thrill-seeking activities, such as a roller coaster ride, but report being more bored with activities which require attention to routine details. Schubert suggests that smoking is associated with an overall personality disposition which he terms arousal seeking.

An interesting finding, because it suggests that smoking may be inversely related to early oral gratification, is the McArthur et al. (1958) finding that the ability to stop smoking was directly proportional to the number of months subjects reported they were fed from their mothers' breasts ($p < .05$). Since it is probably very difficult to accurately remember events from one's infancy (breast feeding data were based on subjects' retrospective reports), perhaps this finding has more to say about the relationship between being able to stop smoking and the number of months one believes one's mother breast fed. Additional support for the oral gratification thesis is found in the research of Jacobs, Knapp, Luleen, Anderson, Karush, Meissner, and Richman (1965). Two studies were carried out: one using 97 adult males who were primarily college graduates, and one using 136 adult males who had no more than high school educations on the average. Early oral frustration in childhood was measured by subjects' responses on a questionnaire which dealt with their mothers' behavior with regard to a number of factors having to do with parent-child relationships. In both studies, early oral frustration was found to be positively associated with heavy smoking (more than 25 cigarettes per day) and negatively associated with an ability to give up smoking.

Among the studies which implicate personality as a determinant of smoking are a number of studies of twins which also suggest that smoking may be related to some enduring, dispositional, genetic aspects of the individual. Fisher (1958), in an attempt to separate out the effects of environment from heredity, studied the smoking habits of 51 pairs of monozygotic male twins and 31 pairs of dyzygotic male twins in Germany, and 53 monozygotic female pairs and 18 dyzygotic female pairs in England. In both instances, Fisher found monozygotic pairs more alike in their smoking habits than dyzygotic pairs. Similar results have been reported by Friberg, Kaij, Dencker, and Jonsson (1959) and by Todd and Mason (1959).

Subsequent reviews of the literature on the use of twin registries have been carried out by both the Surgeon General (U.S. Department of Health, Education, & Welfare, 1971) and the Karolinska Institute (1969) international symposium on twin studies of chronic disease. These reviews show that the twin studies are so far inconclusive with regard to the role of genetic factors in coronary heart disease. If anything, the studies have tended to suggest that cigarette smoking is a "cause" of coronary heart disease. This is contrary to the proponents of the constitution hypothesis such as Seltzer (1968) who has argued that there are no grounds for inferring a causal link between smoking and coronary heart disease, and that constitutional differences between smokers and nonsmokers may account for differences in the prevalence of heart disease among the two groups. The Surgeon General (1971) concludes that "the hypothesis that genetic factors 'cause' both heart disease and smoking is open to question" (p. 37).

Physiological Risk Factors

The risk factors which we shall be examining in this study include serum cholesterol, diastolic and systolic blood pressure, glucose, serum uric acid, serum cortisol, alpha-beta-lipoprotein ratio, pulse rate, and ponderal index (which is a measure of obesity). Most of these dependent variables in our model have come up in the literature we reviewed. In that literature one or more of these factors were related to stress situations such as overload and deadlines. Other of these factors were also related to Type A behavior pattern. Here, we shall briefly acknowledge the extent to which each of these physiological variables is a worthy risk factor in coronary heart disease.

There is substantial evidence linking high serum cholesterol levels with coronary heart disease (for example, Cady, Gertler, & Nowitz, 1964; Chapman & Massey, 1964; Doyle, Heslin, Hilleboe, & Formel, 1959; Doyle & Kannel, 1970; Epstein & Moore, 1968; Gertler, Whiter, & Welsh, 1957; Paul, 1970; Ward & Hook, 1962). Unfortunately, while cholesterol is believed to build up in arterial plaques and obstruct arteries, the exact mechanism by which this occurs or by which cholesterol exerts other harmful effects is still unknown (Moses, 1963).

Turning to blood pressure, we should note that the pressure of the arterial system is maintained by an intricate system of factors including blood volume, viscosity of the blood, elasticity of the major arterial walls, and chemical regulators such as norepinephrine and epinephrine. With each cardiac cycle pressure waves are set up whose peak and trough are a function of this system of regulators. The peak or maximum pressure sustained by the cardiovascular system occurs during ventricular contraction and is known as systolic pressure. The minimum pressure corresponding to the resting phase of the cardiac cycle is known as the diastolic blood pressure. Again, as is true of cholesterol, the processes by which the elevation of blood pressure occurs, and often remains consistently high as in the case of hypertension, is still a matter open to "vigorous debate" (Geiger & Scotch, 1963). Furthermore, the mechanisms by which blood pressure may produce coronary heart disease are also not well understood.

Doyle (1966), reviewing epidemiological studies of coronary heart disease, reports that coronary heart disease is three to five times more common among individuals who habitually exhibit elevated diastolic blood pressure. A number of such studies demonstrating this relationship between high levels of blood pressure and coronary heart disease have appeared in the literature (Chapman & Massey, 1964; Doyle et al., 1959; Doyle & Kannel, 1970; Epstein, 1967b; McDonough et al., 1965; Paul, 1970; Rosenman et al., 1970; Stamler, 1964).

The next risk factor which will be considered is pulse rate. The identification of pulse rate as a risk factor has occurred only recently. There are only two studies, besides the already reported on research of Caplan and French (1968), which link pulse rate to coronary heart disease. The first of these studies is by Stamler, Berkson, Lindberg, Miller, Stevens, Soyugenc, Tokich, and Stamler (1969). They examined the relationship between resting heart rate and ten-year age-adjusted mortality rates for sudden death coronary heart disease. The sample was composed of 1,329 male employees of Peoples Gas Company in Chicago. To control for possible contributory effects of cholesterol level, diastolic blood pressure, relative weight, and smoking behavior on coronary heart disease, they divided their sample up into high and low groups on these measures (in the case of smoking the groups were smokers and nonsmokers). They found that regardless of the group tested, the relationship between resting pulse rate and death rate was positive.

The second study, examining disorders of rate and rhythm, Hinkle, Carver, Stevens, and Scheidt (1970), studied 301 men who were followed up over a six-year period. The men were between 54 and 58-years-old at the beginning of the study during which time six hour recordings were made of electrocardiograms as the subjects underwent "standard routines of position, activity, eating and digestion" (p. 6). Out of this group, 19 deaths occurred during the study. Pulse rate, measured in the morning in a supine position which was greater than 70 beats per minute and higher than that mean by 15 beats per minute during the p.m. hours, significantly distinguished between those who died and survived ($p < .005$).

Ever since the early work of Levine (1922) and Joslin (1927) it has been well-known that diabetes, an inability to properly metabolize glucose, predisposes the individual to atherosclerosis. Kendall (1954) has observed that the links of these biochemicals to diabetes could easily be used to illustrate links to atherosclerosis since both may be manifestations of the same metabolic disease.

Epstein (1967a) reviews a number of studies which link glucose to coronary disease as a risk factor including research from the Tecumseh Community Study (Epstein, Francis, Hayner, Johnson, Kjelsberg, Napier, Ostrander, Payne, & Dodge, 1965) which suggests that the risk of dying of coronary heart disease is significantly greater among persons with antecedent hyperglycemia. Elevated blood sugar levels in that study were associated with coronary heart disease independent of serum cholesterol and blood pressure elevation, even though hypertension and hyperglycemia were correlated. Unpublished observations from the longitudinal Framingham

Community Study (reported in Epstein, 1967a) on "casual" blood sugar corroborate this finding. They show that

> Even by this relatively crude measurement, the total incidence of deaths from heart attacks during the subsequent 12 years were clearly related to blood sugar. [P. 612]

The role of serum uric acid in coronary heart disease is somewhat unclear. Indeed, it is not an accepted risk factor in heart disease although it is known that persons with gout, a condition associated with excessively high levels of serum uric acid, are more prone to coronary heart disease than age- and sex-matched individuals free of gout (Bellet & Roman, 1969). One recent epidemiological study by Gertler, Whiter, and Welsh (1965) has shown that a significantly higher level of serum uric acid was found in subjects who were coronary prone because of high levels on a number of other risk factors. Specifically, serum uric acid has been shown to be associated with serum cholesterol and obesity (Gertler, White, Cady, & Whiter, 1964).

On the other hand, there has been a significant body of research which has shown an association between achievement-oriented behavior and serum uric acid levels. Brooks and Mueller (1966), in a study of 51 university professors described earlier herein, found impressively large correlations between serum uric acid and measures of drive ($r = .59$), achievement ($r = .53$) and leadership ($r = .53$). The fascination with these personality variables derives from the closeness to the conception of behavior Type A--the hard-driving, achievement-oriented individual. A relationship between serum uric acid and achievement behavior has been demonstrated in professor populations by Mueller (1970), in populations of high school boys (Dunn, Brooks, Mausner, Rodnan, & Cobb, 1963; Kasl, Brooks, & Rodgers, 1970), and in populations of employed men from various occupations (Dodge & Mikkelsen, 1964; Montoye, Faulkner, Dodge, Mikkelsen, Willis, & Block, 1967).

Other studies on serum uric acid have suggested that it may be a useful indicator of psychological stress. Rahe and his co-workers (Rahe & Arthur, 1967; Rahe, Rubin, Arthur, & Clark, 1968) studied Navy men during a four-month underwater demolition training program and found that serum uric acid was higher during that time than expected or noted in healthy men. Furthermore, serum uric acid appeared to fluctuate as a direct function of the anticipation of some arduous aspect of the program providing the men were optimistic about their ability to meet the situation--but these latter inferences are based only on the judgment of the researchers rather than on subjects self-reports of anticipation and optimism. Similarly, in the Kasl et al. (1968) study of men losing jobs, which we have described earlier, the anticipation of job loss was associated with elevated serum uric acid levels.

Cortisol is yet another biochemical of interest in our study. The author could find no study which documented its relationship to coronary heart disease. Nevertheless, it may be a relevant indicator of stress because: (a) it is secreted by the adrenal cortex which is highly responsive in reacting to stress (Selye, 1956); (b) it is synthesized from serum cholesterol (Moore, 1963); and (c) cortisol exerts an influence on the metabolism of fats and carbohydrates by increasing blood sugar and mobilizing fat, both of which are related to coronary heart disease as risk factors.

The last risk factor which we shall examine will be obesity which is often measured in terms of ponderal index. The index is the person's weight divided by the cube root of his height. Obesity might be thought of as a controversial risk factor. On the one hand, it has been found to be associated with coronary heart disease in a number of studies (Chapman & Massey, 1964; Dawber, Moore, & Mann, 1957; Doyle, 1963; Pell & D'Alonzo, 1961, 1963). Other studies, however, have failed to find an association between coronary heart disease and obesity (Borhani, Hecter, & Breslow, 1963; Keys, Taylor, Blackburn, Brozek, Anderson, & Whiter, 1963; Paul, Lepper, Phelan, Dupertuis, MacMillan, McKean, & Park, 1963). Since obesity is often associated with hypertension, diabetes, abnormal serum cholesterol, and triglycerides, all of which are risk factors, coronary proneness in overweight people may be merely a result of the presence of these other factors (Bellet & Roman, 1969).

A recent study using Framingham data (Gordon in Damon, Damon, Harpending, & Kannel, 1969) found that risk of coronary heart disease was still highest for obese individuals in several age groups even when systolic blood pressure, cigarette smoking, and serum cholesterol were statistically controlled. However, Damon et al. reviewed 32 studies of ponderal index of which 14 studies showed a positive relationship between obesity and coronary heart disease and 18 showed no relationship. A few other studies, also reviewed, included either measures of sheer weight or relative weight computed by some other index. The same equivocal pattern of results appear in these also.

Hypotheses to Be Tested

In a moment of idleness, the author once figured that there were over 4,500 separate predictions which could be tested in the study. In light of this voluminosity, it seems reasonable to content ourselves with a brief presentation of the major hypotheses to be tested.

Essentially, there are two major tasks which lie before us in this study. First, we need to explore the nature of basic links between stress, strain, and personality. Second, we must examine the occupational differences in stress, strain, and personality, and occupational differences in the relationship between stress and strain. In this way, we may begin to get some idea as to why administrators at NASA seem to have a higher incidence of coronary heart disease than do engineers and scientists.

We should point out here that we shall often be searching for unknown relationships between stress and strain, and in such cases, our hypotheses will really be open questions rather than predictions about what should happen--although in many cases the hypotheses follow from the literature we have reviewed or from our model.

The nature of the study to be described is cross-sectional rather than longitudinal which means that it is difficult (except in rare instances such as parental history of heart disease) to infer which variables precede others in some time sequence. Nevertheless, in terms of our theory, we shall assume that the stresses precede the strains, and therefore, we shall refer to stresses as independent variables. It will remain for field and laboratory experimentation to determine the empirical basis of this assumption.

General Hypotheses

(1) Objective quantitative overload will be positively related to subjective quantitative overload. Confirmation would essentially replicate Caplan and French's (1968) findings.

(2) The relationship between objective quantitative work load and indicators of strain will be explored. On the basis of the study by

Caplan and French (1968), objective quantitative work load should be positively related to serum cholesterol even when the effect of subjective quantitative overload is removed (statistically). On the other hand, the relationship between objective overload and pulse rate should drop to zero when the effect of subjective quantitative overload is removed (assuming we again find objective overload and pulse positively correlated). We shall also see what other strains are related to quantitative work load including the following psychological strains:

(a) job-related dissatisfaction,

(b) job-related threat,

(c) low job-related self-esteem.

We shall also see whether the following physiological strains are related to objective work load:

(a) pulse rate,

(b) diastolic and systolic blood pressure,

(c) glucose,

(d) serum cortisol,

(e) serum uric acid,

(f) obesity (ponderal index).

The relationship of objective work load to smoking will also be considered.

(3) The relationship between <u>subjective</u> stresses and psychological and physiological strains will be explored. These stresses will include subjective measures:

(a) role ambiguity,

(b) subjective quantitative overload and work load,

(c) role conflict,

(d) utilization and under-utilization,

(e) qualitative overload and work load,

(f) responsibility for people as opposed to responsibility for things,

(g) territoriality invasion,

(h) low participation.

We shall not repeat the list of strain indicators here because they are the same as listed in (2) above.

(4) The relationship between supportive interpersonal relations with one's role senders and strain will be examined. It is predicted that high levels of work supportiveness by one's superior, subordinates, and peers or work group will be negatively correlated with psychological and physiological strain. This hypothesis comes from the research of Likert and other organizational theorists who have written about the positive psychological effects of supportive relationships.

(5) The relationship between personality and objective quantitative overload will be examined. The personality traits we shall consider are those specifically characterized as part of the Type A cluster. They include:

(a) Involved Striving,

(b) Persistence,

(c) Competitive Orientation,

(d) Tendency to Engage in Multiple Activities,

(e) Positive Attitude Toward Pressure,

(f) Tendency to Environmental Overburdening,

(g) Sense of Time Urgency,

(h) Leadership,

(i) History of Past Achievements,

(j) an overall measure of Type A called "What I Am Like."

These measures will be described further in the method section of this study.

Other personality variables which will be considered include Emotional Dependency, Need for Social Approval, and Flexibility-Rigidity.

We shall assume that these traits are relatively enduring aspects of the individual which were roughly the same before the person entered his current occupational role. With the exception of Sense of Time Urgency, we shall suggest that any such relationship between personality and objective work load may mean that certain types of persons self-select themselves, or are selected by NASA, into objectively overloaded jobs. We make an exception for Sense of Time Urgency because that trait may reflect the job environment.

(6) The relationship between the above personality variables and the subjective job stresses noted above will be examined. These findings will indicate the extent to which individuals with certain personality characteristics, such as Type A, tend to perceive their work environment as stressful.

(7) The relationship between personality and strain will be examined. Any such relationship could suggest that individuals already at high physiological risk may have entered the organizational role in that state. Alternatively, such persons may have self-selected themselves, or the organization may have selected them, into jobs where the stresses subsequently led to high strain.

(8) Similarly, any differences between administrators, engineers, and scientists in personality would suggest that some self-selection into jobs may be present.

(9) Personality should condition the effect of subjective stress on psychological and physiological strain. The relationship between subjective stresses (listed in Hypothesis 7) and the strains (listed in Hypothesis 2) will be positive and of greater magnitude for Type A than for Type B individuals. The conditioning effects of other personality variables including Need for Social Approval, Emotional Dependency, and Flexibility-Rigidity will also be examined.

We could also hypothesize that personality will condition the relationship between objective stress and strain or between objective stress and subjective stress. Unfortunately, these latter hypotheses will not be tested in this study since a preliminary look at the data shows that the sample of persons on whom we have objective data will be too small for such an analysis and will have an inadequate (highly skewed) distribution of personality scores.

(10) The interaction of person and environment will explain variance in strain <u>in addition to</u> that explained by either personality or environment alone. In other words, additional variance in strain will be accounted for by measures of person-environment fit.

(11) The relationships between psychological and physiological strain will be examined. This follows from research such as that by Sales and House (in press) on the negative relationship between job satisfaction and coronary heart disease and by Kasl et al. (1968, 1970) relating poor mental health states, particularly low self-esteem, to high levels of risk factors.

Hypotheses Regarding Occupational Differences

The next set of hypotheses are explicitly concerned with determining why administrators appear to have higher rates of coronary heart disease than engineers and scientists. These hypotheses deal with occupational differences.

(12) Administrators will report higher levels of subjective stress than engineers and scientists. A similar prediction could be made with regard to occupational differences in objective quantitative overload. Again, because of the small number of persons on whom we shall have objective data, and because of an inadequate representation of all three occupational groups in that subsample, this latter prediction will not be tested.

(13) Administrators should show higher levels of strain than non-administrators.

(14) The positive relationship (given that one exists) between subjective job stresses and strain will be higher for administrators than for non-administrators. Confirmation of this statement would suggest that administrators are at higher risk of coronary heart disease because they react more to stress than nonadministrators. A similar hypothesis could be stated substituting objective for subjective job stress, but again, for reasons stated in Hypothesis 13, no test of this question will be performed. The presence of occupational differences in relationships between stress and strain will indicate the extent to which certain findings hold or do not hold across all occupational groups in the study. Occupation is treated as a conditioning variable like personality. When used in this manner, occupation may be conceived of as including or representing, in part, global personality differences which may condition the relationship between stress and strain. Thus, this hypothesis is related to Hypothesis 10 which has to do with the specific role of personality as a conditioning variable.

(15) Finally, where occupational differences in stress, personality, and strain exist, attempts will be made to see whether or not these

differences in stress and personality are related to differences in strain. For example, if one occupational group is higher than the other occupational groups on some specific stress <u>and</u> some specific strain, the overall relationship between the stress and the strain will be examined to see if this relationship accounts for the finding that the occupational group in question is highest on both the stress and the strain.

These complete the major hypotheses. As the findings are presented, they will imply certain supportive predictions not listed here. These predictions, however, will be taken up in the appropriate sections of the study. In the chapter which follows, the methodology of the study is described.

PART 2

Methods

CHAPTER 2

Methods

Sampling and Data Collection Procedures

The subjects for this study were volunteer employees of the Goddard Space Flight Center, NASA. Three hundred sixty-three names of male employees were selected from the personnel rosters of Goddard, and letters informing these individuals of the study and of their opportunity to volunteer were sent out (see letter in Appendix I).

The 363 names were selected to represent the following five categories of respondents:

(a) administrators in an administrative environment,

(b) administrators in an engineering environment,

(c) engineers in an administrative environment,

(d) engineers in an engineering environment,

(e) scientists in a science environment.

This stratification was based on some research presented earlier suggesting that persons who work in environments which differ from their own occupation in orientation tend to be under the most stress (Jean Mockbee, personal communication, 1968). Thus, attempts were made to get samples of administrators and engineers in their own and in other environments. Occupation, for purposes of sampling, was defined as the civil service occupational title of the person listed in the personnel roster.

Environment was defined, for the immediate purposes of sampling (more shall be said about other definitions of environment later on), as follows. Figure 3 presents the Goddard organizational chart. There are six major directorates immediately below the level of the base director (Administration and Management, Manned Flight Support, Tracking and Data Systems, Projects, Technology, and Space Sciences). These directorates have the heading of "Assistant Director for . . ." Within each of these directorates is a number of divisions. Each division was examined and a ratio of administrators to engineers was computed for it. Those divisions with the highest ratios were designated "administrative environments" and those divisions with the lowest ratios were designated "engineering environments." The actual divisions assigned to represent administrative and engineering environments and their respective ratios of administrators to engineers are presented in Table 3. These ratios range from 1.24 to 5.54 for environments defined as administrative in nature and range from .12 to .33 for environments defined as engineering in nature. Letters sent to administrators and engineers in each of these environments provided potential samples of administrators in administrative and engineering environments as well as engineers in administrative and engineering environments. Scientists at Goddard were located almost exclusively in a single organizational directorate which had few administrators (the ratio of administrators to scientists was .38) and few engineers. Thus, a fifth group of scientists in a science environment was available, but there were no groups of scientists in other environments.

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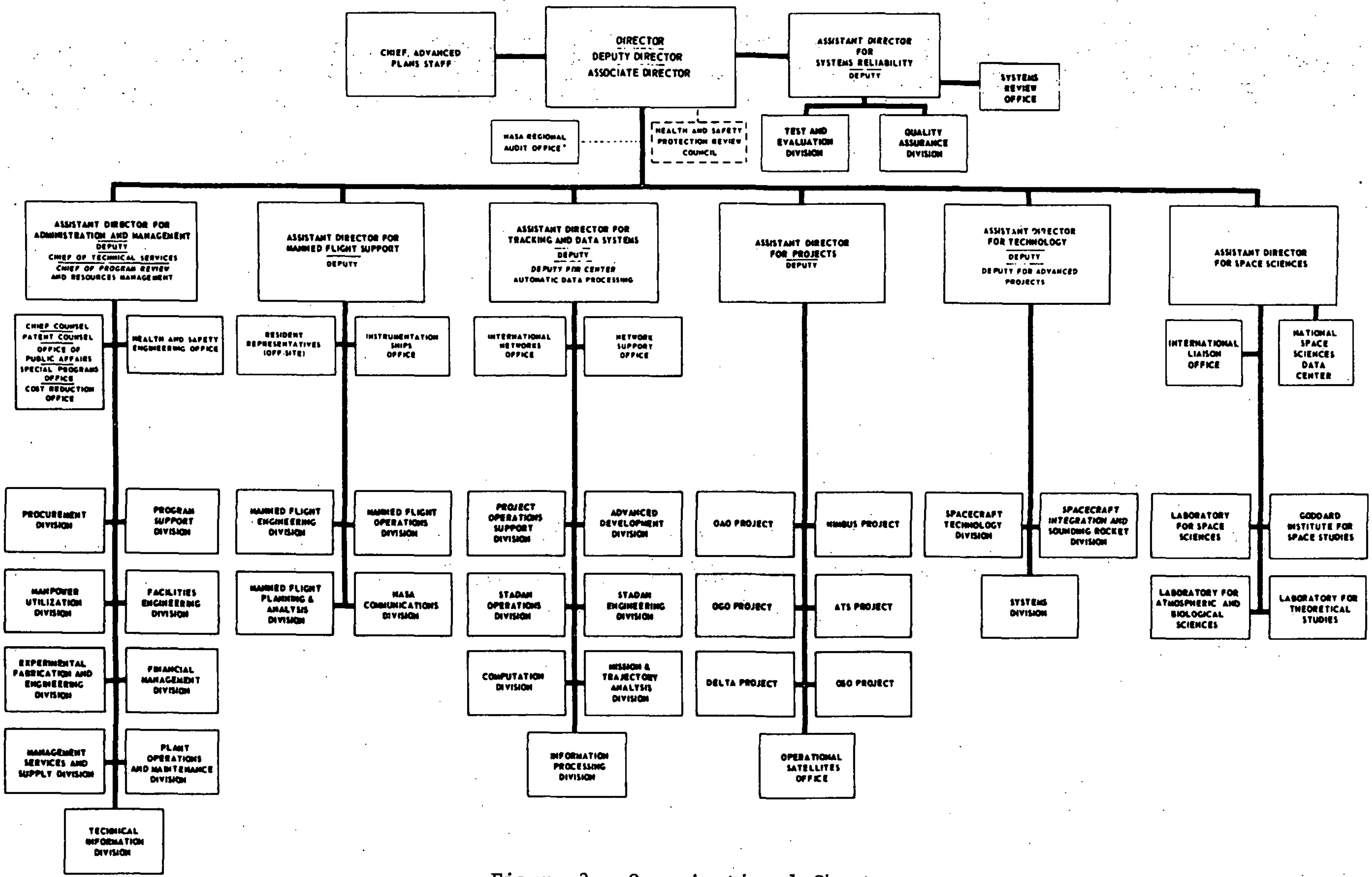

Figure 3. Organizational Chart.

TABLE 3

RATIO OF ADMINISTRATORS TO ENGINEERS IN DIFFERENT ORGANIZATIONAL UNITS OF GODDARD AND THE ACCOMPANYING CHARACTERIZATIONS OF THE ENVIRONMENT OF THESE UNITS

Characterization of Environment	Organizational Unit	Ratio of Administrators to Engineers	N[2]
Administrative	(a) All divisions of the Administrative and Management Directorate	5.54	170
	(b) Advanced Development Division in the Tracking and Data System Directorate	1.24	57
	(c) Manned Flight Operations Division in the Manned Flight Support Directorate	3.62	74
Engineering	(a) All divisions of the Projects Directorate	.12	175
	(b) All divisions of the Technology Directorate	.33	310
Science	(a) All divisions of the Space Sciences Directorate	.38[1]	219[3]

[1]This is the ratio of administrators to scientists. The ratio of administrators to engineers is 5.25, but this is a misleading figure since there were 63 persons in administrative positions, only 12 engineers, and 156 scientists.

[2]Administrators plus engineers.

[3]Administrators plus scientists. See table footnote 1.

Table 4 presents the number of letters which were sent out to each group, the number of persons in each group it was hoped would volunteer once contacted, and the number who actually volunteered for the study. The initial selection of names within each of the five categories was random.

Once these letters were sent out, a medical technician from the Institute for Social Research contacted 285 of these men in person in their offices at Goddard (the other 78 persons sent letters were not contacted since an adequate number of these 285 volunteered). She asked them if they wished to volunteer, and if they did, she proceeded with a medical interview and handed them a lengthy questionnaire (it takes about 1.5 to 2 hours to complete) to fill out and return to the Institute. Appendix II presents the procedures she followed in more detail. Briefly, she took two readings of resting pulse rate, each 30 seconds apart for 30 seconds. Then she took two measures of systolic and diastolic blood pressure, again waiting 30 seconds between each pair of measurements. Next she took a 30 cc sample of blood to be used for later biochemical analyses. These samples were immediately spun to sera and frozen for shipment to the Institute laboratory in Ann Arbor, Michigan (the biochemical analyses procedures will be described shortly). Finally, she handed each person the questionnaire, requested that the individual fill it out as soon as possible and return it in a prepaid, pre-addressed envelope to the Institute. The questionnaires were confidential since no names of respondents appeared on them, nor could they be matched with the names of the volunteers by NASA. The questionnaire cover letter explaining these details to the respondent is presented in Appendix III. Feedback to all volunteers on early results from the study was provided by means of a detailed report

TABLE 4

VOLUNTEER AND RESPONSE RATES

Group	Number of Letters Sent	Number of Persons Contacted	Percentage of Refusals	Number of Volunteers	Questionnaire Returns	
					Number	Percentage
Administrators in Administration	80	57	10.5	51	39	76.4
Administrators in Engineering	60	62	16.1	52	46	88.5
Engineers in Administration	63	54	14.8	46	38	82.6
Engineers in Engineering	80	59	10.2	53	46	86.8
Scientists	80	53	3.8	51	41	80.4
All Groups	363	285	11.2	253	210	83.0

(French & Caplan, 1970).

To return to the data in Table 4, only 11.2% of those contacted refused to participate in the study. Thus, blood samples and other physiological data were obtained from 253 persons altogether. Of these 83% (210) returned their questionnaires to the Institute. The final number of usable questionnaires matched with physiological data came to 205.

An examination of Table 4 shows that there are no significant differences in the refusal rate for the study among the administrative and engineering groups. There is a slight, but nonsignificant ($X^2 = 1.29$, d.f. = 1) tendency for administrators and engineers in alien job environments (engineering and administrative environments respectively) to show the highest refusal rates compared to administrators and engineers in their respective environments. Some findings to be presented in the results section of this study indicate that alien environments are more likely to be associated with stress and strain for administrators and engineers than nonalien environments. Nevertheless, since the differences in refusal rates are slight and nonsignificant, the possibility that systematic bias has been introduced in the sample from this source is slight.

While there is no available data on which to compare volunteers and nonvolunteers for the study, there is comparable information on both those who responded on the questionnaire and those who failed to return or adequately complete the questionnaire. This information, presented in Table 5, was obtained as part of the medical interview or in the process of drawing our sample.

TABLE 5

COMPARISON OF QUESTIONNAIRE RESPONDENTS AND NONRESPONDENTS

Measure	Nonrespondents			Respondents			Significance of the Difference
	N	Mean	S.D.	N	Mean	S.D.	
Age	41	39.68	6.84	200	39.78	7.83	n.s.
Government Salary Level	41	13.24	1.55	200	13.44	1.38	n.s.
Pulse Rate	45	78.40	12.15	208	74.59	10.79	.05
Systolic Blood Pressure	45	130.24	14.54	207	131.40	12.66	n.s.
Diastolic Blood Pressure	45	82.56	7.96	204	82.78	7.33	n.s.
Serum Cholesterol	45	197.27	41.58	200	190.56	31.79	n.s.
Serum Uric Acid	45	5.86	1.61	204	5.77	1.12	n.s.
Casual Glucose	45	94.04	17.01	202	95.07	18.44	n.s.
Serum Cortisol	45	15.85	6.04	201	14.05	5.34	.05
Serum Lipoprotein Ratio	45	5.01	3.10	199	3.86	2.25	.001

There are no significant differences between the respondents to the questionnaire and the nonrespondents with regard to age, job status as indicated by government salary level, systolic and diastolic blood pressure, serum cholesterol, serum uric acid, or casual glucose level. There are, however, significant differences in pulse rate, serum cortisol, and serum lipoprotein level ($p < .05$, .05, and .001 respectively). For these three variables, the nonrespondents have the higher values.

This suggests, that if these three physiological variables are related to stress, then the sample has had a slight tendency to exclude people in high stress environments and/or persons at higher risk of coronary heart disease. These nonrespondents could be the people who were too overloaded to fill out the questionnaire (later analyses will show that our current measures of work load are not correlated with pulse rate and lipoprotein ratio but with cortisol). Since the nonrespondent rate in all of our five groups of subjects (administrators in administration, administrators in engineering, etc.) is fairly similar, there is little reason to believe that the physiological differences reported here represent differences due to occupational group per se.

The Independent Variables

The independent variables are of two kinds already noted as objective and subjective. First the objective measures will be described and then the subjective measures will be turned to.

Occupation and Objective Quantitative Work Load

Occupation and objective quantitative work load were the only objective measures in the study. To obtain the measure of objective quantitative work load, a note was attached to each questionnaire asking the respondent if he would be willing to have his secretary keep a tally of his phone calls, office visits, and meetings, hour by hour, for three days. If the respondent agreed, he gave his secretary an attached letter of explanation which asked her if she would like to help in this segment of the study. If she agreed, she then read some attached instructions on how to keep the tally on provided forms. The letters, instructions, and forms are presented in Appendix IV.

From these data a number of measures of job activity were computed which included the number of (a) incoming phone calls per hour, (b) outgoing phone calls per hour, (c) office visits per hour, (d) boss-initiated meetings per hour, and (e) other-person-initiated meetings per hour. An office visit is any encounter with just one other person. A meeting involves two or more other persons. Details of these definitions can be found in the instructions in Appendix IV.

Table 6 presents the intercorrelations between the five measures. To form a total score, incoming and outgoing phone calls and office visits were combined. In terms of content, this is identical to the measure of objective quantitative overload used in the Caplan and French (1968) study of 22 men at NASA Headquarters. The average interitem correlation between these three components of the total score is .62, and the estimated reliability of the score is .88.

TABLE 6

INTERCORRELATION MATRIX OF OBJECTIVE WORK LOAD MEASURES[1]

Measure	a	b	c	d
a. Phone calls incoming	---			
b. Phone calls outgoing	.80	---		
c. Office visits	.50	.49	---	
d. Meetings, boss-initiated	.18	.32	.37	---
e. Meetings, initiated by others	.08	.14	.56	.22

[1] $N = 25$, $r \geq .40$, $p < .05$.

Unfortunately, only 11.9% of the sample (25 subjects) took part in this optional aspect of the study. Of those who agreed to have their secretaries keep a tally, 22 of the respondents were administrators, 2 were engineers, and one was a scientist. This bias is not surprising since interview experience at Goddard indicates that few engineers and scientists have their own secretaries. Instead, one secretary may serve several such persons making it difficult and perhaps unreasonable for such a person to keep track of the activities of one engineer or scientist for three days. The fact that so few persons volunteered for the tally indicates that the tally may have placed an undue burden on the respondents in view of the already lengthy questionnaire they had just completed.

One other difference between those who volunteered to have a tally of their activities kept and those who did not was in terms of smoking. Those who volunteered have a higher percentage of smokers among them than is true of the general sample ($p < .05$). This finding will be elaborated on later when the results of the study are discussed.

Subjective Environment Measures

All of these measures are based on reports by the respondents of how they perceive conditions in their job environments. The following variables, already defined in the review of the literature, were constructed:

(a) role ambiguity,

(b) quantitative work load,

(c) role conflict,

(d) utilization of abilities,

(e) complexification

(f) qualitative work load

(g) responsibility for persons,

(h) responsibility for things,

(i) time spent in other territories,

(j) supportive relations from superior, peers, and subordinates,

(k) participation.

To construct these indices, a number of approaches were used. First, where existing indices purporting to measure the construct were available, these were incorporated into the questionnaire. Where such factors were not available, attempts were made to construct items based on theoretical definitions of the construct. A large pool of such items was constructed by the author and John R. P. French, Jr. The total set of items was reduced to a manageable number which we believed would measure the several variables just mentioned. These items were then incorporated into the questionnaire.

This completed the theoretical stage of the index construction.

Next, attempts were made to validate empirically these indices. In some cases an item had been categorized as measuring two or more constructs and therefore potentially belonged in two or more indices. To construct indices of mutually exclusive item sets, the following criteria (Sales, 1969a), in most cases, were adopted:

(a) All items within a variable must correlate at a significance level of $p \leq .05$ (one-tailed). This turned out to be $r \geq .195$ ($N = 100$).[4]

(b) Not more than 25% of the intravariable correlations should fall

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[4] In light of the large number of analyses carried out for this study and the attendant need to economize on analysis costs, random halfs of the effective sample (approximately 100 respondents) have often been used to test predictions. However, where proper analyses required a larger sample, the total pool of data was used.

below $p \leq .01$ (one-tailed). This turned out to be $r \geq .254$.

(c) If an item satisfies these criteria for more than one variable cluster, it is placed in the index in which it showed the highest interitem correlations.

(d) The above criteria must hold up in a replication of the procedure on half the sample. Thus, the sample was first split randomly in half, then intercorrelation matrices were constructed for each set of items, and the procedure was repeated on the remaining half of the sample.

In most cases, indices were separately retained, rather than collapsed when interindex correlations were high (no such correlation exceeded .66), to either preserve the theoretical content of the item or for purposes of replicating a previous measure.

The average interitem correlation for each index and the estimated index reliability are presented in Table 7.[5] Appendix V contains the actual intercorrelation matrices for each index using data from the first random half of the total sample (the replication on the second random half has been omitted since the results are virtually the same except where noted).

Of all the subjective work environment indices which were initially constructed, only one failed to stand up under the empirical criteria set

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[5]The estimate of reliability used throughout this study is computed by 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.

TABLE 7

AVERAGE INTERITEM CORRELATIONS AND ESTIMATED RELIABILITIES FOR CONSTRUCTED INDICES OF SUBJECTIVE ENVIRONMENT

Index	Average Interitem r	Estimated Reliability	Number of Items
Role ambiguity	.46[1]	.77	4
Subjective quantitative work load index	.42	.87	9
Subjective quantitative overload factor	.49	.78	6
Complexification	.53	.82	4
Role conflict	---[2]	---	---
Role conflict theoretical cluster	.24	.49	3
Subjective qualitative work load index	.34	.51	2
Subjective qualitative overload factor	.36	.63	3
Utilization of abilities	.46	.77	4
Utilization of leadership	.64	.84	3
Responsibility for persons	.49	.66	2
Responsibility for things	.33	.66	4
Advancement and recognition	.59	.85	4
Participation	.44	.80	5
Relations with immediate superior	.47	.86	7
Relations with subordinates	.51	.88	7
Relations with work group	.54	.89	7

[1]The N varied slightly for each correlation but was generally about 100.

[2]No index could be formed.

out above. This index was an attempt to measure role conflict. All of the items in this measure (see Appendix V) ended up in other indices as a result of the empirical index construction procedures. In Chapter 1, it was pointed out that the Kahn et al. (1964) subjective role conflict measure had high conceptual and item overlap with measures of high subjective quantitative work load and overload. In the current study, many of the items initially included in the role conflict index ended up as items in the subjective quantitative work load index thus supporting the contention that greater conceptual differentiation between role conflict and work overload must be made if the two are to have any unique descriptive power.

In the course of constructing indices, it occurred to us that several of the items accompanying the subjective quantitative overload factor measure also dealt with role conflict and particularly interpersonal conflict. Only three of seven items survived the index construction process, one of which had already been included as part of the original subjective quantitative overload factor (see discussion of factor below). The correlation between the factor and the "role conflict theoretical cluster," as this set of items has been labeled, is .54 ($p < .001$). In light of the overlap between this measure and the overload factor, the role conflict cluster is used in those analyses where a specific prediction is made about the relationship between role conflict and other stresses or strain. For example, in instances where an attempt to replicate Kahn et al.'s (1964) findings on role conflict and stress is made, the theoretical cluster is used.

Because it was important to replicate French et al.'s subjective overload factors from the university professors study, the study has measures of the same variable using two different methods (the factor score uses a different response scale than does the index score constructed in this study). This provides an opportunity to examine the convergent and discriminant validity of subjective quantitative and qualitative work load in a multitrait-multimethod correlation matrix (Campbell & Fiske, 1959). Table 8 presents these measures in such a matrix.

TABLE 8

MULTITRAIT-MULTIMETHOD CORRELATION MATRIX OF WORK LOAD MEASURES[1]

Measure	a	b	c
a. Subjective Quantitative Work Load Index			
b. Subjective Quantitative Overload Factor	.66[3]		
c. Subjective Qualitative Work Load Index	.33[3]	.19[2]	
d. Subjective Qualitative Overload Index	-.11	.23[2]	-.12

[1] $N = 200$

[2] $p < .01$

[3] $p < .001$

Note that the heteromethod convergent validity for subjective quantitative work load is high ($r = .66$) and that it is higher than correlations of either the quantitative overload factor or index with the two measures of qualitative overload, giving us some indication of discriminant validity for the measure as well. On the other hand, the heteromethod convergent validity for the subjective qualitative work load measures is quite low ($r = -.12$) and nonsignificant. Furthermore, there are correlations between measures using the same method but different constructs which are higher, indicating that the subjective qualitative work load measures have no discriminant validity.

The lack of convergent validity for the subjective qualitative work load measures is not surprising if one takes a look at the item content of the Subjective Qualitative Overload Factor in Appendix V. Two of the three items in the factor deal with "The pressure to succeed" and the "Pressure to keep up with one's colleagues." The content of these items has no clear relationship with qualitative work load. Indeed, they seem primarily related to constructs such as competition and achievement. The only item which seems to be relevant to the factor name is "Not measuring up to the demands of the job: Lack of training or knowledge or talent."

Table 7 indicates that the average interitem correlations range from .33 to .64. The modal interitem correlation is .49. The indices of estimated reliability range from .51 to .89; the mode is .82. Nunnally (1967) suggests that reliabilities above .50 be considered acceptable for early stages of research.

Table 9 presents the intercorrelations between these various multi-items indices of the subjective environment. The average intercorrelation between indices is .27 which is below the range of average interitem correlations within each index. Thus, most of the indices are relatively uncorrelated with one another. On the other hand, the fact that some measures of stress are intercorrelated with one another will be taken into account in analyses which involve findings dealing with two or more such stresses. In such cases multivariate techniques such as multiple regression will be used to indicate the unique contribution of each measure of stress to the variance of some other measure.

TABLE 9

INTERCORRELATIONS BETWEEN MULTI-ITEM INDICES OF SUBJECTIVE ENVIRONMENT

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Role Ambiguity														
2. Subjective Quantitative Work Load Index	-.09[1]													
3. Subjective Quantitative Overload Factor	.10	.66												
4. Complexification	-.35	.20	.12											
5. Subjective Qualitative Work Load Index	-.44	.33	.19	.35										
6. Subjective Qualitative Overload Factor	.16	-.11	.23	.10	-.12									
7. Utilization of Abilities	-.46	.07	-.01	.28	.46	.00								
8. Utilization of Leadership	-.27	.42	.20	.00	.27	-.15	.25							
9. Responsibility for Persons	-.33	.57	.31	.13	.45	-.04	.24	.60						
10. Responsibility for Things	-.37	.29	.11	.18	.41	.11	.46	.38	.54					
11. Advancement and Recognition	-.28	.11	.02	.16	.28	.00	.53	.24	.25	.32				
12. Participation	-.42	.20	.05	.16	.42	-.12	.52	.50	.47	.59	.47			
13. Relations with Immediate Superior	-.41	.16	.04	.09	.41	-.24	.38	.32	.26	.34	.41	.52		
14. Relations with Subordinates	-.41	.35	.19	.18	.41	-.15	.23	.37	.47	.24	.16	.34	.27	
15. Relations with Work Group	-.43	.15	.00	.19	.40	-.21	.40	.22	.29	.29	.33	.43	.48	.40

[1] $r \geq .14$, $p < .05$ for all correlations in the matrix except those involving variables 9 and 10. For the latter, $r \geq .19$, $p < .05$. The sample size varies slightly from correlation to correlation ($n \cong 200$).

Some Other Measures of the Subjective Environment

In addition to these multi-item indices of subjective environment, ratings and estimates of amount of time spent in and amount of stress received from specific work conditions were obtained. Appendix VI presents several questionnaire measures dealing with quantitative work load. These measures ask the individual to estimate (a) the percent of time on incoming and outgoing phone calls, office visits, meetings, and working alone (Item 14); (b) the number of incoming and outgoing phone calls, office visits, and meetings in a typical five-day work week (Item 20); (c) the extent to which various role senders create different levels of deadline pressure (Item 8); and (d) the percent of time the respondent spends under different intensities of deadline pressure (Item 25).

Each subject was also asked to estimate the percent of time he spends carrying out responsibilities related to persons and things (Item 29). And finally, an estimate was obtained of the percent of time each person spends communicating with role senders from different levels of the organization (Item 21) and the extent to which each of these categories of role senders constitute a source of overall stress for the individual (Item 22).

Global Measures of Job Environment

Earlier it was noted that administrators and engineers had originally been sampled from both administrative and engineering environments. Environment was defined as the ratio of administrators to engineers in any division of the NASA organization. This, of course, is a rather crude definition of environment. As another attempt to obtain a global definition of environment, the subjects were given the following questionnaire item:

30-R. Aside from your immediate job, your work life may be affected by the wider environment of your section, branch, division, or directorate. As far as it affects your job, is this wider environment mostly administration, engineering, or science? Considering the mission, the people, and the organizational climate, my organizational environment is:

____% Administration

____% Engineering

____% Science

Total = 100%

This measure, labeled the "perceived environment," was included in the questionnaire since it may be that only the perceived rather than the actual environment has any effect on the strain an individual experiences. As it turns out, persons selected from the administrative environment, compared to persons selected from the engineering environment, in the initial sampling tend to report their environment as administrative on the measure of perceived environment ($r = .45$, $p < .001$). This finding holds irrespective of the person's occupation. Similarly, persons from engineering environments, compared to persons selected from administrative environments and irrespective of occupation, tend to report their environment as more engineering in nature on the perceived environment measure ($r = .43$, $p < .001$). This finding provides some validation for the questionnaire measure. In the analysis of the effects of environment, both measures will be used to compare the effects objective and subjective environment have on stress and strain.

Measuring Occupational Group

Persons were asked to indicate in the questionnaire the occupational group they felt they belonged to. The item used is as follows:

13. In sum, I consider myself an (CHECK ONE)

____ Administrator (nontechnical, administrative)

____ Engineer

____ Scientist

While the civil service occupational title of each respondent was already obtained from the personnel rosters of the organization, it seemed important to ask the above question since formal job titles do not always reflect the occupation of the person (for example, the known head of a section or branch in NASA might be designated as "materials engineer" but might have administrative responsibility for the work unit). Table 10 presents a chi square analysis to test the goodness of fit between the two measures of the respondent's occupation. Overall, there is a fairly

TABLE 10

BIVARIATE FREQUENCY DISTRIBUTION OF PERSONNEL ROSTER AND SELF-REPORTED OCCUPATIONAL DESIGNATIONS[1]

	Personnel Roster		
Self-Report	Administrator	Engineer	Scientist
Administrator	86.2[2] 50[3]	10.3 6	3.4 2
Engineer	32.0 31	63.9 62	4.1 4
Scientist	8.3 4	22.9 11	68.8 33

[1] $\chi^2 = 153.61$, $p < .001$; C = .66.

[2] Row percent.

[3] Cell N.

good degree of overlap between the two measures ($\chi^2 = 153.61$, $p < .001$, $C = .66$). To avoid doubling the large number of analyses which are performed on occupational differences, only one of these two measures of occupation is used in this study. The self-report of occupation has been chosen in preference to the civil service titles since the latter are clearly misleading in many cases.

Further validation of the self-report measure will now be presented. The findings relate the self-report measure of occupation to another questionnaire measure which asks people how they spend their time on the job. This latter measure appeared in the questionnaire as follows:

9. Of your total work time, about what proportion do you normally spend on the following types of activities? (If it fluctuates, strike and average.) Under Column A enter nearest 5-10%. FILL ALL SPACES.

	Percent of Time
	A
A. Contract monitoring	____%
B. Basic research, other than monitoring (include technical reading, technical supervision, technical collaboration and consultation)	____%
C. Technical development, other than monitoring (include technical reading, technical supervision, technical collaboration and consultation)	____%
D. Managerial, administrative, and other non R & D work	____%
E. Other ______________________________ (Specify)	____%
TOTAL (should add to 100%)	____%

The above four categories, according to Pelz and Andrews (1966), characterize the major activities that occur in research and design organizations.

In the sample, 81% of the subjects find the first four categories exhaustive for describing how they spend their time. The other 19% of the respondents spend an average of 23.5% of their time carrying out work described as "Other."

As a validation check on the self-report measure of the person's occupation, an inspection was made of the occupational differences in the percent of time reported spent in each of the four activities above. These findings are presented in Table 11. As expected (based on research by Pelz and Andrews, 1966), the scientists primarily spend their time in basic research, the engineers spend their time in technical development, and the administrators in administration. Engineers spend more time than the other two occupational groups in contract monitoring, but no prior predictions were made regarding this.

TABLE 11

TIME SPENT IN OCCUPATIONALLY-LINKED ACTIVITIES AS A FUNCTION OF SELF-REPORTED OCCUPATION

	Occupation				
Activity	Administrator	Engineer	Scientist	F	p <
Contract Monitoring	8.0	15.2	6.4	7.61	.001[1]
Basic Research	5.1	12.0	46.1	79.61	.001
Technical Development	9.0	40.6	25.1	42.97	.001
Managerial Administration	73.0	25.5	10.3	137.50	.001
Other	4.9	6.7	10.1	1.13	n.s.[1]

[1]Two-tailed test; all other p values are one-tailed.

TABLE 12

PERCENT OF TIME SPENT IN OCCUPATIONALLY-LINKED ACTIVITIES AS A FUNCTION OF CIVIL SERVICE-BASED OCCUPATIONAL CLASSIFICATION

Activity	Occupation			F	p <
	Administrator	Engineer	Scientist		
Contract Monitoring	9.3	14.5	7.5	4.05	.025
Basic Research	7.5	16.2	46.3	55.58	.001
Technical Development	19.4	40.6	21.1	21.44	.001
Managerial Administration	58.8	22.4	10.3	68.06	.001
Other	4.9	6.2	12.4	2.53	n.s.

Table 12 presents the same analysis using civil service-based occupational classifications rather than self-reported occupation. The pattern of data is virtually identical to that presented in Table 11 in that administrators report the greatest amount of time in managerial administration, scientists report the most time in basic research, and engineers report spending the most time in technical development. However, comparison of the F tests in Tables 11 and 12 shows that the magnitude of the F values is higher in the first table. This last finding indicates that the self-report measure of occupation discriminates more between the percent of time spent in occupation-related activities than the supposedly more "objective" measure of occupation based on civil service titles, and provides additional support for using the self-report measure as an indicator of occupation.

Personality Measures

A number of personality measures have been developed for use in the study. The first set of these are the Sales clusters which attempt to measure Type A behavior pattern traits. There are nine of these clusters: Involved Striving, Persistence, Competitive Orientation, Range of Activities, Positive Attitude toward Pressure, Environmental Overburdening, Sense of Time Urgency, Leadership, and History of Past Achievements. Sales' (1969a) conceptual definitions of these measures are presented in Appendix VII.

Sales originally constructed the clusters using a sample of subjects at Goddard Space Flight Center, the site of the current study. It was possible to test the reliability of each cluster's item content by reconstructing the clusters using our subjects. This was done following the procedure described on Pages 101 and 103. (The procedure is almost identical to that described by Sales, 1969a.) Appendix VIII presents the format for the measures, the instructions for filling out the Sales questionnaire, the interitem correlation matrices for the clusters, and the item content of the clusters. Overall, the content of the clusters has been replicated in the NASA population.

Table 13 presents the interitem correlations as well as the estimated reliability for each of the nine Sales clusters (measures (a) through (i)). The interitem correlations range from .27 to .82; the median is .44, which is not significantly lower than the median (.52) derived from Sales' data. The estimate of index reliability of these measures is still quite high.

Table 14 presents the intercorrelations between the different Sales clusters (measures (a) through (i)). The average intercluster correlation is .41--almost as high as the typical interitem correlation. Despite this finding, which would suggest that one might collapse or combine certain

TABLE 13

AVERAGE INTERITEM CORRELATION AND ESTIMATED RELIABILITY FOR EACH PERSONALITY MEASURE

Personality Measure	Average r	Estimated Reliability	Number of Items
a. Involved Striving	.33	.82	9
b. Persistence	.42	.85	8
c. Competitive Orientation	.82	.95	4
d. Range of Activities	.44	.70	3
e. Positive Attitude toward Pressure	.43	.86	8
f. Environmental Overburdening	.38	.65	3
g. Sense of Time Urgency	.51	.86	6
h. Leadership	.57	.84	4
i. History of Past Achievements	.59	.81	3
j. What I Am Like: Type A	.27	.53	3
k. Repressors-Sensitizers	.30	.56	3
l. Emotional Dependency	.28	.54	3

clusters, the clusters have been retained intact to preserve certain theoretical differences for examination in the research. In any event, only about 17% of the variance is shared between clusters on the average.

Several other measures of personality have also been included in the study. The first of these, What I Am Like: Type A, is a short-form attempt to represent Type A as a syndrome. The items and intercorrelations between items for this measure and for the other personality measures discussed here are presented in Appendix IX. Evidence for the concurrent validity of the What I Am Like: Type A measure comes from the following

TABLE 14

INTERCORRELATIONS AMONG VARIOUS MEASURES OF PERSONALITY (N = 205)[1]

Measure	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
a. Involved Striving																
b. Persistence	.62															
c. Competitive Orientation	.47	.53														
d. Range of Activities	.36	.35	.42													
e. Positive Attitude toward Pressure	.51	.44	.56	.35												
f. Environmental Overburdening	.65	.39	.35	.29	.42											
g. Sense of Time Urgency	.54	.19	.14	.23	.33	.58										
h. Leadership	.38	.44	.56	.62	.39	.23	.18									
i. History of Past Achievements	.35	.40	.45	.45	.27	.32	.20	.39								
j. What I Am Like: Type A	.53	.50	.43	.29	.44	.40	.22	.36	.21							
k. Repressors-Sensitizers	-.16	.08	.15	.19	.01	.10	.28	.25	.19	.10						
l. Emotional Dependency	-.04	.11	.14	.10	.20	.01	.25	.21	.04	.01	-.41					
m. C-M Deny Bad Self	-.08	.00	.00	-.01	.05	.00	.14	.09	-.01	-.09	.26	.34				
n. C-M Overconformity to Norms	.19	.31	.22	.22	.12	.13	.04	.17	.19	.10	.16	.25	.32			
o. Flexibility	.28	.45	.24	.14	.09	.12	.08	.19	.21	.14	.00	-.03	-.08	.33		
p. Family History of CHD	-.01	-.09	-.02	-.11	.03	.08	.10	-.02	-.02	-.04	-.09	-.12	.03	-.09	-.10	
q. Age	.11	.03	.02	.03	.15	.05	-.03	.05	-.12	.04	.08	.09	.07	.07	.21	.07

[1] $r \geq .14$, $p < .05$, $r \geq .18$, $p < .01$.

comparisons. First, in a follow-up study of 16 subjects from NASA Headquarters (Caplan & French, 1968), the author examined the relationship between the What I Am Like measure and the Jenkins Activity Scale (Jenkins, 1967), a validated questionnaire measure of behavior pattern Type A. The correlation was .80 ($p < .001$). The What I Am Like measure also correlated significantly and positively with ten of the Sales clusters (there were 14 in the original form). The average correlation with these ten was .67. The Subjective Quantitative Overload Factor and the What I Am Like measure correlated .28 (n.s.) in that study.

Sales (1969) was able to gather similar questionnaire material from 67 white collar subjects at Goddard Space Flight Center. The correlogram in Figure 4 depicts the various relationships between the different measures of Type A based on data from the research by Sales and by Caplan and French. Sales' data show that 12 of his 14 original clusters correlate significantly and positively with the Jenkins measure, and that the average correlation with the 12 clusters is .48 ($p < .01$). Furthermore, six of the Sales clusters similarly show an average correlation of .28 ($p < .05$) with the Subjective Quantitative Overload Factor, and the Jenkins correlates with the factor .46 ($p < .01$).

Table 14 shows that in the current data the What I Am Like measure correlates significantly with all nine of the Sales clusters (the correlations range from .21, $p < .01$ to .53, $p < .001$ using an N of about 200). Considering these findings, it appears that there is as good a degree of support for the concurrent validity of the What I Am Like measure as there is for the Sales clusters. Table 14 shows, however, that the inter-item correlation for the What I Am Like measure is .27 and the estimated reliability is .53, somewhat less than the same coefficients for the Sales

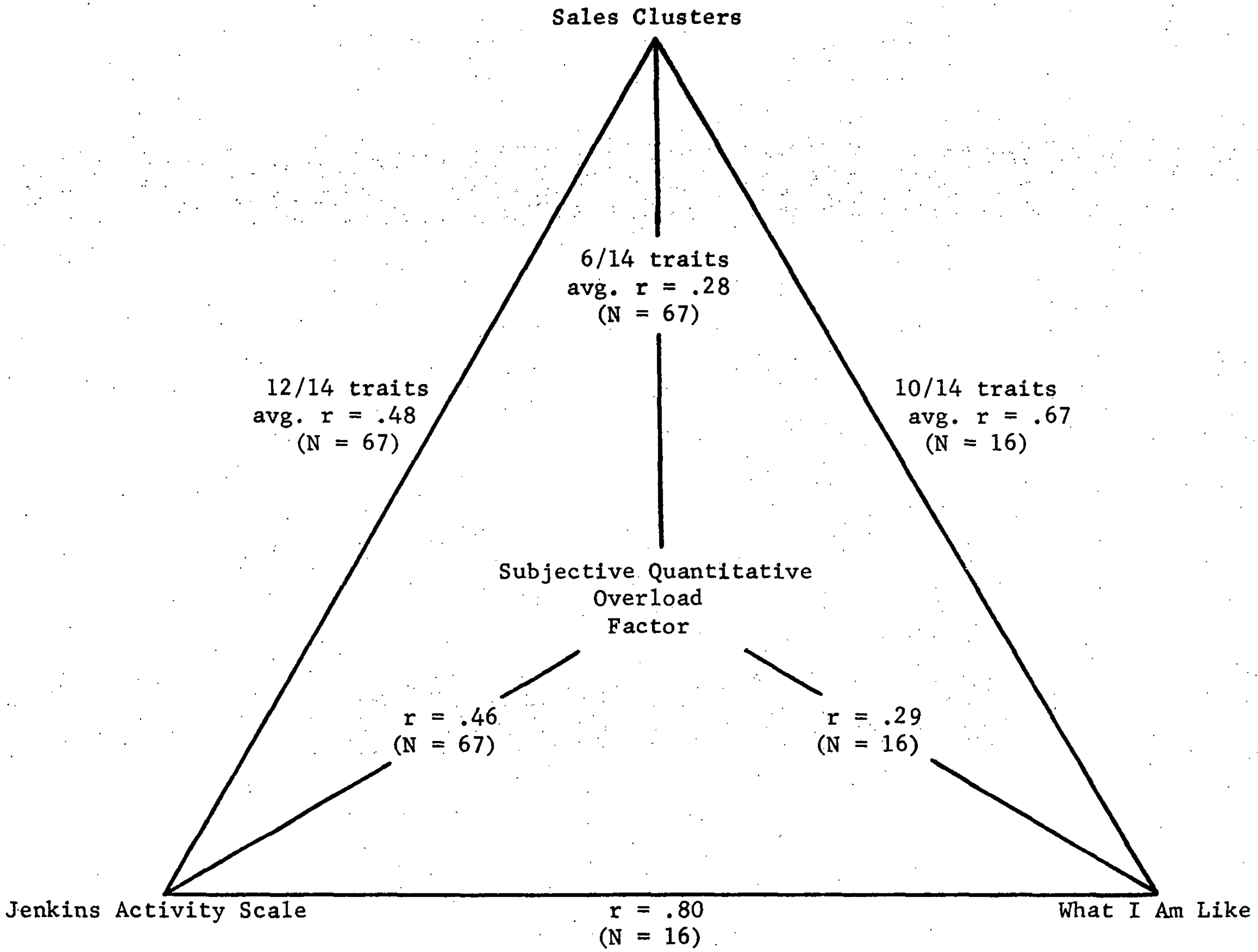


Figure 4. Relationships between measures of Type A and subjective quantitative overload.

clusters.

A Repression-Sensitization measure, also described in Appendix IX, has also been included here. Some evidence suggests that sensitizers, compared with repressors, are more likely to experience strain due to their heightened awareness of the more stressful states of the self and the environment. Weinstein, Opton, and Lazarus (1968) have shown that sensitizers show greater self-report reactions than repressors to a stress-producing film about aboriginal subincision rites, although both groups show approximately the same physiological responses to the films. Unfortunately, the Repression-Sensitization measure which has been used in the literature (Byrne, Golightly, & Sheffield, 1965) is over 100 items long and is impractical to include in an already large questionnaire. The measure developed in this study attempts to reflect Repression-Sensitization in a small set of items similar in form to the What I Am Like measure of Type A. The average interitem correlation for the three items in the measure is .30 and the estimated reliability is .56. Thus, the estimated reliability is low. Table 14 shows that this measure intercorrelates fairly low with most of the other personality measures.

Another personality measure, Emotional Dependence, comes from the work of Sampson (1960). The measure was one of several factors derived by Sampson and was included as a conditioning personality variable because persons high on this trait may be more threatened by social stress which affects this need than persons low on this trait. The items, in Appendix IX, reflect a need by the person to lean on others for emotional support particularly under conditions of stress. The average interitem correlation and estimated reliability for this measure is low like those for the two previous measures. Sampson's (1960) same items show an estimated reliability of .70 which is considerably higher. The difference between the two studies may reflect the fact that Sampson created the measure using college subjects. Selection processes at NASA may have eliminated variance in this measure by leaving behind those college students who were particularly high on emotional dependency. Data to test this explanation, however, are not available since a smaller subset of the original seven items and a different interval scale was used in this study. Table 14 indicates that Emotional Dependence correlates rather negligibly with most of the other personality measures. The most noticeable exception is the .41 ($p < .001$) correlation between the measure and Repression-Sensitization. This suggests that people who tend to be sensitive to stress in the environment are also persons who tend to cope by "crying on the other guy's shoulder."

The Crowne-Marlowe Need for Social Approval (Crowne & Marlowe, 1964) is also included in this study. While the originators of this measure originally conceived of it as a unitary measure of the need to win approval from others, recent work by Lillibridge (1970) has shown that there are two rather different factors in the measure. These have been labeled the C-M Deny Bad Self and the C-M Overconformity to Others. The items are listed in Appendix IX.

Deny Bad Self refers to the tendency of the individual to do precisely that on questionnaires. <u>All</u> of the items deal with the expression of anger, irritation, resentment, and all of the items in the index require the individual to deny that he does something potentially bad to others by checking off the response category "false." Thus, the index is conceptually a measure of the defense mechanism of denial. Overconformity to Others might better be called the "Mary Poppins Factor." Persons, in order to score highly on this measure, must indicate as "true" that they <u>always</u> do good things.

No analysis of interitem correlations was performed in light of the rather careful factor analysis performed by Lillibridge using effective samples varying from 222 to 384 men from several industrial firms. Table 14 shows that the intercluster correlation between these two Crowne-Marlowe factors is fairly low, .32. Table 14 also shows that neither of the two factors correlates very highly with any of the other personality measures.

Some readers may be disturbed by the fact that the mode of answering, either always saying "false" or "true," and the content of the scales are perfectly confounded. This criticism is countered by asking is there a better way of measuring the defense mechanism of denial other than by giving people the opportunity to deny? There were other items in the original, unfactored measure which could be answered "true" or "false," and, as Lillibridge's report shows, these items did not load highly on either of these two factors although the content of these items was similar to that in the factors. Thus, the two Crowne-Marlowe factors appear to measure the <u>interaction</u>--not the confounding--of psychological content and behavior response in dealing with that content.

The final personality measure included in this study is the Flexibility-Rigidity scale from the California Personality Inventory. Gough (1957) provides substantial information on the reliability and validity of the measure. Table 14 shows that the scale is generally uncorrelated with the other measures of personality. The outstanding exceptions are correlations with Involved Striving ($r = .28$, $p < .01$), Persistence ($r = .45$, $p < .001$), and Competitive Orientation ($r = .24$, $p < .01$). At first, these findings seem like a contradiction in terms since a persistent person should be somewhat rigid. However, the items in the Flexibility-Rigidity scale in Appendix IX show that the flexible person is one who is willing to tolerate a certain degree of uncertainty, disorganization, and interruptions. It seems that these are the prerequisites for the hard-driving, persistent, involved, competitive Type A individual who hopes to buck the complexity, instability, and uncertainty of the modern organization. Thus, the findings do not appear so contradictory after all. Perhaps, then, a better name for the Flexibility-Rigidity Scale would be "Tolerance-Intolerance of Uncertainty." This would not be an unjustified label for the Flexibility measure since Gough reports that it correlates -.58 with the F scale measure of authoritanian personality, and authoritarianism has been shown to be positively related to intolerance for both emotional and cognitive ambiguity (Adorno, Frenkel-Brunswik, Levinson, & Sanford, 1950; Frenkel-Brunswik, 1949).

Person-Environment Fit Measures

In the questionnaire we asked each individual to indicate the extent to which some aspect of work was present in the person's job and to what extent the person would like it to be present. This was done for items found in the following subjective environment clusters: role ambiguity, subjective quantitative work load index, complexification, subjective qualitative work load index, utilization of abilities, responsibility for persons, responsibility for things, advancement and recognition, participation, relations with the immediate superior, and relations with subordinates. A typical item pair is shown below:

CHECK ONE BOX IN EACH LINE:	Very Little [1]	Little [2]	Some [3]	Great [4]	Very Great [5]
43A. The work load, the amount of things that need to be done	☐	☐	☐	☐	☐
B. The work load you would like	☐	☐	☐	☐	☐

The A component was the measure of subjective environment, and the B component was assumed to measure the subjective state of the person. By subtracting one score from the other, a measure of P-E fit was obtained for each item pair.

In addition, P-E fit clusters were also constructed. To do this and insure good commensurability between P and E, the P components for each cluster listed above were examined in an intercorrelation matrix following procedures described on Pages 100 and 101. Those clusters of P items which survived this analysis were then subtracted from their E components and clusters of P-E fit items were formed. The content of these P-E fit clusters and the interitem correlations for the items within each cluster are presented in Appendix X. Table X-10 in that appendix gives the average interitem correlation and estimated reliability for each cluster. Table X-11 in Appendix X gives the intercorrelations among all of the P-E fit clusters.

Using Nunnally's (1967, p. 226) criteria for reliability, any cluster with an estimated reliability of less than .50 was dropped from the analyses. This leaves the following P-E fit clusters in the study: role ambiguity, subjective quantitative work load index, complexification, subjective qualitative work load index, utilization of abilities, responsibility for persons, responsibility for things, participation, and relations with immediate superior.

The Dependent Variables

Psychological Dependent Variables

There are three such measures: job-related satisfaction, job-related threat, and occupational self-esteem. The first of these, job satisfaction, is presented in Appendix XI. The content for this measure came from a variety of job satisfaction questionnaires (Robinson, Athanasiou, & Head,

1967) as well as from our theoretical conceptualizations of those aspects of the work situation (such as quantitative overload) which lead to dissatisfaction. To get the person to indicate those aspects of the job which were particularly satisfying at NASA, he was asked to rate each item on the extent to which it was more satisfying than would be the case in other organizations. The score for the measure was simply the overall mean for those items the subjects responded to. Table 15 presents the average inter-item correlation and estimated reliability for this measure and the other two psychological dependent variables. The average interitem correlation for the satisfaction measure is .30, while the estimated reliability is .89.

TABLE 15

AVERAGE INTERITEM CORRELATIONS AND ESTIMATED RELIABILITY FOR PSYCHOLOGICAL DEPENDENT VARIABLES

Measure	Average r	Estimated Reliability	Number of Items
Job-related satisfaction	.30	.89	19
Job-related threat	.43	.92	17
Occupational self-esteem	.37	.89	15

The second measure, job-related threat, was constructed by creating one item to reflect the potential threat-producing effect of each of the subjective stresses in the study. The items and format are presented in Appendix XII. Threat is reflected by the stem of the measure which asks about potential future effects of current job stresses. The person is asked to what extent each job aspect may eventually be harmful to the person's physical or mental health if the aspect continues as it is. This is consistent with Lazarus' definition of threat as the "awareness of present cues about future harms" (1966, p. 32).

The threat measure has been scored by taking the average of all completed items. The 17-item measure has an average interitem correlation of .43 which is moderately high, and an estimated reliability of .92 which is quite acceptable.

The third psychological dependent variable, occupational self-esteem, has scale properties based on French and Sherwood's (1963) theoretical work. The measure is presented in Appendix XIII. The respondent is asked to indicate on 15 bipolar scales where he stands, as a measure of subjective real self, and where he would like to stand, as a measure of subjective aspired self. Self-esteem is conceived of as dissatisfaction with the self, and therefore, the greater the discrepancy between real and aspired self across all scales, the lower the person's self-esteem. The content for the scales comes essentially from two sources: (a) interview material gathered prior to the construction of the questionnaire in which people at NASA indicated what was important to them in determining their own feelings of self-worth, and (b) similar material from research by Pelz and Andrews (1966) on persons in research and design organizations.

Scoring was carried out by taking the overall mean absolute discrepancy score between real and aspired self across all completed dimensions. The average correlation between all of the items (each item is represented by a difference score) is .37, and again estimated reliability is high ($r_{kk} = .89$).

The intercorrelations between these three measures of strain are presented in Table 16. The highest intercorrelation is between the satisfaction and threat measures ($r = -.44$, $p < .001$).

TABLE 16

INTERCORRELATIONS BETWEEN PSYCHOLOGICAL STRAIN MEASURES[1]

Variable	a	b
a. Job satisfaction	---	
b. Job-related threat	-.44[3]	---
c. Job-related self-esteem	.14[2]	-.25[3]

[1]N = 205.

[2]$p < .05$.

[3]$p < .001$.

Physiological Dependent Variables

The procedures for the medical interview, during which pulse rate, blood pressures, and a blood sample were obtained, have already been presented in Appendix II. Two measurements of the pulse and of the blood pressures were taken to ensure reliability, and, as expected, the pulse readings and systolic and diastolic readings on each subject were highly consistent (r = .97, .96, and .86 respectively). Therefore, in the analyses which follow, the first reading of each pair was arbitrarily adopted. The means and standard deviations of the physiological dependent variables and age for the total sample have already been presented in Table 5.

Biochemical analyses of the blood sera were carried out under the supervision of George Brooks, M.P.H. These analyses were performed on a Technicon "auto-analyzer," an automated analysis device.

The method of analysis for the serum cholesterol is based on a modification of the procedure described by Levine and Zak (1964). The

The mean for the serum cholesterol level was a little lower than we expected (191.37 mg/100 ml). Therefore, we decided to check the reliability of the determinations by selecting a random sample of 24 sera and having them reanalyzed by an independent laboratory (Walter D. Block, Ph.D., Associate Professor of Biological Chemistry at The University of Michigan Medical School performed these analyses; the raw data are presented in Appendix XIV). As it turned out, the two sets of values for this subsample correlated .97 which is quite adequate. On the other hand, the analysis by Dr. Block produced significantly higher mean values for the cholesterol in the subsample ($p < .001$). However, since the study is concerned primarily with the relationship between variables rather than the absolute values of the variables, it was decided that the high correlation provided sufficient support for using the cholesterol values from our own laboratory rather than going to the expense of redoing the analyses (besides, we would need a third determination to decide which laboratory was more accurate). Repeat reliability between analysis runs was kept within $\pm$ 3 mg/100 ml in the analyses by George Brooks.

The procedure for the determination of serum uric acid was adopted from the manual method described by Hawk, Oser, and Summerson (1954). Between-run reliability was kept to $\pm$ 3 mg/100 ml.

The method for the determination of glucose is an adaptation of nonautomated procedures (Technicon, 1965). Run to run reliability was kept to within 2%.

Plasma cortisol was determined by the fluorometric method described by Dale (1967). No data on reliability were available from the laboratory.

The determination of lipoprotein values is described by Gebott (1968). The ratio used was the sum of beta and prebeta lipoproteins divided by the quantity of alpha lipoproteins. Unfortunately, it was necessary to freeze the sera for shipping to our laboratory in Michigan, and this, according to Fredrikson, Levy, and Lees (1967) "irreversibly alters the lipoprotein pattern." Therefore, there is great question as to the validity of these determinations, and they have been excluded from analysis in the study.

Cigarette smoking has been measured in the study in terms of self-report. Persons were asked whether they smoked, and how much they smoked of cigarettes, pipes, and cigars. The questionnaire measures of smoking behavior are presented in Appendix XV (Items 8-11). Respondents were also asked on this form to indicate the number of times they had visited the health dispensary during the year, the members of their family who had a history of coronary heart disease, and their height (in stocking feet) and their weight (office clothes, no heavy coat, and without shoes). The height and weight measures were combined as a ponderal index which is the height in inches divided by the cube root of the weight in pounds. These measures also appear in Appendix XIV as Items 12-17.

Table 17 presents the intercorrelations between these health variables. Age is also included in the table. Diastolic blood pressure and serum cholesterol are significantly and positively correlated with age ($r = .28$, $p < .01$; and $r = .32$, $p < .01$ respectively). Systolic and diastolic blood pressure correlate .68 ($p < .001$) and both are positively correlated with pulse rate ($r = .30$, $p < .01$; and $r = .31$, $p < .01$ respectively). Both pulse rate and systolic blood pressure are identically correlated with serum cortisol ($r = .17$, $p < .05$). However, the correlation of pulse with cortisol drops to .12 when systolic blood pressure is statistically partialled out, and the correlation of systolic blood pressure with cortisol also drops to .12 when pulse rate is statistically controlled. The

TABLE 17

INTERCORRELATIONS BETWEEN PHYSIOLOGICAL RISK VARIABLES

Variable	a	b	c	d	e	f	g	h	i	j
a. Pulse rate	---									
b. Systolic blood pressure	<u>.30</u>[2]	---								
c. Diastolic blood pressure	<u>.31</u>	<u>.68</u>	---							
d. Serum cholesterol	.04	.17	.16	---						
e. Serum uric acid	-.01	.08	.12	-.04	---					
f. Casual glucose	.05	.11	.15	<u>.23</u>	.04	---				
g. Serum cortisol	<u>.17</u>	<u>.17</u>	.11	.13	.06	.16	---			
h. Number of cigarettes smoked[1]	<u>.35</u>	<u>.32</u>	.21	.06	-.03	.18	.06	---		
i. Age	.07	.15	<u>.28</u>	<u>.32</u>	-.11	.17	-.04	.15	---	
j. Ponderal index	-.06	<u>-.20</u>	<u>-.30</u>	-.09	<u>-.32</u>	-.12	-.03	-.02	-.10	---
k. Family history of CHD	.06	.12	<u>.22</u>	<u>.20</u>	.07	-.05	.00	.05	.07	-.05

[1]For persons smoking one or more cigarettes per day.

[2]Underlined correlations are significant at $p \leq .05$.

relationship between pulse rate and systolic blood pressure is negligibly affected by holding cortisol statistically constant (r drops from .30 to .28). Figure 5 depicts the relations between systolic blood pressure, pulse rate, and cortisol in a correlogram. Essentially, only pulse and systolic blood pressure are related.

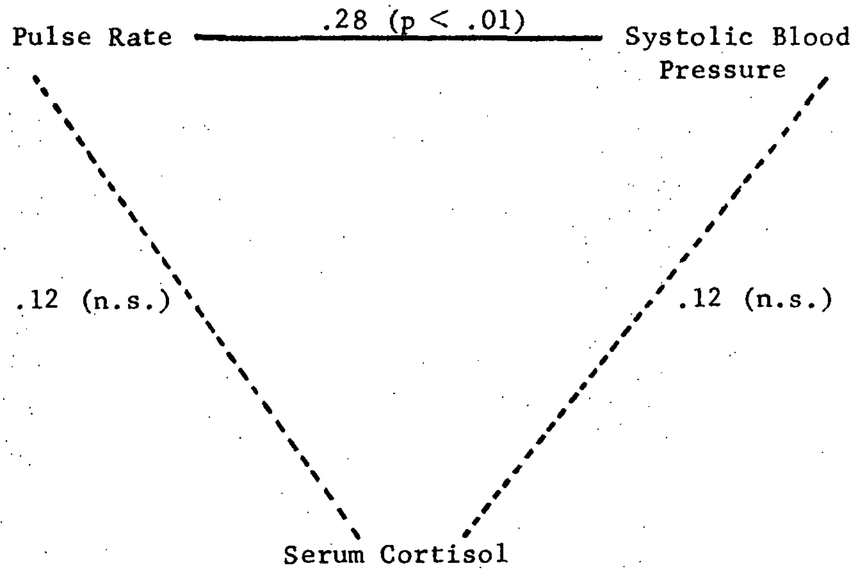


Figure 5. Correlogram of pulse rate, systolic blood pressure, and serum cortisol. Partial correlations are presented between adjacent pairs of variables with the third variable held statistically constant.

Returning to Table 17 we see that serum cholesterol and casual glucose are correlated .23 ($p < .05$). A high ponderal index indicates that the person is under- rather than overweight. Ponderal index is negatively correlated with systolic blood pressure, diastolic blood pressure, and serum uric acid ($r = -.20$, $-.30$, and $-.32$, all significant at $p < .01$). Thus, overweight people tend to score higher on these three risk factors. Since systolic and diastolic blood pressure are correlated, it is again necessary to hold each statistically constant while examining the relationship of the other to ponderal index to determine the unique shared variance between each of the blood pressure measures and this measure of obesity. Figure 6 presents another correlogram indicating the partial correlations among the three variables. Essentially, it is diastolic, and not systolic, blood pressure which is negatively related to ponderal index.

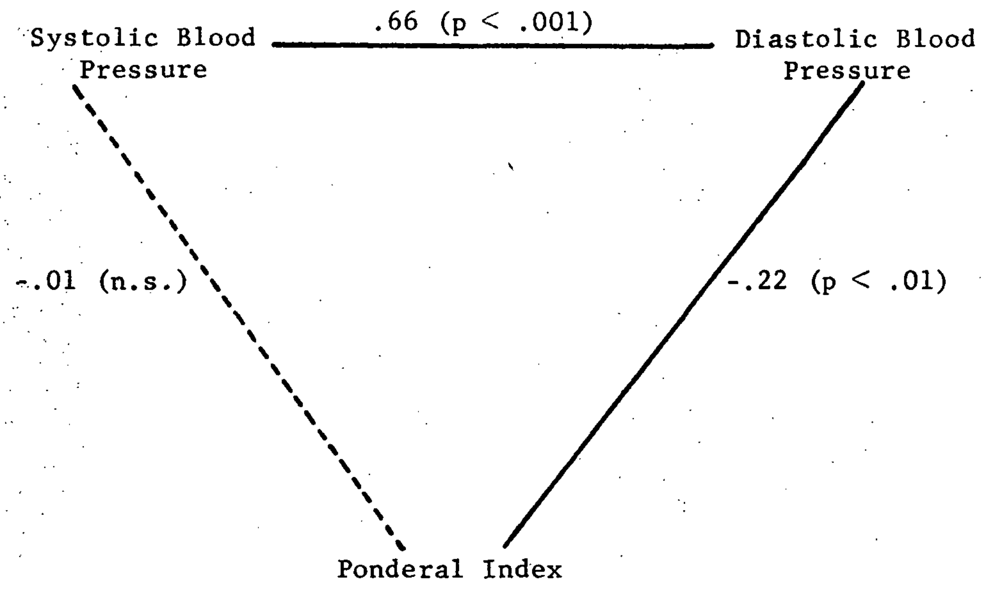


Figure 6. Correlogram of systolic and diastolic blood pressure and ponderal index. Partial correlations are presented between adjacent pairs of variables with the third variable held statistically constant.

The number of cigarettes a person smokes is positively correlated with pulse rate ($r = .35$, $p < .05$) and with systolic blood pressure ($r = .32$, $p < .05$). It is positively but nonsignificantly correlated with diastolic blood pressure ($r = .21$).

The last variable in the table is family history of coronary heart disease. Each person was asked to indicate, on a check list, which members of his side of the family had some form of CHD "as verified by a physician." A count was made and a total score compiled. Family history correlates with two of the other dependent variables in the study. These are diastolic blood pressure ($r = .22$, $p < .01$) and serum cholesterol ($r = .20$, $p < .01$). These data suggest that the early "environment" of the individual may have played a significant role in the determination of his risk of coronary disease although, at the very most, less than 5% of the variance in either of the two physiological variables is explained by family history of CHD.

The rest of the correlations in the matrix are nonsignficant. Of the significant correlations, each represents less than 10% of the variance between pairs of variables--the one exception being the correlation between systolic and diastolic blood pressure. Thus, for the most part, this study utilizes several relatively independent theoretical measures of strain.

The Effect of Time of Day on the Reliability of Physiological Measures in the Study

In this study it was not possible to obtain measures of blood physiology either from fasting subjects or at the same time of the day for each subject. In the case of glucose, it is possible that samples taken right after meals such as in the early morning or afternoon, might produce markedly different results than samples taken in late morning or afternoon. For physiological measures which show a diurnal rhythm there might be constant errors introduced in the mean value of such samples obtained during different times in the work day.

To test out these possibilities, one-way analyses of variance were run using the hour of the day the blood sample was taken as the independent variable and blood sera levels as the dependent variables. The results of these analyses are summarized in Table 18. In every case there is no significant difference in values of physiological variables obtained from one time to another during the day. These findings suggest that the measures were relatively unaffected by diet and/or time of day.

TABLE 18

SUMMARY OF F TESTS OF THE EFFECT OF TIME OF DAY PHYSIOLOGICAL MEASURE WAS TAKEN ON AVERAGE VALUE OF THE MEASURE

Physiological Measure	F[1]
Pulse	1.38
Systolic blood pressure	1.10
Diastolic blood pressure	1.55
Serum uric acid	.75
Serum cholesterol	.59
Casual glucose	.49
Serum cortisol	.67

[1]Degrees of Freedom = 6,165 $\pm$ 2. All F tests are nonsignificant.

There is one finding in Table 18, however, which is contrary to our expectations. This is the nonsignificant F test for serum cortisol (F = .67, d.f. = 6,163). According to research by Hellman, Nakada, Curti, Weitzman, Kream, Roffwarg, Ellman, Fukushima, and Gallagher (1970); Krieger, Allen, Rizzo, and Krieger (1971); Mason (1959); Midgeon, Tyler, Mahoney, Florentin, Castle, Bliss, and Samuels (1956); and Nilsson, Arner, and Hedner (1963), people show a diurnal change in serum cortisol which begins with high levels of cortisol when the person awakes at the beginning of the day followed by a steady decline during the rest of the day. A more detailed examination of the mean levels of cortisol throughout the day in our sample is presented in Table 19. As you can see, there is little change in serum cortisol from morning to late afternoon. On the bases of some hypotheses

TABLE 19

SERUM CORTISOL BY TIME OF DAY SAMPLE WAS OBTAINED[1]

	Cortisol mg/100 ml		
Time[2]	N	$\bar{x}$	S.D.
9	48	14.8	4.8
10	26	15.1	6.0
11	5	16.0	6.2
Noon	--	---	---
1	23	14.8	4.6
2	17	12.6	3.0
3	48	14.4	5.3
4	3	12.5	1.2

[1]Overall $F_{(6,163)} = .67$, eta = .15.

suggested by Dr. Sidney Cobb (personal communication, 1971), further analyses of the relationship between serum cortisol and time of day were carried out examining the effects of work stress as a third variable which would tend to obscure the expected diurnal pattern. These findings are reported on in the results section of this study, but, for now, we should point out that when we control on job stress, the expected diurnal pattern does reappear. Thus, we may continue to have some degree of confidence about the reliability of the cortisol analyses.

The Analyses

Analyses for this study have been carried out using the OSIRIS/40 Data Management and Analysis Programs (Computer Services Facility, Institute for Social Research, 1970) on an IBM 360/40 computer. A variety of analysis procedures were used including correlation, analysis of variance, and other statistical programs. Where special procedures are used, they will be explained in the section on results which now follows.

PART III

Results

CHAPTER 3

First-Order Relationships between Stress, Personality, and Strain

The presentation of results essentially follows the order in which the hypotheses were presented in Chapter 1. This chapter will examine the first-order relationships between stress, personality, and strain. Chapter 4 will examine the role of personality in accounting for relationships between stress and strain, while Chapter 5 will examine the nature of occupational differences between administrators, engineers and scientists with regard to stress, personality, and strain.

Objective and Subjective Quantitative Work Load

Based on earlier findings by Caplan and French (1968), it was hypothesized that objective and subjective quantitative overload would be positively correlated. Earlier it was noted that only 25 persons were able to have their secretaries keep a tally of their office visits and phone calls in this study. Therefore, the findings are limited to a very small portion of the total sample. As it turns out, the subjective quantitative overload factor correlated negligibly and nonsignificantly with our tally measure of total phone calls and office visits per hour ($r = -.03$). The same is the case for the relationship between objective work load and the subjective quantitative work load index (r = .18, n.s.).

Since there is objective data on phone calls separately, office visits separately, and meetings separately, an examination can be made of the relationship of each of these to subjective work load measures. Again the findings are negative. This failure to replicate the Caplan and French findings may be due, in part, to a difference in the type of observers used. The former study used trained observers while this study used untrained secretaries who probably had a number of other competing demands to meet at the same time they were carrying out the tally.

However, one can look at other measures of subjective work load including those which ask the person to estimate (a) the number of phone calls, office visits, and meetings he actually has in a work week, and (b) the percent of time he spends in such activities. These findings are presented in Tables 20 and 21.

TABLE 20

RELATIONSHIP BETWEEN COMMENSURATE OBJECTIVE AND SUBJECTIVE MEASURES OF OFFICE ACTIVITIES

Number	r[1]
Outgoing phone calls	-.07
Incoming phone calls	.03
Office visits	-.13
Meetings initiated by others[2]	-.10

[1]N = 25, all r's nonsignificant.

[2]There was no objective measure of self-initiated meetings.

TABLE 21

RELATIONSHIP BETWEEN OBJECTIVE MEASURE OF NUMBER OF DIFFERENT OFFICE ACTIVITIES PER DAY AND SUBJECTIVELY ESTIMATED PERCENT OF TIME IN SUCH ACTIVITIES

Measure	r[1]	p <
Outgoing phone calls	.06	n.s.
Incoming phone calls	.54	.01
Office visits and meetings initiated by others	.06[2]	n.s.
	.38[3]	.10

[1]N = 25.

[2]Strictly commensurate measures were not obtainable. The correlation is between the subjective measure listed in the left hand column and the objective measure of number of office visits. For correlation in the line below, objective number of other-initiated meetings was substituted for office visits. There was no objective measure of self-initiated meetings.

In Table 20 the objective and commensurate subjective measures of number of different office activities which occurred are all uncorrelated. The coefficients range between -.13 and .03.

In the second table, where estimated percent of time is used as the subjective measure of work load, there are somewhat higher correlations. The objective and subjective measures of outgoing phone calls are unrelated ($r = .06$) but the two measures of incoming phone calls are positively correlated ($r = .54$, $p < .01$). The subjective measure of other-initiated office visits and meetings does not correlate with the objective measure of office visits but does tend to correlate with the objective measure of other-initiated meetings ($r = .38$, $p < .10$). There is no objective measure of self-initiated meetings.

While the estimated percent of time on outgoing phone calls is uncorrelated with the actual number of such phone calls, the percent of time measure is related to actual number of incoming phone calls. The relationship between the two subjective estimates of percent of time on the phone and the objective measures of office activities are presented in Table 22.

TABLE 22

RELATIONSHIP BETWEEN CERTAIN SUBJECTIVE AND OBJECTIVE ESTIMATES OF WORK LOAD

Objective Measure	Subjective Estimate[1]: % of Time on Incoming Calls	Subjective Estimate[1]: % of Time on Outgoing Calls
Number of Incoming Calls per Hour	.54[2]	.10
Number of Outgoing Calls per Hour	.56	.06
Number of Office Visits per Hour	.47	.01

[1]Subjective estimates of the <u>number</u> of incoming and outgoing phone calls per week are unrelated to the corresponding objective measures of number of phone calls.

[2]$r \geq .40$, $p \leq .05$; $r \geq .50$, $p \leq .01$. $N = 25$. All pairs of correlations within rows are significantly different from one another at $p < .05$.

As we just noted, the observed number of incoming calls correlates .54 with the person's estimate of the percent of time he spends on such calls ($p < .01$). Furthermore, the observed number of incoming calls only correlates .10 with the estimated percent of time on <u>outgoing</u> calls. This certainly does not seem unusual. It is the next row of correlations in the table which is unexpected. The observed number of outgoing calls fails to correlate with the estimated time spent on such outgoing calls ($r = .06$) but does correlate with the estimated percent of time on incoming calls ($r = .56$, $p < .01$).

This pattern of findings suggests that people are fairly accurate in estimating the amount of work others make for them (incoming phone calls) but are rather inaccurate in estimating the work they make for themselves (outgoing phone calls). Furthermore, their estimate of time on incoming calls correlates rather highly with the actual number of outgoing calls they make suggesting that they perceive the actual interactions they initiate as time spent in interactions initiated by others. "I don't make work for myself. It's the other guys who are always doing it!"

Another measure of subjective quantitative work load is the person's report of what percent of time he spends under various levels of deadline pressure. Table 23 presents the relationships between this measure and

TABLE 23

RELATIONSHIP BETWEEN OBJECTIVE WORK LOAD AND REPORTED PERCENT OF TIME A PERSON IS UNDER VARIOUS LEVELS OF DEADLINE PRESSURE

Level of Pressure	r^1	$p <$
None	-.15	n.s.
Slight	-.34	n.s.
Moderate	.59	.01
Great	-.15	n.s.
Extreme	-.14	n.s.

[1] N = 24.

the objective work load measure of total phone calls, office visits, and meetings per hour. The person is asked to indicate the percent of time spent under each level of pressure, and the percentages must add to 100. Therefore, the measures in the left column of the table are not independent of one another. Objective work load is only significantly related to the percent of time the person spends under moderate deadline pressure ($r = .59$, $p < .01$). Thus, asking the person to estimate the percent of time he spends under this level of pressure appears to be the best way of estimating objective work load in this case.

Objective work load is also related to the amount of overall stress persons report from various parts of the organization. These data are presented in Table 24. Each person was asked to rate on a four-point

TABLE 24

RELATIONSHIP BETWEEN OBJECTIVE WORK LOAD AND EXTENT TO WHICH DIFFERENT PARTS OF THE ORGANIZATION ARE SOURCES OF STRESS

Source of Stress	r[1]	p <
Own branch	.44	.05
Other branches	.13	n.s.
Other divisions	-.10	n.s.
Other directorates	-.04	n.s.
Other bases	.05	n.s.
Non-NASA employees	.46	.05

[1]N = 24.

scale the extent to which various parts of the organization were sources of stress. The extent to which the branch and non-NASA employees are sources of stress are positively correlated with the measure of objective quantitative work load (r's = .44 and .46 respectively, both $p < .05$). These two findings are independent of one another since the correlation between amount of stress from own branch and from non-NASA employees is nonsignificant (r = .12). Overall stresses from other parts of the organization are unrelated to objective work load (r's range from -.10 to .05, all n.s.).

Overall, these findings show that the relationship between objective and subjective measures of work load are not simple: the comparison made of subjects' subjective estimates of work load and tallies kept by the secretaries shows that the focal person's perception of what is an incoming, as opposed to an outgoing, phone call is, indeed, very subjective; the overall measure of objective work load is related to the percent of time under one intensity of deadlines but not others; and stress from two levels of the organization but not from other levels of the organization are related to objective work load. Some caution, however, is urged in interpreting these findings. As was pointed out earlier, the sample of volunteers for the work tally are primarily administrators, and thus, the findings presented here may only hold for that occupational group.

Objective Quantitative Work Load and Strain

These findings are presented in Table 25.

Psychological Strain

There appears to be no relationship between the objective quantitative work load measure and our measures of job satisfaction, job-related threat, and job-related self-esteem (r = .02, .23, and .16 respectively).

TABLE 25

RELATIONSHIP BETWEEN OBJECTIVE QUANTITATIVE WORK LOAD[1] AND STRAIN

Strain	r	p <
Job-related satisfaction	.02	n.s.
Job-related threat	.23	n.s.
Job-related self-esteem	.16	n.s.
Pulse rate	.23	n.s.
Systolic blood pressure	.18	n.s.
Diastolic blood pressure	.15	n.s.
Serum cholesterol	-.29	n.s.
Serum uric acid	-.39	.10
Serum cortisol	-.03	n.s.
Casual glucose	.13	n.s.
Ponderal index	.00	n.s.
Number of cigarettes smoked	.52[2]	.10

[1]Average number of phone calls and office visits per hour. N = 25.

[2]For persons smoking one or more cigarettes per day. N = 11.

Physiological Strain

Similarly, there are no significant relationships between objective quantitative work load and pulse rate, systolic and diastolic blood pressure, serum cholesterol (which, if anything, shows a negative relation, -.29, n.s.), serum cortisol, casual glucose, and ponderal index.

There is a negative correlation between objective quantitative work load and serum uric acid which almost reaches statistical significance ($r = -.39$, $p < .10$). This finding is of theoretical interest since Brooks and Mueller (1966) suggest that high serum uric acid is positively related to the ability to master one's environment rather than be overburdened by it. The correlation presented here could be interpreted as support for the Brooks and Mueller hypothesis if we regard the presence of excessive phone calls and office visits as evidence that the person cannot master his job environment.

Finally, there is a positive correlation between objective quantitative work load and the number of cigarettes a person reports he smokes per day given that he smokes ($r = .52$, $p < .10$). This suggests that people may smoke more under conditions of objective job stress. However, it may also mean that <u>heavy</u> smokers are more likely to get into objectively overloading jobs than light smokers. With regard to whether a person smokes or not, there is no relationship between being a smoker, nonsmoker, or exsmoker and objective overload ($F = 1.24$, n.s.).

Overall, there appear to be few links between objective stress and psychological or physiological strain in these data. The negative findings regarding the relationship of objective stress to serum cholesterol constitute a failure to replicate the earlier positive findings of Caplan and French (1968). There are a number of reasons why such a failure to replicate may have occurred. First of all, the earlier study drew blood samples <u>after</u> the objective measurements were obtained. In this study, blood samples were drawn <u>before</u> objective work load measurements were obtained so that if there is some cause-effect sequence, we may have missed it. Second, as already noted, the reliability of the observers may have been higher in the first study. Third, in the current study, we may be dealing with a highly selective sample; 90% of the persons in the first study volunteered for the tally, while only about 10% volunteered for the tally in this study.

Note, however, that the findings from the first study do suggest that most of our results should be negative since how a person views his environment, rather than what his environment objectively is, may have the greatest effect on determining his reaction to it. The next section examines this relationship between subjective stresses and strain.

Subjective Stress and Strain

In Table 9, intercorrelations were presented between several different measures of subjective stress. In this section, each type of stress shall be considered along with its relationship to both psychological and physiological strain. As this is done, interrelationships among the different types of stress will be discussed since these interrelationships can tell us something about the nature of each stress variable. In many cases, the relationship between the stress being studied and some other stress may be due to the mutual relationships of both to some third measure of stress. In such cases discussing of the relationships between two such stresses will be withheld until analyses using multiple and partial regression techniques are presented to help clarify the meaning of some of the findings.

Role Ambiguity

In Chapter 1 it was noted that the Kahn et al. (1964) study of the national work force found that role ambiguity was fairly prevalent. Table 26 presents the percentage of persons at Goddard who also reported role ambiguity. Compared to the national work force estimates, Goddard has over one and a half times as much ambiguity. This is in keeping with the characterization of Goddard as a high stress setting. Table 26 also

TABLE 26

THE PREVALENCE OF SEVERAL MAJOR TYPES OF JOB STRESS

Type of Stress	% Reporting Stress	
	Goddard[1]	Kahn et al., 1964[2]
Role Ambiguity	60.0	34.7
Role Conflict	67.1	48.0
Subjective Quantitative Overload	72.6	44.0
Subjective Qualitative Overload	53.8	---

[1]These percents represent those people whose average scores are equivalent to at least the "some" category on the measuring scale used.

[2]From a national survey of male wage and salary workers (N = 725). There is substantial, but not perfect, overlap between the measures of stress used in the Kahn et al. study and the measures of stress used in the Goddard study.

presents comparative data on the prevalence of other major stresses at Goddard. The figures again are higher than they are in the work force study with 67.1% of the Goddard respondents reporting role conflict, 72.6% reporting subjective quantitative overload, and 53.8% reporting subjective qualitative overload (compared to 34.7, 48.0, and 44.0 respectively from the Kahn et al. study). Now let us return to an examination of role ambiguity as a major organizational stress variable.

Role ambiguity correlates with a number of other stress variables. This type of stress is apparently characteristic of persons who tend to be under- rather than overloaded. Thus, persons reporting role ambiguity tend to report low complexification of their organizational environment ($r = -.35$, $p < .001$), and low utilization of abilities ($r = -.46$, $p < .001$). They also report little utilization of their leadership talents ($r = -.27$,

$p < .01$), low participation in decision-making ($r = -.42$, $p < .001$), and little responsibility for persons ($r = -.33$, $p < .001$) and for impersonal aspects of their jobs such as the budget, equipment, and projects ($r = -.37$, $p < .001$).

In addition, people who report high role ambiguity also report very poor relations with their immediate superior ($r = -.41$, $p < .001$), their subordinates ($r = -.41$, $p < .001$), and their work group or peers ($r = -.43$, $p < .001$).

When one puts these findings on participation, relations with others and role ambiguity together, a hypothetical and rather cyclical process of conditions leading to role ambiguity can be constructed. The person either experiences role ambiguity or strained relations with his senders. This leads them to exclude the focal person from participation in decisions; in turn, this increases the knowledge gap between the focal person and the role senders since he now knows even less about what is going on in his organization. His increased ignorance leads to further ambiguity and strained relationships and further exclusion from decision making--a self-fulfilling prophecy of organizational member ignorance.

With such grim conditions surrounding role ambiguity, it is not surprising to find that persons high in role ambiguity report that their job offers little chance for advancement ($r = -.28$, $p < .01$). In other words, they are in an environment of futility. Kahn et al. (1964), in their national study of the labor force, report similar findings. They found high role ambiguity associated with feelings of futility with regard to being able to cope with the demands of the work environment ($r = .41$, $p < .001$). In their study, persons experiencing role ambiguity also reported, as is the case in our study, low trust, respect, and liking for their role senders and little communication with them--a pattern we have described above.

Since many of these stress correlates of role ambiguity are related to one another, a stepwise multiple regression of the stress correlates of role ambiguity on ambiguity has been carried out. The theory for stepwise multiple regression is described in Walker and Lev (1953), however, some aspects of the procedure should be pointed out here since this procedure will be used elsewhere in this study.

The regression procedure works by selecting from the pool of predictors that variable which reduces the variance of the dependent variable by the greatest amount. This predictor is then generated as the first step in the prediction equation. Next, a search is made among the remaining predictors to find that variable which does the best job of further accounting for variance in the dependent variable while holding statistically constant the predictor (or predictors) entered into the equation in preceding steps. This process continues until all of the predictors have been entered into the equation or until the reduction in remaining variance in the dependent variable becomes negligible at each succeeding step (that is, nonsignificant). Although the terms predictors and dependent variables have been used to describe this procedure, there is no implication in most of the analyses that any of these stresses necessarily precede the dependent variable in time. The procedure is used primarily for descriptive purposes to identify some of the main stresses which accompany other stresses.

Table 27 presents the result of the regression of other stresses on role ambiguity. In this table, as well as in future tables presenting such stepwise regression analyses, the predictor variable generated at each

TABLE 27

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT STRESS CORRELATES OF ROLE AMBIGUITY[1]

Step	Correlate Added	R	Final β
1	Low participation	.54	.32
2	Low utilization of abilities	.59	.23
3	Poor relations with immediate superior	.61	.20

[1]After Step 3, the following variables did not have beta weights significantly different from zero: low utilization of administrative leadership, complexification, poor relations with the workgroup, and with subordinates, few opportunities for advancement and recognition, and responsibility for persons and for things.

step will be noted as well as the cumulative or multiple regression coefficient at that step. In addition, the final beta weight for each variable in the regression will be presented. This beta weight may either drop or increase as subsequent variables are added to the regression equation since it represents the contribution of the variable with all other variables in the equation statistically held constant.

The regression analysis here shows that low participation accounts for the most variance in role ambiguity. Next comes low utilization of abilities, and then poor relations with one's immediate superior. The multiple R for the three steps generated is .61 which represents 37% of the variance in the role ambiguity measure.

Now let us examine the relationship between role ambiguity and our dependent variables or measures of strain. Role ambiguity correlates significantly and negatively with our measure of job satisfaction ($r = -.42$, $p < .001$) and significantly and positively with job-related threat ($r = .40$, $p < .001$). Persons who experience role ambiguity also tend to experience low job-related feelings of self-esteem ($r = -.18$, $p < .01$).

Since the three measures of psychological strain are intercorrelated, a stepwise multiple regression of them on role ambiguity can suggest the relative contribution of each of these measures in terms of shared variance with role ambiguity. The results of such an analysis are presented in Table 28. The results show that job satisfaction and job-related threat both explain significant, independent amounts of the variance in role ambiguity ($p < .001$), and job-related self-esteem still tends to show an inverse relationship with role ambiguity ($p < .10$). Overall, these findings provide evidence of an inverse relationship between role ambiguity and psychological strain.

TABLE 28

STEPWISE MULTIPLE REGRESSION OF PSYCHOLOGICAL STRAIN ON ROLE AMBIGUITY

Step	Correlate Added	R	Final β
1	Job satisfaction	.40	-.28[1]
2	Job-related threat	.47	.26[1]
3	Job-related self-esteem	.48	.08[2]

[1] $p < .001$.

[2] $p < .10$.

Now let us again turn to the research on role ambiguity by Kahn et al. They similarly find that role ambiguity is inversely correlated with job satisfaction ($r = -.32$, $p < .05$), positively related to a measure of job tension ($r = .51$, $p < .01$), and negatively related to self-confidence ($r = -.27$, $p < .05$). Low self-confidence in the Kahn et al. study was defined as having experienced "a loss of effectiveness as a personal shortcoming" (p. 85). This seems analogous to what might be terned low self-esteem. It appears, therefore, that the Kahn et al. findings regarding the negative effects of role ambiguity on psychological strain have been replicated in the research at Goddard.

Turning to our measures of physiological strain we find no evidence of any relationship between the risk factors and role ambiguity. The coefficients are of low magnitude and nonsignificant.

In summary, it has been shown that role ambiguity is likely to be found in organizational members who are not fully utilized by the organizations they work in. And, we have found that ambiguity is related to at least one risk factor in coronary heart disease--job satisfaction. These relationships are summarized for the reader in Figure 7.

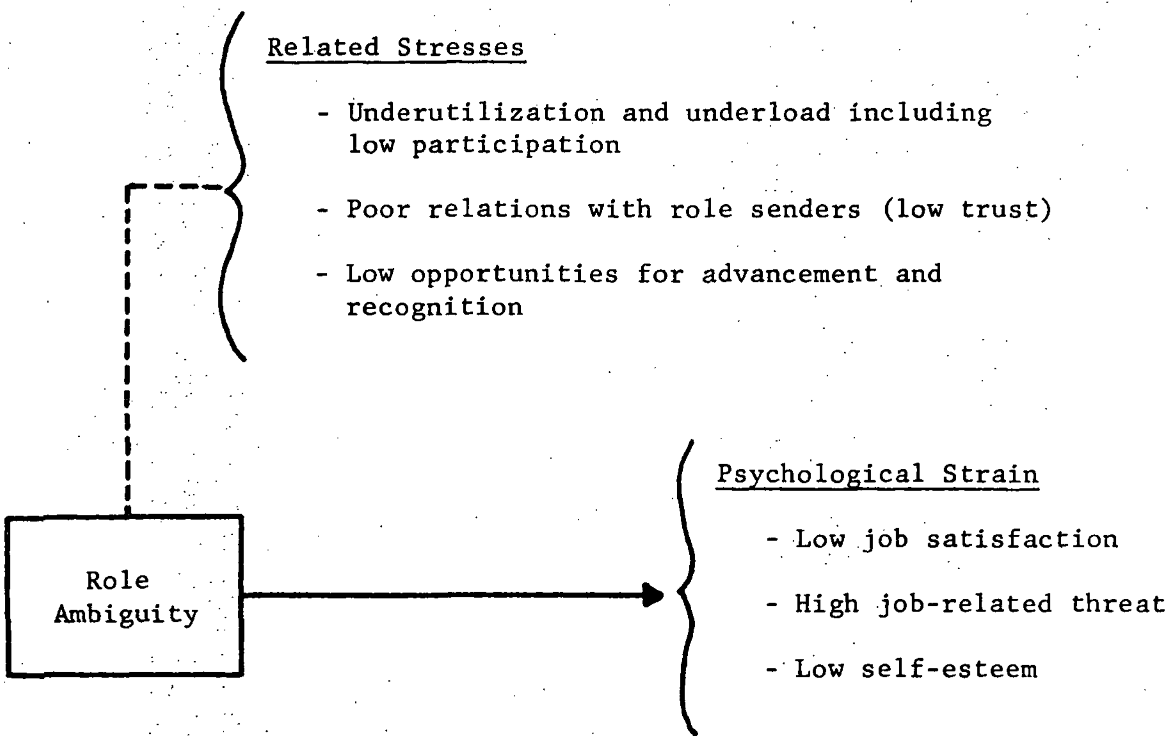


Figure 7. Theoretical interpretation of the findings dealing with role ambiguity.

Subjective Quantitative Work Load

Table 26 indicates that 72.6% of the people at Goddard report at least "some" degree of subjective quantitative overload. This is approximately 1.6 times the prevalence reported in the Kahn et al. national survey. In this section the relationship between subjective quantitative work load and strain will be examined.

Earlier a .66 correlation between the subjective quantitative work load index and the subjective quantitative overload factor was reported. In light of this moderately high correlation between the two measures, the relationship of both to strain will be reported. Although the factor measure is called a measure of overload rather than work load, it is not clear that overload is what it measures. Since persons are asked to indicate how much "stress" they experience from different sources of work load, it may be that the measure reflects the amount of strain the person experiences as well as the amount of stress. Admittedly there is a danger of contamination in the test of the hypothesis, but the factor measure is included here since it has been used in previously cited studies of work load and its relationship to stress and strain.

Again, as was done with role ambiguity, it is fruitful to examine the subjective environmental correlates of these work load measures. This will provide a fuller picture of what the environment is like for a person under heavy perceived work load.

Table 29 presents some of the findings on the relationship between these two measures of subjective quantitative work load and some single-item measures of the subjective work environment. The data show that the percent of time people report spending on other- and self-initiated phone calls and meetings are positively and, for the most part, significantly

TABLE 29

COMPARISON OF THE RELATIONSHIPS BETWEEN THE FACTOR AND INDEX MEASURES OF SUBJECTIVE QUANTITATIVE WORK LOAD AND SINGLE ITEM MEASURES OF JOB STRESSES[1]

Job Stress	Subjective Quantitative		$r_1 - r_2 \neq 0$
	Overload Factor	Work Load Index	p <
Percent of time on:			
Other-initiated phone calls	.19[2]	.35[3]	n.s.
Self-initiated phone calls	.10	.26[2]	n.s.
Other-initiated office visits and meetings	.30[3]	.40[4]	n.s.
Self-initiated office visits and meetings	.12	.28[3]	n.s.
Working alone	-.38[4]	-.52[4]	n.s.
Estimated number per week of:			
Outgoing phone calls	.05	.31[3]	.05
Incoming phone calls	.15	.42[4]	.05
Office visits	.20[2]	.23[2]	n.s.
Other-initiated meetings	.28[3]	.45[4]	.10
Self-initiated meetings	.11	.43[4]	.01
Percent of time under:			
No deadline pressure	-.45[4]	-.47[4]	n.s.
Great deadline pressure	.53[4]	.54[4]	n.s.
Number of days until questionnaire returned[5]	.21[3]	.14[2]	n.s.

[1] $N \cong 100$.

[2] $p < .05$.

[3] $p < .01$.

[4] $p < .001$.

[5] $N \cong 200$.

correlated with both the factor and index measures of subjective quantitative work load. These various measures of percent of time in different activities are not independent of one another since the percents of time must add to 100%. It is not surprising to see that the percent of time the person reports working alone is negatively correlated with the factor measure ($r = -.38$, p $.001$) and with the index measure ($r = -.52$, p $.001$) of subjective quantitative work load.

Turning to the next set of measures in the table, one finds that the person's estimate of the number of phone calls, both outgoing and incoming, as well as office visits and other- and self-initiated meetings are all positively and significantly correlated with the subjective quantitative work load index (r's range from .23 to .45, $p < .05$ to $p < .001$). On the other hand, only the reported number of office visits and other-initiated meetings are significantly correlated with the subjective quantitative overload factor ($r = .20$, $p < .05$; and $r = .28$, $p < .01$ respectively). The difference in the correlations with the factor measure and the correlations with the index measure form a regular pattern for the first ten sets of correlations in the table. In every case, the coefficients for the index measure are higher than for the factor measure. One major reason for this difference between the two measures may derive from the fact that they differ in the objectivity of the content they ask the respondent about. The factor measure asks the person to rate how much stress he experiences from different sources of work load while the index measure asks the person to indicate how little or how great is his work load. Thus, the index measure's elicited response set for objectivity is more similar than the factor's response set to items in the table which ask the person about "what percentage of time" and "how many" such work events he experiences. It is this similarity in the objective set which may account for the relatively higher correlations between the index and other measures of subjective work load.

To continue with other data in the table, there is a negative correlation between the percent of time the person is under <u>no</u> deadline pressure and the person's score on both the index and factor measures (r's = -.45 and -.47, both $p < .001$), and conversely, there is a positive correlation between the amount of time the person reports spending under <u>great</u> deadline pressure and both the index and the factor scores (r's = .53 and .54, both $p < .001$). These two sets of correlations are again somewhat dependent on one another since the percent measures ask about the time the person spends under these as well as intermediate levels of pressure (the latter are uncorrelated with the index and factor measures of work load) and must all add to 100%.

The last finding in the table is rather interesting because it makes use of an objective and somewhat unobtrusive measure (Webb, Campbell, & Sechrest, 1969) of quantitative work load: the number of days it took until the questionnaire was returned to the Institute for Social Research. This measure correlates positively with both the factor measure ($r = .21$, $p < .01$) and the index measure ($r = .14$, $p < .05$; the p values are higher than they were for other coefficients in the table because the sample size was 200 for this analysis). Thus, the busiest people appear to have so many competing role demands to fulfill, that they take longer to get around to completing their questionnaires.

Overall, these findings present a very consistent picture of the high quantitative work load person as one who has, and spends, a good deal of time interacting with other individuals both in meetings and on the phone. Furthermore, such persons appear to be under a good deal of deadline pressure.

The next table presents relationships between other job stresses and the two subjective quantitative work load measures. The first finding

TABLE 30

COMPARISON OF THE RELATIONSHIPS OF THE SUBJECTIVE QUANTITATIVE WORK LOAD INDEX AND OVERLOAD FACTOR TO SUBJECTIVE JOB STRESS INDICES[1]

Subjective Job Stress	Subjective Quantitative: Overload Factor	Subjective Quantitative: Work Load Index	$r_1 - r_2 \neq 0$ $p <$
Qualitative work load index	.33[4]	.19[3]	.10
Complexification	.13	.20[3]	n.s.
Utilization of leadership	.20[3]	.42[4]	.01
Participation	-.05	.20[3]	.01
Responsibility for persons	.32[3]	.57[4]	.005
Responsibility for things	.11	.29[3]	.05
Good relations with:			
Superior	.03	.16[3]	.10
Work group	.00	.15[3]	.10
Subordinates	.19[3]	.35[4]	.05

[1] N = 200.

[2] $p < .05$.

[3] $p < .01$.

[4] $p < .001$.

deals with subjective qualitative work load. The more such work load persons report, the more the quantitative work load they experience. This is not surprising in light of a point made earlier in a theoretical discussion of the meaning of different types of work load. There it was pointed out that in many cases it is possible for both quantitative and qualitative work load to overlap with one another. The subjective qualitative work load index is correlated somewhat higher with the subjective quantitative overload factor ($r = .35$) than it is with the subjective quantitative work load index ($r = .19$). This suggests that the qualitative work load index is more a measure of quantitative overload and its related strain than a measure of quantitative work load.

Persons who report high work load also tend to report high complexification in their job environment although in this case the correlation is only significant for the work load index measure. The relationship between subjective quantitative work load and complexification is somewhat expected; a rapid rate of change in technology and the development of the profession would be expected to provide additional work load for the person who is trying to keep up with the complexification process.

The next finding in the table deals with participation and suggests that persons who score high on the subjective quantitative work load index are persons who participate a lot ($r = .20$, $p < .01$). On the other hand, participation is nonsignificantly and negatively correlated ($r = -.05$) with the subjective quantitative overload factor, and the difference between the two coefficients is statistically significant ($p < .01$). The relationship between participation and subjective work load will be discussed shortly when some additional data are presented which bear on the interpretation of the findings.

Responsibility for persons is another subjective stress variable which also is positively associated with subjective quantitative work load. It correlates .32 ($p < .01$) with the factor measure and .57 ($p < .001$) with the index measure of subjective quantitative work load. The difference between these two coefficients is significant at $p < .005$, and again, the difference will be explained shortly when additional analyses are presented which are relevant to the issue. Responsibility for impersonal aspects of the job (responsibility for things) is also positively correlated with the work load measures, and again the correlation is higher with the index measure than with the factor measure. Thus, the person who reports high work load also tends to report a good deal of responsibility for person-related and impersonal aspects of the job.

The last set of findings presented in Table 30 deals with the quality of relations the person has with various role senders. Good relations with the superior, work group, and subordinates are consistently and positively associated with reports of high quantitative work load using the index measure (r's range from .15, $p < .05$ to .35, $p < .001$). Why, however, should good relations with role senders be associated with reports of high quantitative work load? An examination of the items for the measures of relations with role senders and the work load index measure (see Appendix V for the item content) shows that good relations are, in part, defined in terms of how well role senders cooperate with the person in getting the work done. Other items deal with whether the focal person is trusted by role senders and can, in turn trust them. It is likely that such trust centers around confidence that members of the role set can be counted on to do the job. Thus, a climate of high expectations with regard to role performance seems to be described by the measures of relations with role senders. In such a climate one would expect that organizational members would feel substantial obligations to one another to do good work and to work harder--hence, they should be more likely than persons experiencing poor relations to report heavy work load. From impressions gained through preliminary interviews at NASA, I have the impression that good task performance goes hand in hand with having the respect of and, consequently, good relations with other members of one's role set.

While relations with role senders is positively correlated with the index measure of work load, it is uncorrelated with the factor measure. This pattern of differences in the magnitude of correlations is common in the table. In eight out of nine pairs of correlations the coefficients for the index measure are greater than the coefficients for the factor measure. Since the index measure and the measures of subjective stress use the identical response scales, it is likely that the differences in correlations just noted are due to shared method variance between the other measures of job stress and the subjective quantitative work load index. Reiterating a point made earlier, the index measure has more objective referents than the factor measure since it asks how much work there is rather than how stressful it is. The fact that its referents are more objective may mean that it is a more reliable measure and therefore has a better chance of relating to other indicators of stress. However, an inspection of the estimated reliabilities of the index and factor measures, presented in the methods chapter, shows that the index measure has a slightly higher estimated reliability coefficient than the factor measure (.87 versus .78). However, this may be because the index has nine items and the factor has only six items.

Now let us examine the results of a stepwise regression analysis to see what are the major independent job correlates, among the ones we have just reviewed, of both the index and factor measures of subjective quantitative work load. The findings dealing with the index measure are presented in Table 31.

TABLE 31

STEPWISE MULTIPLE REGRESSION OF CORRELATES OF THE SUBJECTIVE QUANTITATIVE WORK LOAD INDEX[1]

Step	Measure	R	Final β
1	Subjective quantitative overload factor	.66	.44
2	Responsibility for persons	.75	.22
3	Reported number of incoming phone calls	.78	.17
4	Complexification	.79	.11
5	Percent of time under great deadline pressure	.80	.11
6	Percent of time in other-initiated office visits and meetings	.81	.14
7	Relations with workgroup	.81	.09

[1]After Step 7, the following variables were nonsignificantly related to the subjective quantitative work load index: percent of time on other- and self-initiated phone calls, self-initiated meetings, and office visits; estimated number of outgoing phone calls, office visits, other- and self-initiated meetings; percentage of time under no deadline pressure; number of days until questionnaire returned; utilization of leadership; participation; responsibility for things; and relations with superior and subordinates.

The first step in the regression on the subjective quantitative work load index is the subjective quantitative overload factor, which, as was noted, correlates .66 with the index. Responsibility for persons turns up as the second important contributor followed by reported number of incoming phone calls, complexification, and percentage of time under great deadline pressure. Then comes the percentage of time in other-initiated office visits and meetings followed by good relations with one's workgroup. Together, these seven variables in the regression account for 66% of the variance in the subjective quantitative work load index (R = .81).

TABLE 32

STEPWISE MULTIPLE REGRESSION OF CORRELATES OF THE SUBJECTIVE QUANTITATIVE OVERLOAD FACTOR[1]

Step	Measure	R	Final β
1	Subjective quantitative work load index	.66	.56
2	Participation	.69	-.19
3	Percent of time under no deadline pressure	.71	-.18
4	Percent of time under great pressure	.73	.17

[1]After Step 4, the following measures were nonsignificantly related to the subjective quantitative overload factor: the reported percent of time on self- and other-initiated phone calls, self- and other-initiated office visits and meetings, and working alone; the estimated number per week of such phone calls, meetings, and office visits; the number of days until the questionnaire was returned; complexification; utilization of leadership; responsibility for persons and things; and relations with one's superior, workgroup, and subordinates.

Table 32 presents a similar analysis for the factor measure. The first step generates the index measure as the main correlate of the factor, but the rest of the variables which emerge from the regression analysis are somewhat different than those presented in Table 31. The second variable to emerge is participation, however, the beta weight has a negative sign in front of it. In Table 30 the first-order correlation between the subjective quantitative overload factor and participation was

-.05 and nonsignificant. There was a suppression effect present due to the subjective quantitative work load index since low participation now emerges as a significant correlate of the factor measure (the second-order r between participation and the factor measure with the work load index partialled out is -.24). One interpretation of this finding is that the more persons participate in decisions affecting their jobs, the more they can make things easier on themselves by resolving inefficiencies in work allocation and role sender expectations regarding their performances.

The third and fourth predictors to emerge in the regression analysis are the percent of time under no deadline pressure and the percent of time under great deadline pressure--each of which contributes separagely to the regression equation despite the fact that the two measures correlate -.47 ($p < .001$) with one another. Time under no deadline pressure is negatively related to the overload factor. Together these four variables in the regression account for 53% of the variance in the subjective quantitative overload factor ($R = .73$).

What accounts for the different sets of predictors in the two regression analyses just presented? In one regression analysis, for example, responsibility for persons appears yet it does not occur in the other. An examination of the item content of the two measures shows that they both cover the same types of job aspects--lack of time, too much work to do, and so on. However, the factor measure asks the person to report the amount of <u>stress</u> each aspect presents to the person. Stress may be interpreted as <u>strain</u> by the respondent. The correlates of the factor measure may represent aspects of the job which are more likely to produce psychological feelings of strain while the correlates of the index measure may merely be attendant stresses which accompany a person with a high subjective quantitative work load. At any rate, the regression analyses show that two measures, which are somewhat related to one another, have some dissimilarities with regard to the predictors of each--even though the predictors of both measures seem to come from a common domain of subjective quantitative work load.

Now let us turn to the findings on the relationship between the factor and index measures of subjective quantitative work load and strain. First findings relating to psychological strain will be considered.

The subjective quantitative overload factor is correlated .22 ($p < .01$) with job-related threat but is unrelated to either job satisfaction ($r = .10$) or job-related self-esteem ($r = .01$). On the other hand, the subjective quantitative overload index is positively correlated with job satisfaction ($r = .18$, $p < .01$) and with job-related self-esteem ($r = .16$, $p < .05$), but it is unrelated to job-related threat ($r = -.02$). One way to interpret these findings is that the experienced stress (the factor measure) of work load is related to feelings of threat while the sheer amount of work load is related to high job satisfaction and high self-esteem. This suggests an important differentiation between the two measures of work load. When the person thinks of work load in terms of its stress, he feels threatened. On the other hand, having a lot of work to do apparently is seen as positively reflecting on one's self-esteem and producing job satisfaction at NASA. The organization is apparently a place where being busy is desirable (later data on person-environment fit will corroborate this conclusion since it shows that most people at NASA want more rather than less work).

Now findings relating subjective work load to physiological strain will be considered. The findings relating subjective quantitative work load, using either the factor or the index, and physiological strain measured by pulse rate and serum cholesterol are negative. This, in essence, represents a failure to replicate findings from the study of 22 men at NASA Headquarters where the factor and pulse rate were found to correlate .68, and the factor and serum cholesterol were found to correlate .41. In the current study, these coefficients are .04 and .01 respectively. Methodological reasons for why pulse rate or serum cholesterol may not correlate with measures of overload in this study compared to the study of 22 men have already been discussed. These included an inability to gather pulse and cholesterol samples at times during or directly following the measurement of objective work load and the potential unreliability of work load measures in this study. One additional point can be added, however. In the study of 22 men, the subjective measures of work load were obtained after approximately nine hours of contact with each subject. In the current study, contact with each subject lasted approximately 10 to 15 minutes allowing for less rapport with the participants in the study. It may be that better rapport between the respondent and the researcher in the study of 22 NASA men increased the reliability of their responses on the subjective quantitative overload measure. While this is reasonable, it is unfortunately untestable.

There are no significant relationships between the other physiological strain measures and the subjective quantitative work load index or overload factor. However, there are two somewhat consistent findings relating serum cortisol to self-reports of phone activity. The first finding is that the percentage of time the person reports spending on self-initiated phone calls correlates .25 ($p < .01$) with serum cortisol. The percent of time reported spent on phone calls initiated by others correlates only

.05 (n.s.) with serum cortisol. The difference between these two correlation coefficients is significant at $p < .05$. Second, we find that the number of reported outgoing (equivalent to self-initiated) phone calls per week is also positively correlated with serum cortisol ($r = .17$, $p < .05$). The number of reported incoming phone calls are also correlated .14 ($p < .05$) with serum cortisol. The difference between these two coefficients is not significant. These correlations are not markedly high, and they could have occurred by chance despite the significance levels. They are presented here, nevertheless, in the hope that attempts might be made to replicate the findings in future studies.

<u>Serum Cortisol and the Stress of Work Load</u>

It was pointed out earlier, in the results section, that serum cortisol failed to show the expected diurnal pattern of <u>steady decline</u> from morning to afternoon. Dr. Sidney Cobb (personal communication, 1971) suggested that the initial high levels of cortisol may have been maintained throughout the day for many subjects because they were under heavy overload. Since one could predict that cortisol, a corticosteroid which responds to stress, should remain high for persons who are overloaded, this seemed like a plausible explanation. Three different types of analyses and the results of these analyses will now be described which, in fact, do tend to confirm the above hypothesis.

In all three analyses, two types of independent variables which might effect strain were considered: subjective quantitative and subjective qualitative work load. In addition, the measure of objective quantitative work load was included as an independent variable although the sample size is small ($N = 20$) for these analyses. In the first analysis, it was predicted that persons who were low on these measures of work load would show the expected inverse correlation between serum cortisol and time of day the blood sample was taken. On the other hand, persons who were high on these measures of work load would show no correlation between serum cortisol and time of day the sample was taken since their cortisol levels would be maintained throughout the day by the work load they worked under, and consequently, any diurnal pattern for cortisol would be masked. The sample was divided into two groups: (1) persons high (the upper one third of the sample) on each of the measures of work load, and (2) persons low (the lower one third of the sample) on each of the measures of work load. The analyses were performed on these two groups and the results are presented in Table 33.

TABLE 33

CORRELATION BETWEEN SERUM CORTISOL AND TIME MEASURE TAKEN[1] FOR PERSONS LOW AND HIGH ON VARIOUS MEASURES OF JOB STRESS

Stress	Stress Low	Stress High	N Low	N High	$r_1 - r_2 \neq 0$ $p <$
Subjective quantitative work load index	-.56	.10	43	50	.005
Subjective quantitative overload factor	-.17	-.10	52	51	n.s.
Mean deadline pressure	-.38	.12	43	51	.01
Estimated phone calls, office visits, and meetings per week	-.42	-.07	56	31	.10
Objective quantitative work load	-.04	.22	12	8	n.s.
Subjective qualitative work load index	-.22	-.14	64	70	n.s.
Subjective qualitative overload factor	-.13	-.32	56	47	n.s.

[1]Time coded to the nearest hour of the day that blood sample was obtained.

The first characteristic worth noting from the table is that every correlation (seven out of seven) between serum cortisol and the time of day the blood sera were collected is negative for persons who have low scores on the various work load stresses. On the other hand, only three out of seven of the correlations are negative for the persons who have high scores on the various stresses. Two of the expected differences in correlations between the high and low groups are significant at $p < .01$ or greater. This is over 25 times as many significant findings as might be expected by chance (although the work load measures are not independent of one another). An additional difference is significant at $p < .10$. Second, all three of these differences in correlation coefficients are associated with high stress from subjective <u>quantitative</u> work load measures (the subjective quantitative work load index, the mean deadline pressures the person experiences, and his estimate of total phone calls, office visits, and meetings per week) rather than subjective <u>qualitative</u> work load measures. Third, the magnitude of the correlations is greater for persons with low rather than high subjective quantitative work load on all four measures of this stress (the first four measures in the table). There is no such clear pattern of differences in correlation coefficients for the subjective qualitative work load measures. Thus, it is quantitative rather than qualitative stress which seems to have the greatest effect on cortisol. This again underscores the importance of differentiating between these two types of work load.

The second type of analysis which was performed involved an examination of the slopes of the regression of cortisol on the time of day the sample was taken for persons scoring high and persons scoring low on the above stresses. Again, it was predicted that the group low on stress should show negative slopes while the group high on stress should show a relatively horizontal or zero slope. The results of this analysis are presented in Table 34. Again the slopes are negative for all seven

TABLE 34

COMPARISON OF THE SLOPES OF THE REGRESSION OF SERUM CORTISOL ON THE TIME THE SAMPLE WAS TAKEN FOR PERSONS LOW AND HIGH ON VARIOUS MEASURES OF JOB STRESS AND STRAIN

Stress or Strain	Level of Stress/Strain		N		$B_1 - B_2 \neq 0$
	Low	High	Low	High	$p <$
Subjective quantitative work load index	-1.12	.10	43	50	.001
Subjective quantitative overload factor	-.34	-.20	52	51	n.s.
Mean deadline pressure	-.74	.28	43	51	.001
Estimated phone calls, office visits, meetings per week	-.75	-.07	56	31	.001
Objective quantitative work load	-.07	.39	12	8	n.s.
Subjective qualitative work load index	-.41	-.28	64	70	.001
Subjective qualitative overload factor	-.26	-.69	56	47	n.s.

regressions of cortisol on time of day for persons low on the work load measures and negative for only three of the seven slopes for persons high on the stress measures. In four out of the seven cases, the differences in slope between persons scoring low and persons scoring high on work load measures are significant at $p < .001$ (the procedure for testing the hypothesis that $B_1 - B_2 \neq 0$ is described in McNemar, 1969, p. 161). This again represents an incidence of significant findings which is far greater than might be expected by chance. Again, three out of four of these significant differences involve measures of subjective quantitative rather than subjective qualitative work load, and they are the same three measures of work load which produced significant differences in correlations between cortisol and time of day for the low and high stress groups. Furthermore, all four of the measures of subjective quantitative work load in the table (the index, the factor, mean deadline pressure, and the estimate of phone calls, office visits, and meetings) produce slopes whose absolute magnitude is larger for the persons under low stress than for persons under high stress. There is no such clear pattern for the two measures of subjective qualitative work load. The difference in slope for persons low and high on objective quantitative work load is not significant, but the sign is in the expected direction with persons having low work load showing a negative slope (the sample sizes are rather small--12 and 8 respectively for those low and high on this measure of stress).

Now let us turn to the third type of analysis which was performed. In this analysis, the mean cortisol level of persons high and low on the above measures of occupational stress was examined. It was predicted that persons low on overload would show lower mean values of cortisol than persons high on work load since those low on stress would exhibit a drop in their serum cortisol over the day as part of the normal diurnal rhythm. The data are summarized in Table 35 and show that there is only one significant difference in cortisol between the high and low overload groups of respondents. Persons scoring low on the subjective quantitative overload factor have higher mean cortisol levels than persons scoring high on the measure (14.79 versus 12.94 mg/100 ml, $p < .025$). One possible

TABLE 35

DIFFERENCES IN SERUM CORTISOL AS A FUNCTION OF REPORTED JOB STRESS OR STRAIN

Stress or Strain	Level of Stress/Strain		N		t	p <
	Low	High	Low	High		
Subjective quantitative work load index	14.53	13.42	42	50	1.19	n.s.
Subjective quantitative overload factor	14.79	12.94	52	50	1.99	.025
Mean deadline pressure	14.94	13.81	42	50	1.09	n.s.
Estimated phone calls, office visits, meetings per week	13.95	14.70	55	30	-.68	n.s.
Objective quantitative work load	14.33	13.31	13	12	.61	n.s.
Subjective qualitative work load index	14.38	14.44	64	70	-.07	n.s.
Subjective qualitative overload factor	14.52	14.27	56	47	.27	n.s.

explanation for the general lack of differences in cortisol between high and low stress groups is that the persons who are under high stress constantly deplete their cortisol level suggesting that they start out the day with relatively <u>low</u> levels of serum cortisol compared to what would be normal. This would be in keeping with Selye's (1956) suggestion that continual stimulation of the adrenals, which produce cortisol, may eventually lead to a decrease in their output. In an attempt to see whether there is any support for this notion, we can further predict that our high stress groups should have lower cortisol in the morning than the low stress groups since they, following Selye's notion, use up their ability to excrete cortisol at its normal maximum rate. Thus, the curves of the high and low stress groups over the day should look like those depicted in Figure 8.

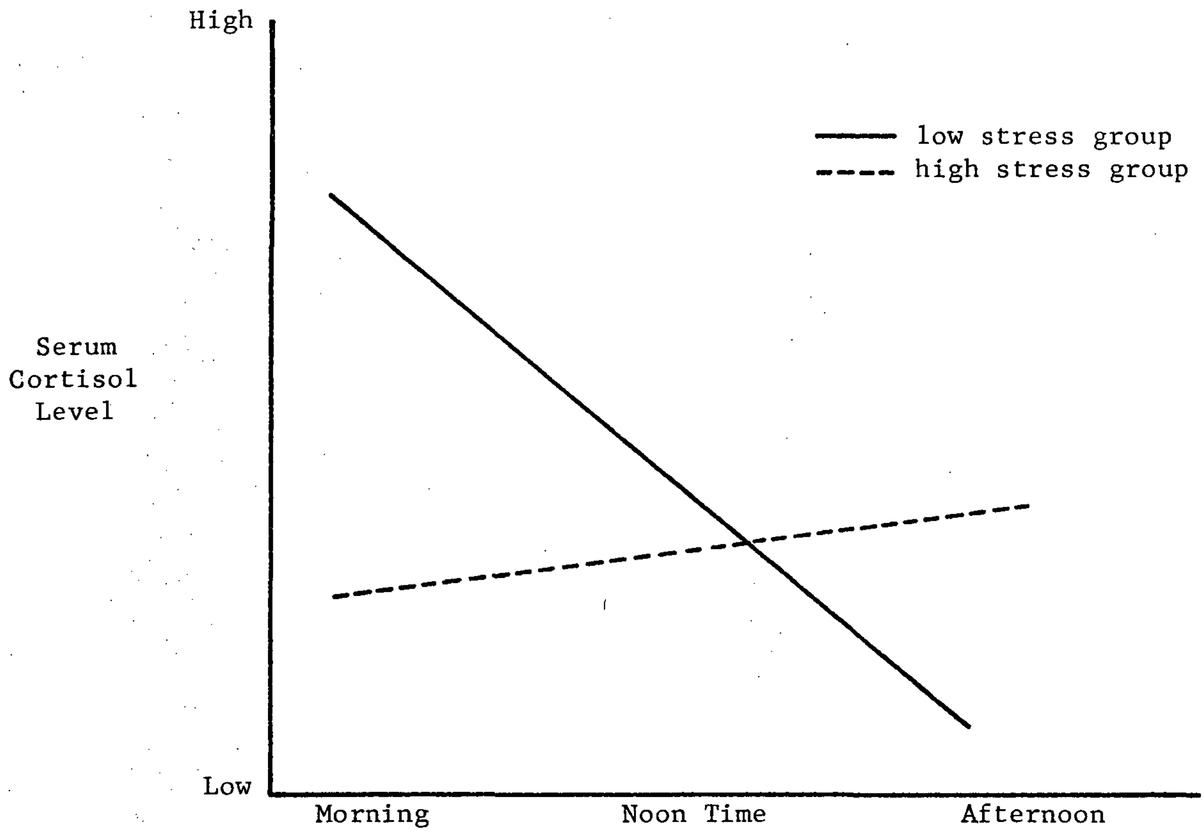
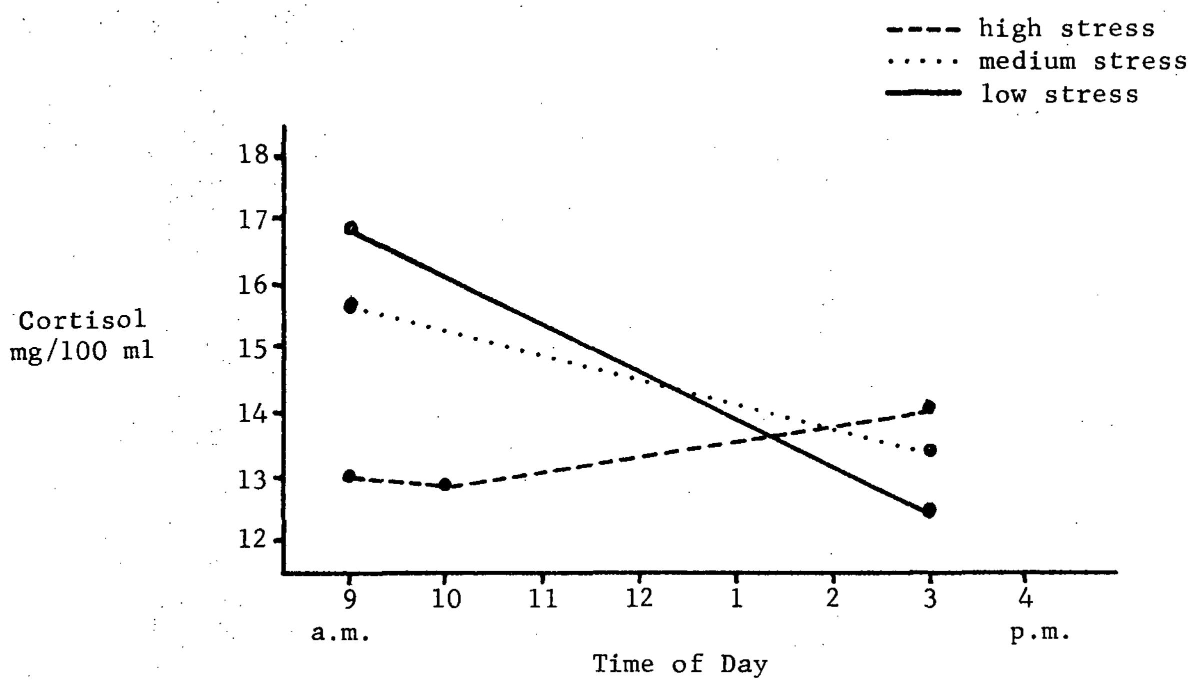
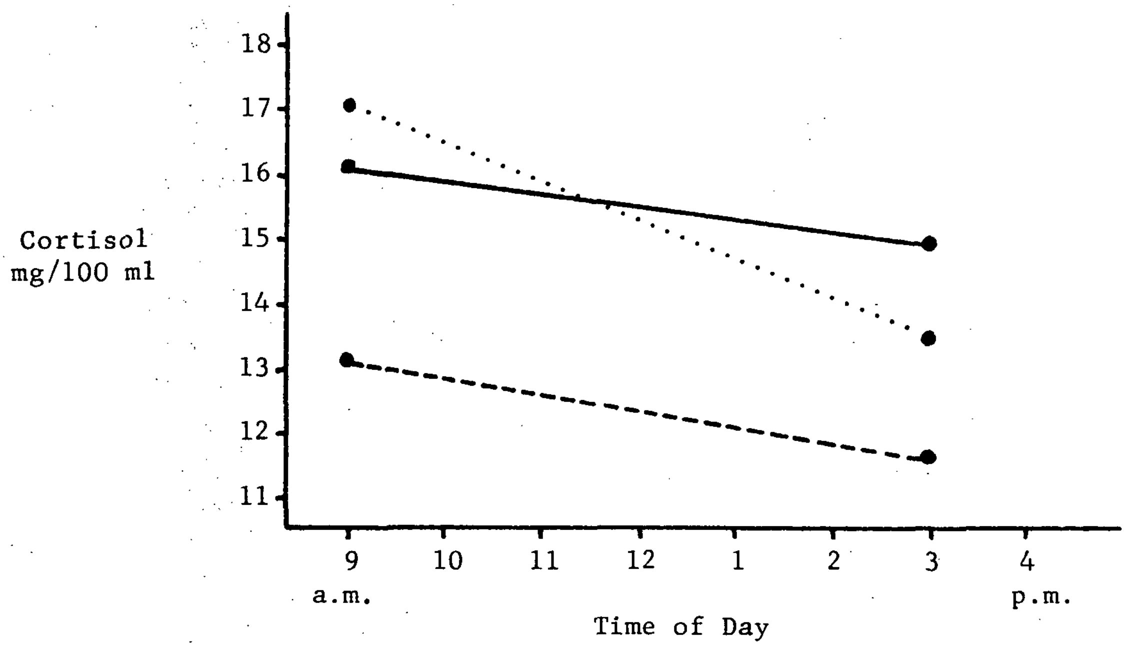


Figure 8. Predicted values of serum cortisol over time for persons who are low and high with regard to work overload.

Figure 9 presents the actual sets of curves which were obtained for each of the six measures of subjective work load. Points have been plotted on the graphs in those instances where there were sample sizes of nine or greater for each data point in order to insure some degree of reliability for each point. The graph for the objective quantitative work load measure has been omitted since the sample sizes were extremely small to begin with. A curve on each graph has also been plotted for the middle tertile stress group.

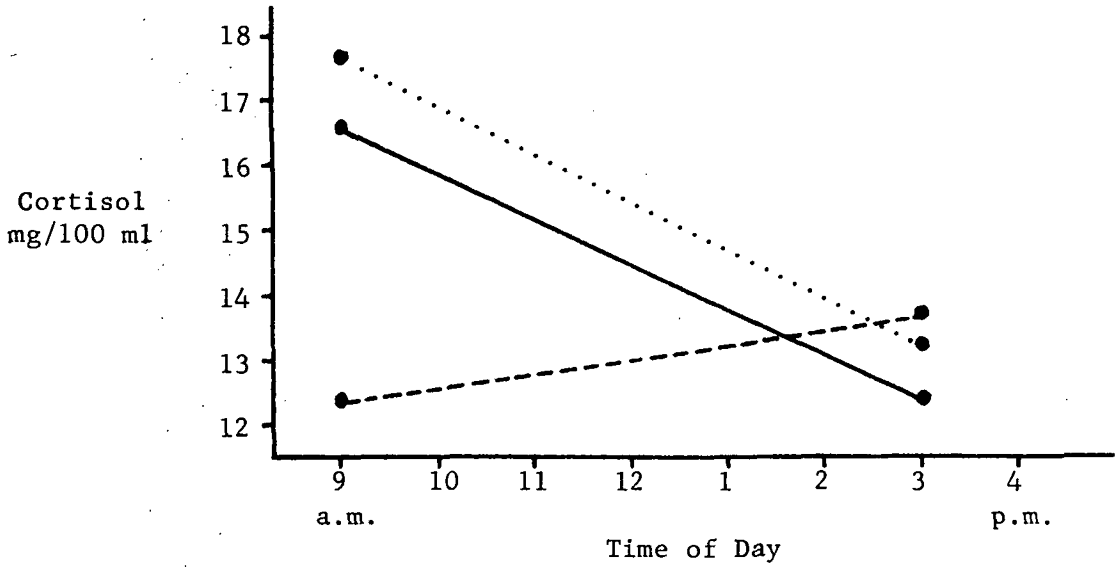


Stress: Subjective quantitative overload index.

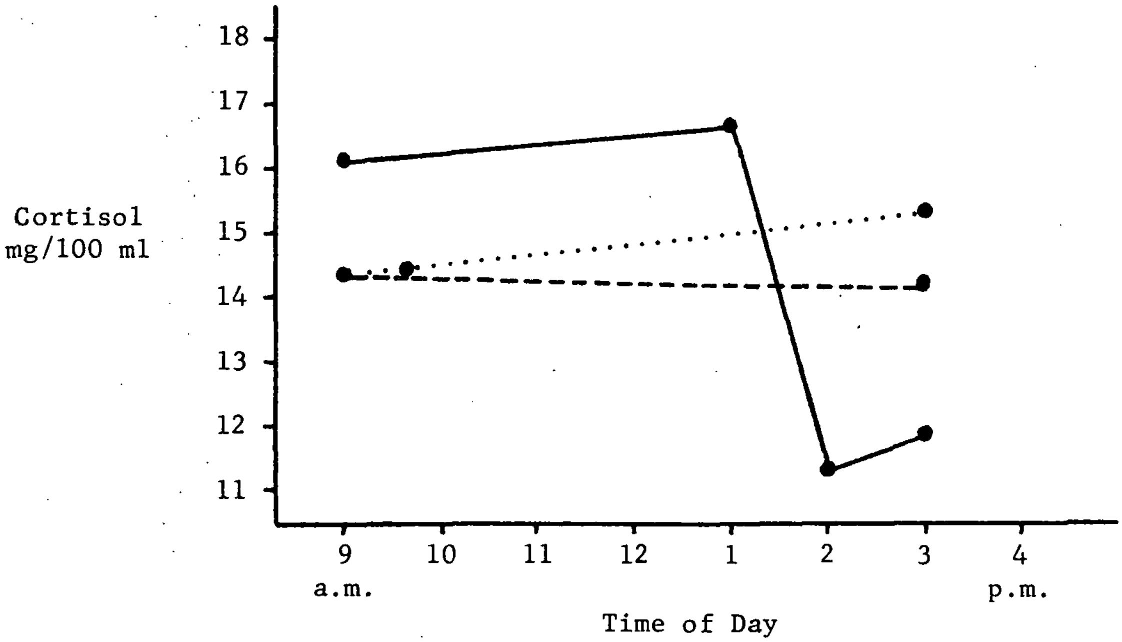


Stress: Subjective quantitative overload factor.

Figure 9. Changes in serum cortisol for low and high stress groups.

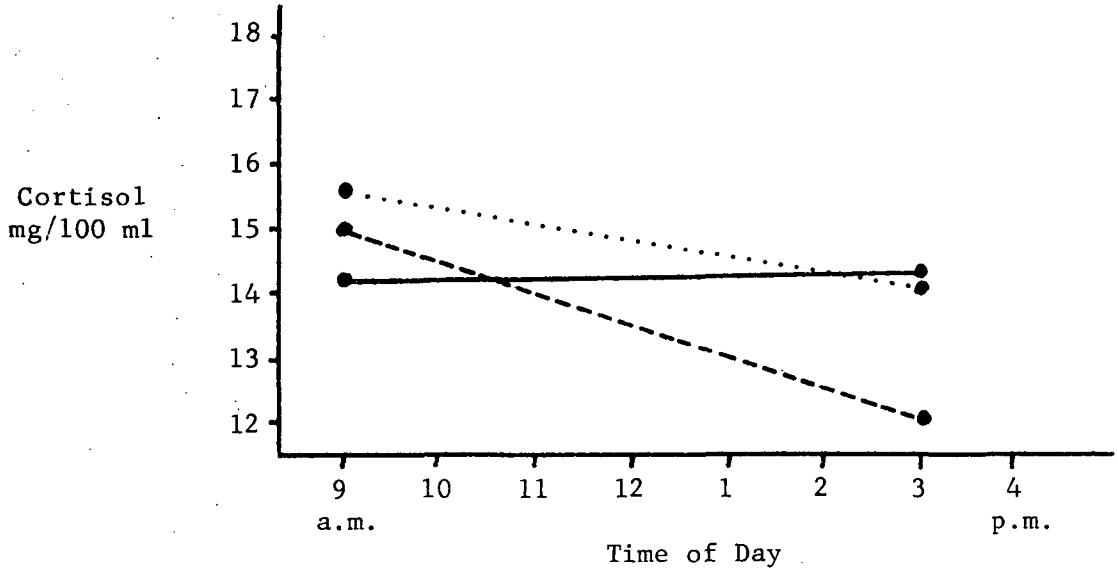


Stress: Mean deadline pressure.

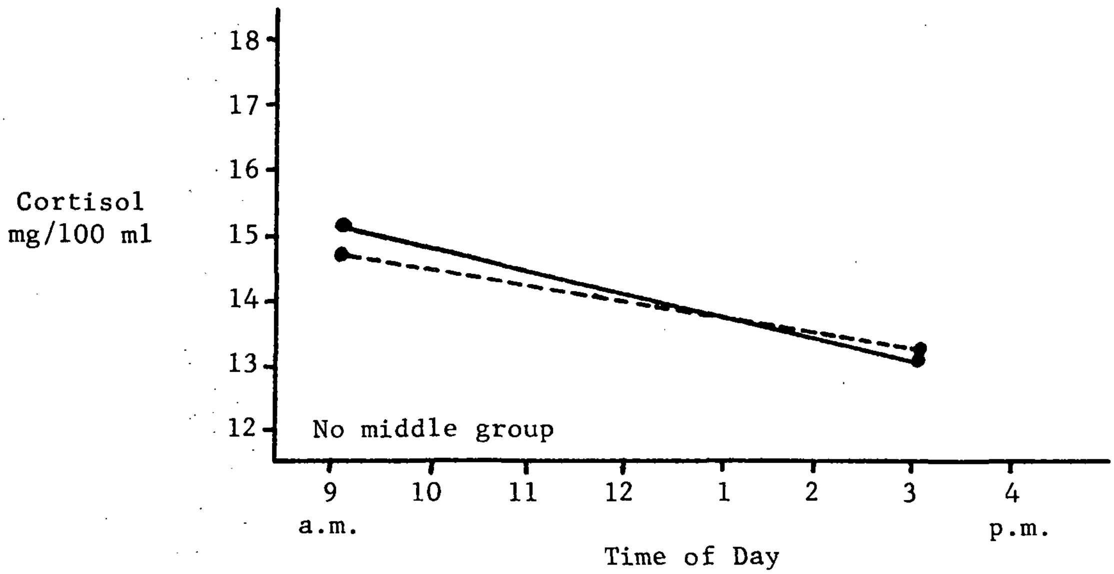


Stress: Estimated phone calls, office visits, and meetings per week.

Figure 9 (cont.)



Stress: Subjective qualitative overload factor.



Stress: Subjective qualitative overload index.

Figure 9 (cont.)

The first four graphs present data for measures of subjective quantitative work load. Three of these graphs show sets of curves similar to those which were predicted: the high stress subjects start out with lower cortisols in the morning (9:00 a.m.) and show a cortisol level which remains about the same by afternoon (3:00 p.m.), while the low stress subjects start out with higher morning cortisols which then drop in the afternoon below the cortisol levels of the high stress subjects.

The mean cortisol for the high and low stress groups at 9:00 a.m. are presented in Table 36. The differences between the two groups in the

TABLE 36

COMPARISON OF MEAN SERUM CORTISOL VALUES TAKEN AT 9:00 A.M. FOR LOW AND HIGH OVERLOAD PERSONS

	Level of Stress							
	Low			High				
Stress	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	N	t	p <
Subjective quantitative work load index	16.98	4.46	10	14.34	4.69	31	1.53	.10
Subjective quantitative overload factor	16.06	4.55	14	13.10	4.69	18	1.73	.05
Mean deadline pressure	16.64	3.51	12	12.47	4.07	19	2.83	.005
Estimated phone calls, office visits, and meetings per week	16.14	3.61	24	13.35	5.67	17	1.87	.05
Subjective qualitative work load index	15.28	4.20	18	14.74	5.17	23	.35	n.s.
Subjective qualitative overload factor	14.38	3.25	15	15.06	4.28	14	-.47	n.s.

morning are statistically significant for all four measures of subjective quantitative work load. The differences between the high and low stress groups at 3:00 p.m. are presented in Table 37. With the exception of

TABLE 37

COMPARISON OF MEAN SERUM CORTISOL VALUES TAKEN AT 3:00 P.M. FOR LOW AND HIGH OVERLOAD PERSONS

Stress	Level of Stress						t	p <
	Low			High				
	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	N		
Subjective quantitative work load index	12.51	4.01	16	13.85	4.52	21	-.91	n.s.
Subjective Quantitative overload factor	14.91	5.18	15	11.55	2.89	15	2.12	.05[1]
Mean deadline pressure	12.47	4.63	11	13.76	4.80	17	-.69	n.s.
Estimated phone calls, office visits, and meetings per week	12.80	3.65	24	14.15	5.36	13	-.88	n.s.
Subjective qualitative work load index	13.25	5.23	19	13.29	3.21	18	-.02	n.s.
Subjective qualitative overload factor	14.43	5.14	14	12.12	3.43	18	1.47	n.s.

[1]Two-tailed test.

differences between persons scoring low and high on the subjective quantitative overload factor, there are no differences in cortisol between high and low stress groups by 3:00 p.m. On the other hand, the two cortisol curves for persons low and high on the subjective qualitative work load measures show rather small mean (nonsignificant) differences in the morning. Furthermore, there are nonsignificant differences between them in the afternoon.

In summary, subjective quantitative but not subjective qualitative work load appears to elevate serum cortisol. This process is masked in traditional linear analyses of the relationship between work stress and serum cortisol because of the diurnal rhythm of cortisol which shows a steady drop from morning to afternoon. Overall, persons high on subjective quantitative work load start the day with low levels of cortisol which are prevented from dropping by the work load they experience. Persons low on subjective quantitative work load start the day with normal, high levels of cortisol and show a steady drop during the day. Findings of this type suggest that serum cortisol may not always show its expected diurnal pattern particularly where the person is involved in an overloading situation. These data also suggest that in studies where the expected diurnal pattern is not found, the investigator should take steps to explore the nature of the psychological stresses encountered by persons under study and see whether or not these have affected serum cortisol readings.

Figure 10 summarizes the findings which have just been presented on subjective quantitative work load. The findings indicate that both the factor and index measures of subjective quantitative work load, but particularly the latter, are related to common happenings in white collar organizational settings--the responsibilities for persons, the amount of meetings and phone calls that get handled, the deadline pressures and so on. Overall there are data indicating that subjective quantitative work load may play a role in elevating serum cortisol, a physiological indicator of strain. The analyses also point out a distinction between the index and factor measures in terms of how they relate to psychological strain. When a person thinks of work load in terms of how much stress there is,

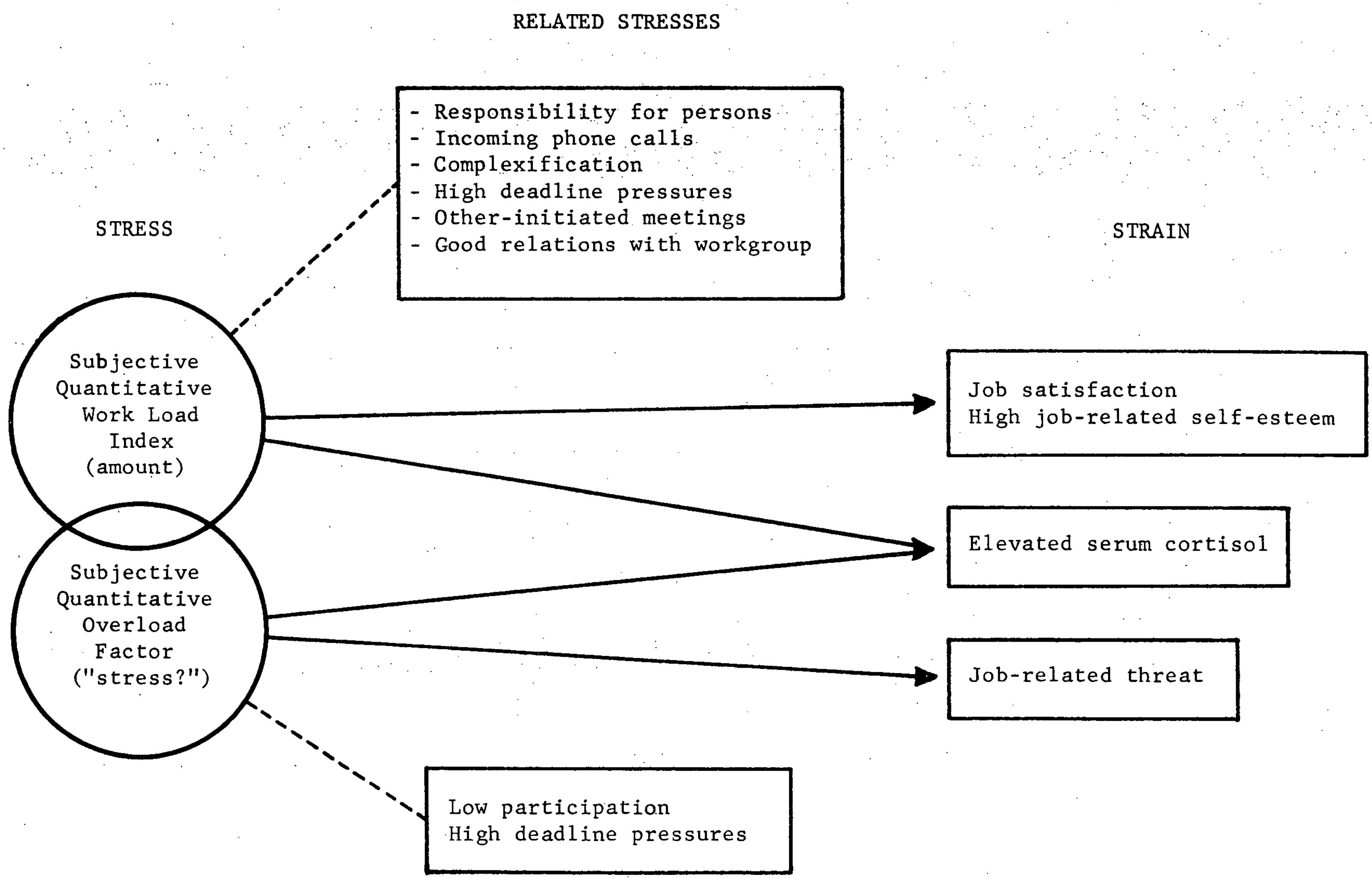


Figure 10. Theoretical interpretation of the findings dealing with the Index and Factor measures of subjective quantitative work load and their relationship to other stresses and strain.

the stress gets linked to feelings of job-related threat. On the other hand, when the person thinks about the absolute amount of work he has to do, this gets related to more positive feelings about the job: specifically, job satisfaction and job-related self-esteem. At least at NASA, having a substantial work load is a source of freedom from psychological strain (perhaps when the work load becomes unusually low, the possibility increases of having one's job phased-out or seen as noncrucial to the overall organizational mission).

Complexification

Complexification, as was noted earlier, refers to the rate at which the environment is becoming increasingly complex. Scientific knowledge develops at a rapid pace, the organization grows, and so on.

In our sample, 77% of the subjects report "some" degree of complexification in their environment. It is not quite clear to what extent complexification represents either quantitative or qualitative overload although in this study the correlations between our subjective measures of overload (see Table 31) and complexification, while positive, are not particularly high. Complexification correlates .13 (n.s.) with the subjective quantitative overload factor, .20 ($p < .01$) with the subjective quantitative work load index, .10 (n.s.) with the subjective qualitative overload factor, and .35 ($p < .001$) with the subjective qualitative work load index. This pattern of results looks more like evidence of shared method variance rather than shared construct domains; the index measures of subjective work load use the same response scales as the complexification index and show the highest correlations with it, regardless of whether quantitative or qualitative work load is the correlate of complexification.

On the other hand, the finding may also be interpreted as evidence that complexification does indeed reflect both quantitative and qualitative subjective work load.

Table 38 presents the other significant job stress correlates of complexification. As already noted, persons who report high complexification report low role ambiguity ($r = -.35$, $p < .001$). Since role ambiguity represents a lack of information, perhaps the lack of ambiguity represents an excess of information symptomatic of an environment in which complexity is increasing rapidly.

TABLE 38

JOB STRESS CORRELATES OF COMPLEXIFICATION

Job Stress		r^1	$p <$
Subjective quantitative work load index		.20	.01
Subjective qualitative work load index		.35	.001
Role ambiguity		-.35	.001
Utilization of abilities		.28	.001
Participation		.16	.05
Opportunities for advancement and recognition		.16	.05
Relations with:	Superior	.09	n.s.
	Work group	.19	.01
	Subordinates	.18	.01

$^1N \cong 100$.

Persons reporting high complexification also tend to report high utilization of their skills and abilities ($r = .28$, $p < .01$). This finding is not surprising since the complexification index orients itself toward rapid changes in the technology and the skills required to meet the technology.

Finally, there are a number of other correlates of complexification which are significant, but so low that the findings will be briefly reported on here and not discussed at length.

High complexification is also associated with high participation ($r = .16$, $p < .05$) although the magnitude of the relationship is not particularly high. This finding suggests that participation may allow people to become increasingly aware of the complexities which surround their jobs and their professions by providing additional information to them. These findings create the impression that the person reporting high complexification is somewhat in the midst of the dynamics of the organization. Some verification for this impression comes from the finding that persons reporting high complexification also tend to report high opportunities for advancement and recognition ($r = .16$, $p < .05$) suggesting that the people who get promoted are likely to be the people who are in the most turbulent organizational environments.

The final set of findings in Table 38 shows that persons who report high complexification tend to report good relations with their work group ($r = .19$, $p < .01$) and their subordinates ($r = .18$, $p < .01$). There is no correlation between relations with one's superior and complexification, however. It is not clear why the positive findings in this set should exist, but perhaps the relationships exist because good relations with others are associated with some third variable which also relates to complexification. For example, utilization of skills and abilities is also associated with relations with work group, $r = .40$, and with relations with subordinates, $r = .23$, in addition to being positively correlated with complexification.

In fact, when stepwise multiple regression procedures are adopted for identifying the most important stress correlates of complexification only one variable contributes significantly, and this variable is self-utilization ($R = .32$). Thus, the apparent key to perceiving that the field is moving along rapidly in terms of technological development is being located in a role in which one's technical skills and abilities are constantly being tapped.

Now the findings on the relationships between complexification and the measures of strain will be presented. Complexification correlates slightly and positively ($r = .16$, $p < .05$) with job satisfaction, but shows no significant correlations with either job-related threat ($r = -.09$) or with job-related self-esteem ($r = .07$).

Complexification fails to show any correlations with the physiological dependent variables with the exception of smoking. The more cigarettes a person smokes, given that they smoke, the <u>less</u> complexification they report ($r = -.35$, $p < .01$). In attempting to interpret this finding, we must introduce the concept of "arousal-seeking behavior." Schubert (1964, 1965) presents evidence which shows that smokers score high on a dimension which he calls arousal-seeking. The characteristics of this dimension are somewhat like those of the Type A behavior pattern. The arousal seeker prefers stimulating social environments, is more bored with routine types of activities, and exhibits more dominance than the person scoring low on this dimension. Several other studies have suggested that such arousal seekers tend to perceive their environment as being far less stimulating than it actually is (Petrie, 1967; Ryan & Foster, 1967; Sales, in press) --hence, they seek out stimulation to reach some level they believe is optimum for them (i.e., they might do this by smoking more, drinking more, taking roller coaster rides given the opportunity, and so on). Arousal avoiders, on the other hand, are oversensitive to stimuli, according to the theory, and they therefore avoid smoking, loud parties, and other such forms of stimulation.

One can make the prediction that arousal avoiders would therefore tend to see the environment as having too much complexification but arousal seekers would feel that the rate at which technological and organizational development is proceeding is <u>not</u> very fast--perhaps they might even feel <u>impatient</u> about it. At any rate, if this is the case, then it would not be surprising to find that those people who perceive low complexification in their environment are also the ones who smoke the most cigarettes, and that these two responses are tied together by the common element of arousal seeking. Unfortunately, the study at NASA had no measure of arousal-seeking behavior to back up this hypothesis. It should be noted, however, that those people who <u>volunteered</u> for the tally part of this study tended to have a disporportionately large percentage of smokers in their group (44% of the tally subjects compared to 23% of the rest of the respondents; significance of the difference is less than .05) and that arousal seekers do tend to <u>volunteer</u> for experiments in college populations (Schubert, 1964).

In summary, complexification is likely to be present in people who report high utilization of their skills. It tends to be associated with high job satisfaction, and negatively with heavy smoking. However, the association between complexification and smoking may be due to a common association with some third personality variable--namely, arousal seeking.

<u>Subjective Qualitative Work Load</u>

Fifty-three point eight percent of the men in this study report they have at least "some" qualitative work load as measured by the index. Thus, high qualitative work load is a rather prevalent job condition at NASA.

Before beginning to look at the relations of subjective qualitative work load to other stresses and strain, one should remember that there are two measures in the study dealing with qualitative work load. One of these is the factor from French et al.'s study of university professors, and the other is an index constructed for this study. In the methods section, it was pointed out that the two measures show little convergent validity (see Table 8), and that furthermore, the item content of the factor suggests it measures something more like competition rather than qualitative overload. When the relationship between these two measures of job stress and other measures of job environment is examined, it will become apparent that this difference in item content seems to produce a consistent and meaningful difference in the pattern of correlations between the measures and other stresses and strain. The data are summarized in Table 39.

First, the data show that persons who score high on the qualitative work load index are persons who report good relations with their immediate superior ($r = .41$, $p < .001$), their subordinates ($r = .41$, $p < .001$), and their workgroup ($r = .40$, $p < .001$). However, the pattern of results using the factor score is just the opposite. The higher the person scores on the factor, the poorer are his reported relations with his superior, subordinates, and peers ($r = -.24$, $p < .01$; $-.15$, $p < .05$; and $-.21$, $p < .01$ respectively). If the factor score does represent competitiveness and stress from competition, as was suggested earlier, then it is

TABLE 39

RELATIONSHIPS OF THE INDEX AND FACTOR MEASURES[1] OF SUBJECTIVE QUALITATIVE WORK LOAD WITH JOB STRESS AND PSYCHOLOGICAL STRAINS[2]

Measure	Subjective Qualitative Work Load: Index	Subjective Qualitative Work Load: Factor	$r_1 - r_2 \neq 0$ $p <$
Relations with immediate superior	.41	-.24	.001
Relations with subordinates	.41	-.15	.001
Relations with workgroup	.40	-.21	.001
Participation	.42	-.12	.001
Utilization of abilities	.46	.00	.001
Utilization of leadership	.27	-.15	.001
Responsibility for persons	.45	-.04	.001
Responsibility for things	.41	.11	.05
Opportunity for advancement and recognition	.28	.00	.005
Job satisfaction	.50	-.16	.001
Job-related threat	-.32	.29	.001
Job-related self-esteem	-.01	-.27	.10

[1]The index and factor correlate -.12, n.s.

[2]$r \geq .13$, $p \leq .05$; $r \geq .18$, $p \leq .01$ for all correlations except those for the two responsibility measures. For the latter, $r \geq .19$, $p < .05$; and $r \geq .25$, $p < .01$.

not surprising that the person reporting such stress gets along rather poorly with role senders. On the other hand, persons who report genuine, high qualitative work load may be more apt to report such work load precisely because they get along so well with role senders and consequently feel the pressure and commitment to do very high quality work for their role set. The interpretation of the factor as a measure of stress of competition is supported by the finding that the subjective qualitative work load index correlates positively with participation in decision-making ($r = .42$, $p < .001$), while the factor measure correlates nonsignificantly and inversely with participation ($r = -.12$, $p < .10$). It is difficult to see how a person can enjoy true psychological participation if the individual is locked into an interpersonally competitive situation. If anything, persons in competitive relationships may be loath to participate with one another.

Since one of the personality measures in this study is Competitive Orientation, it seems relevant to examine the relationship between the subjective qualitative overload factor and this measure. The two are nonsignificantly and negatively correlated ($r = -.14$). It is not clear, however, whether a person high on Competitive Orientation should report high pressure due to competition or low pressure. Persons who enjoy competition may do so because they find it produces less stress than persons who do not enjoy pressure. On the other hand, persons with such an orientation may experience the most stress from competition because they become involved in more competitive situations.

The rest of the findings in the table also suggest that the person high on the subjective qualitative work load index tends to be positively involved in his work. He feels his technical skills and abilities are well-utilized ($r = .46$, $p < .001$), his leadership abilities are utilized ($r = .27$, $p < .01$), he has a good deal of responsibility for persons ($r = .45$, $p < .001$) as well as for things ($r = .41$, $p < .001$), and he tends to report excellent opportunities for advancement and recognition ($r = .28$, $p < .01$). One would perhaps expect that such utilization would be high for the person with high qualitative overload--yet no such impression is received upon examination of the meager correlations between the above measures of work environment and the factor score.

When all of these correlates of the subjective qualitative work load index are entered into a stepwise regression, four variables are found to contribute significantly to the variance in the work load measure. The results are presented in Table 40. Utilization of abilities explains most

TABLE 40

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT JOB STRESS CORRELATES OF THE SUBJECTIVE QUALITATIVE WORK LOAD INDEX[1]

Step	Correlate Added	R	Final β
1	Utilization of abilities	.47	.27
2	Relations with subordinates	.56	.23
3	Responsibility for things	.60	.22
4	Relations with immediate superior	.63	.19

[1]After Step 4, the following variables were not significantly related to the subjective qualitative work load index: relations with superior and workgroup, participation, utilization of leadership, responsibility for persons, and opportunity for advancement and recognition.

of the variance followed by good relations with one's subordinates, responsibility for things, and good relations with one's immediate superior. Altogether, these four variables account for about 40% of the variance in the subjective qualitative work load index (R = .63). Following the same procedure with the correlates of the subjective qualitative overload factor yields only one predictor in the regression equation--poor relations with one's immediate superior, which accounts for only 6% of the variance in the factor (R = .24, beta = -.24).

These findings on the measures of subjective qualitative work load lead to the following points. First, it appears that the factor should be relabeled "stress from competition" and called into question as a measure of subjective qualitative overload.

The second point is that it appears that people pay for having opportunities to participate and having good interpersonal relations with their role senders in terms of mutual role expectations for high quality work output. It appears, however, that high expectations and standards for work are a source of satisfaction. This satisfaction may derive from the possibility that the focal person receives such work load as an indicator that role senders think he is competent and can do such work.

With this prediction in mind, it seems appropriate to turn to the findings relating subjective qualitative work load to strain. Consistently enough, we find that the subjective qualitative work load index correlates positively rather than negatively with job satisfaction ($r = .50$, $p < .001$). The coefficient, when job-related threat is held constant, only drops to .42. Similarly, the index is negatively correlated with job-related threat ($r = -.32$, $p < .001$; the second order r with job satisfaction held constant is $-.13$, $p < .05$). The index shows no significant correlation with job-related self-esteem.

The subjective qualitative overload factor, which can now be thought of as a stress of competition measure, correlates negatively with job satisfaction ($r = -.16$, $p < .05$), positively with job-related threat ($r = .29$, $p < .01$), and negatively with job-related self-esteem ($r = -.27$, $p < .01$). Since all three measures of psychological strain are correlated with one another, an idea of the extent to which each independently relates to the subjective qualitative overload factor may be obtained by multiple regression of the strain measures against the factor. When this is done, job-related threat emerges with a beta = .23, followed by job-related self-esteem with a beta of -.21 to yield R = .35. Job satisfaction plays a nonsignificant role in the regression equation. These data suggest that being involved in the stress of competition has its costs in terms of increased feelings of threat (probably related to some anticipation of the possibility of failing) and decreased self-esteem.

Turning to physiological strain, there are no first-order relationships between either of the subjective qualitative work load measures and the physiological measures of strain. The coefficients are very low and all nonsignificant and will not be discussed further.

In summary, qualitative work load may produce increased job satisfaction and a reduction in feelings of job-related threat. Stress from competition with others, on the other hand, appears to have quite the opposite effect since it is positively associated with psychological strain. Figure 11 summarizes these findings.

Low and High Utilization

Closely aligned with the concept of overload is the notion of utilization. The extent to which a person's talents are utilized can be a potential source of satisfaction as well as strain. In this study, we have distinguished between two types of utilization: (1) utilization of skills and abilities learned, in part, during one's formal education, and (2) the utilization of one's leadership skills which deals more with the handling of the organizational process of getting the task done.

At Goddard, 66% of the sample reports at least "some" utilization of technical skills and abilities relating to their profession. This means

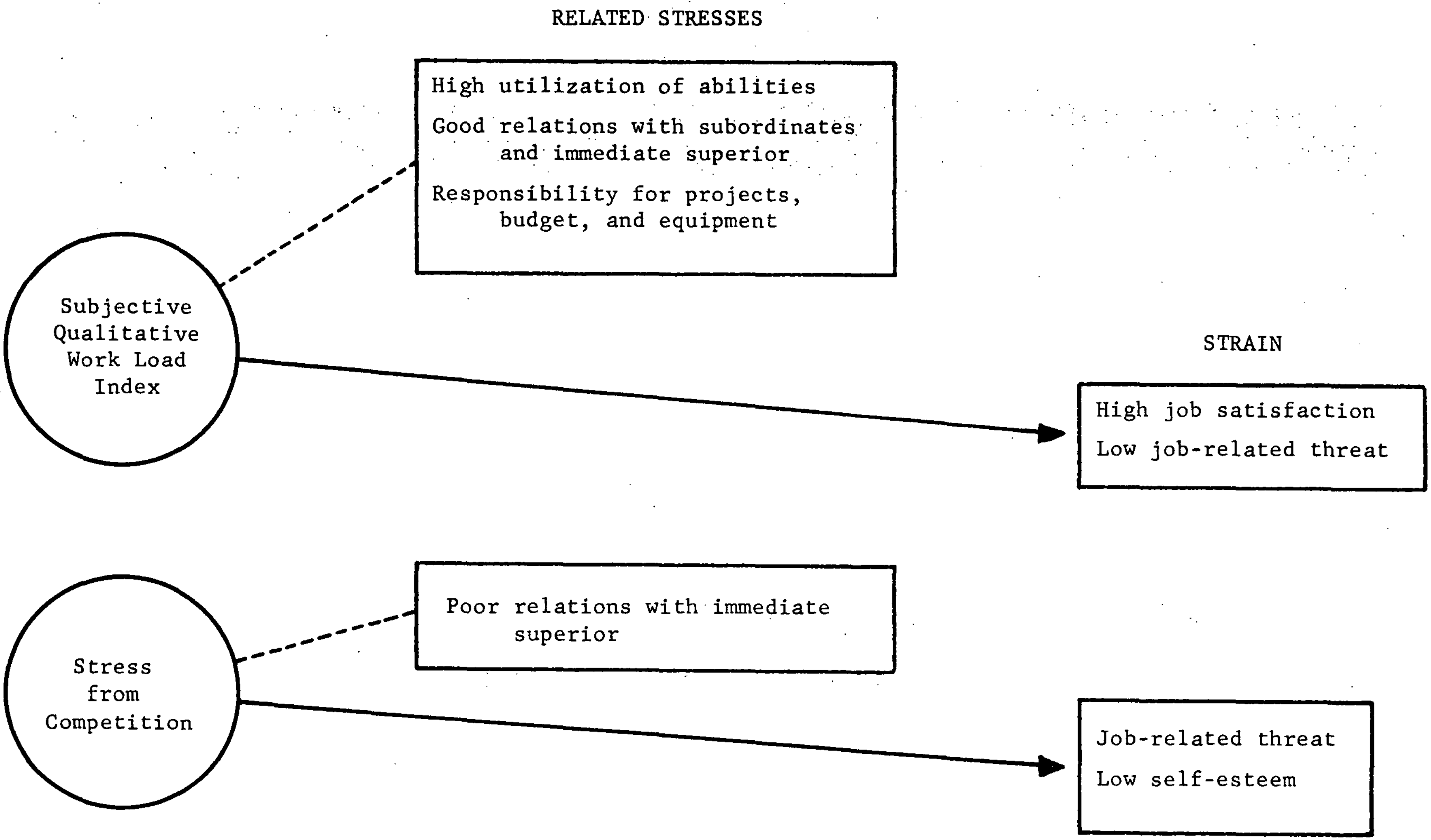


Figure 11. Theoretical interpretation of the findings dealing with the Index and Factor measures of subjective qualitative work load and their relationship to other stresses and strain.

that 34% report less than "some" utilization of such talents. Forty-two percent of the sample reports "some" or more utilization of leadership skills. As we shall see, the utilization of these two types of skills--technical and organizational--may be related to quite different aspects of the work environment even though the two indices are somewhat correlated ($r = .24$, $p < .01$). The findings are summarized in Table 41.

The first six entries in Table 41 concern respondent's reports of their office and work activities. In every case utilization of abilities correlates less with the amount of these activities (time spent in and number of meetings, number of phone calls, and percent of time working alone) than does utilization of leadership. The absolute value of the correlations for these measures and utilization of abilities ranges from .01 to .16 while the absolute value of the correlations for these measures and utilization of leadership ranges from .20 to .42. Utilization of abilities shows no relation to the reported amount of interaction with people although there is a slight <u>inverse</u> correlation between such utilization and percent of time reported spent in meetings initiated by other persons ($r = -.16$, $p < .05$). In contrast, high utilization of leadership means high rates of interaction and a high percent of time reported spent with role senders with little time available for working alone. Again, it should be noted that the percent of time measures are not independent of one another since they must sum to 100%.

The next three findings in the table deal with deadline pressures and indicate a similar pattern of results. Utilization of abilities is <u>inversely</u> related to perceiving one's immediate and high level superiors as sources of deadlines ($r = -.38$, $p < .001$; and $r = -.24$, $p < .01$ respectively). These same variables correlate with utilization of leadership

TABLE 41

THE RELATIONSHIPS OF TWO TYPES OF UTILIZATION TO SUBJECTIVE JOB STRESS[1]

Stress Measure	Correlation with Utilization of Abilities	Correlation with Utilization of Leadership	$r_1 - r_2 \neq 0$ $p <$
Estimated percent of time in self-initiated office visits and meetings	-.01	.28[3]	.05
Estimated percent of time in other-initiated office visits and meetings	-.16[2]	.34[4]	.005
Estimated percent of time spent working alone	.11	-.42[4]	.001
Estimated number of incoming phone calls per week	-.06	.20[3]	.05
Estimated number of outgoing phone calls per week	-.11	.26[3]	.005
Estimated number of self-initiated meetings per week	.09	.30[3]	.10
Estimated number of other-initiated meetings per week	-.04	.34[3]	.005
Immediate superior as source of deadlines	-.38[4]	.03	.005
Higher superiors in the division as source of deadlines	-.24[3]	.10	.01
Subordinates as source of deadlines	.06	.23[3]	n.s.
Role ambiguity	-.46[4]	-.27[3]	.05

(Continued)

TABLE 41 (cont.)

Stress Measure	Correlation with Utilization of Abilities	Correlation with Utilization of Leadership	$r_1 - r_2 \neq 0$ $p <$
Subjective quantitative work load index	.07	.42[4]	.005
Subjective quantitative overload factor	-.01	.20[3]	.05
Complexification	.28[3]	.00	.005
Subjective qualitative work load index	.46[4]	.27[3]	.05
Subjective qualitative overload factor	.00	-.15	.10
Responsibility for persons	.24[2]	.60[4]	.005
Responsibility for things	.46[4]	.38[4]	n.s.
Opportunity for advancement and recognition	.53[4]	.24[3]	.005
Participation	.52[4]	.50[4]	n.s.
Relations with immediate superior	.38[4]	.32[3]	n.s.
Relations with workgroup	.40[4]	.42[4]	n.s.
Relations with subordinates	.23[3]	.37[4]	n.s.

[1] $N \cong 200$, except for the two responsibility measures where $N = 100$.

[2] $p < .05$.

[3] $p < .01$.

[4] $p < .001$.

nonsignificantly but positively ($r = .03$ and $.10$ respectively). Finally, utilization of leadership is positively related to the extent to which subordinates are perceived as sources of deadline pressure ($r = .23$, $p < .01$) but utilization of abilities is not related ($r = .06$, n.s.). Thus, if anything, persons reporting high utilization of technical skills and abilities are less likely to experience deadline pressures than persons reporting low utilization. On the other hand, utilization of organizational leadership tends to be associated with having role senders who are sources of deadline pressures.

Earlier it was noted that there is an inverse relationship between both forms of utilization and role ambiguity. The table shows, however, that low utilization of abilities has a significantly greater inverse relationship to role ambiguity than low utilization of leadership (significance of the difference in correlations is less than .05).

The table also shows that the two types of utilization have different relationships to the subjective work load measures. Persons reporting high utilization of skills and abilities report high subjective qualitative work load while persons reporting high utilization of leadership tend to show high subjective quantitative work load. These latter findings are in keeping with data which have just been presented showing that persons high on the utilization of leadership tend to spend a lot of time in meetings and on phone calls.

While both forms of utilization show positive relationships with responsibility for persons, utilization of leadership correlates significantly higher than utilization of abilities ($r = .24$, $p < .01$ versus $r = .60$, $p < .001$; the difference between the two coefficients is significant at $p < .005$). This is in keeping with the characterization of utilization of leadership as behavior dealing primarily with the maintenance of organizational processes rather than with the actual production of technical and scientific output from the organization. Both forms of utilization correlate significantly with responsibility for things although there is a nonsignificant trend for utilization of skills and abilities to correlate most highly with this form of responsibility ($r = .46$ versus $r = .38$, both significant at $p < .001$).

Perhaps one of the most interesting differences between the two types of utilization are the correlations with perceived opportunity for advancement and recognition. The path to fame in this sample is associated more with high utilization of one's technical skills and abilities ($r = .53$, $p < .001$) than with one's administrative abilities ($r = .24$, $p < .01$). These relationships are significantly different from one another ($p < .005$). Thus, people with low skill and ability utilization perceive a bleak picture for advancement and recognition.

Finally, findings from the table show that both types of utilization are associated with high levels of participation in decision making (r's = .52 and .50, both $p < .001$), and with good relations with one's role senders (including the superior, work group, and subordinates--the correlations range from .23 to .40, all significant at levels ranging from $p < .01$ to $p < .001$). In other words, persons who report involvement in the decisions of their organization and are able to get along well with their role senders are persons who feel highly utilized in their organization.

Again, it is useful to turn to a stepwise multiple regression analyses of these many correlates of utilization in order to isolate the major contributors to low and high utilization. Table 42 presents the results

TABLE 42

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT JOB STRESS CORRELATES OF UTILIZATION OF ABILITIES[1]

Step	Correlate Added	R	Final β
1	Opportunity for advancement and recognition	.51	.32
2	Subjective qualitative work load index	.62	.32
3	Estimated percent of time in other-initiated office visits and meetings	.65	-.17
4	Participation	.68	.22
5	Percent of time communicating with persons in own branch office	.70	.15
6	Immediate superior as a source of deadline pressure	.71	-.13

[1]After Step 6, the following variables were nonsignificantly correlated with utilization of abilities: estimated percent of time in self-initiated meetings and working alone; estimated number per week of incoming phone calls, and self- and other-initiated meetings; subordinates and higher superiors in the division as sources of deadlines; role ambiguity, complexification, responsibility for persons and for things, opportunity for advancement and recognition, and relations with immediate superior, work group, and subordinates.

of the regression on utilization of technical skills and abilities. Six major correlates contribute significantly to this form of utilization, accounting for 50% of the variance (R = .71. Half of this variance is accounted for in terms of the opportunity for advancement and recognition measure again indicating the relevance of high skills utilization for advancement at NASA.

The remaining five contributors to the regression present the following picture of the person with high technical skills and ability utilization. First of all, his overload is qualitative rather than quantitative. He apparently is able to devote his time to such high utilization because he occupies an office where few demands are made on him to spend time in office visits and meetings--in other words, he can isolate himself effectively from much of the organizational interaction that occurs around him. Nevertheless, he does participate in decisions which are relevant to him and which may involve some communication with others--but this communication is apparently confined to his own immediate work group. In other words, he is well-isolated from other sections and levels of the organization. The most outstanding characteristic of his immediate superior is that the superior rarely pushes his men to meet deadlines (the fact that they report high utilization suggests, however, that such men do not need such proding anyway).

With regard to technical skills, the person at NASA with high utilization of abilities may present a desirable picture for many people. He has a lot of privacy to get his work done, he participates in decisions relevant to him, does not have to bother much with the rest of the organization, does not have a superior who "rides" his men hard, and appears to end up with the best chances for promotion and recognition.

Now contrast this with the person who is high on utilization of leadership. The results of the stepwise multiple regression are presented in Table 43. Three variables survive the analysis to account for 43% of the variance ($r = .65$). The major contributor to high utilization of leadership is responsibility for persons which explains 37% of the variance accounted for in the regression. The other two positively-signed contributors to the regression are participation and good relations with one's immediate superior. The fourth step, while not significant ($p < .10$), and therefore not presented in Table 43, is low-reported percent of time working alone. This finding is reported here because while low percent

TABLE 43

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT JOB STRESS CORRELATES ON UTILIZATION OF LEADERSHIP[1]

Step	Correlate Added	R	Final β
1	Responsibility for persons	.61	.51
2	Participation	.64	.18
3	Relations with immediate superior	.65	.13

[1]After Step 3, the following variables were nonsignificantly correlated with utilization of leadership: estimated percent of time spent in self- and other-initiated meetings, and working alone; estimated number of incoming and outgoing phone calls, and self- and other-initiated meetings per week; subordinates as sources of deadlines; role ambiguity; subjective quantitative work load index and overload factor; complexification; subjective qualitative work load index; responsibility for things; opportunity for advancement and recognition; and relations with work group and subordinates.

of time working alone is associated with utilization of administrative leadership, just the opposite is associated with utilization of skills and abilities.

Thus, in contrast to utilization of one's skills and abilities in technical pursuits, utilization of them for administrative and leadership purposes does little to provide the same guarantees of good opportunities to advance, freedom from a superior who is a source of deadline pressures, and fairly good isolation from the rest of the organization. The latter, good isolation, may, of course, be very undesirable for a person concerned with organizational maintenance or process coordination who needs to have access to all parts of the organization.

These findings suggest an interesting organizational question. Namely, can an organization continue to be productive if it mainly conveys hopes for advancement and recognition to those who provide technical or task skills rather than to those who provide perhaps equally important organizational maintenance skills?

Now the findings relating these two types of utilization to measures of psychological and physiological strain will be considered. First the findings dealing with psychological strain will be examined.

The first finding is that utilization of abilities is positively correlated with job satisfaction ($r = .45$, $p < .001$). This correlation drops nonsignificantly to .35 ($p < .001$) when job-related threat is held constant. Furthermore, utilization of abilities is negatively correlated with job-related threat ($r = -.36$, $p < .001$), and this correlation drops nonsignificantly to -.20 ($p < .01$) when job satisfaction is held constant. There is no relationship between utilization of abilities and job-related self-esteem ($r = .10$).

There is a similar pattern of findings for the relationship between utilization of leadership and these measures of psychological strain. Utilization of leadership is positively correlated with job satisfaction ($r = .35$, $p < .001$). This correlation drops nonsignificantly to .27 ($p < .001$) when job-related threat is held constant. Utilization of leadership is negatively related to job-related threat ($r = -.27$, $p < .001$), and this correlation drops nonsignificantly to -.14 ($p < .05$) when job satisfaction is held constant. Furthermore, utilization of leadership is positively correlated with job-related self-esteem ($r = .21$, $p < .01$). This latter correlation drops to .15 ($p < .05$) when job-related threat is held constant. Stepwise multiple regression shows that the psychological strains uniquely related to utilization of leadership are as follows: job satisfaction (beta = .38) and self-esteem (beta = .17) provide an $R = .38$ while job-related threat is unrelated to utilization of leadership with the preceding two measures of psychological strain statistically controlled.

Thus, both types of utilization are negatively related to psychological strain. Furthermore, the magnitude of the relationships do not differ for the two types of utilization.

Regardless of how these two types of utilization relate to other job stresses, we find that at NASA, in terms of freedom from psychological strain, high utilization is preferable to low utilization.

When we turn to the measures of physiological strain, the correlations between the two measures of utilization and the risk factors are close to zero and nonsignificant. Figure 12 summarizes the significant findings dealing with the two types of utilization and their relationship to stress and strain.

Responsibility for Persons and for Things

About 59% of the respondents at Goddard report some degree of responsibility for people and about the same amount report some degree of impersonal responsibility for things. The former type of responsibility, to review briefly, deals with responsibilities for the futures and careers of others as well as for the work of others. Responsibility for things is less person-oriented and focuses on responsibility for budget, equipment, projects, and project planning. In presenting these findings, the coefficient for responsibility for persons followed by the coefficient for responsibility for things will be presented in parentheses whenever no differentiation is made between the two forms of responsibility in the text.

Although these two types of responsibilities, as measured by their respective indices, correlate .54 ($p < .001$), they differ markedly from one another in the extent to which each is associated with different types

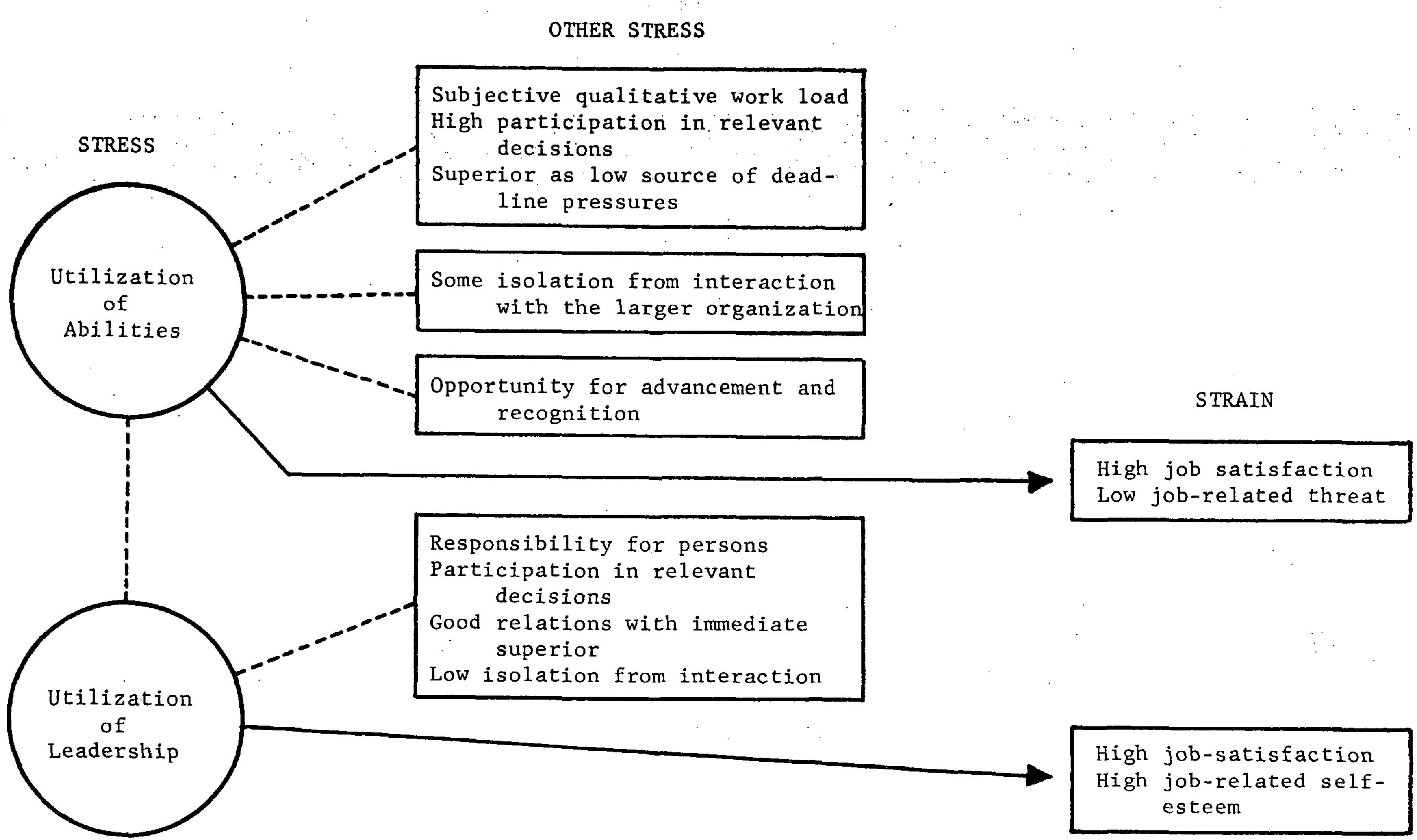


Figure 12. Theoretical interpretation of the relationships between two types of utilization and other stresses and strain.

TABLE 44

COMPARISON OF RELATIONSHIPS BETWEEN RESPONSIBILITY FOR PERSONS AND FOR THINGS AND SELF-REPORTED OFFICE ACTIVITIES[1]

Self-Report Measure	Responsibility for Persons	Responsibility for Things	$r_1 - r_2 \neq 0$ $p <$
% of time:			
on self-initiated phone calls	.13	.01	n.s.
on other initiated phone calls	.29	.09	.01
in self-initiated meetings and office visits	.42	.16	.001
in other-initiated meetings and office visits	.36	.06	.001
working alone	-.47	-.19	.05
Number per week of:			
incoming phone calls	.32	-.03	.005
outgoing phone calls	.30	-.08	.001
self-initiated meetings	.35	-.09	.001
other-initiated meetings	.34	-.14	.001
% of time under:			
no deadline pressure	-.44	.18	.001
moderate deadline pressure	.26	-.09	.005
great deadline pressure	.34	-.24	.001

(Continued)

TABLE 44 (cont.)

Self-Report Measure	Responsibility for Persons	Responsibility for Things	$r_1 - r_2 \neq 0$ $p <$
% of time communicating with subordinates	.48	-.26	.001
% of time in work independent of others	-.40	.02	.001

[1] $r \geq .13$, $p \leq .05$; $r \geq .18$, $p \leq .01$.

of job stress conditions. Table 44 presents the data bearing on these findings.

The first 16 pairs of correlations across the rows of the table provide a pretty clear picture of a major difference between having responsibility for persons and having responsibility for things. The more a person reports having responsibility for persons the more time he reports spending on self- and other-initiated phone calls ($r = .13$, $p < .05$; and $r = .29$, $p < .01$ respectively), in office visits and meetings which are initiated by himself ($r = .42$, $p < .001$) and by others ($r = .36$, $p < .001$), and the less time he reports spending working alone ($r = -.47$, $p < .001$).

When the same set of correlates are examined to see how they relate to responsibility for things, almost the opposite picture is presented. High reported responsibility for things is not significantly correlated with the reported percent of time the person spends on phone calls but is inversely related to the percent of time in office meetings initiated by the person ($r = -.16$, $p < .05$) and is unrelated to the percent of time spent in meetings initiated by others ($r = .06$). Persons with responsibility for things, like those with reported responsibility for persons, also tend to report spending less time working alone, but the magnitude of the relationship is much lower ($r = -.19$ compared to $r = -.47$; the difference between the two coefficients is significant at $p < .05$). The differences between the corresponding correlations for the two types of responsibility are statistically significant in four out of these five cases.

A similar pattern emerges when self-reports of the number of office events rather than the percent of time spent in them are examined. Individuals with high responsibility for persons tend to report high numbers of incoming and outgoing phone calls as well as high numbers of self- and other-initiated meetings (the r's range from .30 to .35, $p < .01$ to $p < .001$). On the other hand, these same reports of the frequency of office events are inversely related to responsibility for things (the correlations range from -.05 to -.14, the latter correlation reaching significance at $p < .05$).

The difference between the two types of responsibility is further reinforeced when we examine the respondents' reports of the percents of time they spend under various levels of deadline pressure. The higher a person is on responsibility for persons, the less time he spends under no pressure ($r = -.44$, $p < .001$), but the higher a person is on responsibility for things, the more time he spends under no pressure ($r = .18$, $p = .01$). Similarly, subjects high on responsibility for persons report spending more time under moderate and great pressure ($r = .26$, $p < .01$; and $r = .34$, $p < .001$ respectively) while persons high on responsibility for things report less time under these same levels of pressure ($r = -.09$, n.s.; and $r = -.24$, $p < .01$).

Thus, the person with heavy responsibility for people appears to be in constant interaction with members of his role set and under a good deal of deadline pressure while the individual with high responsibility for things has relatively little role sender interaction and enjoys freedom from deadline pressures. It is not surprising, then, to find that high responsibility for persons is associated with high reported percents of time in interaction with subordinates ($r = .48$, $p < .001$) and with little time spent in work which is independent of other role senders' work ($r = -.40$, $p < .001$). In contrast, high responsibility for things is associated with little reported time communicating with subordinates ($r = -.26$, $p < .01$) and is not associated significantly with the percent of time the person spends in work independent of others ($r = .02$). All in all, it appears that responsibility for persons, as opposed to responsibility for things, goes hand in hand with several indicators of quantitative overload.

Table 45 lists relationships between our two forms of responsibility and multi-item stress indices, including the subjective quantitative work load index. The subjective quantitative work load index correlates significantly higher ($p < .01$) with responsibility for persons ($r = .57$, $p < .001$) than it does with responsibility for things ($r = .29$, $p < .01$). Similarly, the subjective quantitative overload factor shows the same pattern of correlations ($r = .31$, $p < .01$ versus $r = .11$, n.s.) although the difference between correlations is not as significant ($p < .10$).

In addition to differing with regard to their relationships to the quantitative work load measures, responsibility for persons and responsibility for things also relate somewhat differently to several other indices of job stress in the study. Table 45 shows that utilization of abilities correlates less ($p < .05$) with responsibility for persons ($r = .24$, $p < .05$) than it does with responsibility for things ($r = .46$, $p < .001$). On the other hand, utilization of leadership correlates more with responsibility for persons ($r = .60$, $p < .001$) than with responsibility for things ($r = .38$, $p < .001$). These findings have already been discussed in the previous section on utilization.

Finally, responsibility for persons and for things both are positively correlated with good relations with one's subordinates but the size of the coefficient is significantly higher ($p < .05$) for responsibility for persons ($r = .47$, $p < .001$ versus $r = .29$, $p < .01$). The fact that organizational members with high responsibility for persons tend to spend relatively more time in contact with their subordinates may provide them with

TABLE 45

COMPARISON OF RELATIONSHIPS BETWEEN RESPONSIBILITY FOR PERSONS AND FOR THINGS AND OTHER JOB STRESS[1]

Job Stress Measure	Responsibility for Persons	Responsibility for Things	$r_1 - r_2 \neq 0$ $p <$
Role ambiguity	$-.33^{3}$	$-.37^{3}$	n.s.
Subjective quantitative work load index	$.57^{4}$	$.29^{3}$	.01
Subjective quantitative overload factor	$.31^{3}$	.11	.10
Subjective qualitative work load index	$.45^{4}$	$.41^{4}$	n.s.
Subjective qualitative overload factor	-.04	.11	n.s.
Utilization of abilities	$.24^{2}$	$.46^{4}$	.05
Utilization of leadership	$.60^{4}$	$.38^{4}$	.05
Participation	$.47^{4}$	$.59^{4}$	n.s.
Opportunity for advancement and recognition	$.25^{3}$	$.32^{3}$	n.s.
Relations with immediate superior	$.24^{2}$	$.34^{3}$	n.s.
Relations with work group	$.29^{3}$	$.29^{3}$	n.s.
Relations with subordinates	$.47^{4}$	$.24^{2}$	.05

[1] $N = 100$.

[2] $p < .05$.

[3] $p < .01$.

[4] $p < .001$.

the opportunity to develop better working relationships with these members of their role set. This interpretation is supported by the finding that the reported percent of time spent with subordinates is positively related to how good one's relations are with subordinates ($r = .22$, $p < .05$).

So far, the differences between the two types of responsibility have been considered here. Now similarities of the two forms of responsibility will be examined to obtain an idea of those characteristics which are general to responsibility per se.

First, there is moderate inverse correlation between both types of responsibility and role ambiguity ($r = -.33$ and $r = -.37$, both $p < .01$). As suggested earlier, responsibility may provide information and thus may serve to reduce ambiguity.

Second, although subjective quantitative work load is correlated primarily with responsibility for persons, the subjective qualitative work load index is correlated with both types of responsibility ($r = .45$ and $r = .41$, both $p < .001$). This again attests to the importance of making a distinction between quantitative and qualitative forms of work load. Most forms of responsibility may require some type of expertise which could tend to make the person feel he is under conditions of high qualitative work load.

Third, regardless of the type, reported responsibility goes hand in hand with reported participation ($r = .47$ and $r = .59$, both $p < .001$).

Fourth, regardless of the type of responsibility, it is positively correlated with perceived good opportunities for advancement and recognition ($r = .25$, $p < .01$; and $r = .32$, $p < .01$).

Finally, people who report responsibility are also likely to report that they have good relations with their immediate superior and their work group or peers (although as noted above, relations with subordinates are more highly correlated with responsibility for persons; r's range from .24 to .47, $p < .05$ to $< .001$).

Now the results of stepwise multiple regression analyses will be presented to examine the primary stress correlates of the two types of responsibility. Table 46 presents the results of this analysis for responsibility for persons.

TABLE 46

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT JOB STRESS CORRELATES OF RESPONSIBILITY FOR PERSONS[1]

Step	Correlate Added	R	Final β
1	Utilization of leadership	.62	.26
2	Subjective quantitative work load index	.70	.14
3	% of time communicating with subordinates	.74	.20
4	Responsibility for things	.78	.19
5	% of time working under no deadline pressure	.79	-.17
6	% of time in self-initiated office visits and meetings	.80	.15
7	% of time on other-initiated phone calls	.81	.20
8	% of time on self-initiated phone calls	.82	-.16
9	Participation	.82	.14

[1]After Step 9, the following variables were nonsignificantly related to responsibility for persons: percent of time in other-initiated office visits and meetings; number per week of incoming and outgoing phone calls, and self- and other-initiated meetings; percent of time under moderate and great deadline pressure; percent of time on work independent of others; role ambiguity; subjective quantitative overload factor; subjective qualitative work load index; utilization of abilities; participation; opportunity for advancement and recognition; and relations with immediate superior, work group, and subordinates.

As the table shows, utilization of leadership is the most important contributor to variance in responsibility for persons. A number of other variables which one might associate with leadership also appear in the regression including the subjective quantitative work load index, large amounts of reported time in office visits and meetings, a good deal of time reported communicating with subordinates, and very little time reported under conditions of no deadline pressure. Interestingly enough, percent of time on phone calls initiated by others is positively weighted in the regression (beta = .20) but time on self-initiated phone calls is negatively related (beta = -.16). Thus, phone calls are from, rather than to, role senders. Thus, the individual with high responsibility for persons is more likely to be interrupted at his work than to interrupt others with a phone call. Responsibility for things still appears as a correlate of responsibility for persons, suggesting that the two forms of responsibility may lead to one another. Finally, participation again turns up as an important correlate of responsibility for persons. The multiple correlation for the nine steps of this regression is high (R = .82), accounting for 68% of the variance in responsibility for persons.

Table 47, which presents the regression analysis for impersonal responsibilities, presents a somewhat different picture. Participation accounts for about 10% of explained variance in responsibility for things in the final multiple regression equation. Responsibility for persons again shows up adding further to the notion that the two types of responsibility feed one another, and qualitative rather than quantitative overload is the third and final significant contributor to the regression yielding R = .64.

TABLE 47

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT JOB STRESS CORRELATES OF RESPONSIBILITY FOR THINGS[1]

Step	Correlate Added	R	Final β
1	Participation	.54	.32
2	Responsibility for persons	.61	.25
3	Subjective qualitative overload index	.64	.21

[1]After Step 3, the following variables were nonsignificantly correlated with responsibility for things: percent of time in self-initiated meetings and office visits and working alone; number per week of other-initiated meetings; percent of time under no and great deadline pressure; percent of time communicating with subordinates, role ambiguity, subjective quantitative work load index, utilization of abilities and leadership; opportunity for advancement and recognition; and relations with immediate superior, work group, and subordinates.

Clearly responsibility for persons seems to be associated with many more types of job stress than does responsibility for things. It might be expected, consequently, that responsibility for persons will be more highly related to the measures of strain in this study than responsibility for things. The findings relating responsibility and strain will now be examined. These are summarized in Table 48.

Examining the relationships between responsibility and psychological strain shows that responsibility for persons is positively correlated with job satisfaction ($r = .40$, $p < .001$), negatively correlated with job-related threat ($r = -.42$, $p < .001$), and positively correlated with job-related self-esteem ($r = .18$, $p < .05$). When the contributions of all three measures of strain are examined in a regression analysis, however, only job satisfaction accounts for significant independent variance in responsibility for persons.

TABLE 48

COMPARISON OF STRAIN CORRELATES OF RESPONSIBILITY FOR PERSONS AND FOR THINGS[1]

Strain	Responsibility for Persons	Responsibility for Things	$r_1 - r_2 \neq 0$ $p <$
Job satisfaction	.40[4]	.45[4]	n.s.
Job-related threat	-.42[4]	-.29[3]	.10
Job-related self-esteem	.18[2]	.02	n.s.
Number of cigarettes smoked	.22	-.04	.10
Pulse rate	.22[3]	.10	n.s.
Diastolic blood pressure	.17[2]	.06	n.s.

[1] N = 100, except for number of cigarettes smoked where N = 60.

[2] $p < .05$.

[3] $p < .01$.

[4] $p < .001$.

Responsibility for things is also positively correlated .45 ($p < .001$) with job satisfaction and -.29 ($p < .01$) with job-related threat. When the effect of each of the strains on the other is statistically held constant, these correlations drop nonsignificantly to .33 ($p < .01$) and -.13 ($p < .10$) respectively. Overall, these findings on psychological strain suggest that responsibility is somewhat desirable regardless of the type of responsibility it is.

Now let us turn to the findings relating responsibility and measures of nonpsychological risk factors in coronary heart disease. The first finding is that there is a positive relationship between responsibility for persons and cigarette smoking. The initial discovery of this relationship occurred when it was first noted that there were significantly more smokers among those who participated in the tally compared to those who did not participate (23% versus 44%, $X^2 = 3.94$, $p < .05$).

In attempting to explain this difference in the incidence of cigarette smokers, it was discovered that most of the sample of tally volunteers were administrators, so an examination of occupational differences in smoking (something which later will be considered at greater length) was carried out. While administrators tend to have more smokers among them than engineers and scientists (the percents of smokers for the three groups are 50.0, 36.2, and 31.3 respectively), the differences are not significant ($F = 2.26$, n.s.) and could not account for the high rate of smokers among tally volunteers.

Another possibility was that tally volunteers, having secretaries, also have higher formal status with its accompanying responsibilities than do nontally volunteers. While this may be so, formal status, as measured by G.S. level and salary, shows no relationship to the number of cigarettes a person smokes. Therefore, formal status could not account for these differences in smoking among tally and nontally volunteers.

With regard to responsibilities, however, quite a different picture emerges. Table 49 presents the average percent of time tally and nontally volunteers report spending in various responsibilities. This percent measure of reported time spend carrying out various responsibilities shows a fair degree of convergent validity with our measures of responsibility for persons and responsibility for things (see Appendix XVI). Responsibility for persons correlates positively and significantly with the

TABLE 49

MEAN PERCENT OF TIME SPENT CARRYING OUT VARIOUS RESPONSIBILITIES BY TALLY AND NONTALLY VOLUNTEERS

Type of Responsibility	Volunteer		$p <$
	Tally N = 25	Nontally N = 175	
Work of others	40.2	27.4	.01
Others' futures	15.6	7.0	.001
Money	11.8	9.6	n.s.
Equipment	3.6	9.1	.05
Projects	29.2	51.6	n.s.

percent of time persons report spending carrying out responsibility for the work of others ($r = .56$, $p < .001$), for others' futures ($r = .29$, $p < .01$), and for budget ($r = .28$, $p < .01$). It is negatively correlated with time spent on responsibility for projects ($r = -.66$, $p < .001$) and on responsibility for equipment ($r = -.07$, n.s.).

On the other hand, responsibility for things correlates positively with the reported percent of time spent carrying out responsibility for budget ($r = .36$, $p < .01$) and responsibility for equipment although this latter finding does not reach acceptable levels of significance ($r = .16$, $p < .10$). Responsibility for things is inversely related to the reported percent of time the person spends carrying out responsibility for projects ($r = -.23$, $p < .05$). However, the magnitude of this coefficient is not as great as the inverse relationship reported between responsibility for things and percent of time carrying out responsibility for projects. Responsibility for things is uncorrelated with percent of time spent carrying out responsibility for the work of others ($r = .07$, n.s.)

and for others' futures (r = .05, n.s.).

Tally and nontally persons significantly differ on three percent time measures of responsibilities. Tally volunteers report spending 40.2% of their time being responsible for the work of others while nontally volunteers report that this responsibility takes up, on the average, only 27.4% of their time. This difference is significant at the .01 level. Tally volunteers also spend over twice as much time in responsibilities having to do with others' futures as do the nontally volunteers: 15.6% compared to 7.0% of the time. This difference is significant at $p < .001$. While both tally and nontally persons spend less than 10% of their time on responsibilities for equipment, the tally persons do spend significantly less time: 3.6% of the time as compared to 9.1% of the time.

Now the crucial question is, do any of these responsibilities on which these two groups differ also relate to cigarette smoking? When data presented in Table 50 are examined, this indeed turns out to be the case.

TABLE 50

CORRELATION BETWEEN PERCENT OF TIME SPENT IN VARIOUS RESPONSIBILITIES AND NUMBER OF CIGARETTES SMOKED[1]

Type	r
Responsibility for the work of others	.31[2]
Responsibility for others' futures	.08
Responsibility for money	-.22
Responsibility for equipment	-.19
Responsibility for projects	-.08

[1]For persons smoking 1 or more cigarettes per day. N = 60.

[2]$p < .05$.

The percent of time spent carrying out responsibility for the work of others correlates .31 ($p < .05$) with the number of cigarettes smoked. The percent of time spent in responsibility for others' futures correlates nonsignificantly but in a positive direction, .08. Responsibility for money, equipment, and projects also correlates nonsignificantly but negatively with the number of cigarettes smoked. These findings are also replicated when the responsibility for persons and for things indices are used. Responsibility for persons correlates .22 ($p < .10$) with the number of cigarettes smoked, given that the person smokes, while responsibility for things correlates negligibly with the number of cigarettes smoked ($r = -.04$, n.s.). While the strength of the relationship between responsibility for persons and smoking is not strong, it is quite consistent with the findings using the percent of time measure and suggests that while responsibility for persons may not appear to be psychologically strainful, it can conceivably contribute to poor health via increased smoking. Of course, it is also possible that heavy smokers seek out high responsibility for persons in the organizational roles they select.

Two other measures of strain also correlate significantly with the responsibility for persons index. The first of these is pulse rate. Pulse rate correlates .22 ($p < .01$) with responsibility for persons and .10 (n.s.) with responsibility for things. The difference between these correlations is not statistically significant. Second, diastolic blood pressure correlates .17 ($p < .05$) with responsibility for persons but only .06 (n.s.) with responsibility for things (the comparable correlations for systolic blood pressure are .10, n.s. and .02, n.s., respectively). Again, the difference between these two coefficients is also nonsignificant. When age-corrected diastolic blood pressure is used, the correlation between it and responsibility for persons drops, nonsignificantly to .13 ($p < .10$). The correlation with responsibility for things remains unchanged. Nevertheless, all three strains (heavy smoking, pulse, and diastolic blood pressure) are highest for responsibility for persons which lends some support to findings suggesting responsibility for persons is a greater stress than responsibility for things. The relative contributions of smoking and responsibility to diastolic blood pressure will be considered toward the end of this chapter when other predictors of blood pressure are also examined.

These findings have considered the amount of smoking among those who smoke. What about smokers versus nonsmokers--do the former have more responsibility for persons? When the data are analyzed in this manner, we continue to find some support for a link between smoking and the responsibility hypothesis. Table 51 summarizes these findings.

The table divides the sample into two groups: smokers and nonsmokers. Note that both with regard to responsibility for persons and responsibility for things, smokers report the highest amount of responsibility while nonsmokers report the lowest ($t = 3.18$, $p < .001$; and $t = 3.62$, $p < .001$ respectively). Thus, with regard to the index measures, responsibility per se is related to whether a person smokes or not.

Further support for these differences is revealed in findings which deal with differences between smokers' and nonsmokers' percents of time spent carrying out various types of responsibility. Smokers report spending significantly more time than nonsmokers (36.3% versus 24.5% of the time) carrying out responsibility for the work of others ($t = 3.93$, $p < .001$). Thus smoking per se as well as number of cigarettes smoked is positively related to responsibility for the work of others. Smokers

TABLE 51

COMPARISON OF SMOKERS' AND NONSMOKERS' REPORTS OF RESPONSIBILITY[1]

Measure of Responsibility	Smokers	Nonsmokers	t	p <
Responsibility for persons[2]	3.26	2.78	3.18	.001
Responsibility for things[2]	3.27	2.91	3.62	.001
Percent of time carrying out responsibility for:				
the work of others	36.34	24.48	3.93	.001
others' futures	9.51	7.22	1.62	.05
projects	36.58	49.88	-3.77	.001
budget	10.01	9.60	.31	n.s.
equipment	7.82	8.90	-.66	n.s.

[1]Degrees of freedom = 204.

[2]Scored on 5-point scales where 1 = very little and 5 = very great.

also spend significantly more time than nonsmokers (9.5 versus 7.2%) carrying out responsibility for others' futures ($t = 1.62$, $p < .05$). Thus, on both responsibilities for persons smokers spend more time.

The picture is different, however, with regard to percent of time spent on responsibilities for things. Smokers report spending significantly less time than nonsmokers on responsibilities for projects (36.6 versus 49.9% of their time; $t = -3.77$, $p < .001$). Furthermore, time spent on responsibility for budget and responsibility for equipment fail to differentiate between the smokers and nonsmokers as you will note in the table. As noted before, the percent of time measures must sum to 100%, and are, therefore, somewhat dependent on another.

Overall, then, there seems to be additional support for the positive relationship between responsibility for persons and smoking. There is also some support for a negative relationship between smoking and responsibility for things.

Two other relationships between the percent of time measures of responsibility and the measures of strain also appear. First, pulse rate is positively correlated with the measure of responsibility for others' futures ($r = .18$, $p = .01$). This coefficient hardly changes when being a smoker is controlled for (partial $r = .16$). Second, serum uric acid is positively correlated with the percent of time reported carrying out responsibility for budget ($r = .16$, $p < .05$). These correlations are of generally low magnitude. The diversity of relationships, however, offers support for a specificity hypothesis of stress and strain since some stresses are related to one kind of strain while others are related to entirely different strains.

This completes the findings on responsibility. They are summarized in Figure 13. Overall, the most telling differences between responsibility for persons and for things lies in the fact that the former is associated with high subjective quantitative overload, cigarette smoking and pulse rate, while the latter is associated with low subjective quantitative overload and is more likely to characterize nonsmokers. Both types of responsibility tend to be associated with freedom from job dissatisfaction and threat however.

Participation

Participation has its advantages and disadvantages. On the one hand, it gives the focal person a say in decisions affecting the functions of the office he holds, but on the other hand, as the data will now suggest,

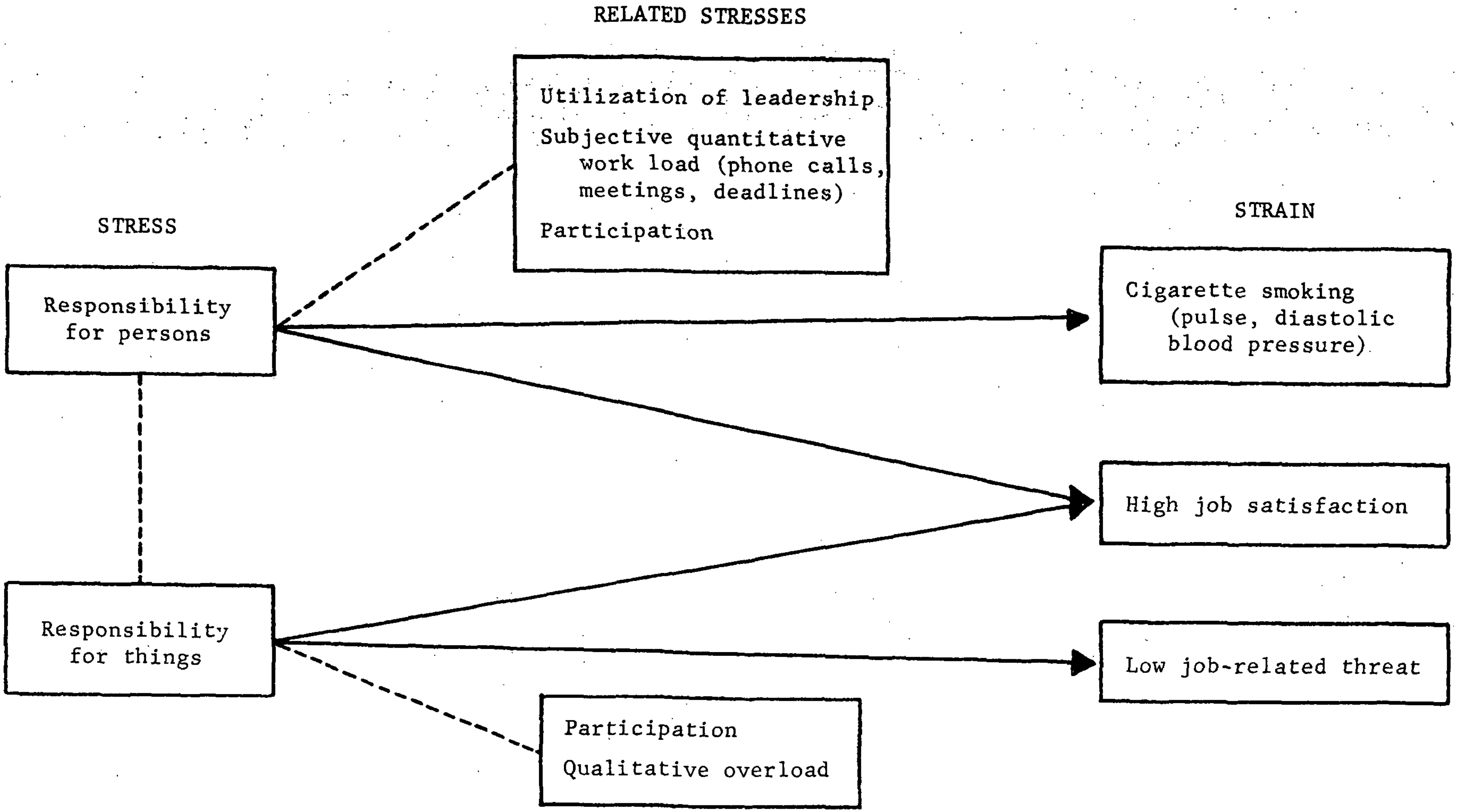


Figure 13. Theoretical interpretation of the relationships between two types of responsibility and other job stresses and strain.

it also demands time from the individual. An examination of the stresses and lack of stresses associated with participation will provide some idea of what the overall balance sheet looks like on this variable.

Table 52 presents data relating participation to various types of office activities and other single-item measures of job stress. The above

TABLE 52

SINGLE ITEM STRESS CORRELATES OF PARTICIPATION

Stress Measure	r	$p \leq$
Percent of time in self-initiated meetings and office visits	.20	.05
Percent of time working alone	-.25	.01
Number of self-initiated meetings	.27	.01
Number of other-initiated meetings	.21	.05
Immediate superior as a source of deadline pressures	-.28	.01
Stress from other branches	-.20	.05
Stress from other divisions	-.25	.01

notion about the time participation takes seems to be borne out by several of the findings. Persons who report high degrees of participation also report a good deal of time in self-initiated meetings ($r = .20$, $p < .05$) and little time working alone ($r = -.25$, $p < .01$). When an examination is made of the number of meetings rather than the percent of time in them, the reports of the high participation people are again quite the same--they tend to report a relatively large number of self-initiated ($r = .27$, $p < .01$) and other-initiated meetings ($r = .21$, $p < .05$) per week.

On the other hand, high participators are less likely than low participators to see their immediate superior as a source of deadline pressures ($r = -.28$, $p < .01$), and tend to report lower overall job stress from role senders in other branches ($r = -.20$, $p < .05$) and other divisions ($r = -.25$, $p < .01$) of the organization. The implication of these findings is that participation serves to reduce these latter stresses.

Now let us turn to the findings relating participation and multi-item indices of job stress. These findings are presented in Table 53. By now

TABLE 53

CORRELATIONS BETWEEN INDEX MEASURES OF STRESS AND PARTICIPATION

Stress Measure	r	p <
Role ambiguity	-.42	.001
Subjective quantitative work load index	.20	.01
Complexification	.16	.05
Subjective qualitative work load index	.42	.001
Utilization of abilities	.52	.001
Utilization of leadership	.50	.001
Responsibility for persons	.47	.001
Responsibility for things	.59	.001
Opportunities for advancement and recognition	.47	.001
Relations with immediate superior	.52	.001
Relations with work group	.43	.001
Relations with subordinates	.34	.001

many of these findings have been presented in previous tables. For example, role ambiguity seems to decrease as reported participation increases. The possible reasons for this have already been discussed. In light of the findings reported above regarding the positive relationship between participation and phone calls, meetings, and office visits, it comes as no surprise to see that people who report high participation tend to score high on the subjective quantitative work load index ($r = .20$, $p < .01$). They also tend to see their professional field and the organization rapidly progressing and getting more complex--that is, high complexification ($r = .16$, $p < .05$).

Overall, qualitative work load rather than quantitative work load seems to account for more variance in participation ($r = .42$, $p < .001$ for the subjective qualitative work load index versus $r = .20$ for the quantitative index). This suggests that participation may be primarily characterized by demands for high quality intellectual performance or problem-solving behavior. Indeed, the findings show that organizational members who report high levels of participation in decision making tend to report high utilization of their technical skills and abilities ($r = .52$, $p < .001$) as well as high utilization of leadership skills ($r = .50$, $p < .001$).

The two factor measures of work load, the subjective quantitative and qualitative overload factors, are uncorrelated with participation (r's = -.05 and -.12 respectively, both n.s.). It was pointed out earlier, however, that the correlation between participation and the subjective quantitative overload factor rises to -.24 when the subjective quantitative work load index is controlled for. However, a regression analysis of the correlates of participation which will be presented shortly will show that neither subjective quantitative work load measure contributes substantially to the regression on participation.

The data also suggest that along with participation goes responsibility (in our society it is not uncommon to think that these two qualities should go hand in hand). Persons reporting high participation report high responsibility for persons ($r = .47$, $p < .001$) and for things ($r = .59$, $p < .001$).

Perhaps because of the opportunity to participate and consequently become more visible to important role senders, high participators tend to perceive greater opportunities then low participators for advancement and recognition in the organization ($r = .47$, $p < .001$).

Finally, high participation seems to be associated with good relations with one's immediate superior ($r = .52$, $p < .001$), one's work group ($r = .43$, $p < .001$), and one's subordinates ($r = .34$, $p < .001$). Role ambiguity is reduced by participation, and low role ambiguity, as we noted, is associated with good relations with role senders. Thus, it may be that there is a process whereby participation provides the focal person with information (reduces ambiguity) and this in turn makes the focal person more valued by his role senders as a source of information.

Now let us turn to the multiple regression analysis to pick out the relative contributions of each of the correlates of participation. The results of this analysis are presented in Table 54. The first variables out of the regression are role ambiguity and responsibility for things. The variable with the next highest beta weight is good relations with one's immediate superior. Then comes responsibility for persons, utilization of skills and abilities, low stress from other branches, and utilization of leadership in the descending order of their beta weights. Thus, the high participator has relatively substantial responsibility for things, high utilization of skills and abilities, information about his role, good relations with his superior, and little stress from other

TABLE 54

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT JOB STRESS CORRELATES OF PARTICIPATION[1]

Step	Correlate Added	R	Final β
1	Role ambiguity	.56	-.24
2	Responsibility for things	.68	.24
3	Utilization of leadership	.71	.13
4	Relations with immediate superior	.74	.19
5	Utilization of abilities	.75	.16
6	Stress from other branches	.76	-.14
7	Responsibility for persons	.77	.18

[1]After Step 7, the following variables were nonsignificantly correlated with participation: percent of time in self-initiated meetings and office visits, working alone; number per week of self- and other-initiated meetings; immediate superior as source of deadline pressures; stress from other divisions; subjective quantitative work load index; complexification; subjective qualitative work load index, responsibility for things, opportunities for advancement and recognition, and relations with work group and superiors.

branches.

With regard to psychological strain, high participators report high job satisfaction ($r = .50$, $p < .001$), low job-related threat ($r = .51$, $p < .001$), and high job-related self-esteem ($r = .17$, $p = .01$). When these three psychological strains are entered into a stepwise multiple regression equation, low job-related threat (beta = -.39) and high job satisfaction (beta = .32) remain as significant contributors to the variance in participation ($R = .60$) while self-esteem is accounted for by these other two measures of psychological strain. Overall, these findings show that participation and freedom from psychological strain are moderately related to one another.

Turning to physiological indicators of strain, there are no significant findings relating participation and these potential risk factors in coronary heart disease.

Figure 14 summarizes the results. Overall they indicate that participation is associated with relative freedom from certain types of organizational stress and psychological strain. Participation, as much of the literature reviewed in Chapter 1 suggested, can indeed produce positively valued outcomes for the individual.

Relations with Role Senders

So far stresses have been considered which deal with the task-oriented role requirements of a focal person. The research has explored what happens when the focal person has inadequate information to carry out his role, when he can't participate enough in decisions which affect his role, when he has too much or too difficult work, when he has high responsibility, high utilization, and so on. Now the focus will be shifted to the quality of interpersonal relations between the focal person and his role set and their related effects.

Table 55 presents findings dealing with the relationships between relations with one's immediate superior, work group, and subordinates and self-reported events in the work environment. The first thing to be pointed out in the data is that good relations with one's subordinates shows the highest absolute magnitude of relationships with the first six findings in the table when compared to findings dealing with good relations with one's immediate superior and with one's work group or peers. While the differences between coefficients are not always significant, the

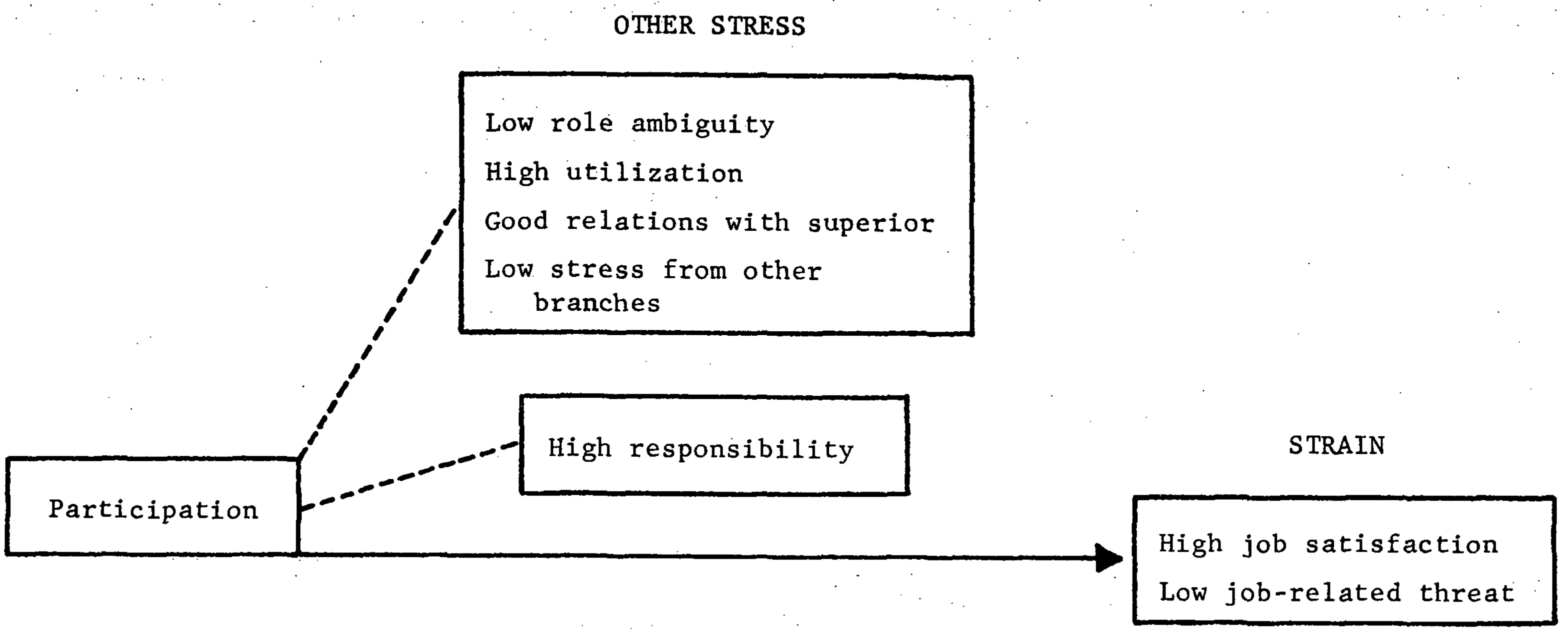


Figure 14. Theoretical interpretation of the relationship between participation in decision making and job stress and strain.

TABLE 55

COMPARISON OF CORRELATIONS BETWEEN RELATIONS WITH VARIOUS ROLE SENDERS AND SELF-REPORTS OF THE JOB ENVIRONMENT[1]

Job Environment Measure	1. Relations with Superior	2. Relations with Work Group	3. Relations with Subordinates	$r_x - r_y \neq 0$, $p <$		
				1-2	1-3	2-3
Percent of time:						
in self-initiated phone calls	.11	.00	.19[2]	n.s.	n.s.	.10
in other-initiated office visits and meetings	-.03	-.10	.20[2]	n.s.	.10	.05
working alone	-.12	-.03	-.31[3]	n.s.	.10	.05
Number per week of:						
outgoing phone calls	.03	.01	.20[2]	n.s.	.10	.10
office visits	.10	.10	.26[3]	n.s.	n.s.	n.s.
other-initiated meetings	.08	.21[2]	.20[2]	n.s.	n.s.	n.s.
Percent of time communicating with:						
subordinates	-.09	-.11	.23[2]	n.s.	.05	.01
own branch	.08	.23[2]	.06	n.s.	n.s.	n.s.
Amount of stress from own branch or office	-.24[2]	-.32[3]	-.15	n.s.	n.s.	n.s.

[1] N = 100.

[2] $p < .05$.

[3] $p < .01$.

direction of the differences is consistent. The findings suggest that good relations with one's subordinates, more than good relations with superiors and work group, must be purchased in terms of more time on self-initiated phone calls ($r = .19$, $p < .05$), more time in office visits and meetings initiated by others ($r = .20$, $p < .05$), less time for working alone ($r = -.31$, $p < .01$), more reported outgoing or self-initiated phone calls per week ($r = .20$, $p < .05$), more office visits per week ($r = .26$, $p < .01$), and more meetings initiated by others ($r = .20$, $p < .05$). In the latter case, good relations with one's work group also correlates with more other-initiated meetings ($r = .21$, $p < .05$). Persons who get along well with their subordinates tend to spend more time communicating with their subordinates ($r = .23$, $p < .05$) than those who do not report good relations with subordinates, indicating further that good working relations with subordinates require relatively high interaction rates with them. Note also that maintenance of good relations with the person's work group seems to be dependent upon spending a good deal of time communicating with members of the person's branch--the most basic work unit of the organization to which the person belongs ($r = .23$, $p < .05$). Relations with one's superior and one's subordinates seem relatively unaffected by the time one spends communicating with persons in the branch ($r = .08$ and $r = .06$ respectively) although the coefficients are not significantly different from the above correlation.

Finally, good relations with all levels of role senders may have some payoffs at the branch level. Reported stress from one's own branch is inversely related to the quality of relations one has with one's superior ($r = -.24$, $p < .05$), one's work group ($r = -.32$, $p < .01$), and one's subordinates ($r = -.15$, $p < .10$).

These conclude the significant findings dealing with these single-item measures of job environment. The results suggest that a good deal of interaction may lead to good psychological relations with one's subordinates but, on the whole, may have little or no effect on the quality of relations with one's immediate superior or work group. This may be because having good relations with one's subordinates is more a function of the social-emotional support the focal person provides to them, given his supervisory responsibility for them, while having good relations with the immediate superior and work group is more a function of the expertise in task-performance which the individual can bring to bear to help his colleagues and superior accomplish their tasks. Two findings in the next table, Table 56, provide direct support for this interpretation.

If the two types of utilization (utilization of abilities and utilization of leadership) in the table are examined, some rather different patterns of correlations show up. Utilization of abilities, which might be thought of as technical expertise utilization, correlates .38 ($p < .001$) with relations with immediate superior, .40 ($p < .001$) with relations with the work group, and significantly less with relations with subordinates ($r = .23$, $p < .01$). The p values for the difference between this latter coefficient and the two preceding coefficients are .10 and .05 respectively.

Utilization of leadership, which might be thought of as utilization of social interaction skills and running a "smooth shop," is correlated most highly with relations with subordinates ($r = .37$, $p < .001$), next most highly with relations with immediate superior ($r = .32$, $p < .001$), and least with relations with the work group ($r = .22$, $p < .01$). The difference between the first and third correlation approach statistical significance ($p < .10$). Thus, _task_ performance may endear the focal

TABLE 56

COMPARISON OF CORRELATIONS BETWEEN RELATIONS WITH VARIOUS ROLE SENDERS AND INDICES OF JOB STRESS[1]

Job Stress Measure	1. Relations with Superior	2. Relations with Work Group	3. Relations with Subordinates	$r_x - r_y \neq 0$, $p \leq$		
				1-2	1-3	2-3
Role ambiguity	-.41	-.43	-.41	n.s.	n.s.	n.s.
Subjective quantitative work load index	.16	.15	.35	n.s.	.05	.05
Subjective quantitative overload factor	.04	.00	.19	n.s.	.10	.05
Complexification	.09	.19	.18	n.s.	n.s.	n.s.
Subjective qualitative work load index	.41	.40	.41	n.s.	n.s.	n.s.
Subjective qualitative overload factor	-.24	-.21	-.15	n.s.	n.s.	n.s.
Utilization of abilities	.38	.40	.23	n.s.	.10	.05
Utilization of leadership	.32	.22	.37	n.s.	n.s.	.10
Responsibility for persons	.26	.29	.47	n.s.	.01	.05
Responsibility for things	.34	.29	.24	n.s.	n.s.	n.s.
Opportunities for advancement and recognition	.41	.33	.16	n.s.	.005	.05
Participation	.52	.43	.34	n.s.	.05	n.s.
Relations with immediate superior	---	.48	.27	---	---	.01
Relations with work group	.48	---	.40	---	n.s.	---

[1] $r \geq .13$, $p \leq .05$; $r \geq .18$, $p \leq .01$; except for the responsibility measures where $r \geq .19$, $p \leq .05$; and $r \geq .26$, $p \leq .01$.

person to his superior and peers, but process performance appears to be more important when it comes to getting along with subordinates. This conclusion essentially replicates the Ohio Leadership Studies' findings dealing with 100 air crew commanders (Halpin & Winer, 1957).

Now let us turn to the rest of the findings in Table 56. First, as already noted, role ambiguity is associated with poor relations with one's superior, work group, and subordinates (r's = -.41, -.43, and -.41 respectively, all $p < .001$), a finding discussed already.

As was previously pointed out, relations with subordinates require a good deal of time in various office activities including meetings and phone calls. This is also indicated by the significant and positive correlation between the subjective quantitative work load index and good relations with all three sets of role senders (r's range from .15 to .35, $p < .05$ to $p < .001$). However, the work load index is significantly more related ($p < .05$) to relations with one's subordinates than to relations with work group and superior. The subjective quantitative overload factor also is significantly correlated with relations with subordinates ($r = .19$, $p < .01$) but not with relations with superior or work group (r's = .04 and .00 respectively).

With regard to complexification, high complexification is positively correlated with good relations with one's work group ($r = .19$, $p < .01$) and with one's subordinates ($r = .18$, $p = .01$), and nonsignificantly related to good relations with one's superior ($r = .09$). The interpretation of these findings is not immediately apparent, but the low magnitude of the coefficients suggests that they may be an artifact of relationships with a third variable which correlates with both complexification and relations with others (results of a stepwise multiple regression of stress measures on relations with others will shortly show this to be the case).

Moving down Table 56 the findings show that good relations with all three sets of role senders and the subjective qualitative work load index are positively correlated with one another (r's range from .40 to .41, p's $< .001$). Since the index measures, in part, the extent to which one's role senders demand high quality work from a person, this suggests that when one has good relations with role senders, they, in turn, have high expectations regarding the focal person's performances. This interpretation has been discussed in the section of this chapter on subjective qualitative work load.

The picture is quite different when relationships between relations with others and the subjective qualitative overload factor are examined. The factor measure has been characterized as measuring stress due to competition with others, and is, not unexpectedly, negatively correlated with the quality of relations organizational members have with their immediate superior ($r = -.24$, $p < .01$), their work group ($r = -.21$, $p < .01$), and their subordinates ($r = -.15$, $p < .05$). Where competition is stressful, it apparently leads to breakdowns in relations with role senders in the organization (for example, see Blake & Mouton, 1961).

Turning to the findings dealing with responsibility, it appears that responsibility for persons, while positively associated with good relations with all three types of role senders, is most highly, and significantly more so ($p < .05$, $p < .01$), correlated with good relations with one's subordinates. The coefficients range from .26 to .47 ($p < .01$ to $p < .001$). On the other hand, the correlations between responsibility for things and relations with the three types of role senders, while also positive and significant (r's range from .24 to .34), are highest for relations with the immediate superior and lowest for relations with subordinates although the differences in magnitude of the coefficients are not statistically significant.

These responsibility findings are interesting because they suggest that (a) focal persons who get along well with their subordinates do so because they provide social-emotional support (a point also corroborated by other data presented above), and (b) that the focal persons provide this support because that is their responsibility--that is, they have responsibility for the well-being and work of others. On the other hand, focal persons who get along well with their superiors do so (a) because they are competent at technical task performance (also consistent with other findings presented above), and (b) they provide this performance because it is their responsibility--that is, they have responsibility for impersonal aspects of the work such as planning and initiating projects, taking care of budget, and looking after equipment.

With regard to the overall promotion value of getting along well with the three types of role senders, there seems to be a definite gradient in correlation coefficients which suggests that advancement and recognition depend more on how a person gets along with his immediate superior ($r = .41$, $p < .001$) than with his work group ($r = .33$, $p < .001$) or subordinates ($r = .27$, $p < .01$). The difference between the first and third coefficient is significant at $p < .005$. Thus, it appears that good relations with the superior have more extrinsic payoffs than good relations with subordinates. The reward system of the organization emanates from the top down to reinforce this hierarchical net following Weber's (1947) theoretical and prescriptive conceptualization of bureaucratic organization.

The next finding in Table 56 deals with participation in decision making. As noted earlier, participation can provide many benefits, one of which is the good relations with immediate superior, work group, and peers which the high participator enjoys (r's = .52, .43, and .34, respectively, $p < .001$ for all coefficients).

Finally, good relations with one level of role senders is not unrelated to how the organizational member gets along with other levels. Relations with the person's immediate superior are positively correlated with relations with his work group ($r = .48$, $p < .001$) and with his subordinates ($r = .27$, $p < .01$). This finding essentially replicates Pelz's (1952) study of effective leadership in first-line supervisors. Pelz found that unless the focal person had influence with his own superiors, supportiveness on the part of the focal person was not likely to elicit good working relations with his subordinates.

Note, however, that the correlation between relations with superior and work group is significantly greater ($p < .01$) than the correlation between relations with superior and subordinates. This suggests the presence of an organizational status gradient in how one relates to people. Specifically, if the individual gets along well or poorly with his boss, he is likely to get along similarly with peers, but the effect is not quite as likely to be passed on to subordinates. Status distance apparently serves as a buffer to limit the consequences, for better or for worse, of the quality of interpersonal relations. Similarly, relations with the work group are, as noted, more related to relations with the superior than with the subordinates ($r = .48$ versus $r = .40$) although the difference is not statistically significant.

TABLE 57

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT JOB STRESS CORRELATES ON RELATIONS WITH IMMEDIATE SUPERIOR[1]

Step	Measure	R	Final β
1	Participation	.52	.28
2	Relations with work group	.59	.23
3	Opportunities for advancement and recognition	.62	.20
4	Subjective qualitative work load index	.63	.13

[1]After Step 4, the following variables were nonsignificantly related to relations with immediate superior: amount of stress from own branch or office, role ambiguity, subjective quantitative work load index, subjective qualitative overload factor, utilization of abilities and leadership, responsibility for persons and for things, and relations with work group.

Now, stepwise regression analyses will be used to identify the key correlates of each of the types of interpersonal relations just examined. Table 57 presents the results for relations with one's immediate superior. Participation in decision making turns out to be the most important behavior, perhaps the key, to good relations with one's superior. Next comes relations with one's work group, followed by opportunity for advancement and recognition, and finally, subjective qualitative overload which, as we noted, suggests that when relations are good, the role sender has high expectations for quality in the performance of the focal person. The R for these variables is .63.

Table 58 presents the same analysis, this time for relations with the work group or peers. Here the pattern of important correlates is different. Relations with one's immediate superior and with one's subordinates appear as the first two steps of the multiple regression on

TABLE 58

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT JOB STRESS CORRELATES ON RELATIONS WITH WORK GROUP[1]

Step	Measure	R	Final β
1	Relations with immediate superior	.46	.31
2	Relations with subordinates	.55	.29
3	Utilization of abilities	.58	.16
4	Stress from own branch	.60	-.15
5	Percent of time communicating with own branch	.61	.13

[1]After Step 5, the following variables were nonsignificantly related to relations with work group: number of meetings per week initiated by others, amount of stress from own branch or office, role ambiguity, subjective quantitative work load index, subjective qualitative work load index and overload factor, responsibility for persons and for things, opportunities for advancement and recognition, and participation.

relations with the work group, again suggesting that how one gets along with one's peers depends a lot on how one gets along with those above and below those peers in organizational status. High utilization of skills and abilities is the third major contributor to good relations with the work group. Finally, low stress from the person's own branch, combined with increased time spent communicating with members of that branch, enter as the last two contributors to the regression equation. These five variables in Table 58 account for 32% of the variance in good relations with the work group (R = .61).

Table 59 presents the regression analysis on relations with subordinates. As was indicated before, responsibility for persons seems to be an important role requirement contributing toward better relations with subordinates and it appears as the first step in the regression. The

TABLE 59

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT JOB STRESS CORRELATES ON RELATIONS WITH SUBORDINATES[1]

Step	Measure	R	Final β
1	Responsibility for persons	.43	.32
2	Relations with work group	.54	.26
3	Subjective qualitative work load index	.57	.20

[1]After Step 3, the following variables were nonsignificantly related to relations with subordinates: percent of time in self-initiated phone calls, other-initiated office visits and meetings, and working alone; number per week of outgoing phone calls, office visits, and other-initiated meetings; percent of time communicating with subordinates; amount of stress from own branch or office; role ambiguity; subjective quantitative work load index and overload factor; complexification; subjective qualitative overload factor; utilization of abilities and leadership; responsibility for things; opportunities for advancement and recognition; and participation.

second major contributing variable in the analysis is relations with the work group, and the third, and last, significant contributor to the regression is the subjective qualitative work load index. Together these three variables account for 32% of the variance in relations with subordinates ($R = .57$).

Now let us turn to the findings dealing with strain. Again the results for psychological strain will be examined first. Table 60 summarizes these findings.

First, it is noted that job satisfaction is positively associated with good relations with all three levels of role senders. However, good relations with one's superior contributes more to job satisfaction ($r = .46$, $p < .001$) than good relations with one's work group ($r = .28$, $p < .001$) or with one's subordinates ($r = .13$, $p < .10$). The differences between the

TABLE 60

CORRELATIONS BETWEEN RELATIONS WITH ROLE SENDERS AND MEASURES OF PSYCHOLOGICAL STRAIN[1]

Psychological Strain Measure	1. Relations with Superior	2. Relations with Work Group	3. Relations with Subordinates	$r_x - r_y \neq 0$, $p <$		
				1-2	1-3	2-3
Job satisfaction	.46[3]	.28[3]	.13	.10	.01	n.s.
Job-related threat	-.41[3]	-.25[2]	-.19[2]	n.s.	.05	n.s.
Job-related self-esteem	.13	.19[2]	.11	n.s.	n.s.	n.s.

[1] $N \cong 100$.

[2] $p < .01$.

[3] $p < .001$.

coefficients are presented in the table. When job-related threat is partialled out, the three coefficients retain the same ordering of magnitude with values of .34, .20, and .05 respectively. The drop in magnitude is nonsignificant.

The pattern of findings with regard to job-related threat is much the same. Job-related threat is inversely correlated with good relations with one's superior, work group, and subordinates (r's = -.41, -.25, and -.19 respectively; p's < .001, .01, and .01 respectively). When the first coefficient is compared with the third, the differences are significant at $p < .05$, indicating, once more, that good relations with the immediate superior are more important than good relations with work group and subordinates as a determinant of freedom from psychological strain. When job satisfaction is statistically partialled out of these relationships, the coefficients retain their ordering of magnitude and drop nonsignificantly to -.26, -.15, and -.15 respectively.

Finally, high self-esteem is positively correlated with good relations with one's work group ($r = .19$, $p < .01$) and positively but nonsignificantly associated with relations with the superior ($r = .13$) and with subordinates ($r = .11$). The positive correlation between self-esteem and relations with the work group, however, drops to a nonsignificant .08 when job-related threat and satisfaction are held constant.

Turning to the results dealing with physiological indicators of strain, there are again no significant findings. Relationships are all near zero and will not be reported on further here.

Figure 15 summarizes the findings dealing with relations with role senders. To get ahead, good relations with one's superior appear most important, and participation may help maintain such relationships. Maintenance of good relations with role senders may increase their evaluation of the person and raise their expectations regarding the quality of work they think the focal person can perform. Thus, a person with good relations may subsequently end up reporting high qualitative work load. Overall, good relations with role senders may pay off in terms of freedom from feelings of threat associated with the job and in increased job satisfaction.

Communicating with Other Organizational Territories

Having to move into alien territory, across the formal organizational boundaries which exist within the organization, or between the organization and its external environment, is quite common in work settings. In the national survey study (Kahn et al., 1964), 43% of the respondents reported they sometimes, rather often, or nearly all the time had contacts outside

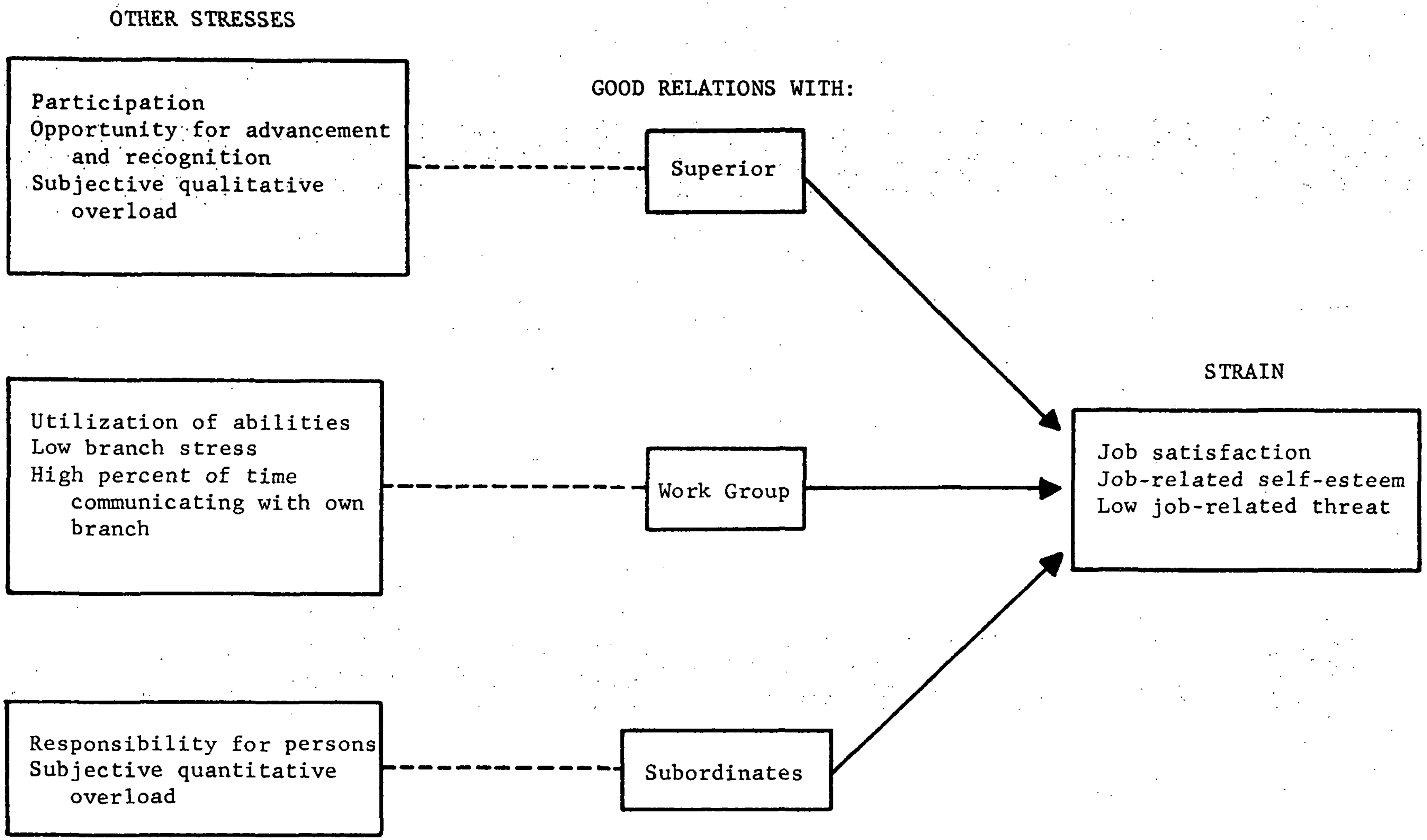


Figure 15. Theoretical interpretation of the relationships between relations with role senders and job stress and strain.

the organization. Forty-seven percent reported they similarly spent such time crossing departmental boundaries within the organization. At Goddard, the sample reports spending more than 50% of their time "interfacing," as they call it, with other sections of the organization. In fact, in preliminary interviews with employees at NASA it was not uncommon for a person to describe his job in terms of how it "interfaced" with other units.

Contact across organizational boundaries, in the intensive study of organizations by Kahn et al. was found to be positively associated with role conflict, which, as already noted, is primarily a form of role overload. Those who were located on either the external or the internal boundaries of the organization reported substantially more role conflict in the Kahn et al. study. In intra-organizational contacts, those interactions with more distant departments were more stressful because the role senders had less adequate understanding of the focal person's job, and hence, they made more unreasonable demands. At Goddard, too, contacts with more distant organizational units are more difficult or stressful. The amount of time under great deadline pressure decreases with increases in the amount of time one spends communicating with people in one's own branch of the organization ($r = -.31$, $p < .01$) but increases with the amount of time one spends communicating with role senders on other bases ($r = .39$, $p < .001$; these latter two coefficients are not completely independent since they are part of the same percent of time measure). Thus, these findings tend to support those of Kahn et al.

As part of the study described here, subjects were asked to indicate the percent of time they spent in contract monitoring. This activity involves communicating with contractors to the organization regarding the work they are performing under such contracts--work which interfaces with the completion of assignments the focal person has direct responsibility for. Such monitoring can again be thought of as contact across organizational boundaries or territory. The more time people report spending in such monitoring, the heavier is their actual work load as measured by the objective measure of phone calls, office visits, and meetings ($r = .61$, $p < .001$). Thus, boundary contacts are associated with high objective, as well as subjective quantitative work load.

Table 61 presents data relating the percent of time a person spends in contact with persons outside of his own office of branch, that is, in contacts with other organizational territories and the percent of time he reports spending in various office activities. The findings show that the amount of time a person spends communicating across the boundary of his own branch is positively correlated with the percent of time he reports spending on self- and other-initiated phone calls ($r = .32$ and $r = .34$ respectively, both $p < .001$). Such contact is also positively correlated with reported time in meetings initiated by others ($r = .42$, $p < .001$), and is negatively associated with having time for working alone ($r = -.37$, $p < .001$). Since the percents of time spent in different work activities are not independent of one another (they must add to 100%), the latter correlation can be taken as an overall indicator of the general finding that time spent in contacts across boundaries in the organization is time which detracts from the opportunity to work alone. This is what one would expect by definition. On the other hand, time spent communicating within one's own branch is time which does produce more time for working alone. Thus, one cannot argue that it is communication per se which decreases the time one has for working alone--it is communication <u>across</u>

TABLE 61

RELATIONSHIP BETWEEN REPORTED PERCENT OF TIME COMMUNICATING OUTSIDE OF OWN BRANCH OR OFFICE AND REPORTED OFFICE ACTIVITIES

Office Activity	Percent of Time Communicating Outside of Own Branch or Office	p <
Percent of time[1] on:		
self-initiated phone calls	.32	.001
other-initiated phone calls	.34	.001
self initiated office visits and meetings	.04	n.s.
other-initiated office visits and meetings	.42	.001
working alone	-.37	.001
Number of:		
outgoing phone calls	.20	.05
incoming phone calls	.16	.10
office visits	.07	n.s.
self-initiated meetings	.16	.10
other-initiated meetings	.20	.05

[1]The percent of time measures are not completely independent of one another since they must add to 100%.

boundaries.

Table 61 also presents similar data relating time spent communicating with persons outside one's own territory to the number of reported office activities per week involving role senders. Communication with persons outside one's own territory means more reported outgoing and incoming phone calls ($r = .20$, $p < .05$; and $r = .16$, $p < .10$), more self-initiated meetings ($r = .16$, $p < .10$), and more other-initiated meetings ($r = .20$, $p < .05$). Thus, the pattern of findings presented in the preceding paragraph are futher supported.

TABLE 62

RELATIONSHIPS BETWEEN REPORTED TIME SPENT COMMUNICATING ACROSS ORGANIZATIONAL BOUNDARIES AND JOB STRESS INDICES[1]

Stress	Percent of Time Communicating with People[2]					
	In Own Branch	In Other Branches	In Other Divisions	In Other Directorates	In Other Bases	In Non-NASA
Subjective Quantitative Work Load Index	-.26[3]	.09	-.10	.25[4]	.26[4]	.09
Subjective Quantitative Overload Factor	-.17	-.02	-.03	.30[4]	.15	.06
Utilization of Abilities	.28[3]	-.10	-.12	-.11	-.19[3]	-.14

[1]N = 100.

[2]Correlations in any one row are not completely independent of one another.

[3]$p < .05$.

[4]$p < .01$.

Table 62 presents findings relating measures of boundary contacts to multi-item indices of job stress. Three such measures of job stress are significantly related to crossing organizational boundaries and are presented in the table. These are the index and factor measures of subjective quantitative work load and utilization of abilities. The correlations between subjective work load and time spent communicating with role senders in one's own branch are negative ($r = -.26$ and $r = -.17$ respectively; $p < .01$, and $p < .10$). However, the correlation coefficients change from negative to positive as the relationship is computed between the subjective quantitative work load measures and time spent communicating with successively more distant parts of the NASA organization (excluding communication with non-NASA personnel such as outside contractors). Thus, the correlations between percent of time communicating with other directorates and bases and the work load measures range from .15 to .30, $p < .10$ to $p < .01$). This provides further support for the Kahn et al. finding that stress increases as contacts with more distant boundaries of the organization occur.

While the correlation between utilization of abilities and reported time spent communicating with persons in one's own branch or office is positive ($r = .28$, $p < .05$), the relationship between such utilization and time spent communicating with other territories of the organization is negative (r's range from -.10 to -.19 for the other five organizational territories listed in Table 62). Thus, communication with distant territories within the organization results in less reported utilization of abilities as well as more reported work load.

Turning to strain, there are no significant relationships between reported percents of time spent communicating with different organizational territories and psychological or physiological strain. However, a measure which asks the person to rate the extent to which each territory of the organization is a general source of stress for the person (see Item 22, Appendix VI), does show some relationships to psychological and physiological strain. The measures of stress from each organizational territory and the measures of the amount of time spent communicating with that territory are not substantially correlated with one another as shown by the correlations presented in Table 63. The coefficients range from .11 to .31.

TABLE 63

CORRELATIONS BETWEEN REPORTED PERCENT OF TIME COMMUNICATING WITH DIFFERENT ORGANIZATIONAL TERRITORIES AND THE AMOUNT OF STRESS REPORTED FROM THOSE TERRITORIES[1]

Territory	r	p <
Own branch	.11	n.s.
Other branches	.29	.01
Other divisions	.12	n.s.
Other directorates	.22	.05
Other bases	.31	.01
Non-NASA personnel	.20	.05

[1]N = 100.

The correlations between the latter measure of boundary stress and physiological strain, where they do appear, are generally quite low and show no clear pattern. The amount of stress a person reports from his own branch is positively correlated with job-related threat ($r = .26$, $p < .01$) and with diastolic but not systolic blood pressure (r's = .25, $p < .01$, and .10, n.s. respectively). Stress reported from other branches is positively correlated with job-related threat ($r = .24$, $p < .05$) and negatively correlated with serum cortisol ($r = -.24$, $p < .10$, two-tailed). Stress from other divisions is positively correlated with serum uric acid ($r = .19$, $p < .05$). There are no correlations between stress from other directorates and strain. Stress from other bases is correlated .18 ($p < .05$) with pulse rate. Finally, stress from non-NASA employees, such as contractors, is positively correlated with job-related threat ($r = .21$, $p < .05$) and with serum uric acid ($r = .22$, $p < .05$).

Overall the measure of stress from different organizational territories indicates that job-related threat is as likely to be related to stress from one's home territory--the branch--as it is from more distant parts of the organization such as other branches and non-NASA employees. The scattered pattern of findings suggests that we have either come upon an example of response specificity where certain stresses produce some strains and not others, or else we are dealing with a random scattering of findings. Unfortunately, the measure only asks the person about stress in general without specifying further the nature of the stress.

There is some question as to why this measure of boundary stress shows positive correlations with measures of strain while the first measure which asked the person to report the amount of time he spends communicating with different organizational territories did not produce any results. It is probably that the respondent interprets the word "stress" in the second measure as psychological <u>strain</u> and therefore reports on the extent to which contact with different organizational territories is a source of psychological strain rather than a stress. The spotty, but present, correlation between the second measure of boundary stress examined here and strain suggests that this may indeed by the case. If a model such as that illustrated in Figure 16 is followed, then it is logical to expect that psychological <u>strain</u> related to

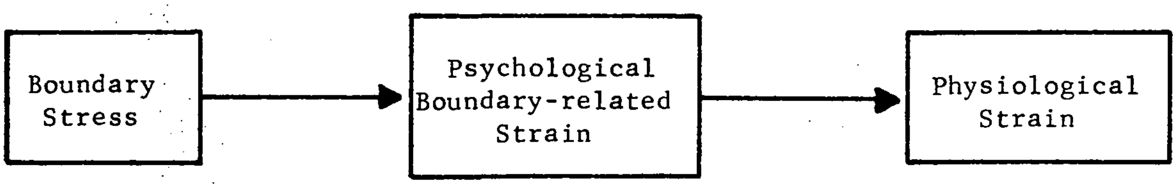


Figure 16. Theoretical model of the relationship between boundary stress and physiological strain.

boundary contacts will be more highly related to physiological strain than the stress of boundary contacts. In this model, psychological strain is an intervening variable in the link between boundary stress and physiological strain.

The Major Determinants of Psychological Strain

In the past sections, a number of organizational stresses have been examined and many of these stresses have shown significant relationships with the three measures of psychological strain in this study. Since many of these stresses, and the psychological strains, are interrelated, stepwise multiple regression techniques will be used, as has been done previously, to determine the main determinants or predictors of each of the three types of psychological strain.

Table 64 presents the results of these analyses for the first measure

TABLE 64

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT CORRELATES OF JOB SATISFACTION[1]

Step	Correlate	R	Final β
1	Participation	.48	.13
2	Subjective qualitative work load index	.56	.24
3	Relations with work group	.61	.18
4	Opportunities for advancement and recognition	.63	.20
5	Job-related threat	.65	-.17

[1]After Step 5, the following variables were nonsignificantly related to job satisfaction: subjective quantitative overload factor, utilization of abilities and leadership, complexification, relations with immediate superior and subordinates, subjective qualitative overload factor, role ambiguity, and responsibility for persons and things.

of psychological strain, job satisfaction. The most important correlate of job satisfaction is subjective qualitative work load, measured by the index. As suggested earlier, qualitative work load seems to indicate that role senders think highly of the focal person's competence and that the person's problem-solving skills and abilities are being utilized. This seems to be the link which ties subjective qualitative work load to job satisfaction. The second and third most important correlates or predictors of job satisfaction are the perceived opportunities for advancement and recognition and the goodness of interpersonal relations the focal person has with his work group or peers. The next significant contributor is low job-related threat which indicates an important overlap between these two measures of strain and suggests that threat may lead to dissatisfaction or vice-versa. Finally, participation appears as the least important contributor to the regression equation. We should note here that its beta weight is not significantly greater than zero and can be dropped from the equation as an important contributor. However, the fact that participation was generated as the first step in the regression equation suggests that it is a general symptom of many of the other predictors of job satisfaction such as good relations with the work group and opportunity for advancement and recognition. In fact, participation may effect job satisfaction via a model such as that shown in Figure 17.

Now let us turn to the similar stepwise regression analysis on job-related threat. The findings are presented in Table 65. Here, participation is generated as the most important contributor to the equation and is again the first step in the regression analysis. Once again, the quality of interpersonal relations with one's work group also appears as important. Low job satisfaction also appears as an important contributor

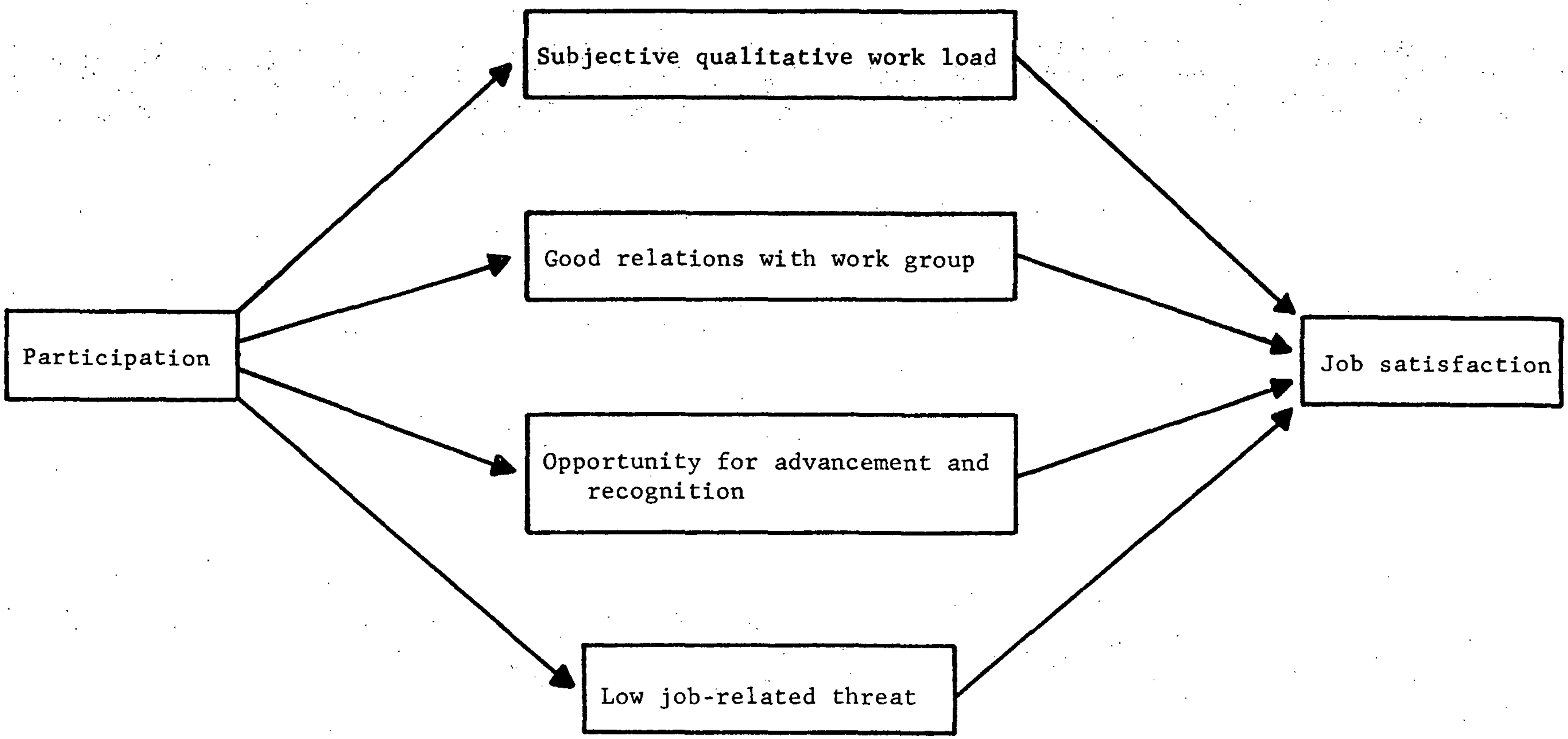


Figure 17. Theoretical interpretation of the effects of participation on job satisfaction.

TABLE 65

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT CORRELATES OF JOB-RELATED THREAT[1]

Step	Correlate	R	Final β
1	Participation	.51	-.32
2	Relations with work group	.56	-.20
3	Percent of time under no deadline pressure	.61	-.17
4	Job satisfaction	.63	-.20
5	Job-related self-esteem	.65	-.15
6	Quantitative overload factor	.66	.13

[1]After Step 6, the following variables were nonsignificantly related to job-related threat: subjective quantitative work load index, opportunities for advancement and recognition, utilization of abilities and leadership, relations with immediate superior and subordinates, subjective qualitative work load index, role ambiguity, and responsibility for persons and for things.

to job-related threat. The next contributor is the time a person spends under no deadline pressure which is inversely related to the measure of threat. Then comes job-related self-esteem which is inversely related to threat, suggesting that the two measures of psychological strain contribute to one another or measure similar domains. The last and smallest significant contributor to job-related threat is the quantitative overload factor.

The third measure of psychological strain on which regression analysis was performed is job-related self-esteem. These findings are presented in Table 66. The most important correlate of the self-esteem measure is low job-related threat. Following that, the subjective qualitative overload factor appears, which has been characterized as an indicator of the stress

TABLE 66

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT CORRELATES OF JOB-RELATED SELF-ESTEEM[1]

Step	Correlate	R	Final β
1	Job-related threat	.29	-.20
2	Subjective qualitative overload factor	.34	-.18
3	Utilization of leadership	.37	.16

[1]After Step 3, the following variables were nonsignificantly related to job-related self-esteem: participation, relations with work group and subordinates, role ambiguity, responsibility for persons, and job satisfaction.

of competition. It contributes negatively to self-esteem. The third and smallest significant contributor to the regression is high utilization of leadership.

A comparison of the multiple R for each of these three measures of psychological strain suggests that both job satisfaction and job-related threat can be moderately accounted for ($R = .65$ and $R = .66$ respectively) by this study's measures of stress. On the other hand, considerably less of the measure of job-related self-esteem is accounted for by the stress measures ($R = .37$). For two out of the three psychological measures of strain (job satisfaction and job-related threat), how one relates to one's work is an important predictor. The variable which best predicts to any of these measures of strain is participation in decision making which has a final beta value of -.32 in the regression equation predicting to job-related threat. Once again (following the research of Argyris, 1964; Likert, 1961, 1967; Mayo, 1966; Roethlisberger & Dickson, 1939), support is obtained for the positive association between having opportunities to participate in decisions which affect one's role and experiencing psychological well-being.

In summary. Considerable evidence has been presented in this study to support the hypothesis that subjective stress and psychological strain are significantly and positively associated with one another. Furthermore, there are some findings suggesting that organizational stresses and risk factors in coronary heart disease such as heavy smoking and physiological indicators of strain are significantly and positively associated with one another. In the case of responsibility for persons, compared to responsibility for impersonal aspects of the job, there are positive relationships with cigarette smoking both in terms of number of cigarettes smoked given that the person smokes, and in terms of whether the person smokes or not; and responsibility for persons is also positively and independently correlated with pulse rate and diastolic blood pressure. These findings statistically control for effects of age by the use of regression techniques. In addition, there is also some evidence suggesting that subjective quantitative, but not qualitative, work load is associated with elevated serum cortisol. However, no associations appear between the physiological strains and most of the other stresses examined in this study.

Personality as a Predictor of Coronary Heart Disease Risk

To What Extent Do Personality Measures Measure Personality Rather Than Environment?

The research of Friedman, Rosenman, and their associates has suggested that certain traits of the individual may be good predictors of risk of coronary heart disease. It was not by accident that these researchers labeled these traits "behavior patterns" rather than "personality." The distinction between these labels gets at the heart of an important conceptual and methodological issue which needs to be examined here and elaborated upon before proceeding further.

Essentially, the term "behavior pattern" was used by Friedman et al. because each subjects behavior was observed and coded during a live interview. The Type A coronary behavior pattern was based on manifest behavior. Personality, on the other hand, was implicitly assumed to interact with environment in determining behavior.

Personality, according to the most rigorous interpretations (for example, Mischel, 1969), resides in the person and cannot be observed. What can be observed on personality tests, according to a strict behaviorist's interpretation, is <u>only</u> behavior--the behavior of placing checks and x's on the answer sheet.

This study takes a somewhat less extreme position. While it is agreed that behavior is what is manifested in a personality test situation, this study follows Lewin's (1951) formulation of behavior as a function of the interaction between personality and environment. This opens the door to the following cases: (1) the measure of personality is primarily a measure of the effects of the organizational environment as would be the case where environment rather than personality played a major role in determining the person's responses to a personality measure; (b) it is primarily a function of the personality of the individual relatively unaffected by organizational environment; or (c) some combination of both factors.

If evidence can be found to indicate that "personality" measures in this study are primarily a function of person rather than environmental factors, then some validational support can be provided for a claim to be tapping an indicator of personality. Such a claim would not refute Mischel's position. It would merely indicate that a behavioral indicator of forces from within the person, as opposed to forces on the person from the environment, were being assessed. In the current study, it is important to attempt this form of validation since many of the personality clusters could either reflect role demands put on the focal person or reflect enduring personality traits of the focal person. For example, consider the Sales cluster labeled "Sense of Time Urgency." While a person could score high on this measure because of some underlying trait which predisposes the individual to perceive of time as subjectively scarce, it is also probable that the individual could be indicating high time urgency because his role senders impose a good deal of deadlines and work load on him and because the nature of his role requires that he try to meet all of these role sender demands.

There appear to be three major strategies for dealing with this problem. One strategy for untangling environment and personality in personality measures is to compare the responses of monozygotic and dyzygotic twins (for example, see Jones, 1971) to the same personality measure. If one is measuring personality rather than environment, there should be more similarity between the responses of monozygotic twins than between the responses of dyzygotic twins. To employ this strategy, one should be willing to assume that heredity rather than, or in addition to, socialization is an important determinant of personality.

Another strategy would be to measure both personality and related environment over time, and then compare the changes in both. Using the above example, measures would be obtained of both Sense of Time Urgency and the amount of deadlines the person experiences at several points in time. If one is really measuring personality with the time urgency measure, then the intertrial variance for the personality measure should be significantly smaller than the same variance for environmental measures of deadlines assuming a clear change in deadline pressures from the environment occurred between trials.

A third strategy attempts to validate personality measures by comparing the extent to which such measures correlate with other measures of personality as compared to measures of the environment which are along commensurate dimensions. To illustrate this approach, again consider the time urgency measure. If the measure taps personality, then, when the respondent is asked to rate the extent to which role senders are a source of deadlines, and the extent to which the respondent himself is a source of deadlines, the personality measure should correlate significantly higher with deadlines internally imposed by the respondent than with deadlines externally imposed by other role senders.

The crux of this latter strategy, however, lies in the ability of the person to correctly discern and report the causes of his behavior and perceptions and the research to measure environment and self along dimensions commensurate with the personality measure one is attempting to validate. For example, if one attempts to validate Competitive Orientation as a measure of personality against the amount of role-sender-imposed and self-imposed deadlines, he may find that neither of the latter measures is more likely than the other to correlate with the Competitive Orientation measure simply because neither is conceptually commensurate with it. Commensurability is important because it is assumed that there is no global dimension of personality; instead, personality is multi-dimensional (an important deduction which follows from this assumption is that not all personality traits will correlate with one another --only those traits, such as Type A, which form a syndrome).

The first two strategies of validation are beyond the scope of this study. There is no available sample of twins nor longitudinal data. By chance, rather than by intent, there is some data from the study's questionnaire which allows some use of the third strategy of validation.

To turn to the relevant analysis, respondents rated the extent to which various role senders in the organization were sources of deadline pressure (the measure is presented in Appendix VI, Item 23). The respondents also indicated the extent to which they were sources of their own deadline pressure. The ratings were performed on a four-point scale ranging from "not a source of deadline pressure" to "great source of deadline pressure." Thus, a measure of reported deadlines from the environment and from the self were available against which to validate Type A personality measures such as Sense of Time Urgency. So personality measures were correlated with the measures of role sender deadline pressure and self-deadline pressure, and a comparison of magnitude of the coefficients was carried out. The data are presented in Table 67. The first column of coefficients are for relationships between the personality measures and the person's rating of the extent to which he reports himself as a source of deadline pressures. The second column presents the average correlation between the personality measure and all environmental sources of deadline pressure. These sources include subordinates, colleagues, immediate superior, higher level superiors within the person's division, head of the directorate, heads of other directorates on the base, head of the base, superiors at other bases (e.g., at Headquarters), and non-NASA

TABLE 67

COMPARISON OF THE CORRELATIONS BETWEEN PERSONALITY AND SELF- VERSUS ENVIRONMENTALLY-IMPOSED DEADLINES[1]

Personality Measure	Source of Deadlines: Self	Source of Deadlines: Environment[2]	$r_x - r_y \neq 0$ $p <$
Involved Striving	.31	.08	.05
Persistence	.18	.04	n.s.
Competitive Orientation	.06	.10	n.s.
Range of Activities	.14	.08	n.s.
Positive Attitude toward Pressure	.28	.10	.10
Environmental Overburdening	.26	.07	.10
Sense of Time Urgency	.36	.12	.05
Leadership	.12	.14	n.s.
History of Past Achievements	.00	.07	n.s.
Flexibility	-.18	.10	.05
Emotional Dependency	.04	.14	n.s.
C-M Deny Bad Self	.19	.10	n.s.
C-M Overconformity to Norms	-.03	.12	n.s.
What I Am Like: Type A	.33	.07	.05

[1] $r \geq .18$, $p < .05$; $r \geq .25$, $p < .01$.

[2] The average absolute value (omitting signs) of correlations between the personality measure and the extent to which each of the following is *a source of deadline pressure for the respondent:* subordinates, colleagues, immediate superior, higher level superiors within the division, head of the directorate, heads of other directorates at the base, head of the base, superiors at other bases (e.g., Headquarters), and non-NASA employees.

employees such as contractors.

The hypothesis tested here specifically predicts that the correlation between the personality measures and self-imposed deadlines will be high. On the other hand, it is specifically predicted that the correlation between the personality measures and deadlines imposed from others will be lower. Therefore, the average correlation between personality and all external environment sources of deadline pressures is based on the absolute values of the contributing coefficients since it is predicted that this correlation will be zero rather than plus or minus.

Furthermore, the tests of differences between coefficients in any one row of Table 67 are tests of the absolute rather than signed differences in magnitude between pairs of correlations. The signs, nevertheless, for the correlations between personality and "self" as a source of deadline pressure have been included in the table. Since the average correlation under the column labeled "environment" may hide particularly large individual correlations, care will be taken to discuss such significant findings where they occur.

Fourteen personality variables are listed in Table 67. Four of these correlate significantly higher ($p < .05$) with self rather than others as a source of deadline pressure. These four personality measures are Involved Striving ($r = .31$ with self, $\bar{r} = .08$ with environment), Sense of Time Urgency ($r = .36$ with self, $\bar{r} = .12$ with environment), Flexibility ($r = -.18$ with self, $\bar{r} = .10$ with environment), and What I Am Like: Type A ($r = .33$ with self, $\bar{r} = .07$ with environment). The latter is a global measure of characteristics of the Type A individual. None of the component coefficients which were averaged together for the three correlations between personality and external environment as a source of deadline pressure are as high as the correlation between the personality measures and self as a source of deadline pressures.

In addition, two other personality measures tend to show higher correlations with self than with environment as a source of deadlines although the differences are only statistically significant at $p < .10$. These two measures are Positive Attitude toward Pressure ($r = .28$ with self, $\bar{r} = .10$ with others) and Environmental Overburdening ($r = .26$ with self, $\bar{r} = .07$ with others). Again, none of the component coefficients in the average correlations are as high as the correlation between the personality measure and self as a source of deadline pressures.

Note that all five of these personality measures could have been influenced by environmental conditions. A high score on Involved Striving could have reflected the fact that the person's role senders place great deadline demands on the individual which draw him into the work. Instead, it appears that the individual is his own source of this involvement. The same issue has already been discussed with regard to Sense of Time Urgency. The What I Am Like: Type A measure could have been merely reflecting deadline pressures the individual tends to respond to. Instead, it also appears to reflect quantitative overload in the form of self-imposed deadlines. It could have been argued that persons with a Positive Attitude toward Pressure adopt this attitude as a form of dissonance reduction in the face of overwhelming demands to meet deadlines by their role senders. Instead, the data show that more of the variance can be explained in terms of the own person's perceived demands on himself than in terms of perceived demands from external sources. Similar arguments can be made with regard to Environmental Overburdening. Thus, there appears to be some validation for these five measures as measures of personality traits rather than as measures of the job environment or the role demands on the person. There are no cases in the above findings where others as a source of deadlines compared to self as a source of deadlines explains significantly more variance in a personality measure.

Now let us consider those cases where personality measures did not significiantly differentiate between the self and others as a source of deadline pressures. These personality measures include Persistence, Competitive Orientation, Range of Activities, Leadership, History of Past Achievements, Flexibility, Emotional Dependency, and the Crowne-Marlowe factors of Deny Bad Self and Overconformity to Norms. Earlier it was pointed out that it is important to validate personality measures using other measures of person and environment which are developed along commensurate dimensions. If one examines the nature of this latter group of personality measures, it becomes apparent that they tend to lack the commensurability with deadline pressures which the first group of personality measures seem to have (although these are post hoc judgments at this point). For example, it is not immediately apparent as to what Leadership, History of Past Achievements, Flexibility, Emotional Dependency, Deny Bad Self, and Overconformity to Norms may have to do with deadlines. On the other hand, there seem to be some direct conceptual links between deadlines, whatever their source, and Sense of Time Urgency, having a Positive Attitude toward Pressure, and perceiving the environment as overburdening.

These results suggest that one should use caution in interpreting some of the findings about to be presented and which deal with what has been labeled "personality" measures. It is conceivable that some of the unvalidated measures will be reflecting subjective environment rather than personality. On the other hand, many of the measures will be treated in analyses as if they are measures of personality--and in light of the above findings, there is some empirical support for doing so.

<u>Objective Quantitative Work Load and Personality</u>

Earlier it was hypothesized that there would be positive relationships between personality and objective quantitative work load. Such a relationship could mean that self- or organization-selection of the person into the high work load job had occurred. The relationship could also mean that the personality measure in question was really a measure of the work environment. And finally, such a relationship could occur if objective environment changes personality.

Table 68 presents the findings on the relationship between personality and objective quantitative work load based on tally observations kept by secretaries of 25 focal persons. In the far right column are the correlation coefficients for the relationships between the various personality measures and the total number of phone calls, office visits, and meetings the person had per hour. Thirteen out of fifteen of these correlations are positive (nine out of ten for the Type A measures) but only one coefficient reaches significance at $p < .05$ which is just slightly better than chance. Thus, if there is any relationship between these measures of personality and objective work load, it is extremely weak but consistent in this data.

There are, however, several significant correlations between the personality measures and the more specific measures of objective quantitative work load. Involved Striving is positively correlated with both the number of incoming and outgoing phone calls the person has (r's = .39 and

TABLE 68

RELATIONSHIP BETWEEN PERSONALITY AND OBJECTIVE QUANTITATIVE WORK LOAD[1]

Personality Measure	Number per Hour					
	Phone Calls		Office Visits	Meetings Initiated by		Total
	In	Out		Boss	Others	
Involved Striving	.39[2]	.45[2]	-.09	-.08	-.27	.26
Persistence	.31	.41[2]	.03	.04	-.35	.27
Competitive Orientation	.27	.24	.05	-.01	-.26	.19
Range of Activities	.38	.41[2]	-.03	-.20	-.16	.24
Positive Attitude toward Pressure	.40[2]	.26	.22	-.09	-.32	.31
Environmental Overburdening	.18	.05	-.09	-.27	-.27	.00
Sense of Time Urgency	.42[2]	.38	.11	.03	-.16	.32
Leadership	.10	.19	.00	.06	.17	.11
History of Past Achievements	.03	.00	-.26	.12	-.40[2]	.16
What I Am Like: Type A	-.18	.05	.13	-.06	.00	.01
Repressors-Sensitizers	-.18	-.21	-.15	.20	-.31	-.18
Emotional Dependency	.04	.21	-.03	.17	.02	.07
Flexibility	.27	.54[3]	.11	-.10	-.10	.35
C-M Deny Bad Self	.07	.02	.09	.03	-.02	.08
C-M Overconformity to Norms	.49[2]	.57[3]	.20	.09	.00	.47[2]
Family History of CHD	-.25	-.17	.10	.14	.10	-.06
Age	.00	.14	-.17	-.25	-.41[2]	.01

[1] N = 25. [2] $p < .05$. [3] $p < .01$.

.45 respectively, both $p < .05$). Persistence is also positively correlated with the number of outgoing phone calls ($r = .41$, $p < .01$) but not with the number of incoming phone calls ($r = .31$, n.s.). Range of Activities is also positively correlated with phone calls--both incoming as well as outgoing ($r = .38$, $p < .10$; and $r = .41$, $p < .05$ respectively). Positive Attitude toward Pressure and Sense of Time Urgency show positive correlations with incoming phone calls (r's = .40 and .42, respectively, both $p < .05$) and tend to be nonsignificantly but positively correlated with outgoing phone calls as well (r's = .26, n.s.; and .38, $p < .10$, respectively).

All of these above mentioned measures of personality, as shown in Table 67, correlate higher with a measure of self- as compared with other-imposed deadline pressures although the magnitude of the findings is weak. Nevertheless, such data suggest that the most plausible interpretation of the findings just presented is one which considers the personality measures as measures of personality rather than as indicators of objective environment. Thus, it is likely that either the person or the organization is selecting the individual into a work environment where a lot of phone calls are handled as part of the job. It is still possible that the job environment changes personality and makes these persons more Type A as their work environment becomes a high work load one. It is more likely, however, that phone calls, particularly outgoing phone calls, are only partly determined by the role demands of the job, and therefore, the number of such phone calls which are made may be due largely to the personality of the individual. This would account for the large correlations between Type A personality and self-initiated rather than other-initiated phone calls. The pattern of findings is like those cited earlier showing that personality is more related to self-generated sources of deadlines rather than deadlines generated by other persons.

Flexibility is positively correlated with the number of outgoing phone calls per hour ($r = .54$, $p < .01$) and positively but nonsignificantly correlated with incoming phone calls per hour ($r = .27$). This finding supports the Kahn et al. (1964) finding that Flexible persons, compared to Rigids, are more likely to cope with role conflict by overloading themselves and trying to meet the demands of all role senders. Such Flexible persons can be viewed as overconforming to norms of the organization which state that it is one's obligation to meet the demands of other role senders. Therefore, it is not surprising to see that both number of incoming and outgoing phone calls per hour are positively correlated with the Crowne-Marlowe Overconformity to Norms measure (r's = .49, $p < .05$; and .57, $p < .01$ respectively). Overconformity to Norms is the only personality measure which shows a positive correlation with the total objective quantitative work load score ($r = .47$, $p < .05$).

Finally, there are significant inverse correlations between History of Past Achievements and number of meetings initiated by others per hour ($r = -.40$, $p < .05$) and between Age and number of meetings initiated by others ($r = -.41$, $p < .05$). There is no apparent interpretation of these correlations other than that persons with either a high History of Past Achievements or who are older may go to fewer meetings initiated by others than persons low on these person measures merely because they spend most of their time in meetings initiated by themselves (the latter type of meeting was, unfortunately, not coded). It is likely that History of Past Achievements and Age are positively correlated with being in a position of authority where one would initiate one's own meetings. In fact, History of Past Achievements and Age, which are uncorrelated with one another ($r = -.12$), correlate positively with government salary level, an indicator of status and authority in the organization (r's = .20 and .27 respectively, both $p < .01$).

In summary, these findings offer some support for the prediction that personality and objective quantitative work load will be correlated with one another. The most plausible interpretation of the findings is one which conceives of the personality measures as measures of personality rather than as measures of the work environment. However, further interpretation of the findings in terms of the extent to which personality was antecedent to work load must await further research which is longitudinal rather than cross-sectional. This latter comment, also applies to the interpretation of other analyses between personality and stress which will now be presented.

Personality and Subjective Stress

In this section, the evidence in support of the prediction that personality will be correlated with subjective job stresses is considered. This prediction, like the previous one made about the relationship between personality and objectively measured stress, can follow from several different hypotheses. First, persons who are Type A may self-select themselves into organizational environments where there is ample opportunity to experience job stress, or the organization may select them into such environments. Second, the environment may, through some process, change their personality. Third, persons with certain personality traits may be more prone than others to perceive the environment as full of stress.

And fourth, the measure of personality may really be a measure of subjective environment--or vice versa.

Role Ambiguity and Personality

Table 69 presents the significant findings relating ambiguity and personality. Only three personality variables correlate significantly with role ambiguity. Competitive Orientation, Environmental Overburdening, and History of Past Achievements all show negative and not particularly high correlations with role ambiguity (r's range from -.16 to -.24, $p < .05$ to $p < .01$). One interpretation of these findings is that persons who

TABLE 69

SIGNIFICANT RELATIONSHIPS BETWEEN ROLE AMBIGUITY AND PERSONALITY[1]

Personality Measure	r	p <
Competitive Orientation	-.16	.05
Environmental Overburdening	-.19	.01
History of Past Achievements	-.24	.01

[1]N ≅ 200.

score high on these personality measures tend to experience low role ambiguity because they have the driving type of personality which pushes them to find out what is expected of them on their job. At any rate, the fact that seven other measures of Type A do not correlate significantly with role ambiguity suggests that support for the relationship is weak, and that further conjecture, at this point, is unwarranted.

Subjective Quantitative Work Load and Personality

All ten of the Type A measures of personality show positive correlations with either the subjective quantitative overload factor or the subjective work load index. These findings are presented in Table 70.

TABLE 70

SIGNIFICANT RELATIONSHIPS BETWEEN MEASURES OF SUBJECTIVE QUANTITATIVE WORK LOAD AND PERSONALITY

Personality Measure	Subjective Quantitative: Overload Factor	Subjective Quantitative: Work Load Index	$r_1 - r_2 \neq 0$ $p <$
Involved Striving	.42[4]	.49[4]	n.s.
Persistence	.14[2]	.18[3]	n.s.
Competitive Orientation	.11	.30[4]	.05
Range of Activities	.10	.22[3]	n.s.
Positive Attitude toward Pressure	.18[3]	.35[4]	.05
Environmental Overburdening	.44[4]	.50[4]	n.s.
Sense of Time Urgency	.62[4]	.58[4]	n.s.
Leadership	.11	.30[4]	.05
History of Past Achievements	.03	.17[2]	n.s.
What I Am Like: Type A	.17[2]	.24[3]	n.s.
Flexibility	.05	.15[2]	n.s.
Crowne-Marlowe Deny Bad Self	-.17[2]	-.06	n.s.
Age	.11	.17[2]	n.s.

[1] $N \cong 200$.

[2] $p < .05$.

[3] $p < .01$.

[4] $p < .001$.

The highest correlations between the measures of subjective quantitative work load and personality are with the measures of Involved Striving, Environmental Overburdening, and Sense of Time Urgency (r's range from .42 to .62, all $p < .001$). Since these three personality measures correlate quite highly with one another (r's from .54 to .65, see specific correlations in Table 14), this finding is not unexpected. The three measures all have in common an emphasis on factors conceptually associated with high quantitative work load--namely, high involvement to finish the task, reports of tending to get into overburdening situations, and a feeling that time is running out which would be quite common in a deadline situation. The other seven measures of personality reflect less of this type of content (for example, Leadership or Competitive Orientation) and show significant correlations with the two subjective quantitative work load measures which range only from .14 to .35 ($p < .05$ to $p < .001$).

Although one likely interpretation of the above findings is that the correlations merely represent content and conceptual overlap between two types of measures of subjective work load, the evidence presented in Table 67 provides support for the conclusion that the personality measures are to some extent measures of personality rather than mere reflections of the subjective work environment of the person. Analyses presented in Table 67 showed that Involved Striving, Environmental Overburdening, and Sense of Time Urgency all correlated higher with self-induced as opposed to other-induced deadline pressures, and the findings dealing with these three personality variables, compared to other personality variables, were among the most marked in the validation analysis. Consistent with these findings, the overall measure of Type A, the What I Am Like set of items, correlates positively with both the factor and index measures of subjective quantitative work load (r's = .17, $p < .05$; and .24, $p < .01$ respectively).

Four other measures of person attributes also show significant correlations with at least one of the two measures of subjective quantitative work load. Flexibility is positively correlated with the index measure ($r = .15$, $p < .05$) but uncorrelated with the factor measure ($r = .05$, n.s.). This finding again provides some support for the Kahn et al. finding, discussed earlier, on the positive relationship between Flexibility, as a personality and coping style, and overload.

The Deny Bad Self subscale of the Crowne-Marlowe is negatively correlated with the subjective quantitative overload factor ($r = -.17$, $p < .05$) and negligibly so correlated with the index measure ($r = -.06$, n.s.). The negative correlation with the factor is almost to be expected if the personality measure is conceptualized as an indicator of the person's tendency to use denial as a defense mechanism. Essentially, persons who are high on denial report little stress from quantitative work load in their environment.

The last finding in Table 70 relates age to subjective quantitative work load, but this aspect can hardly be thought of as a personality measure although it may represent certain stable dispositions which characterize people at different developmental and secular stages in their life. In this case, however, it is conceivable that the .17 ($p < .05$) correlation between age and the subjective quantitative work load index ($r = .11$, n.s. with the factor measure) also represents a relationship between seniority (and therefore status) in the organization and the amount of work which persons at higher levels of the organization may be given. In fact, an even better indicator of status, government salary level (which correlates .27 with age), correlates even higher, .34 ($p < .001$), with the subjective quantitative work load index, offering support for this interpretation of the correlation between age and the index.

When the magnitudes of the correlations between the two measures of subjective quantitative work load and personality is compared, it turns out that 11 out of 14 personality measures correlate more highly with the index measure than with the factor measure. This finding is significant at $p = .06$ using the sign test and suggests that personality is a better predictor of the more "objective" index measure, which asks the person <u>how much</u> work load he experiences, than of the less objective factor measure, which asks the person to rate the extent to which work load is a source of stress--a somewhat more ambiguous task for the respondent. At any rate, the findings are apparently not due to differences in the reliability of the two subjective quantitative work load measures since they have identical estimated reliabilities ($r_{kk} = .87$).

These results complete the findings relating personality to subjective quantitative work load. Overall, they provide evidence which supports the hypothesis that Type A personality is positively correlated with reporting the work environment as being high in quantitative work load.

<u>Complexification and Personality</u>

Only four personality measures show significant correlations with complexification. The measures, Range of Activities, Environmental Overburdening, Sense of Time Urgency, and History of Past Achievements are all positively correlated with Complexification although the correlations only range from .14 to .16 (all $p < .05$). The findings are presented in Table 71. The first three personality measures, as already noted, are substantially correlated with one another which may explain,

TABLE 71

SIGNIFICANT RELATIONSHIPS BETWEEN COMPLEXIFICATION AND MEASURES OF PERSONALITY[1]

Personality Measure	r	p <
Range of Activities	.16	.05
Environmental Overburdening	.14	.05
Sense of Time Urgency	.14	.05
History of Past Achievements	.16	.05

[1] $N \cong 200$.

in part, why they appear as significant correlates of complexification. Again, it does not seem unlikely that persons high on such traits might self-select themselves into rapidly changing, high complexification environments, but again the interpretation of the time sequence processes requires more data.

Subjective Qualitative Work Load and Personality

Subjective qualitative work load is correlated with eight of the ten measures of Type A in this study although the magnitude of the relationships is only small to moderate (r's range from $-.14$, $p < .05$ to $.29$, $p < .01$). These findings are presented in Table 72.

In performing analyses on the data, the subjective qualitative overload factor has also been included to further demonstrate that it does not measure what the index measures. While the index is significantly correlated with all eight Type A measures in the table, the factor measure is correlated only with Competitive Orientation ($r=-.14$, $p < .05$). The inverse correlation may reflect the fact that persons high on stress due to compe-

TABLE 72

SIGNIFICANT RELATIONSHIPS BETWEEN MEASURES OF SUBJECTIVE QUALITATIVE WORK LOAD AND PERSONALITY[1]

Personality Measure	Subjective Qualitative Work Load Index	Subjective Qualitative Overload Factor	$r_1 - r_2 \neq 0$ $p <$
Involved Striving	.21[3]	.09	n.s.
Persistence	.19[3]	-.01	.05
Competitive Orientation	.16[2]	-.14[2]	.005
Range of Activities	.19[3]	-.07	.005
Positive Attitude toward Pressure	.17[2]	-.03	.05
Environmental Overburdening	.29[3]	-.01	.005
History of Past Achievements	.14[2]	-.13	.005
What I Am Like: Type A	.15[2]	.11	n.s.
C-M Deny Bad Self	.04	-.22[3]	.005
Age	.15[2]	-.21[3]	.005

[1] $N \cong 200$.

[2] $p < .05$.

[3] $p < .01$.

tition (the factor measure) may not be competitively oriented as was noted in the section on qualitative work load. Unlike the index measure of qualitative work load, the factor is negatively, but nonsignificantly, correlated with most of the other measures of personality suggesting that persons who report stress due to qualitative work load tend not to be Type A.

Interestingly enough, the Crowne-Marlowe Deny Bad Self measure is negatively correlated with the subjective quantitative overload factor

$r = -.22$, $p < .01$) but is uncorrelated with the index measure ($r = .04$; the difference between this and the preceding correlation is significant at $p < .005$). It appears that people who characteristically use denial as a defense mechanism are likely to report low stress from competition, which could be in keeping with the definition of denial. On the other hand, the measure of denial is unrelated to a seemingly less arousing measure of defense--how qualitatively difficult is the work the person is given.

Finally, age, which was discussed earlier as a potential indicator of some secular personality characteristics, is positively correlated with the index measure of subjective qualitative work load ($r = .15$, $p < .05$) but negatively correlated with the factor measure ($r = -.21$, $p < .01$). In other words, older people report more qualitative work load but report less stress from competition. The first correlation between age and qualitative work load can again be explained in terms of government salary level, a correlate of age, which correlates even higher than age with the subjective qualitative work load index ($r = .20$, $p < .01$). The inverse correlation between age and stress from competing may merely reflect the fact that as one gets older and survives in the organization, the competition falls by the wayside, and the stress of competition, consequently, diminishes.

Overall, these findings suggest that Type A personality is positively correlated with subjective qualitative work load. Thus, subjective qualitative as well as quantitative work load are positively correlated with Type A personality measures.

Utilization and Personality

The findings presented in Table 73 show that of the eight Type A personality measures which are significantly correlated with either utilization of abilities or utilization of leadership, six are more highly correlated with the latter rather than the former type of utilization. While this difference is not significant, it does suggest that

TABLE 73

SIGNIFICANT RELATIONSHIPS BETWEEN MEASURES OF UTILIZATION AND PERSONALITY[1]

Personality Measure	Utilization of Activities	Utilization of Leadership	$r_1 - r_2 \neq 0$ $p <$
Involved Striving	.21[3]	.23[3]	n.s.
Persistence	.14[2]	.03	n.s.
Competitive Orientation	.12	.17[2]	n.s.
Positive Attitude toward Pressure	.13	.22[3]	n.s.
Environmental Overburdening	.30[4]	.29[3]	n.s.
Sense of Time Urgency	.11	.21[3]	n.s.
Leadership	.02	.24[3]	.05
History of Past Achievements	.14[2]	.21[3]	n.s.
Age	-.07	.14[2]	.05

[1] $N \cong 200$.

[2] $p < .05$.

[3] $p < .01$.

[4] $p < .001$.

Type A personality measures are more likely to predict to administrative behaviors rather than behavior which makes use of technical or scientific skills and abilities (this trend is borne out in findings presented in a later section showing that persons in administration are more likely than persons in engineering and science to have high Type A personality scores). Overall, however, the magnitude of the correlations is not particularly high (significant r's in the table range from .14, $p < .05$ to .30, $p < .001$).

Age shows a low but positive correlation with utilization of leadership. Again, this probably reflects the fact that seniority provides people with the opportunity to move up into positions of leadership responsibility. On the other hand, age is uncorrelated with utilization of abilities ($r = -.07$, n.s.).

Responsibility and Personality

Both responsibility for persons and for things are significantly and positively correlated with a number of Type A personality measures (the r's range from .14, $p < .05$ to .36, $p < .001$). An inspection of the findings, presented in Table 74, shows that there are no significant differences in the magnitude of correlations of personality with either responsibility for persons or for things. The only finding which comes close to distinguishing the two measures of responsibility are their correlations with age. Age is positively correlated with responsibility for persons ($r = .18$, $p < .01$) but is uncorrelated with responsibility for things ($r = .03$, n.s.). Like the positive correlation reported above between age and utilization of administrative leadership, this finding probably reflects an association between seniority or experience in the

TABLE 74

SIGNIFICANT RELATIONSHIPS BETWEEN MEASURES OF RESPONSIBILITY AND PERSONALITY[1]

Personality Measure	Responsibility for		$r_1 - r_2 \neq 0$
	Persons	Things	$p <$
Involved Striving	.32[4]	.36[4]	n.s.
Persistence	.14[2]	.19[3]	n.s.
Competitive Orientation	.24[3]	.13	n.s.
Range of Activities	.11	.19[3]	n.s.
Positive Attitude toward Pressure	.34[4]	.28[3]	n.s.
Environmental Overburdening	.35[4]	.27[3]	n.s.
Sense of Time Urgency	.31[4]	.24[3]	n.s.
Leadership	.28[3]	.18[3]	n.s.
What I Am Like: Type A	.28[3]	.27[3]	n.s.
Age	.18[3]	.03	.10

[1] $N = 200$.

[2] $p < .05$.

[3] $p < .01$.

[4] $p < .001$.

organization (or organizations) and movement into positions of responsibility or supervision over other persons. As already noted, responsibility for persons and utilization of administrative leadership do share some overlap ($r = .24$, $p < .01$).

These complete the findings dealing with responsibility and its relationship to personality. Overall, they show a moderate, but consistent, positive relationship between the Type A personality and reporting responsibility both for things and persons in one's job.

Participation and Personality

Participation is also positively correlated with measures of Type A personality. These findings are presented in Table 75. These correlations,

TABLE 75

SIGNIFICANT RELATIONSHIPS BETWEEN PARTICIPATION AND PERSONALITY[1]

Personality Measures	r	p <
Involved Striving	.21	.01
Persistence	.15	.05
Competitive Orientation	.17	.05
Positive Attitude toward Pressure	.29	.001
Environmental Overburdening	.23	.01
Leadership	.18	.01
History of Past Achievements	.19	.01
What I Am Like: Type A	.17	.05

[1] $N \cong 200$.

however, are only of moderate magnitude ranging from .15 ($p < .05$) to .29 ($p < .001$). Together, the findings suggest that Type A persons tend to participate in decision making which affects their job. The fact that personality traits such as Leadership, Competitive Orientation, and Involved Striving correlate with participation suggests that persons with this type of temperament are not likely to sit it out while others make decisions affecting their jobs.

Relations with Role Senders and Personality

These findings are presented in Table 76. Only two of the ten Type A personality measures correlate significantly with good relations with the superior (average r = .14 for the significant coefficients); only four of the ten with good relations with the work group (average r = .19 for the significant coefficients); but nine out of ten of the Type A personality measures correlate significantly and positively with good relations with subordinates (average r = .28 for the significant coefficients). In three out of the four cases where there are significant correlations between personality and either relations with the superior or the work group, the corresponding correlations for relations with subordinates have higher coefficients.

Overall, these findings suggest that Type A personality is a better predictor of the quality of relations a person reports with his subordinates than it is of the relations he reports with his superior and work group or peers. Earlier, in a section describing stress correlates of relations with role senders, it was suggested that the individual's ability to give social-emotional support to other organizational members was related more to how one got along with subordinates than it was to how one got along with the work group and superior. These findings relating personality to relations with role senders are in keeping with the earlier findings. The personal style of the individual, that is, his Type A personality, appears to be more related to relations with subordinates than to relations with work group and superior.

The last two findings in Table 76 deal with the two Crowne-Marlowe subscales. The Deny Bad Self scale is positively related to relations with the superior ($r = .16$, $p < .05$) and positively, but nonsignificantly,

TABLE 76

SIGNIFICANT RELATIONSHIPS BETWEEN MEASURES OF RELATIONS WITH OTHERS AND PERSONALITY[1]

Personality Measure	Good Relations with			$r_y - r_x \neq 0$, $p <$		
	1. Superior	2. Work Group	3. Subordinates	1-2	1-3	2-3
Involved Striving	.04	.04	.24[3]	n.s.	.05	.05
Persistence	.00	.06	.16[2]	n.s.	n.s.	.05
Competitive Orientation	.10	.20[3]	.31[4]	n.s.	.05	n.s.
Range of Activities	.05	.12	.25[3]	n.s.	.05	n.s.
Positive Attitude toward Pressure	.07	.21[3]	.40[4]	.10	.005	.05
Environmental Overburdening	.15[2]	.18[3]	.31[4]	n.s.	.05	.10
Sense of Time Urgency	.05	.03	.15[2]	n.s.	n.s.	n.s.
Leadership	.08	.09	.30[4]	n.s.	.05	.05
History of Past Achievements	.14[2]	.16[2]	.13	n.s.	n.s.	n.s.
What I Am Like: Type A	.05	.04	.26[3]	n.s.	.05	.05
C-M Deny Bad Self	.16[2]	.11	.06	n.s.	n.s.	n.s.
C-M Overconformity to Norms	.10	.10	.23[3]	n.s.	n.s.	n.s.

[1] $N = 200$. [2] $p < .05$. [3] $p < .01$. [4] $p < .001$.

correlated with relations with the work group and subordinates (r's = .11 and .06 respectively). The positive correlation between Deny Bad Self and good relations with the immediate superior makes a certain degree of conceptual sense. It is to be expected that persons who use denial as a defense mechanism will be consistent and deny any bad feelings toward their superior. The relationship is strongest between the denial measure and relations with superior, compared to relations with work group and subordinates. This suggests that the superior, due to his or her status and power in the organization, is more likely to be a source of threat to the individual, and is, consequently, more likely to arouse defense mechanisms such as denial in the respondent. Thus, underreporting of poor relations with the superior is theoretically more likely than underreporting the same about one's work group and subordinates.

The second Crowne-Marlowe subscale, Overconformity to Norms, is positively and significantly correlated with relations with subordinates ($r = .23$, $p < .01$) and positively and nonsignificantly correlated with relations with superior and work group (both r's = .10). Again, the same type of argument about defense mechanisms can be raised. Persons who overconform to group or organizational norms, one of which is certainly "thou shalt not go about casting aspersions on your role senders," are likely to overreport good relations with their subordinates and other role senders.

These complete the findings on relations with role senders and personality. They suggest that Type A personality is a better predictor of relations with subordinates than with work group or superior. The findings also provide some evidence of the presence of under- and over reporting tendencies which vary from person to person with regard to their reports of how well they and their role senders get along with one another.

Contact with Different Organizational Territories and Its Relationship to Personality

Unlike relationships between personality and other stresses just examined, no clear pattern of findings relating Type A personality measures to contact with other organizational territories appears. The relevant data are presented in Table 77.

TABLE 77

SIGNIFICANT RELATIONSHIPS BETWEEN REPORTED PERCENT OF TIME IN CONTACT WITH DIFFERENT ORGANIZATIONAL TERRITORIES AND PERSONALITY[1]

Personality Measure	Percent of Time Communicating with					
	Own Branch	Other Branches	Other Divisions	Other Directorates	Other Bases	Non-NASA Employees
Involved Striving	-.22[2]	.16	.07	.08	.14	.00
Competitive Orientation	-.09	.21[2]	.13	.04	.02	-.10
Range of Activities	-.17	.20[2]	-.07	.03	.14	.05
Positive Attitude toward Pressure	-.08	.05	-.01	-.03	.26[2]	.11
Sense of Time Urgency	.34[3]	.18[2]	.05	.07	.13	.19[2]
Leadership	.01	.06	-.02	.00	-.21[2]	-.14
Emotional Dependency	-.07	.16	.19[2]	-.06	.01	.05
Flexibility	-.18[2]	.20[2]	.10	.01	.03	-.07

[1] $N \cong 100$.

[2] $p < .05$.

[3] $p < .01$.

The most consistent pattern of findings in Table 77 is that there is a positive correlation between reported percent of time spent communicating with branches other than the person's own branch and several of the Type A measures. This reported percent of time tends to be positively correlated with Involved Striving ($r = .16$, $p < .10$), and is significantly and positively correlated with Competitive Orientation ($r = .21$, $p < .05$), Range of Activities ($r = .20$, $p < .05$), and Sense of Time Urgency ($r = .18$, $p < .05$). However, Sense of Time Urgency is correlated even higher with percent of time spent communicating with one's own branch ($r = .34$, $p < .01$). Finally, Flexibility is also positively correlated with the reported percent of time spent communicating with other branches.

Together these findings suggest that there are some positive associations between Type A personality and contact across organizational boundaries. However, the best predictions appear to be with regard to percent of time communicating with other branches rather than more distant territories of the organization. Overall, the magnitude of the significant findings does not exceed .34 with most of the correlations in the .20's. Thus, whatever relationships there are between the measures of personality and crossing organizational boundaries or territories is not great.

Personality and Subjective Stress in Summary

The findings just reviewed provide more than chance evidence of a relationship between the Type A measures of personality and subjective job stress. At the beginning of this section several alternative interpretations of any relationships between subjective measures of the work environment and personality were suggested. One of these interpretations suggested that the measure of personality was really a measure of environment. However, most of the findings have a degree of plausibility to them if one interprets the personality measures as measures of the person rather than as measures of the subjective environment. In addition, evidence has been presented which suggests that the personality measures are, in fact, measures of the person rather than the subjective environment. Future research can further interpret these findings by answering questions about the extent to which the work environment changes the person, and/or to what extent personality plays a role in directing the person toward certain job environments.

Strain and Personality

The studies by Friedman, Rosenman, et al. have shown that persons with Type A behavior patterns are more prone to coronary heart disease than persons low on these traits. To the extent that this hypothesis is true, it might be predicted that persons with Type A personality traits should also have high scores on risk factors of coronary heart disease including psychological and physiological strains.

Table 78 presents the findings relating personality to measures of psychological strain. None of the findings are in the expected direction and none of the findings are significant using a one-tailed test. That is, none of the personality variables are positively correlated with psychological strain. In terms of the theory of stress and strain presented in Figure 1, however, this lack of findings is not surprising since the model for this study places personality in the role of a conditioner of the relationship between stress and strain rather than a correlate of strain.

Using two-tailed tests of significance, however, uncovers several findings which exceed chance probability. Both Environmental Overburdening

TABLE 78

RELATIONSHIPS BETWEEN MEASURES OF PERSONALITY AND MEASURES OF PSYCHOLOGICAL STRAIN[1]

Personality Measure	Psychological Stress		
	Job Satisfaction	Job-Related Threat	Job-Related Self-Esteem
Involved Striving	.15	.03	.15
Persistence	.10	-.13	.21[2]
Competitive Orientation	.14	-.14	.24[2]
Range of Activities	.09	-.04	.18
Positive Attitude toward Pressure	.15	-.13	.10
Environmental Overburdening	.24[2]	-.05	.16
Sense of Time Urgency	.08	.14	-.03
Leadership	.11	-.13	.24[2]
History of Past Achievements	.20[2]	-.14	.30[3]
What I Am Like: Type A	.09	.12	.24
Emotional Dependence	.04	-.31[3]	.12
Flexibility	.08	.10	-.09
C-M Deny Bad Self	.00	-.20[2]	.16
C-M Overconformity to Norms	.09	-.19[2]	.20
Family History of CHD	.01	.13	-.04

[1] $N \cong 200$, except for analyses of relationships with Family History of CHD where $N \cong 100$.

[2] $p < .05$, two-tailed.

[3] $p < .01$, two-tailed.

and History of Past Achievements are positively correlated with job satisfaction (r's = .24 and .20 respectively, both $p < .05$). History of Past Achievements is also positively correlated with job-related self-esteem ($r = .30$, $p < .01$). Leadership is also positively correlated with job-related self-esteem ($r = .24$, $p < .05$). The latter correlations between these personality measures and self-esteem may merely reflect the fact that persons who report tending to achieve and report being asked to take on positions of leadership are persons whose esteem is raised by such accomplishments. Thus, these measures of personality may, in fact, reflect actual behavior patterns of the individuals as well as personality.

On the other hand, the positive correlation between Environmental Overburdening and job satisfaction may be quite in keeping with the characterization of the Type A person as an individual who tends to get into overburdening situations, but who also tends to enjoy, or derive, satisfaction from such environments.

Emotional Dependency and the two Crowne-Marlowe subscales, Deny Bad Self and Overconformity to Norms, are negatively correlated with job-related threat (r's = -.31, $p < .01$; -.20, $p < .05$; and -.19, $p < .05$ respectively). The latter two findings dealing with the Crowne-Marlowe measures suggest that persons who use denial or tend to conform to organizational norms are not likely to report feeling job-related threat. This type of finding should follow almost by definition of the Crowne-Marlowe measures. It is not clear why persons high on Emotional Dependency, however, should report low job-related threat. This may be a chance finding, and, at any rate, will not be speculated on further here.

Finally, Persistence and Competitive Orientation correlate positively with job-related self-esteem (r's = .21 and .24 respectively, both $p < .05$). In these cases, one might suspect that the self-esteem measure reflects some aspect of the individual's personality since one could argue that persons who are competitive by nature and who persist do so, in part, because they believe they can succeed or achieve their goal. Such a belief in one's competence is conceptually similar to having high self-esteem or placing high value on one's attributes.

Overall, then, there is little support for the hypothesis that Type A personality will be negatively related to psychological strain. In some instances the opposite is true, and in these cases such a finding appears to have a reasonable, although post hoc interpretation.

While measures of subjective stress account for 40% of the variance in job satisfaction, 29% of the variance in job-related threat, and 10% of the variance in job-related self-esteem, personality measures account for considerably less of the variance in two of these measures of psychological strain. Personality accounts for 9% of the variance in job satisfaction (the major independent correlates are Environmental Overburdening and History of Past Achievements), 8% of the variance in job-related threat (the major independent correlates are Deny Bad Self, Overconformity to Norms, and Emotional Dependency), and 11% of the variance in job-related self-esteem (the major predictors being History of Past Achievements, Leadership, and Competitive Orientation which is an interesting finding since all three deal with achievement, yet all three, independently of one another, are related to high self-esteem). Therefore, the reported conditions of the environment have more to do with a person's psychological well-being than does his personality in this study.

Now the relationships between personality and physiologically-linked indicators of strain will be examined. For the most part, the findings are primarily negative and only the exceptions will be elaborated on here.

The first two significant findings deal with cigarette smoking as an indicator of strain. Emotional Dependency correlates positively with the number of cigarettes a person smokes given that they smokes ($r = .27$, $p < .05$). Thus, the more the person reports relying on others for emotional support under duress, the more cigarettes he reports smoking. The theoretical work of Henry A. Murray (1938) provides a psychoanalytic explanation for this finding. In Murray's theory of the developmental stages of a person, reliance on other persons for inclusion and for emotional nurturance is referred to as the <u>orality succorance complex</u>. The complex also includes cathexis for oral objects such as the nipple, breast, or thumb; certainly cigarettes can be added to this list of objects. On the basis of Murray's work, which derives, in part, from Freudian developmental theory, the positive correlation between Emotional Dependency and cigarette smoking is not unexpected. On the other hand, there is no evidence in this study of any difference in the Emotional Dependency scores of smokers and nonsmokers (a comparison of smokers and nonsmokers will be specifically described in the next section). Thus, the finding only holds for persons who smoke, and only relates to the difference between light and heavy smokers.

Environmental Overburdening also correlates positively with the number of cigarettes the person reports smoking given that he smokes ($r = .36$, $p < .01$). In this case, it is conceivable that the Environmental Overburdening measure reflects the nature of the environment since evidence reported earlier in this study also linked cigarette smoking to the measures of objective quantitative work load. However, objective quantitative work load and Environmental Overburdening are uncorrelated ($r = .00$). On the other hand, the Environmental Overburdening measure does correlate significantly with the subjective quantitative work load index ($r = .50$, $p < .001$) and with the subjective quantitative overload factor measure ($r = .44$, $p < .001$). However, neither of these latter measures correlates significantly with cigarette smoking (r's = .16 and .17 respectively, both n.s.). These negative findings only increase the possibility that the variance heavy cigarette smoking shares with the Environmental Overburdening measure is due to heavy smoking's association with a measure of personality rather than with a measure of job environment.

There are two positive findings which relate personality to pulse rate. Both Positive Attitude toward Pressure and Leadership are positively correlated with pulse rate (r's = .17 and .15 respectively, both $p < .05$). The magnitude of these correlations, however, is far from impressive.

Overall, five out of 98, or just over 5%, of the findings relating personality to physiological strain are significant at $p < .05$. Similarly, two out of 42, or just under 5%, of the findings dealing with psychological strain are significant at $p < .01$. The lack of significant findings, however, is not unexpected. While it follows from the work of Friedman and Rosenman that personality should directly predict to risk of coronary heart disease, the theoretical model of this study, presented in Figure 1, would not necessarily lead to this prediction. In this model, personality conditions the relationship between stress and strain. This major role of personality will be examined in the next chapter.

Being a Smoker, an Exsmoker, or a Nonsmoker: Response to Personality or Environment or Both?

Once a person makes a decision to become a cigarette smoker, it is not unreasonable to expect that the number of cigarettes which the person smokes may fluctuate from day to day in response to opportunities to smoke on the job and in response to stresses which may lead the person to smoke. Data has just been presented which indicates that such fluctuations in smoking may indeed occur in response to the work setting and its attendant stresses. On the other hand, the decision to smoke, to quit smoking and become an exsmoker, or to not start in the first place probably does not change from day to day. Literature reviewed in Chapter 1 indicated that the decision is often made as early as the teen years.

In this study, a number of differences in personality, stress, and strain appear when comparisons are made of smokers, exsmokers (that is, persons who have given up smoking as a habit), and nonsmokers. It is hard to know to what extent being a smoker as opposed to a non- or an exsmoker should be characterized as a response to strain or a predisposition of the person and an indicator of personality. Therefore, special consideration is given in this section to an examination of the differences between smokers, exsmokers, and nonsmokers before describing further analyses which may include these three groups of persons. Personality, stress, and strain differences in the three groups will now be considered.

Personality and Smoking

In thinking about whether smoking behavior is linked to personality, it should be noted that a number of the studies reviewed earlier showed that the personality of smokers and nonsmokers differed from one another as early as college. Table 79 presents the scores of smokers, exsmokers,

TABLE 79

PERSONALITY DIFFERENCES AMONG SMOKERS, EXSMOKERS, AND NONSMOKERS

Personality Measure[1]	Smoking Behavior			F	p <
	Smoker	Exsmoker	Nonsmoker		
Involved Striving	5.2	4.8	4.8	3.46[2]	.05
Persistence	5.3	5.0	5.2	1.40	n.s.
Competitive Orientation	4.9	4.7	4.7	1.01	n.s.
Range of Activities	4.6	4.2	4.7	2.20	n.s.
Positive Attitude toward Pressure	5.1	4.8	4.9	3.11	.05
Environmental Overburdening	5.5	5.0	5.3	2.65	n.s.
Sense of Time Urgency	4.5	4.0	4.3	2.30	n.s.
Leadership	4.6	4.2	4.5	1.48	n.s.
History of Past Achievements	4.7	4.4	4.8	2.42	n.s.
What I Am Like: Type A	3.5	3.2	3.2	2.95	.10
Repressors-Sensitizers	2.9	2.9	3.0	.53	n.s.
Emotional Dependency	2.2	2.2	2.2	.07	n.s.
Flexibility	2.6	2.6	2.6	.23	n.s.
C-M Deny Bad Self	1.4	1.4	1.5	1.65	n.s.
C-M Overconformity to Norms	1.6	1.5	1.6	2.26	n.s.
Age	40.6	39.6	38.8	.99	n.s.
Family History of CHD	.9	1.2	1.1	.83	n.s.

[1] The first nine scales are 7-point scales, the next four are 4-point, and the last two are 2-point scales.

[2] d.f. = 2,201.

and nonsmokers on the personality measures in this study. The first ten measures are all specifically intended to measure traits characteristic of the Type A person. Two of the measures, Involved Striving and Positive Attitude toward Pressure differentiate significantly between the three smoking groups ($p < .05$). In both cases, the smokers have the highest mean score on the personality measure, and in both cases exsmokers score as low or lower than nonsmokers. There is also a significant difference among the three groups ($p < .10$ level) on the What I Am Like: Type A measure. Again, smokers score the highest and ex- and nonsmokers score the lowest of the three groups. For all ten Type A measures, exsmokers score lower than smokers. For eight out of ten of the measures, nonsmokers score lower than smokers ($p < .11$ by the sign test). On three out of the ten measures, exsmokers score exactly as low as nonsmokers. On the other seven personality measures, where there are differences between the two groups, the exsmokers have the lowest means scores of the three groups. It is highly improbable that this latter finding could occur by chance. Thus, with regard to the Type A measures, exsmokers tend to score lowest, nonsmokers next lowest, and smokers highest. This strongly suggests that smoking behavior and traits believed associated with coronary heart disease are linked to one another.

The next five measures in the table are not traditionally thought of as traits associated with the Type A behavior pattern. Perhaps not unexpectedly, therefore, they do not discriminate between the three groups of smokers.

<u>Job Environment</u>

Table 80 presents relationships between measures of subjective work load and smoking behavior. The bulk of the findings in the table concern

TABLE 80

SUBJECTIVE WORK LOAD DIFFERENCES AMONG SMOKERS, EXSMOKERS, AND NONSMOKERS

Overload Measure	Smoking Behavior			F	p<
	Smoker	Exsmoker	Nonsmoker		
a. Percent of time in office visits and meetings initiated by others	21.88	17.56	17.94	3.15[2]	.05
b. Percent of time working alone	35.93	45.37	44.43	4.04	.05
c. Percent of time on independent work	19.57	32.06	32.21	8.01	.001
d. Number of office visits	19.28	10.96	11.58	7.27	.01
e. Head of directorate as source of deadlines[1]	2.30	1.80	1.82	4.64	.05
f. Heads of other directorates as sources of deadlines	1.96	1.56	1.61	3.39	.05
g. Head of the base as a source of deadlines	1.81	1.39	1.55	3.11	.05
h. Other bases as sources of deadlines	1.94	1.36	1.62	5.65	.01
i. Percent of time under no deadline pressure	19.69	32.28	24.74	3.80	.05
j. Percent of time under great deadline pressure	16.61	7.89	13.42	4.38	.05
k. Percent of time under extreme deadline pressure	5.82	1.72	4.69	4.17	.05
l. Subjective quantitative overload factor	2.50	2.18	2.28	4.45	.05
m. Subjective quantitative work load index	3.64	3.18	3.37	10.53	.001
n. Subjective qualitative overload index	3.90	3.40	3.70	5.80	.005

[1] Items e-h are scored on a 4-point scale where 1 = not a source of pressure and 4 = great source of pressure. Item l is scored on a 4-point scale where 1 = not a source of pressure and 4 = a great source of pressure. Item m is scored on a 5-point scale ranging from 1 = very little to 5 = very great.

[2] d.f. = 2,200 $\pm$ 3.

subjective quantitative work load and show that smokers compared to non- and exsmokers score highest on the time they spend in office visits and meetings initiated by others, spend the least amount of time working alone and the least amount of time on work which is independent of other people's work, experience the most deadline pressures from role senders (particularly the head of the directorate, other directorates, the base, and other bases), spend the least time under no deadline pressure, the most time under great and extreme deadline pressure, and score highest on the subjective quantitative overload factor and the subjective quantitative work load index. In addition, smokers score highest on the subjective qualitative work load index. Thus, the smoker is the most likely to experience high subjective work load both quantitatively and qualitatively. With regard to objective work load, practically all of the persons in the observation study were smokers, so no comparable test can be made; but it is worth noting that by volunteering, the participants in the observation study did, in effect, add to their total work load (and NASA, at the time of the study, was certainly not characterized by a lack of things to do).

Consistent with the personality findings in Table 80, exsmokers score more in the low stress direction than nonsmokers on all 14 of the comparisons made in the table. Thus, again the same order with regard to associated risk of heart disease appears: smokers report the most stress, followed by nonsmokers, and then followed by exsmokers. The findings are overwhelmingly consistent--the interpretation, however, is problematical. One could be tempted to argue that exsmokers self-select themselves or are selected by the organization into low stress jobs while smokers do just the opposite in keeping with their personality dispositions. On the other hand, one could also suggest that a person can only become an exsmoker when some antecedent low-anxiety atmosphere of a low overload work environment occurs.

One further finding, however, adds fuel to the argument for links between personality and smoking behavior. When medical interviews were conducted with the men in the sample, they were allowed to schedule the interview at a time that was convenient for them. Interestingly enough, smokers tended to arrange to be interviewed in the morning, exsmokers about noon, and nonsmokers in the afternoon (the respective average times of day were 11:22 a.m., 12:04 p.m., and 12:54 p.m.; $F = 4.77$, $p < .025$). Perhaps it is no coincidence that smokers also scored highest on Sense of Time Urgency which seems to have been reflected in the impatience they showed by scheduling early medical interviews. In addition, the smokers, being worried about time, may have felt they would have run out of opportunities for such an interview by the end of the day, perhaps in anticipation of overload quickly filling up their schedule.

In addition to the exsmoker having the least stress from overload, data presented below in Table 81 suggest that the exsmoker is somewhat of a social isolate. For one thing, the exsmoker participates the least of the three groups while the smoker participates the most. He also has the least amount of responsibility both for persons and for things while the smoker has the most.

Consistent with the notion of being an isolate, the exsmoker reports the poorest quality relations with his immediate superior and subordinates while the smoker reports the best relations. To follow up on Murray's concept of the orality succorance complex, one could suggest that verbal interaction, as well as smoking, is characteristic of the complex and,

TABLE 81

OTHER JOB STRESS DIFFERENCES AMONG SMOKERS, EXSMOKERS, AND NONSMOKERS

Job Stress	Smoking Behavior			F^1	p <
	Smoker	Exsmoker	Nonsmoker		
Participation	3.4	3.1	3.2	4.09	.025
Responsibility					
for persons	3.3	2.7	2.9	7.62	.001
for things	3.3	2.8	3.0	6.97	.001
Relations					
with superior	3.6	3.3	3.4	3.76	.05
with subordinates	3.8	3.5	3.6	7.12	.001

[1]d.f. = 201 ± 3.

therefore, activities which involve verbal interaction, such as participation in the decision making process, maintaining good relations with others, and time spent talking in office visits, meetings, and on the phone ought to be positively associated with smoking.

Differences in Strain

There are no significant differences in psychological strain between smokers, ex-, and nonsmokers. On the other hand, there are two significant differences in physiological strain among the three groups, and these are summarized in Table 82. The first finding is not surprising and merely reflects the positive relationship between cigarette smoking and high pulse rate reported on earlier in this paper and elsewhere in the medical literature. The second finding is a bit more interesting. It shows that exsmokers have the highest serum uric acid level (6.1 mg/100 ml) followed by smokers and nonsmokers (5.8 and 5.6 mg/100 ml respectively). This

TABLE 82

PHYSIOLOGICAL DIFFERENCES AMONG SMOKERS, EXSMOKERS, AND NONSMOKERS

Physiological Measure	Smoking Behavior			F	d.f.	p <
	Smoker	Exsmoker	Nonsmoker			
Pulse rate	78.8	72.4	71.4	11.28	2,203	.001
Serum uric acid	5.8	6.1	5.6	2.94	2,199	.10

finding is similar to that found in a comparison of smokers, exsmokers, and nonsmokers in the Tecumseh Community Study (Dodge & Mikkelsen, 1964). There is now research evidence (recently reviewed by Mueller, Kasl, Cobb, 1970) which shows that serum uric acid concentration is positively correlated with achievement behavior. This finding may explain the association between high serum uric acid and being an exsmoker since only those persons who are most likely to achieve their goals, in general, may be most likely to achieve the somewhat difficult task of giving up a habit such as smoking.

Coping

Although coping is not a major focus of the study, respondents were asked to indicate on their questionnaires the extent to which various behaviors they engaged in served as sources of relief from the stresses they faced. This measure of sources of relief is presented in Appendix XVII. The significant differences in responses to these items are presented in Table 83. The first difference is hardly profound. Smokers report that smoking serves as a source of relief from stress while ex- and non-smokers report no relief from smoking. Since self-reports of smoking behavior were relied on, this finding provides some validation of the

TABLE 83

DIFFERENCES IN SOURCES OF RELIEF FROM JOB STRESS AMONG SMOKERS, EXSMOKERS, AND NONSMOKERS

Source of Relief from Stress	Smoking Behavior			F	d.f.	p<
	Smoker	Exsmoker	Nonsmoker			
Smoking	2.5[1]	1.1	1.0	115.10	2,197	.001
Swearing	1.7	1.3	1.5	3.28	2,201	.05
Getting a drink of water	1.5	1.5	1.7	3.02	2,202	.10

[1]Score on a 4-point rating scale ranging from 1 = not a source of relief from the stresses of my job to 4 = great source of relief from the stresses of my job.

self-reports. It also suggests that smoking at least serves some useful purpose for smokers. The next finding suggests that smokers are more likely to use swearing compared to ex- and nonsmokers for relief from stress. Exsmokers score the lowest on swearing as a source of relief from job stress. The third finding in the table is not highly significant ($p < .10$) but shows that the nonsmoker also has his source of oral relief from stress--he takes a drink of water.

An overall view of the most important first-order predictors of smoking can be obtained by examining the stepwise regression analysis of significant correlates of smoking behavior. In this analysis, smokers versus nonsmokers comprise the dependent variable. The results are presented in Table 84, and show that the most important correlate of whether a person is a smoker or not is the number of estimated office visits per week he reports. Other significant predictors of being a smoker rather than a nonsmoker are the extent to which other bases are a source of

TABLE 84

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT CORRELATES OF WHETHER THE PERSON SMOKES OR NOT[1]

Step	Correlate	R	Final β
1	Subjective quantitative work load index	.29	.11
2	Estimated number of office visits per week	.35	.18
3	Extent to which other bases are a source of deadlines	.39	.16
4	Responsibility for things	.41	.14
5	Percent of time on work independent of other people's work	.43	-.14

[1]After Step 5, the following variables were nonsignificantly related to whether the person smokes or not: percent of time in other-initiated office visits and meetings, and working alone; the extent to which the head of the directorate, other directorates, and other bases are sources of deadlines; percent of time under no, great, and extreme pressure; subjective quantitative overload factor; participation; relations with immediate superior and subordinates; and responsibility for persons.

deadlines, high responsibility for things, a low percent of reported time on work which is independent of other people's work (that is, low functional autonomy with regard to other role senders), and a high score on the subjective quantitative work load index. These five variables account for 18% of the variance in the smoking measure (R = .43).

Smoking Behavior in Summary

It is clear that one must not think of smokers merely in terms of those who smoke and those who do not. Exsmokers are clearly different from both nonsmokers and smokers in terms of their personality characteristic, being the least Type A, and in terms of their reports of occupational stress since they tend to report the lowest amount of stress.

Furthermore, once one has made these distinctions, it is important to look at the number of cigarettes used per day by smokers for the relations found within this latter group of persons is not necessarily the same as the relations found between smokers, ex- and nonsmokers.

The Major Determinants of Number of Cigarettes Smoked among Smokers

Since a number of variables also correlate with heavy cigarette smoking, regression analyses have again been used to identify the main predictors of heavy cigarette smoking. In this analysis, blood pressure and pulse levels, while correlates of number of cigarettes smoked, have been omitted from the analysis, since it is highly unlikely that they are antecedent to smoking and more likely that they are consequences of smoking (for example, see literature reviewed by the Surgeon General, U.S. Public Health Service, 1971).

The regression analysis, presented in Table 85, shows that the main predictors of heavy cigarette smoking among smokers are the Type A

TABLE 85

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT CORRELATES OF THE NUMBER OF CIGARETTES A PERSON SMOKES FOR SMOKERS[1]

Step	Correlate	R	Final β
1	Environmental Overburdening	.36	.31
2	Complexification	.44	-.27

[1]Systolic blood pressure and pulse rate were not included as correlates in the regression since they are not thought of as predictors of smoking but rather consequences of smoking. After Step 2 the following variables were nonsignificantly related to number of cigarettes smoked: percent of time carrying out responsibility for the work of others and Emotional Dependency. However, with these variables in the regression R is raised from .44 to .51 (the increase is nonsignificant).

personality measure, Environmental Overburdening, and low complexification. This latter negative correlate of smoking has already been discussed in terms of possible relationship to arousal-seeking, a behavioral and perceptual disposition of persons which is associated with cigarette smoking (Schubert, 1964, 1965). Together these two correlates of heavy smoking account for 19% of the variance in smoking ($R = .44$). These two findings suggest that the main predictors of heavy smoking are variables related to personality rather than environment.

The Relationship between Psychological and Physiological Strain

Tabel 86 presents the correlations between measures of psychological and physiological strain. As can be seen, there are no significant

TABLE 86

CORRELATIONS BETWEEN PSYCHOLOGICAL AND PHYSIOLOGICAL STRAINS[1]

	Psychological Strain		
Physiological Strain	Job Satisfaction	Job-Related Threat	Self-Esteem
Pulse rate	.00	-.03	.03
Systolic blood pressure	.05	.04	.01
Diastolic blood pressure	.04	.07	.09
Serum cholesterol	.01	.03	.04
Serum uric acid	.03	.04	.10
Casual glucose	.08	-.07	.04
Serum cortisol	.16	-.18	-.01
Number of cigarettes smoked[2]	-.16	.10	.24
Ponderal index	-.15	.04	.04

[1]N = 200.

[2]Smokers only, N = 52.

relationships. These findings suggest that if there are links between the two types of strain, they will be identified when a wider range of more specific psychological strains is examined.

First-Order Relationships between Stress, Personality, and Strain: A Review of the Findings

This is a brief summarization of the main theoretical findings from this chapter. The general findings are as follows:

1. While objective and subjective quantitative work load are positively correlated with one another, the relationship is not simple. Therefore, conceptual and methodological distinctions should continue to be made between objective and subjective work load.

2. There are no significant relationships between objective quantitative work load and either psychological or physiological strain in this study, except for a positive correlation between number of cigarettes smoked and work load.

3. There are a number of significant relationships between subjective job stress and psychological as well as physiological indicators of strain. (a) Role ambiguity is positively correlated with psychological strain; (b) subjective quantitative <u>work load</u> is <u>negatively</u> correlated with psychological strain but positively correlated with serum cortisol; (c) however, the subjective quantitative <u>overload</u> factor is <u>positively</u> correlated with job-related threat, a measure of psychological strain; (d) complexification is negatively correlated with psychological strain; (e) subjective qualitative work load is negatively associated with psychological strain; (f) on the other hand, the subjective qualitative overload factor, a measure of stress due to competition, is positively related to psychological

strain; (g) utilization, in general, is negatively correlated with psychological strain; (h) both responsibility for persons and responsibility for things are negatively correlated with psychological strain; however, responsibility for persons is positively correlated with heavy cigarette smoking, pulse rate, and diastolic blood pressure while responsibility for things is uncorrelated with these indicators of strain. These findings support the importance of distinguishing between the two types of responsibility. (i) Participation in decision making is negatively correlated with psychological strain; and (k) there are no first-order relationships between interaction with other territories of the organization and strain.

4. The most important predictor of high job satisfaction and low job-related threat, in terms of variance accounted for in these measures, is high reported opportunity to participate in decision making. The most significant predictor of high job-related self-esteem is low job-related threat.

5. There are significant and positive correlations between Type A personality measures and measures of both objective and subjective work load. Most of the other subjective environment measures also show significant and positive relationships with the measures of Type A. Analyses suggest that the measures of personality are primarily measures of the person rather than measures of the subjective environment, therefore offering some validation of the personality measures.

6. Type A personality shows some, but not many, associations with psychological strain. The findings are somewhat unexpected since the correlations between personality and psychological strain are inverse. Thus, Type A persons tend to show high job-related self esteem. Most of

the personality measures are unrelated to other measures of strain including the physiological measures. However, both Emotional Dependence and Environmental Overburdening are positively associated with heavy cigarette smoking. Furthermore, Positive Attitude toward Pressure and Leadership are positively correlated with pulse rate.

7. Smokers experience more subjective stress than nonsmokers and exsmokers. Exsmokers report the least such stress of the three groups. Smokers score highest on the Type A measures while exsmokers score lowest on these measures. Smokers have the highest pulse rates, exsmokers the next highest, and nonsmokers the lowest pulse rates. Exsmokers have higher serum uric acid levels than smokers and nonsmokers. These findings underscore the importance of distinguishing between exsmokers and nonsmokers and suggest that the discontinuation of smoking is related to the personality of the person.

Overall, the findings in this chapter provide support for a number of predictions linking objective to subjective environment, objective and subjective environment to strain, and personality to environment and strain. Thus, broad support is evidenced for the first-order relationships depicted in the theoretical model in Figure 1.

CHAPTER 4

Variables Which Condition the Relationship between Stress and Strain

In this section two types of conditioning variables are considered: (1) personality variables associated with the Type A syndrome, and (2) the nature of interpersonal relations one has with role senders. Personality variables are used as conditioning variables following the theoretical model in Figure 1 which suggests that people with certain types of personality characteristics (such as Type A) may have less ability or tolerance for handling and coping with organizational stress than persons with other types of personality. Interpersonal relations are also considered as conditioning variables following the reasoning that a focal person may be able to cope with organizational stress, given that his role senders are supportive and can help him through rough seas, but may exhibit strain if that type of support is lacking.

Earlier a specificity theory regarding the relationship between stress and strain was discussed. To briefly review this theory, it hypothesizes that certain stresses produce certain strains and not others. Thus, role overload may produce anxiety but not necessarily job dissatisfaction. Or some stress may elevate serum cortisol but have no effect on serum glucose.

Because tests of many relationships between stress and strain and how they are conditioned by personality or role sender relations are being made for the first time, it is impossible in many cases to say which dependent variable or risk factor may be elevated by stress and which might not. This venture into previously untested predictions raises several considerations. First, where there are only a few unrelated findings presented on the conditioning effects of personality on relationships between stress and strain, these should be viewed with extreme caution meriting further replication since the results may be due to chance. Second, where there are several findings which closely parallel one another, these results should be interpreted as a greater degree of support for the general hypothesis or prediction being tested--but again, replication will be needed in those cases where it is impossible to predict specifically which relationships turn out to be significant and which should not. Findings in directions opposite to those predicted will be tested by two-tailed tests. Otherwise, one-tailed tests will be used. Finally, in the main, those findings which are statistically significant will be presented. The voluminous number of tests of the effect of conditioning variables on the relationship between stress and strain makes this an expedient requirement and spares the writer and the reader from a volume approaching the size of a large telephone directory. However, nonsignificant findings may also be meaningful and theoretically relevant. In those cases, such findings will be presented.

The general hypothesis, which states that personality conditions the relationship between stress and strain, is essentially a hypothesis that leads to a search for the interaction effect of personality and stress on strain. One way to test such predictions is to use analysis of variance with job stress as one main effect and personality as the other. In view of the large number of tests that were carried out on the data, this procedure proved to be too costly. Therefore, a less expensive method for searching for interaction effects was adopted and will now be described.

The adopted procedure involves examining the correlations between stress and strain for persons who were high (Type A), medium, and low (Type B), on each of the conditioning variables. These three divisions represent tertiles of the total sample for each conditioning variable. If the magnitude of the correlations between stress and strain for these three groups of respondents differs, then an interaction between stress and personality is present.[6] For example, if stress and strain are highly correlated for the Type A persons but not correlated, or negatively correlated, for Type B persons, then there is an interaction between stress and personality which is associated with differences in strain. Table 87 illustrates such an interaction effect in a hypothetical analysis of variance table. In this particular table, there are no main effects. Note, however, that the interaction clearly shows up in the difference in the signs of correlations between stress and strain for each level of personality as indicated in the last row of the table. There is, however, one weakness in using correlational analyses to search for interaction effects.

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[6]While the low, medium, and high personality groups are independent of one another in the sense that they are made up of different sets of persons, there is some interdependence between these groups. Once lows and mediums are chosen, the highs, being the remainder of the sample, are determined. When a z test of $r_{lows} - r_{highs} \neq 0$ is used (Hays, 1963), there is only some, unassessable interdependence between the lows and the highs since the middle group is omitted. Out of respect for this interdependence, a conservative level of acceptable significance, $p < .025$, has been adopted. Findings with $p < .05$ will be noted but treated with appropriate caution.

TABLE 87

HYPOTHETICAL TWO-WAY ANALYSIS OF VARIANCE DEMONSTRATING THE CONDITIONING EFFECTS OF PERSONALITY ON THE RELATIONSHIP BETWEEN STRESS AND STRAIN

	Type A Personality		
Job Stress	Low	Medium	High
Low	3[1]	2	1
Medium	2	2	2
High	1	2	3
$r_{\text{Stress, strain}}$	-1.00	.00	+1.00

[1]Level of strain: 1 = low, 3 = high.

With correlations one cannot search for nonlinear relationships within any one column or row of the table. Nevertheless, this should not be a particularly disturbing weakness here since there is little conceptual reason to believe that most of the conditioned relationships between stress and strain should not be linear. As one clear exception to this generalization, some nonlinear analyses involving the fit between the characteristics of the person and his environment as they relate to job-related strains will be reported on toward the end of this chapter.

Now let us turn to the findings. The results for this chapter are organized in sections, each of which deals with a particular stress and those conditioning variables which interact with it to produce associations with strain.

The Effect of Relations with Others on the Relationship between Role Ambiguity and Strain

In Chapter 3, it was reported that role ambiguity was negatively related to job satisfaction and job-related self-esteem and positively correlated with job-related threat. There were no relationships between role ambiguity and any measures of physiological strain. In the analyses now performed no significant conditioning effects of personality are found on the relationship between role ambiguity and strain. One significant interaction effect is found in which relations with subordinates serve as the conditioning variable. The data for the effect are presented in Table 88. In this table serum cortisol is associated with high role

TABLE 88

THE EFFECT OF RELATIONS WITH SUBORDINATES ON THE CORRELATION BETWEEN ROLE AMBIGUITY AND SERUM CORTISOL

Relations with Subordinates	r	p <	n
Poor	.35[1]	.01	60
Medium	.26	.05	57
Good	.06[1]	n.s.	76

[1] $p_{r_1 - r_2} \neq .05$.

ambiguity ($r = .35$, $p < .01$) but only if the person also reports poor interpersonal relations with his subordinates. There is no relationship between amount of role ambiguity experienced and serum cortisol for persons reporting good relations with their subordinates ($r = .06$, n.s.). The difference between the two coefficients is significant at only $p < .05$. The group which is intermediate with regard to reported relations with subordinates shows a correlation of intermediate magnitude ($r = .26$, $p < .05$).

This pattern of findings is not found when relations with one's immediate superior is used as the conditioning variable (r's = .02, .29, and -.11 for low, medium, and high groups respectively) or when relations with one's work group or peers is used (r's = .21, -.03, and .07 respectively for the poor, medium, and good groups). This suggests that, in particular, good relations with one's subordinates may protect the person from strain under conditions of role ambiguity.

Perhaps the person does not experience strain under ambiguous work conditions because he knows that eventually his subordinates will help him to clarify the ambiguity. In fact, findings presented earlier showed that role ambiguity tends to be low where relations are good with subordinates or with peers or superior which suggests that when ambiguity is felt, good relations with subordinates serve to dissipate ambiguity's effects.

The Effect of Personality on the Relationship between Subjective Quantitative Work Load and Strain

Unlike the previous section, there are a rather large number of findings to present here. Analyses have been performed only on the subjective, self-report measures of quantitative work load rather than on objective measures since it has proved unfeasible to perform interaction analysis on the objective work load data because of small sample sizes. Earlier analyses of the first-order relationships between subjective quantitative work load measures and strain showed that they were positively correlated with job satisfaction and job-related self-esteem. Subjective quantitative work load measures were also shown to be associated with serum cortisol; however no other measures of physiological strain were found to be related to subjective quantitative work load measures. In the analyses reported on here we shall see whether using personality as a conditioning variable uncovers additional relationships between subjective quantitative work load and strain which were previously masked.

Persistence

The first set of findings is presented in Tables 89 and 90. In the first of these two tables systolic and diastolic blood pressure as

TABLE 89

THE EFFECT OF PERSISTENCE ON THE CORRELATION BETWEEN THE ESTIMATED NUMBER OF OUTGOING PHONE CALLS THE PERSON MAKES PER WEEK AND MEASURES OF PHYSIOLOGICAL STRAIN

Physiological Measure	Persistence Low n=76	Medium n=55	High n=70	$r_{low} < r_{high}$, p<
Systolic blood pressure	.02	-.30[1]	.35[2]	.025
Diastolic blood pressure	.08	-.15	.37[2]	.05
Serum cortisol	-.08	-.20	.26[1]	.025

[1] $p < .05$.

[2] $p < .01$.

TABLE 90

THE EFFECT OF PERSISTENCE ON THE CORRELATION BETWEEN THE ESTIMATED NUMBER OF INCOMING PHONE CALLS THE PERSON RECEIVES PER WEEK AND MEASURES OF PHYSIOLOGICAL STRAIN

Physiological Measure	Persistence Low n=76	Medium n=55	High n=70	$r_{low} < r_{high}$, p<
Systolic blood pressure	.06	-.18	.20	n.s.
Diastolic blood pressure	.15	-.18	.17	n.s.
Serum cortisol	-.05	.09	.21	.10

well as serum cortisol are positively correlated with the number of outgoing phone calls the person reports per week--but only if the person is high on the personality cluster labeled "Persistence." These correlations range from .26 to .35 ($p < .05$ to $p < .01$). For persons low on Persistence, the correlations are nonsignificant and close to zero (r's range from -.08 to .08). The difference between these sets of correlations for the two groups is significant at $p < .01$. The group which falls in the middle tertile on Persistence shows an inverse relationship between outgoing phone calls and these physiological variables, although the coefficients are nonsignicant in two out of the three cases.

The second of the two tables presents comparable data using the estimated number of incoming rather than outgoing phone calls as the index of stress. Here the pattern of findings is similar but not as striking and not statistically significant. The group which is high on Persistence shows a nonsignificant and positive relationship between incoming phone calls and each of the three physiological measures of strain. Persons low on Persistence show correlations of lower magnitudes between incoming phone calls and the strains in Table 90, and the middle tertile group on Persistence again shows a tendency to exhibit an inverse but nonsignificant stress-strain relationship.

Some other data also show similar patterns of results. Table 91 presents findings showing the effect of Persistence, as a trait, on the relationships between the person's estimated percent of time on self-initiated (outgoing) phone calls and the same risk factors examined in the preceding two tables: systolic and diastolic blood pressure, and serum cortisol. Table 92 presents identical analyses, using the person's estimate of the percent of time he spends on other-initiated (incoming) phone calls.

TABLE 91

THE EFFECT OF PERSISTENCE ON THE CORRELATION BETWEEN REPORTED PERCENT OF TIME ON SELF-INITIATED PHONE CALLS AND MEASURES OF PHYSIOLOGICAL STRAIN

Physiological risk factor	Persistence			$r_{low} < r_{high}$, p<
	Low N=76	Medium N=55	High N=70	
Systolic blood pressure	-.10	-.12	.20	.05
Diastolic blood pressure	-.08	.02	.41[1]	.005
Serum cortisol	.17	.08	.37[1]	.10

[1] $p < .01$.

TABLE 92

THE EFFECT OF PERSISTENCE ON THE CORRELATION BETWEEN REPORTED PERCENT OF TIME ON OTHER-INITIATED PHONE CALLS AND MEASURES OF PHYSIOLOGICAL STRAIN

Physiological risk factor	Persistence			$r_{low} < r_{high}$, p<
	Low N=76	Medium N=55	High N=70	
Systolic blood pressure	-.02	.04	-.01	n.s.
Diastolic blood pressure	.04	.04	.10	n.s.
Serum cortisol	.03	.04	.03	n.s.

The pattern of results in the first of these two tables is quite similar to the results for the preceding two tables. Highly persistent people show a positive association between the reported percent of time on self-initiated phone calls and blood pressure and cortisol (r's range from .20 to .41). Persons low on Persistence do not show any significant relationship between this stress and the physiological strains (r's range from -.10 to .17). Thus, a first-order interaction of personality and stress on strain again tends to appear. On the other hand, no such effect is demonstrated for other-initiated or incoming phone calls in Table 92. All the relationships are nonsignificant.

A third table presents additional data also showing a similar pattern of findings. Table 93 compares the relationship between the

TABLE 93

THE EFFECT OF PERSISTENCE ON THE CORRELATION BETWEEN ESTIMATED NUMBER OF PHONE CALLS PER WEEK AND NUMBER OF CIGARETTES SMOKED[1]

Estimated Number Per Week of	Persistence Low n=19	Persistence High n=33	$r_{low} < r_{high}$, p<
Outgoing phone calls	-.26	.19	.10
Incoming phone calls	-.56[2]	.12	.01

[1]Smokers only.

[2]$p < .05$ (2-tailed).

estimated number of phone calls and the number of cigarettes the person smokes, given that they smoke, for persons high and low on Persistence. Because of the small number of smokers (less than 60), personality is divided at the median to form only high and low Persistence groups. This median split will be used whenever number of cigarettes smoked is examined as an indicator of strain. In this table, for persons high on persistence the number of cigarettes smoked is positively, but non-significantly, correlated with the estimated number of incoming as well as outgoing phone calls (r's = .12 and .19 respectively). However, for persons low on persistence, the correlations between number of cigarettes smoked and outgoing or incoming calls is negative (r = -.26, n.s.; and r = -.56, $p < .05$). The meaning of these negative coefficients will be discussed shortly when additional and similar findings are presented.

Overall, these findings suggest that persons who are high, compared to those who are low, on the Type A trait of Persistence may react to the job stresses of phone calls by showing high levels of blood pressure and serum cortisol, and by smoking more heavily. Although the two measures of blood pressure are correlated (r = .68, $p < .001$), systolic and diastolic blood pressure are nonsignificantly correlated with glucose in this study (r's = .11 and .15 respectively) or with the of number of cigarettes smoked given that one smokes (r's = .24 and .33 respectively). Furthermore, serum cortisol level and the number of cigarettes smoked are also nonsignificantly related (r = .06) -- all of which suggests that there is relatively independent confirmation of the conditioning effects of Persistence on the relationship between measures of subjective work load and strain.

The data also show a second-order interaction since the effect on the physiological indicators of strain seems to be more pronounced when the job stress is outgoing or self-initiated phone calls rather than incoming or other-initiated phone calls. An attempt to conceptually explain this latter interaction will now be made.

The measure of Persistence describes a person who does not easily give up, who relentlessly pursues other members of his role set because he requires information and work from them in order to complete his own work. This suggests that when a high persistent person makes an outgoing phone call, compared to a low persistent person, he is in the act of trying to reduce some strain or tension arising from a need to complete the task at hand. In all likelihood, as his need to complete the task increases so does the number of phone calls he makes. Under particularly frustrating events, each phone call he places is a stress compared to his incoming phone calls, in the sense that each call may be laced with uncertainty regarding the success or failure of the outcome. For the low Persistence person, neither type of phone call may have any special psychological meaning.

The image one gets of the Persistent individual is of a person who tends to be quite <u>involved</u> with his work as he pushes ahead to complete the task. Research on the work situation and mental health by Gurin, Veroff, and Feld (1960) has already demonstrated that high ego-involvement by the organizational member can be a double-edged sword; it can provide great psychological rewards when task performance is good, but it can also provide great disappointments and emotional strains when things do not go right. Is a similar phenomenon being dealt with here? If so, then similar patterns of results should be expected for persons who are high on the personality cluster "Involved Striving." This latter measure correlates the highest of all Type A personality measures with Persistence ($r = .62$, $p < .001$).

<u>Involved Striving</u>

It is appropriate, then, to turn to the findings where Involved Striving is used as a conditioning variable in the relationship between work load and strain. Table 94 presents data on the relationship between phone calls and cigarette smoking for persons who are high

TABLE 94

THE EFFECT OF INVOLVED STRIVING ON THE CORRELATION BETWEEN ESTIMATED NUMBER OF PHONE CALLS PER WEEK AND NUMBER OF CIGARETTES SMOKED[1]

Estimated Number Per Week of	Involved Striving: Low n=21	Involved Striving: High n=31	$r_{low} < r_{high}$, p<
Outgoing phone calls	-.17	.36[2]	.05
Incoming phone calls	-.16	.14	n.s.

[1]Smokers only.

[2]$p < .05$.

and low on Involved Striving. As was the case when Persistence was used as the conditioning variable, the correlation between number of cigarettes smoked and estimated number of outgoing as well as incoming phone calls is positive (r's = .36, $p < .05$ and .14, n.s.) for high persistent people but negative and nonsignificant for low persistent people (r's = -.16 and -.17 respectively. Furthermore, the conditioning effect of personality is again greater with regard to outgoing than with regard to incoming phone calls.

When an examination is made of the effects of these stresses on blood pressure and serum cortisol, as was done when Persistence was used as a conditioning variable, a similar pattern of results emerges. These latter findings are presented in Tables 95 and 96.

TABLE 95

THE EFFECT OF INVOLVED STRIVING ON THE RELATIONSHIP BETWEEN ESTIMATED NUMBER OF OUTGOING PHONE CALLS PER WEEK AND MEASURES OF PHYSIOLOGICAL STRAIN

Strain	Involved Striving			$r_{low} < r_{high}$, p<
	Low N=80	Medium N=51	High N=69	
Systolic blood pressure	-.11	.19	.30[1]	.01
Diastolic blood pressure	.04	.24	.21	n.s.
Serum Cortisol	.05	.41[1]	.04	n.s.

[1] $p < .05$.

TABLE 96

THE EFFECT OF INVOLVED STRIVING ON THE RELATIONSHIP BETWEEN ESTIMATED NUMBER OF INCOMING PHONE CALLS PER WEEK AND MEASURES OF PHYSIOLOGICAL STRAIN

Strain	Involved Striving			$r_{low} < r_{high}$, p<
	Low N=80	Medium N=51	High N=69	
Systolic blood pressure	-.03	.23	.10	n.s.
Diastolic blood pressure	.10	.20	-.04	n.s.
Serum Cortisol	.10	.27	-.01	n.s.

The data in Table 95 shows that the correlation between estimated number of <u>outgoing</u> calls per week and blood pressure is positive ($r = .30$, $p < .05$ for systolic and $r = .21$, $p < .10$ for diastolic blood pressure) for persons high in Involved Striving, but the correlations are low and nonsignificant for persons low on Involved Striving. There is no similar pattern of findings for serum cortisol. The middle tertile group shows the highest correlation between serum cortisol and outgoing phone calls ($r = .41$, $p < .05$). If Involved Striving and serum cortisol were highly correlated, there could be ceiling effects for the top and bottom tertile personality groups producing their low correlation coefficients. However, Involved Striving and serum cortisol are uncorrelated ($r = .04$, n.s.). Thus, there does not appear to be any ready explanation as to why the stress-strain correlation is highest for the middle tertile group.

Examining Table 96, where the stress is incoming calls, the magnitude of the correlations between stress and strain is low for all groups, regardless of their level of Involved Striving. Thus, there is again a second-order interaction pattern where the conditioning effect of a personality variable is higher for relationships between outgoing phone calls and strain than between incoming phone calls and strain.

Sense of Time Urgency

As part of these analyses, several other personality variables have been found which show similar conditioning effects on the relationship between job activities and measures of strain. Data in Table 97 shows that Sense of Time Urgency, which correlates .19 ($p < .01$) with Persistence and .54 ($p < .001$) with Involved Striving, has similar conditioning effects. Persons high on this personality measure show positive correlations between the number of cigarettes they smoke and their estimated number of incoming and outgoing phone calls, office visits (with one other role sender), and meetings (with more than one

TABLE 97

THE EFFECT OF SENSE OF TIME URGENCY ON THE RELATIONSHIP BETWEEN SUBJECTIVE WORK LOAD AND NUMBER OF CIGARETTES SMOKED[1]

Subjective Work Load	Sense of Time Urgency: Low n=20	Sense of Time Urgency: High n=32	$r_{low} < r_{high}$, p<
Number of:			
incoming phone calls	-.57[3]	.20	.005
outgoing phone calls	-.41	.38[2]	.005
office visits	-.50[2]	.32	.005
self-initiated meetings	-.21	.24	.10
other-initiated meetings	-.30	-.08	n.s.

[1] Smokers only.

[2] $p < .05$.

[3] $p < .001$.

other role sender) which are self-initiated. No relationship exists between cigarettes smoked and meetings initiated by others. Persons low on Sense of Time Urgency, on the other hand, show negative relationships between the number of cigarettes they smoke per day and the estimated number of such work activities. Can it be that persons who are low on Time Urgency (and Persistence, as noted in Table 93) tend to decrease their level of cigarette smoking under stress? This certainly would seem like a functional response for maintaining good physical health in the face of environmental stresses. It may also be that persons low on Time Urgency, who smoke infrequently, tend to get into roles where little interaction with others is required. Unfortunately, a longitudinal study is required to untangle these alternative explanations.

Unlike the case for Persistence and Involved Striving, there are no significant findings to report on the conditioning effects of Sense of Time Urgency on relationships between these stresses and blood pressure or cortisol.

Environmental Overburdening

Table 98 presents the findings where Environmental Overburdening is the conditioning variable. This personality variable correlates .39 with Persistence, .65 with Involved Striving, and .58 with Sense of Time Urgency (all $p < .001$). Persons who are high on this measure show positive correlations between both the estimated number of outgoing as well as incoming phone calls and the number of cigarettes they smoke (r's = .36, $p < .05$ and .12, n.s. respectively). Persons low on Environmental Overburdening show inverse correlations between these

TABLE 98

THE EFFECT OF ENVIRONMENTAL OVERBURDENING ON THE RELATIONSHIP BETWEEN SUBJECTIVELY ESTIMATED NUMBER OF PHONE CALLS PER WEEK AND NUMBER OF CIGARETTES SMOKED[1]

	Environmental Overburdening		
Estimated Number of Phone Calls	Low N=20	High N=32	$r_{low} < r_{high}$, $p<$
Outgoing	-.25	.36[2]	.025
Incoming	-.22	.12	n.s.

[1]Smokers only.

[2]$p < .05$.

measures of phone calls and number of cigarettes smoked (r's = -.22 and -.25, both n.s.). Again, the conditioning effect of personality is strongest when the stress is outgoing rather than incoming phone calls.

Positive Attitude Toward Pressure

In the next set of relevant findings, Positive Attitude Toward Pressure is the conditioning personality variable. This measure correlates .44 with Persistence, .51 with Involved Striving, .33 with Sense of Time Urgency, and .42 with Tendency Toward Environmental Overburdening (all $p < .001$), the other four conditioning Type A measures which have been discussed up to now. Table 99 presents data which shows the conditioning effect of Positive Attitude Toward Pressure on the

TABLE 99

THE EFFECT OF POSITIVE ATTITUDE TOWARD PRESSURE ON THE RELATIONSHIP BETWEEN SUBJECTIVE WORK LOAD AND NUMBER OF CIGARETTES SMOKED[1]

Subjective Work Load Measure	Positive Attitude Toward Pressure		$r_{low} < r_{high}$, $p<$
	Low N=31	High N=21	
Number of:			
Outgoing phone calls	-.19	.48[2]	.01
Incoming phone calls	-.01	.05	n.s.
Self-initiated meetings	-.22	.48[2]	.01
Other-initiated meetings	-.20	-.04	n.s.

[1]Smokers only.

[2]$p < .05$.

relationship between the person's report of the frequency of various work activities and the number of cigarettes he smokes per day. Two significant conditioning effects are present in the table. Both outgoing phone calls and self-initiated meetings are positively correlated with number of cigarettes smoked but only for persons high on Positive Attitude Toward Pressure (both r's = .48, $p < .05$). For persons low on the personality measure, the correlations are -.19 and -.22, both nonsignificant. Nonsignificant trends of conditioning effects are present for both other-initiated phone calls and meetings. Thus, the pattern of conditioning effects is similar to that already presented using other conditioning variables.

Flexibility-Rigidity

This personality variable does not come from the literature on Type A behavior pattern. Interest in Flexibility-Rigidity, a measure from the California Personality Inventory, was raised by Kahn et al.'s (1964) findings which showed that Flexible persons are more likely than Rigid persons to report anxiety and worry under conditions of role conflict. Kahn et al. suggest this is due to the Flexible person's higher involvement in the job and the inability of the Flexible person, unlike the Rigid, to reject role senders who are creating the conflict.

Our findings, presented in Tables 100 and 101 show a similar effect. In Table 100 Flexible persons show positive and significant correlations between the percent of time they report spending on self-initiated phone calls and the following measures of physiological strain: systolic and diastolic blood pressure, glucose, and serum cortisol (r's range from .30 to .43). Persons with low scores on Flexibility show no such stress-strain association (r's range from .09 to -.14), and those people in the

TABLE 100

THE EFFECT OF FLEXIBILITY ON THE RELATIONSHIP BETWEEN ESTIMATED PERCENT OF TIME ON SELF-INITIATED PHONE CALLS AND MEASURES OF PHYSIOLOGICAL STRAIN

Physiological Measure	Flexibility			$r_{low} < r_{high}$, p<
	Low N=75	Medium N=50	High N=76	
Systolic blood pressure	-.14	-.05	.30[1]	.01
Diastolic blood pressure	-.07	.16	.36[2]	.01
Casual glucose	.02	-.16	.43[2]	.01
Serum cortisol	.09	.28[1]	.42[2]	.025

[1] $p < .05$.

[2] $p < .01$.

TABLE 101

THE EFFECT OF FLEXIBILITY ON THE RELATIONSHIP BETWEEN ESTIMATED PERCENT OF TIME ON OTHER-INITIATED PHONE CALLS AND MEASURES OF PHYSIOLOGICAL STRAIN

Physiological Measure	Flexibility			$r_{low} < r_{high}$, p<
	Low N=75	Medium N=50	High N=76	
Systolic blood pressure	-.16	.03	.06	n.s.
Diastolic blood pressure	-.09	.09	.15	.10
Casual glucose	.04	-.20	.11	n.s.
Serum cortisol	-.08	.22	.11	n.s.

middle tertile on Flexibility show correlation coefficients which tend to fall intermediate between the high and low groups.

In Table 101 similar analyses are presented for the percent of time on other-initiated phone calls. Again, for Flexible persons the time spent on this type of phone call and measures of physiological strain are positive but nonsignificant (r's range from .06 to .15). The coefficients for the low Flexible Ss tend to be lower in magnitude, negative, and nonsignificant. Furthermore, the differences in coefficients between the high and low Flexible groups is nonsignificant.

Thus, the familiar second-order interaction effect of self-initiated versus other-initiated phone calls and personality on strain appears again. Personality again conditions the relationship between stress and strain but primarily for outgoing phone calls.

Flexibility correlates .45 ($p < .001$) with Persistence, .28 ($p < .01$) with Involved Striving, .09 (n.s.) with Positive Attitude Toward Pressure, .08 (n.s.) with Sense of Time Urgency, and .12 (n.s.) with Environmental Overburdening, the other five personality measures which have just been reviewed. Thus, the other personality measures are by no means complete substitutes for Flexibility-Rigidity.

The moderate positive correlations between Flexibility and Persistence and Involved Striving are comparable to the findings of Kahn et al. which characterized the Flexible person as highly involved in his work. For the Flexible person, outgoing phone calls may represent the attempts of the individual to meet demands of conflicting role senders, and large numbers of such calls may imply that the Flexible person may particularly feel the burden of such involvement as he works full steam to gather information and secure cooperation from other members of his role set.

If phone calls are interaction burdens for the Flexible person but not for the Rigid, then there should be a positive correlation between the percent of time the person estimates he spends on phone calls and the amount of role conflict he experiences. This correlation coefficient should be lower in magnitude for the Rigid person than for the Flexible person. The results of a test of these predictions are presented in Table 102.

TABLE 102

THE EFFECT OF FLEXIBILITY ON THE CORRELATION BETWEEN ESTIMATED PERCENT OF TIME ON PHONE CALLS AND ROLE CONFLICT

Estimated % of Time on	Flexibility Low N=75	Medium N=50	High N=76	$r_{low} < r_{high}$, $p<$
Self-initiated phone calls	-.08	.30[1]	.03	n.s.
Other-initiated phone calls	.08	.33[1]	.26	n.s.

[1] $p < .01$.

The findings are nonsignificant, but the pattern of results are in the predicted direction. High and moderately Flexible persons show more positive correlations between percent of time on phone calls and role conflict than do low Flexible persons. The second-order interaction effect of self- versus other-initiated phone calls and personality on strain fails to appear.

These findings support Kahn et al.'s (1964) conclusion that members of the person's role set react differently to the person depending on whether he is flexible or rigid. The flexible person is more likely to receive heavy demands and experience role conflict because he complies more often to the requests of role senders.

Additional analyses show that Flexibility has no conditioning effect on the relationship between role conflict and blood pressure, glucose, and cortisol. The results of the latter analyses are presented in Table 103.

TABLE 103

THE EFFECT OF FLEXIBILITY ON THE CORRELATION BETWEEN ROLE CONFLICT AND MEASURES OF PHYSIOLOGICAL STRAIN

Physiological Strain	Flexibility Low N=75	Medium N=50	High N=76	$r_{low} < r_{high}$, $p<$
Systolic blood pressure	-.04	.00	.07	n.s.
Diastolic blood pressure	.17	.03	.10	n.s.
Casual glucose	.12	-.12	.18	n.s.
Serum Cortisol	.02	-.17	.04	n.s.

Competitive Orientation and Leadership

The next two tables show interaction effects which are somewhat the opposite of what might be expected. Table 104 presents the effect of Competitive Orientation, a personality measure, on the relationship between phone calls and glucose level. In this table it is the non-Type A persons, those who are low on Competitive Orientation who show positive and significant correlations between glucose level and both incoming and outgoing phone calls (r's = .42 and .36 respectively, both

TABLE 104

THE EFFECT OF COMPETITIVE ORIENTATION ON THE CORRELATION BETWEEN SELF-REPORTED NUMBER OF PHONE CALLS PER WEEK AND CASUAL GLUCOSE

Phone Calls Per Week	Competitive Orientation Low N=67	Medium N=69	High N=64	$r_{low} - r_{high} \neq 0$, p<
incoming	.42[1]	.08	-.14	.025[2]
outgoing	.36[1]	.09	-.17	n.s.

[1]p < .05 (2-tailed).

[2]Two-tailed test.

$p < .01$). Persons high on Competitive Orientation show no relationship between glucose and the phone calls (r's = -.14 and -.17 respectively, n.s.).

The same pattern of results appears in Table 105. Here a personality measure which correlates .54 with Competitive Orientation, Leadership,

TABLE 105

THE EFFECT OF LEADERSHIP ON THE CORRELATION BETWEEN SELF-REPORTED NUMBER OF PHONE CALLS PER WEEK AND CASUAL GLUCOSE

Phone Calls Per Week	Leadership Low N=73	Medium N=62	High N=63	$r_{low} - r_{high} \neq 0$, p<
incoming	.35[1]	.15	-.04	.10[2]
outgoing	.31[1]	.16	-.08	.10[2]

[1]p < .05 (2-tailed).

[2]Two-tailed test.

serves as the conditioning variable. Persons low on Leadership show positive and significant correlations between the estimated number of both incoming and outgoing phone calls and glucose (r's = .35 and .31 respectively, both $p < .01$). The comparable coefficients for persons high on Leadership are low and nonsignificant (r's = -.04 and -.08 respectively). The group which occupies the middle tertile on leadership has coefficients which are of intermediate magnitude. In both of the above tables, the interaction effect is greater for incoming than for outgoing phone calls.

The only significant measure of strain which correlates with glucose in this study is serum cholesterol ($r = .23$, $p < .01$). Therefore, the interaction of Competitive Orientation and Leadership with phone calls was also examined using serum cholesterol as the dependent variable. The results of these analyses are presented in Tables 106 and 107.

TABLE 106

THE EFFECT OF COMPETITIVE ORIENTATION ON THE CORRELATION BETWEEN SELF-REPORTED NUMBER OF PHONE CALLS PER WEEK AND SERUM CHOLESTEROL

Phone Calls Per Week	Competitive Orientation			$r_{low} < r_{high}$, p<
	Low N=67	Medium N=69	High N=64	
incoming	.19	.05	-.16	.025
outgoing	.14	.06	-.11	n.s.

TABLE 107

THE EFFECT OF LEADERSHIP ON THE CORRELATION BETWEEN SELF-REPORTED NUMBER OF PHONE CALLS PER WEEK AND SERUM CHOLESTEROL

Phone Calls Per Week	Leadership			$r_{low} < r_{high}$, p<
	Low N=73	Medium N=62	High N=63	
incoming	.02	-.04	.08	n.s.
outgoing	.03	.01	.03	n.s.

Table 106 shows that similar interaction effects are obtained for cholesterol when Competitive Orientation is the conditioning variable. Both incoming and outgoing phone calls are positively correlated with serum cholesterol for persons low on Competitive Orientation but negatively correlated for persons high on the Type A measure. The positive correlations are higher in absolute magnitude than the negative ones. Again, only incoming calls produce a statistically significant interaction effect although the pattern of correlation coefficients is similar for outgoing phone calls. On the other hand, the findings in Table 107 show that there are no such interaction effects of Leadership and phone calls on serum cholesterol.

Clearly, in these cases the personality measures do not indicate that the high Type A person is the one who manifests the most physiological strain under stress. One interpretation of the data suggests that persons who are low on Leadership and Competitive Orientation are not the types of persons who enjoy the interaction with other people which is required for competitive and leadership activities. Therefore, when they encounter interaction, such as on phone calls, they should be more likely to manifest physiological strain than persons high on these traits.

Furthermore, persons who are poor leaders or who are noncompetitive may be more likely to receive demanding and dominating forms of interaction which "push them around" compared to the person who is a good, competitive leader. This is reflected by the presence of higher stress-strain correlations for incoming rather than outgoing phone calls suggesting that the focal person's personality influences the behavior of members of his role set. The fact that there tend to be negative correlations between the measures of phone calls and both glucose and cholesterol for persons high on Competitive Orientation and Leadership further suggests that the nature of the interactions which good, competitive leaders have directed towards them reduce the stressful nature of their work since such interaction apparently produces good working relations with members of their role set. There is some support for this interpretation since persons who have high scores on Competitive Orientation are more likely to report good relations with their role set than persons who have low scores (correlations between Competitive Orientation and relations with immediate superior, work group, and subordinates = .10, n.s.; .20, $p < .01$, and .31, $p < .001$ respectively). The pattern of correlations between Leadership and relations with members of the role set is also positive (correlations between Leadership and relations with immediate superior, work group, and subordinates = .09, n.s.; .09, n.s.; and .30, $p < .005$ respectively).

Another prediction which follows is that persons low on Competitive Orientation and Leadership should show a positive correlation between experienced role conflict and glucose level since role conflict should be an equally unpalatable interaction-linked social stress for these people. Data to test this prediction are available and are presented in Table 108. As expected, the data in the table show that the role

TABLE 108

THE EFFECT OF COMPETITIVE ORIENTATION AND LEADERSHIP ON THE CORRELATION BETWEEN ROLE CONFLICT AND GLUCOSE LEVEL

Personality Measure	Tertile			$r_{low} < r_{high}$, p<
	Low	Medium	High	
Competitive Orientation	.22 (N=67)	.12 (N=69)	-.05 (N=64)	.10
Leadership	.20 (N=73)	.06 (N=62)	.05 (N=63)	n.s.

conflict theoretical cluster and glucose are positively and non-significantly correlated but only for persons low on Competitive Orientation (r = .22) and low on Leadership (r = .20). The coefficients are close to zero for persons high on the two personality measures (r's = -.05 and .05 respectively), and the middle tertile groups on the personality measures have coefficients which rank intermediate in magnitude. Thus, while the interaction effects are not statistically significant, the interaction pattern of the data is quite consistent with our prediction. This adds support to the notion that people low on Competitive Orientation and Leadership fare poorly in demanding social interactions.

<u>What I am Like Type A</u>

The next table presents data using the What I am Like syndrome measure of Type A as the conditioning personality variable. Table 109 shows the effect of this measure of personality on the relationship between the subjective quantitative overload factor and two of our measures of psychological strain--job satisfaction and job-related

TABLE 109

THE EFFECT OF WHAT I AM LIKE TYPE A ON THE CORRELATION BETWEEN THE SUBJECTIVE QUANTITATIVE OVERLOAD FACTOR AND MEASURES OF PSYCHOLOGICAL STRAIN

Strain Measure	Type A: Low N=83	Type A: Medium N=36	Type A: High N=85	$r_{low} < r_{high}$, p<
Low job satisfaction	-.24	.22	.18	.005
Job-related threat	.05	.33[1]	.37[2]	.025

[1] $p < .05$.

[2] $p < .01$.

threat. As noted earlier, these two measures of psychological strain are correlated .44 so that findings dealing with each should not be regarded as completely independent of one another.

The data in Table 109 show that the conditioning effects of Type A on relationships between stress and strain are significant. The subjective quantitative overload factor and psychological strain are positively correlated (.18, n.s., with low job satisfaction; and .37, $p < .001$ with job related threat)--but only for persons who are Type A. For persons who are low on Type A the correlations are -.24 and .05 (both n.s.) respectively. Thus, persons who have high scores on this overall measure of Type A are persons for whom high subjective quantitative overload produces psychological strain. The Type B person shows less, if any, of a relationship between subjective overload stress and psychological strain.

<u>Summary of the Conditioning Effects of Personality on Relationships Between Subjective Quantitative Work Load and Strain</u>

A number of points may be summarized from the findings. First, all of the relationships reported on in this section have involved subjective quantitative rather than qualitative work load. There are no conditioning effects of personality on the relationship between subjective qualitative overload and strain in this study. This pattern of results is consistent with the results presented earlier which showed that quantitative rather than qualitative work load tended to be associated with other stresses and strain.

Second, these findings dealing with subjective quantitative work load have primarily included highly specific measures of work load such as the percent of time in different activities or the number of such activities (such as phone calls, office visits, and meetings). The subjective quantitative overload index and factor have not accounted for as much variance in the measures of strain as have the more specific measures of office activity. A theoretical explanation of this phenomenon will be suggested after the next point is examined.

The third point is that the Type A personality measures show greater conditioning effects on the relationship between self-initiated activities and strain than on the relationship between activities initiated by others and strain. This suggests that the focal person's personality is more likely to condition the relationship between the person's own behavior and strain than between the behavior of other role senders and strain. This third point may be viewed as an example of the specificity theory of stress and strain. The theory states that, in general, and for most usual types of stress and strain, only specific stresses are related to specified manifestations of strain, and no general response to all stresses should be expected. That is, we must differentiate between the qualitative differences of various stress and strain. To some extent, the second point made above also fits into the specificity hypothesis since well-differentiated measures of job activity, rather than overall indices, seem to explain the most variance in the analyses conducted and not all measures of stress related to all measures of strain.

Overall, the conditioning effects of personality suggest that whether or not subjective quantitative work load is a stress for the person is to some extent dependent on the person's personality. Persons with high scores on any of the following personality measures are more likely than persons who score low on these measures to show high levels of physiological strain when they experience subjective quantitative work load particularly in the form of outgoing phone calls: Persistence, Involved Striving, Time Urgency, Environmental Overburdening, Positive Attitude Toward Pressure, What I am Like Type A, and Flexibility. Furthermore, persons who have low rather than high scores on Leadership and Competitive Orientation are also more likely to show physiological strain under conditions of heavy subjective work load particularly in the form of incoming phone calls. The strains shown to be conditioned by one or more of these personality measures include elevated glucose, serum cholesterol, blood pressure, and serum cortisol as well as heavy cigarette smoking. The What I am Like Type A measure is the only personality variable which conditions a relationship between subjective quantitative overload and psychological strain producing a positive correlation for persons high on the Type A measure. Figure 18 provides a theoretical summary of these findings.

The Effect of Relations with Others on the Relationship between Subjective Quantitative Work Load and Strain

Research on the patterns of interaction and leadership in organizations, such as the work summarized by Likert (1961, 1967) and Argyris (1964), suggests that supportive relations among organizational members may serve as a buffer between organizational stress and individual strain. To test this out, relations with role senders has been treated as a conditioner of stress-strain relationships just as has been done in the case of this study's personality measures.

The Conditioning Effect of Relations with Others on Physiological Strain

These data are summarized in Table 110. In this case, the measure of stress is the person's estimated total number of phone calls, office visits, and meetings per week. The findings show that this measure of subjective quantitative work load is positively correlated with pulse rate, systolic and diastolic blood pressure, and serum glucose for persons who report poor relations with their role senders. For persons who report good relations, the correlations tend to be lower and close to zero. For persons who report poor relations with role senders, the stress-strain correlations range between .03 and .36 with a mean of .20.

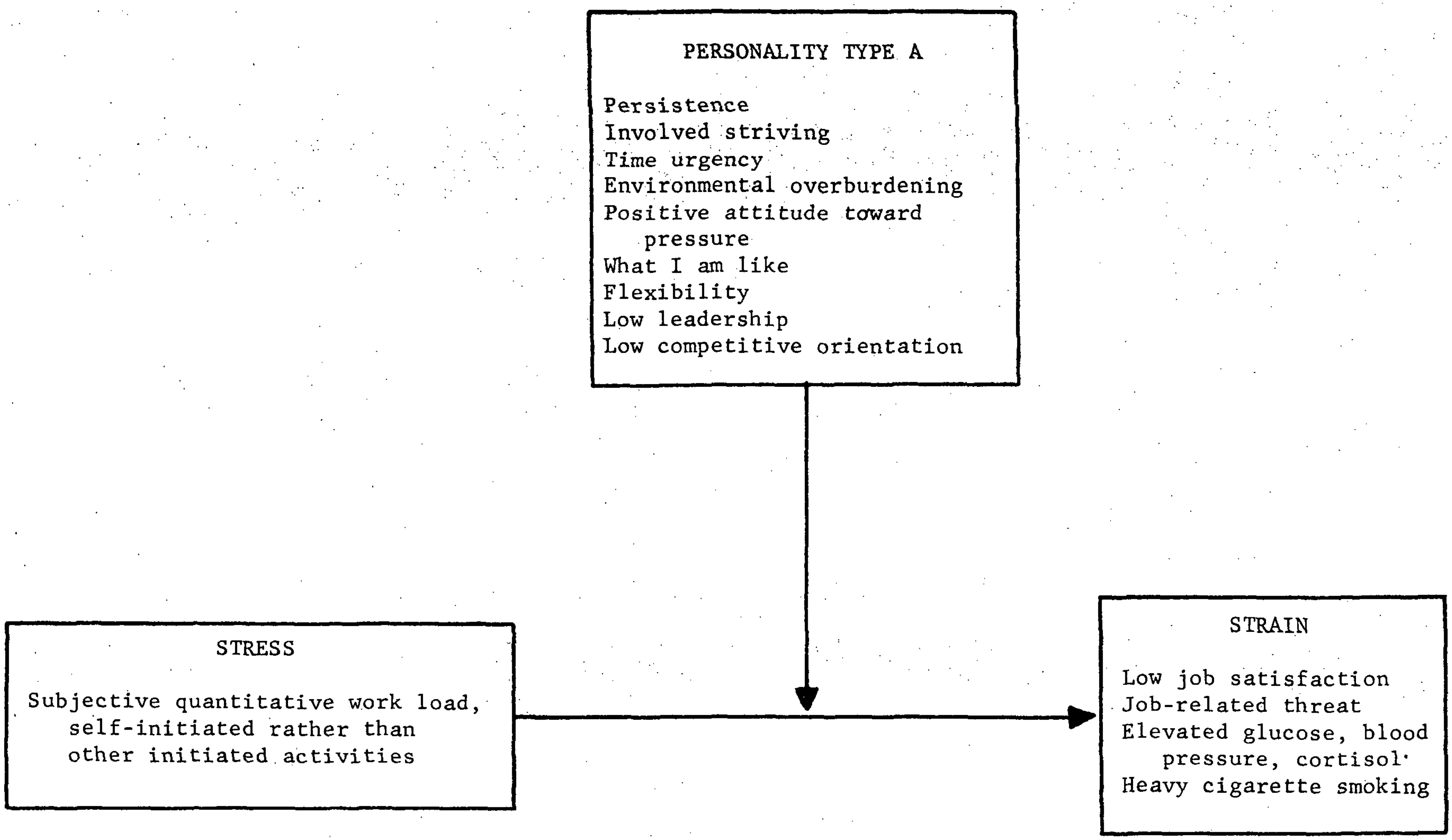

Figure 18. Theoretical interpretation of the conditioning effects of personality on the relationship between subjective quantitative work load and strain.

On the other hand, for persons who report good relations with their role senders, the stress-strain correlations range between -.13 and .13 with a mean of .00. An inspection of the correlation coefficients in Table 110 shows that the conditioning effect of role relations is strongest for the quality of relations with subordinates, with the quality of relations with the immediate superior and with the work group showing weaker effects.

TABLE 110

THE EFFECT OF RELATIONS WITH ROLE SENDERS ON THE CORRELATION BETWEEN ESTIMATED TOTAL NUMBER OF PHONE CALLS, OFFICE VISITS, AND MEETINGS AND PHYSIOLOGICAL STRAIN

Relations with / Strain	Quality of Relations			$r_{poor} > r_{good}$, p<
	Poor	Medium	Good	
Immediate Superior				
Pulse	.14	.00	-.01	n.s.
Systolic blood pressure	.20	-.03	.05	n.s.
Diastolic blood pressure	.33[1]	-.06	.06	.05
Serum glucose	.17	.18	.04	n.s.
Work Group				
Pulse	.03	.13	-.09	n.s.
Systolic blood pressure	.05	.17	-.02	n.s.
Diastolic blood pressure	.03	.17	.13	n.s.
Serum glucose	.31[1]	.03	-.01	.05
Subordinates				
Pulse	.16	-.03	-.05	n.s.
Systolic blood pressure	.24	.22	-.09	.05
Diastolic blood pressure	.31[1]	.19	-.13	.01
Serum glucose	.36[1]	.06	.04	.05

[1] $p < .01$.

While pulse rate is positively correlated with systolic and diastolic blood pressure (r's = .30 and .31, both $p < .001$), and the two types of blood pressure are correlated .68, glucose is uncorrelated with pulse rate ($r = .05$), systolic, and diastolic blood pressure (r's = .11 and .15 respectively). Thus, the findings dealing with serum glucose represent results independent of the other findings.

As a set these findings suggest that heavy reported work load is likely to lead to physiological strain under those conditions where the quality of relations with role senders, particularly subordinates, is poor. The presence of good relations may provide the support the person needs to weather conditions of heavy work load. Thus, good relations may serve as a buffer between job stress and strain. Furthermore, persons who already are under the stress of poor relations with role senders may have reached a threshold point where any increase in work load will begin to take effect on them physiologically. The fact that the conditioning effects are strongest for the quality of relations with subordinates suggests that under heavy work load it is one's subordinates rather than one's peers or superior who will provide the necessary support in meeting the demands of the job. While only one interaction effect exceeds $p < .025$, the acceptable significance level in the study, the pattern of results is quite consistent.

There are no similar effects on other measures of physiological strain such as serum cholesterol, serum cortisol, or serum uric acid nor are there additional effects using other measures of work load. Furthermore, there are no findings to report using measures of psychological strain. However, there are some findings using smoking as the measure of strain, and these are presented in the section which follows.

<u>The Conditioning Effect of Relations with Role Senders on the Correlation Between Reported Work Load and the Number of Cigarettes Smoked Among Smokers</u>

The first set of findings are presented in Tables 111 through 113. The first of these three tables presents the conditioning effect of the quality of relations with one's immediate superior on the correlation between the person's estimate of his weekly work load and the number of cigarettes he smokes per week. Outgoing phone calls and number of cigarettes are positively correlated ($r = .36$, $p < .10$) for persons who report poor relations with their superior but are negatively and non-significantly correlated for persons reporting good relations with their superior ($r = -.26$, n.s.). There is a similar pattern of results when other specific measures of reported stress are used including incoming phone calls, office visits, and meetings. When the total number of all such office activities is used as the measure of stress, stress and number of cigarettes smoked are correlated .36 (n.s.) for persons who have poor relations with their superior and are correlated -.17 (n.s.) for persons having good relations with their superior. The difference between these two correlation coefficients is significant at $p < .05$.

Tables 112 and 113 present similar patterns of findings. In Table 112 the conditioning variable is the quality of relations with the work group, and in Table 113 the conditioning variable is the quality of relations with subordinates. In each of these latter two tables reported work load is positively correlated with number of cigarettes smoked for persons who report poor relations and negatively correlated with number of cigarettes smoked for persons who report good relations. In all three sets of tables, the conditioning effects of relations with

TABLE 111

THE EFFECT OF RELATIONS WITH THE IMMEDIATE SUPERIOR ON THE CORRELATION BETWEEN SUBJECTIVE WORK LOAD AND NUMBER OF CIGARETTES SMOKED[1]

Subjective Work Load Measure	Relations with Superior: Poor N=24	Relations with Superior: Good N=28	$r_{poor} > r_{good}$, p<
# per week of:			
outgoing phone calls	.36	-.26	.025
incoming phone calls	.32	-.06	.10
office visits	.06	-.26	n.s.
self-initiated meetings	.30	-.34	.025
other-initiated meetings	.09	-.44[2]	.05
total activities	.36	-.17	.05

[1]Smokers only.

[2]$p < .05$ (2-tailed).

TABLE 112

THE EFFECT OF RELATIONS WITH THE WORK GROUP (PEERS) ON THE CORRELATION BETWEEN SUBJECTIVE WORK LOAD AND NUMBER OF CIGARETTES SMOKED[1]

Subjective Work Load Measure	Relations with Work Group		$r_{poor} > r_{good}$, $p<$
	Poor N=22	Good N=30	
# of:			
outgoing phone calls	.30	-.24	.05
incoming phone calls	.23	-.07	n.s.
office visits	-.13	-.10	n.s.
self-initiated meetings	.13	-.12	n.s.
other-initiated meetings	-.12	-.30	n.s.
total activities	.22	-.14	n.s.

[1]Smokers only.

TABLE 113

THE EFFECT OF RELATIONS WITH SUBORDINATES ON THE CORRELATION BETWEEN SUBJECTIVE WORK LOAD AND NUMBER OF CIGARETTES SMOKED[1]

Subjective Work Load Measure	Relations with Subordinates		$r_{poor} > r_{good}$, $p<$
	Poor N=21	Good N=31	
# of:			
outgoing phone calls	.32	-.20	.05
incoming phone calls	.22	-.02	n.s.
office visits	.00	-.20	n.s.
self-initiated meetings	.28	-.27	.05
other-initiated meetings	.08	-.45[2]	.05
total activities	.25	-.13	n.s.

[1]Smokers only.

[2]$p < .05$ (2-tailed).

other role senders is stronger for outgoing than for incoming calls; this repeats an additional interaction effect due to type of phone call which has been found and discussed in previous sections where personality was used as the conditioning variable.

Outgoing phone calls, compared to incoming ones, may be considered to have their primary origin in the person rather than in his environment. Relations with superior, work group, and subordinates, on the other hand, are measures of the reported job environment. Thus, these findings again represent the interaction effect of person and environment on strain. In this case, persons with a disposition to make many phone calls may show physiological strain in the absence of a supportive work environment. In a nonsupportive environment such persons may find that their phone calls only elicit noncooperative and hostile responses rather than help from persons at the other end of the line.

The inverse correlation between reported work load and number of cigarettes smoked among persons reporting good relations with their role senders is somewhat unexpected since we would predict that the relationship should be zero rather than inverse. On the other hand, the positive stress-smoking relationship found for persons reporting poor relations with role senders is consistent with similar findings reported earlier using other measures of risk factors in coronary heart disease. These other measures were systolic and diastolic blood pressure, pulse rate, and serum glucose. When these latter measures of strain were used, rather than cigarette smoking, persons reporting good relations with role senders had work load-strain correlations which were quite close to zero although there was a tendency for the coefficients to be negative in sign.

How might the inverse correlations be explained? There are two major explanations:

1) <u>Response biases are at work.</u> Persons who use denial as a defense mechanism may deny they smoke heavily by under-reporting the number of cigarettes they smoke. Those who are under more stress use more denial. If this is true, then denial might be expected to reduce any positive correlation between work load and number of cigarettes to zero, but it is unlikely that it would reverse the correlation changing its sign. Nevertheless, if the response bias effect is present, it may be strongest for persons who report good relations with role senders because they may, in reporting such relations, be denying the presence of poor quality associations between themselves and their role senders. On the other hand, persons who report poor relations with their role senders may be consequently low on denial, and therefore they would show the expected positive correlation between work load and cigarette smoking.

There are a number of additional reasons why this explanation is inadequate. First of all, denial should be positively correlated with relations with role senders. That is, persons who report the best relations should do so because they are denying that the relationships are bad. This, however, is not the case. The Deny Bad Self scale from the Crowne-Marlowe is only weakly correlated with relations with immediate superior ($r = .16$, $p < .05$), relations with the work group ($r = .11$, n.s.), and relations with subordinates ($r = .06$, n.s.).

Second, we would predict that the correlation between work load and number of cigarettes smoked should be zero for persons who have high scores on Deny Bad Self and positive for persons with low scores on Deny Bad Self. The test of this prediction is summarized by the findings in Table 114. Deny Bad Self fails to condition the relationship between reported work load and cigarette smoking, and all of the

TABLE 114

THE EFFECT OF DENY BAD SELF ON THE CORRELATION BETWEEN SUBJECTIVE WORK LOAD AND NUMBER OF CIGARETTES SMOKED[1]

Subjective Work Load Measure	Deny Bad Self Low N=29	Deny Bad Self High N=23	$r_{low} > high$, p<
# per week of:			
Outgoing phone calls	.10	.04	n.s.
Incoming phone calls	-.16	.24	.10
Self-initiated meetings	.20	-.15	n.s.
Other-initiated meetings	-.14	-.12	n.s.
Total activities	-.06	.12	n.s.

[1]Smokers only.

correlations in the table low, near zero, and appear randomly distributed with regard to their sign.

2) <u>Persons who have good relations with others actually cut down on the number of cigarettes they smoke when the work load gets heavy</u>. Literature on the nature of groups, such as that reviewed and discussed by Cartwright and Zander (1968), suggests that strong norms for conformity may operate in highly cohesive groups but not in loosely knit groups. Let us assume that when persons report good relations with their role

senders, they are indicating that they are members of highly cohesive groups. This is a reasonable assumption supported by the findings of Seashore (1954) who showed that highly cohesive groups are sources of satisfaction and allay the anxiety of their members. In our own data it was reported earlier that good relations with role senders are similarly associated with high job satisfaction, low job-related threat, and high self-esteem.

It is conceivable that a norm against smoking may operate in cohesive groups when the work load becomes great. Under such circumstances persons may be expected to concentrate heavily on their work and not smoke since smoking may interfere with getting the job done. On the other hand, when the work load is relatively low, persons may smoke more (a) either because this norm is less in effect or (b) because there is a new norm which suggests that persons should smoke more when they have time to socialize with one another and are doing so.

While the pressure to smoke more under heavy work load may also be present as a reaction to the stress of the work, the pressure for conformity may be greater than the pressure to smoke more particularly in highly cohesive groups--in other words, in groups where good relations exist. On the other hand, where good relations do not exist, this counter pressure to conform may be absent, and therefore, under heavy work load, persons with poor relations would increase their smoking.

One prediction which follows from these assumptions is that Overconformity to Norms should be positively correlated with good relations with role senders. The support for this prediction is weak although in the expected direction. Overconformity to Norms is positively correlated with the quality of relations with one's immediate superior ($r = .10$, $p < .10$), work group ($r = .23$, $p < .01$), and subordinates ($r = .10$, $p < .10$).

A second prediction is that subjective work load should be more negatively correlated with number of cigarettes smoked for persons high on Overconformity to Norms than for persons low on Overconformity to Norms. The test of this prediction is presented in Table 115. As can be seen from the findings, the data tend to support this prediction. Persons who report high conformity to norms report smoking fewer cigarettes as their reported work load increases.

TABLE 115

THE EFFECT OF OVERCONFORMITY TO NORMS ON THE CORRELATION BETWEEN SUBJECTIVE WORK LOAD AND NUMBER OF CIGARETTES SMOKED[1]

Subjective Work Load Measure	Overconformity to Norms: Low N=30	Overconformity to Norms: High N=22	$r_{low} > r_{high}$, $p<$
# per week of:			
Outgoing phone calls	.22	-.29	.05
Incoming phone calls	.10	-.11	n.s.
Self-initiated meetings	.14	-.08	n.s.
Other-initiated meetings	-.07	-.31	n.s.
Total activities	.17	-.25	.10

[1]Smokers only.

Table 116 presents some additional findings of relevance. In this table percent of time under different degrees of deadline pressures has been substituted for reported number of phone calls, office visits, and meetings. Overconformity to Norms again shows a similar conditioning effect on the relationship between stress and cigarette smoking for great and extreme levels of deadline pressure. Such pressure is positively associated with number of cigarettes smoked for persons low on conformity ($r = .44$, $p < .01$ for both levels of pressure) but is negatively correlated with number of cigarettes smoked for persons high on conformity (r's = -.24 and -.30, both n.s., respectively). However, unlike the findings in Table 115, the stress-smoking correlations are stronger for persons with low rather than high scores on Overconformity to Norms. This latter finding suggests that persons low on Overconformity to Norms smoke more under conditions of deadline

TABLE 116

THE EFFECT OF OVERCONFORMITY TO NORMS ON THE CORRELATION BETWEEN DEADLINE PRESSURES AND NUMBER OF CIGARETTES SMOKED[1]

% Time Under:	Overconformity to Norms Low n=30	Overconformity to Norms High n=20	$r_{low} > r_{high}$, $p<$
No pressure	-.15	-.03	n.s.
Slight pressure	-.22	-.07	n.s.
Moderate pressure	-.40[2]	.31	.025[4]
Great pressure	.44[3]	-.24	.025
Extreme pressure	.44[3]	-.30	.01

[1]Smokers only

[2]$p < .05$ (2-tailed)

[3]$p < .01$

[4]Two-tailed test

pressure. On the other hand, any positive effect of pressure on smoking for persons high on conformity may be counteracted by pressures to cut down on smoking when there is work to be done. This would account for the negative stress-strain correlations which are of lower strength for high conformity persons.

One can make the argument that persons high on conformity may be biasing their reports of how much they smoke to conform to norms regarding what is the proper amount to smoke. This is possible since our measure of smoking is based on self-reports. However, there are a couple of findings which go against this argument. First, such bias has already been shown to be unlikely since our measure of Denial could not explain the findings we have been dealing with. Second, Deny Bad Self and Overconformity to Norms are not strongly correlated with one another ($r = .32$, $p < .001$) suggesting that only a minor percentage of the variance in the measure of conformity is accounted for by denial bias. Third, if reported smoking behavior in these analyses reflects actual smoking, then we should expect to find similar interaction effects of Overconformity to Norms and deadline pressures on pulse rate and systolic blood pressure -- two significant correlates of number of cigarettes smoked (r's = .35 and .32 respectively, both $p < .05$). Both pulse rate and systolic blood pressure are not self-report measures, and therefore they are not subject to response biases such as denial and over-reporting.

This prediction was tested and the findings are presented in Table 117. Persons with high scores on Overconformity to Norms under extreme levels of deadline pressure show inverse relationships between the amount of time under such pressure and both pulse rate ($r = .15$, n.s.)

TABLE 117

THE EFFECT OF OVERCONFORMITY TO NORMS AMONG CIGARETTE SMOKERS *ON THE CORRELATION BETWEEN DEADLINE PRESSURES AND* PHYSIOLOGICAL CORRELATES OF HEAVY SMOKING

% Time Under	Overconformity to Norms Low N=30	Overconformity to Norms High N=22	$r_{low} > r_{high}$, p<
No pressure			
Pulse rate	-.04	.03	n.s.
Systolic blood pressure	-.02	-.22	n.s.
Slight pressure			
Pulse rate	.09	.01	n.s.
Systolic blood pressure	.22	.08	n.s.
Moderate pressure			
Pulse rate	-.41[1]	-.03	n.s.
Systolic blood pressure	-.32	.41	.025[2]
Great pressure			
Pulse rate	.01	.08	n.s.
Systolic blood pressure	-.01	-.30	n.s.
Extreme pressure			
Pulse rate	.45[1]	-.15	.05
Systolic blood pressure	.07	-.22	n.s.

[1] $p < .05$

[2] Two-tailed test

and systolic blood pressure ($r = -.22$, n.s.). On the other hand, persons low on conformity show positive correlations between the amount of time under extreme deadline pressure and both pulse rate ($r = .45$, $p < .05$), and systolic blood pressure ($r = .07$, n.s.). The latter finding for systolic blood pressure, however, is quite weak and only represents a trend. No similar findings occur when other measures of physiological strain including diastolic blood pressure are examined. All of the other strain measures, however, are non-significantly correlated with heavy cigarette smoking. Note that the analysis used smokers only.

The fact that cigarette smoking as well as related physiological strains decrease under heavy work load for persons high on conformity suggest that the forces for conformity to group and organizational norms under such conditions may actually cause these persons to cut down on such smoking. The presence of such norms is likely to be found among groups where persons report good relations with one another. The evidence on response bias and denial does not support the contention that the negative correlations between work load and smoking can be explained by response bias mechanisms such as under- or over-reporting how one smokes.

<u>Summary of Conditioning Effects of Relations with Role Senders on the Correlation Between Subjective Work Load and Strain</u>

The presence of good relations with role senders appears to serve as a buffer protecting the person from physiological strain under conditions of heavy reported work load. While pulse rate, systolic and diastolic blood pressure, and serum glucose are positively correlated with heavy reported work load for persons with poor relations with their role senders, these strains are unrelated to reported work load for persons who report good relations with their role senders. Furthermore, while work load is positively associated with heavy cigarette smoking among persons with poor role sender relations, such job stresses are negatively correlated with smoking among persons reporting high quality relations with role senders. It is suggested that this inverse relationship is due to pressures to conform present in highly cohesive groups and that these pressures operate by preventing people from smoking under high stress since smoking might interfere with the pressure to get their work done. These findings are summarized in Figure 19 which presents a theoretical interpretation of the results.

These findings are exciting for they provide evidence which suggests that the prescriptive person-oriented and human relations theories of organizational structure and interaction, if carried out, may improve the physical as well as mental health of the organizational member. The institution of supportive relations described by Likert may reduce or prevent the elevation of risk factors in coronary heart disease.

The Effect of Personality on the Relationship between Responsibility and Strain

In carrying out the analyses for this section, the distinction has been maintained between different types of responsibilities in keeping with the hypothesis that specific stresses provoke specific strains. To review briefly, analyses of the first order relationships between responsibility and strain showed that both responsibility for persons and for things were positively correlated with job satisfaction. Responsibility for things was further associated with low job-related threat. Finally, responsibility for persons but not for things was positively correlated with heavy cigarette smoking, pulse rate, and diastolic blood pressure. Now the conditioning effects of personality will be examined to see what further relationships between responsibility and strain are uncovered.

Involved Striving

As part of the study, persons were asked to indicate the percent of time they spent in each of five different responsibilities. These responsibilities are listed in the left column of Table 118. The

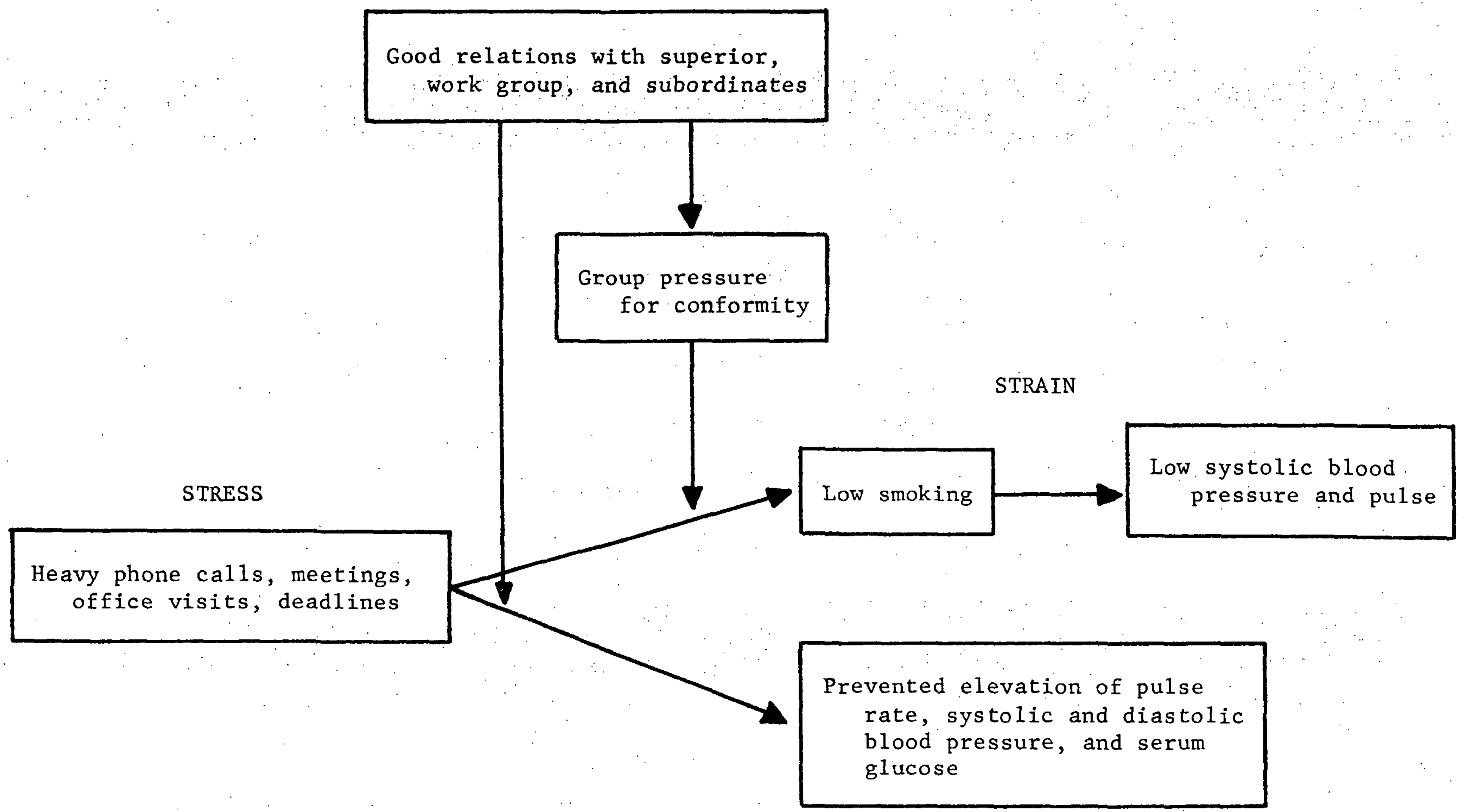

Figure 19. Theoretical interpretation of the effects of supportive relations with role senders on the correlation between subjective quantitative work load and strain.

TABLE 118

THE EFFECT OF INVOLVED STRIVING ON THE CORRELATION BETWEEN REPORTED PERCENT OF TIME CARRYING OUT DIFFERENT RESPONSIBILITIES AND MEASURES OF PHYSIOLOGICAL STRAIN

% Time Carrying Out Responsibility for / Strain	Involved Striving			$r_{low} < r_{high}$, p<
	Low N=76	Medium N=51	High N=70	
Others' futures:				
Systolic blood pressure	-.13	.04	.21	.025
Diastolic blood pressure	-.08	.26	.35[2]	.005
Serum cholesterol	-.14	.19	.26[1]	.01
The work of others:				
Systolic blood pressure	.06	.08	.12	n.s.
Diastolic blood pressure	.06	.22	.06	n.s.
Serum cholesterol	-.08	.13	-.07	n.s.
Equipment				
Systolic blood pressure	.07	.11	-.03	n.s.
Diastolic blood pressure	.09	.11	.02	n.s.
Serum cholesterol	.24	-.08	-.06	.05
Projects				
Systolic blood pressure	-.04	-.13	.17	n.s.
Diastolic blood pressure	-.07	-.34[2]	-.10	n.s.
Serum cholesterol	.03	-.13	-.03	n.s.
Budget				
Systolic blood pressure	-.01	.10	.03	n.s.
Diastolic blood pressure	-.04	.20	.12	n.s.
Serum cholesterol	-.07	.14	.21	.05

[1] $p < .05$.

[2] $p < .01$.

first two responsibilities are what have been labeled responsibilities for persons: responsibility for others' futures and responsibility for the work of others. The next three responsibilities have been labeled responsibilities for things or impersonal responsibilities: responsibility for equipment, projects, and budget or money.

This table presents the conditioning effects of Involved Striving on the relationship between the percent of time the person reports spending in each of the responsibilities and systolic and diastolic blood pressure, and serum cholesterol. An inspection of the findings in the table shows that responsibility is positively correlated with blood pressure and cholesterol--but only if it is responsibility for others' futures and only if the persons are also high on Involved Striving. Thus, we are dealing with a triple interaction in which the distinction between different forms of responsibility is important. It should be noted that the different measures of responsibility are not independent of one another since all five must add up to 100 percent. With this in mind, the findings suggest that of all the allotments of time the person makes, the allotment for responsibility for others' futures, for person's high on Involved Striving, is the most important as a determinant of physiological strain. Apparently people who do not tend to become highly involved in their work do not experience strain under the stress of any type of responsibility in this study. This is in keeping with Gurin et al.'s (1960) findings on ego-involvement and consequent strain under job stress.

Other Type A Measures

The above pattern of findings is repeated frequently in the data as other personality measures of Type A are substituted for Involved Striving. In Table 119 the findings for the following six other measures of Type A are presented: Leadership, Competitive Orientation, Persistence, History of Past Achievements, Positive Attitude Toward Pressure, and What I am Like: Type A. Rather than present data for each type of responsibility, just the findings dealing with reported

TABLE 119

THE EFFECT OF OTHER TYPE A PERSONALITY MEASURES ON THE RELATIONSHIP BETWEEN REPORTED PERCENT OF TIME ON RESPONSIBILITIES FOR OTHERS' FUTURES AND MEASURES OF PHYSIOLOGICAL STRAIN

Personality Measure	Personality Level: Low	Medium	High	$r_{low} < r_{high}$, $p <$
Leadership				
Systolic blood pressure	-.20	.07	.14	.025
Diastolic blood pressure	.01	.13	.28[1]	.10
Cholesterol	-.09	.13	.24	.05
Competitive Orientation				
Systolic blood pressure	-.13	.07	.07	n.s.
Diastolic blood pressure	-.01	.23	.22	.10
Cholesterol	-.13	.23	.22	.025
Persistence				
Systolic blood pressure	-.17	-.02	.26[1]	.01
Diastolic blood pressure	-.08	.23	.36[2]	.005
Cholesterol	-.09	.02	.37[2]	.005
History of Past Achievements				
Systolic blood pressure	.14	-.04	-.10	.10
Diastolic blood pressure	.09	.25	.14	n.s.
Cholesterol	-.21	.34[1]	.20	.01
Positive Attitude Toward Pressure				
Systolic blood pressure	-.18	.07	.20	.025
Diastolic blood pressure	-.04	.17	.35[2]	.01
Cholesterol	-.14	.24	.22	.025
What I am Like Type A				
Systolic blood pressure	-.16	.00	.18	.025
Diastolic blood pressure	.08	.21	.17	n.s.
Cholesterol	.10	-.26	.26	n.s.

[1] $p < .05$.

[2] $p < .01$.

percent of time carrying out responsibility for others' futures are presented since it is this measure of responsibility which provided the significant findings in the previous table. From an inspection of the table, it is clear that there are significant interaction effects in which the correlations between responsibility for others' futures and blood pressure and cholesterol are positive and more often significant for persons high rather than low on measures of personality Type A.

The three Type A measures which did not show significant conditioning effects, and are not included in the table, are Sense of Time Urgency, Range of Activities, and Tendency Toward Environmental Overburdening.

Additional Effects of Leadership on Relationships Between Responsibility and Strain

Some additional findings using pulse as the measure of strain will now be presented. Table 120 presents data similar to that presented in the previous table. Along the left column of the table are listed the various responsibilities. In this table the conditioning variable is Leadership, a propensity to become involved in leading other individuals in various tasks and settings. Again the percent of time the person reports spending in responsibilities for others' futures is positively correlated with a measure of strain, pulse rate, for persons high on the Type A measure, Leadership (r = .29, p .05). Persons in the middle tertile on Leadership also show a positive correlation between this responsibility and pulse rate (r = .40, p .01). However, responsibility for others' futures is unrelated to pulse rate for persons low on Leadership (r = -.12, n.s.).

TABLE 120

THE EFFECT OF LEADERSHIP ON THE CORRELATION BETWEEN RESPONSIBILITY AND PULSE RATE

Responsibility	Leadership			$r_{low} < r_{high}$, p<
	Low N=73	Medium N=62	High N=63	
% time for:				
others' futures	-.12	.40[2]	.29[1]	.01
work of others	.11	-.08	.02	n.s.
money, budget	.13	.10	.05	n.s.
equipment	.23	.00	-.10	n.s.
projects	.24	-.09	-.12	n.s.
Responsibility for:				
persons	-.02	.17	.35[2]	.025
things	.08	-.02	.15	n.s.

[1] $p < .05$

[2] $p < .01$

In addition to these findings, there is also a similar interaction effect for the index measures of responsibility for persons and for things. The findings for these data are presented at the bottom of the table. Here responsibility for persons is positively and significantly correlated with pulse rate ($r = .35$, $p < .01$) but only if the person is high on Leadership. There is a non-significant but positive correlation between responsibility for things and pulse rate for persons high on Leadership, so that the conditioning effect of Leadership is weaker for effects of responsibility for things.

The above findings are replicated in data presented in Tables 121 and 122 but the findings only represent trends in the same direction.

TABLE 121

THE EFFECT OF COMPETITIVE ORIENTATION ON THE CORRELATION RESPONSIBILITY AND PULSE RATE

Responsibility	Competitive Orientation Low N=67	Medium N=69	High N=64	$r_{low} < r_{high}$, p<
% time for:				
others' futures	.10	.05	.34[2]	.10
work of others	.20	-.01	-.10	.05
budget	.25	-.02	.10	n.s.
equipment	.05	-.02	.10	n.s.
projects	-.33[2]	.27[1]	-.10	.10
Responsibility for:				
persons	.31	.03	.23	n.s.
things	.23	-.12	.10	n.s.

[1] $p < .05$.

[2] $p < .01$.

TABLE 122

THE EFFECT OF RANGE OF ACTIVITIES ON THE CORRELATION RESPONSIBILITY AND PULSE RATE

Responsibility	Range of Activities Low N=82	Medium N=51	High N=66	$r_{low} < r_{high}$, p<
% time for:				
others' futures	.04	.30[1]	.29[1]	.10
work of others	.09	.00	.00	n.s.
budget	.11	-.04	.22	n.s.
equipment	.10	-.06	.03	n.s.
projects	.16	-.04	-.21	.025
Responsibility for:				
persons	.12	.23	.32[1]	n.s.
things	.04	.11	.14	n.s.

[1] $p < .05$.

These tables present data using Competitive Orientation and Range of Activities as the two conditioning variables. In both tables the only positive and significant correlations between responsibility and pulse rate are for persons high on the Type A variable and for relationships either between percent of time carrying out responsibility for others' futures and pulse rate or between the responsibility for persons index and pulse rate. Impersonal responsibilities show little or no relationship with pulse rate.

Summary

Taken together, the five tables which have just been examined indicate that there is a conditioning effect of Type A personality variables on the relationship between responsibility for persons and risk factors in coronary heart disease. These risk factors include systolic and diastolic blood pressure, serum cholesterol, and pulse rate. No such findings appear when the stress is responsibility for things. Thus, the distinction between responsibility for persons and for things again seems to be an important one. In addition, attention to specificity seems warranted in that no significant findings turn up for other measures of strain including serum cortisol, serum glucose, ponderol index, and number of cigarettes smoked when analyses using conditioning variables are performed. Furthermore, relations with others does not serve as a conditioning variable. These findings are summarized in Figure 20.

The Effect of Conditioning Variables on the Relationship between Amount of Contact across Organizational Boundaries and Strain

On the basis of earlier research on boundary stress by Kahn et al. (1964) it was predicted that the effects of conditioning variables, such

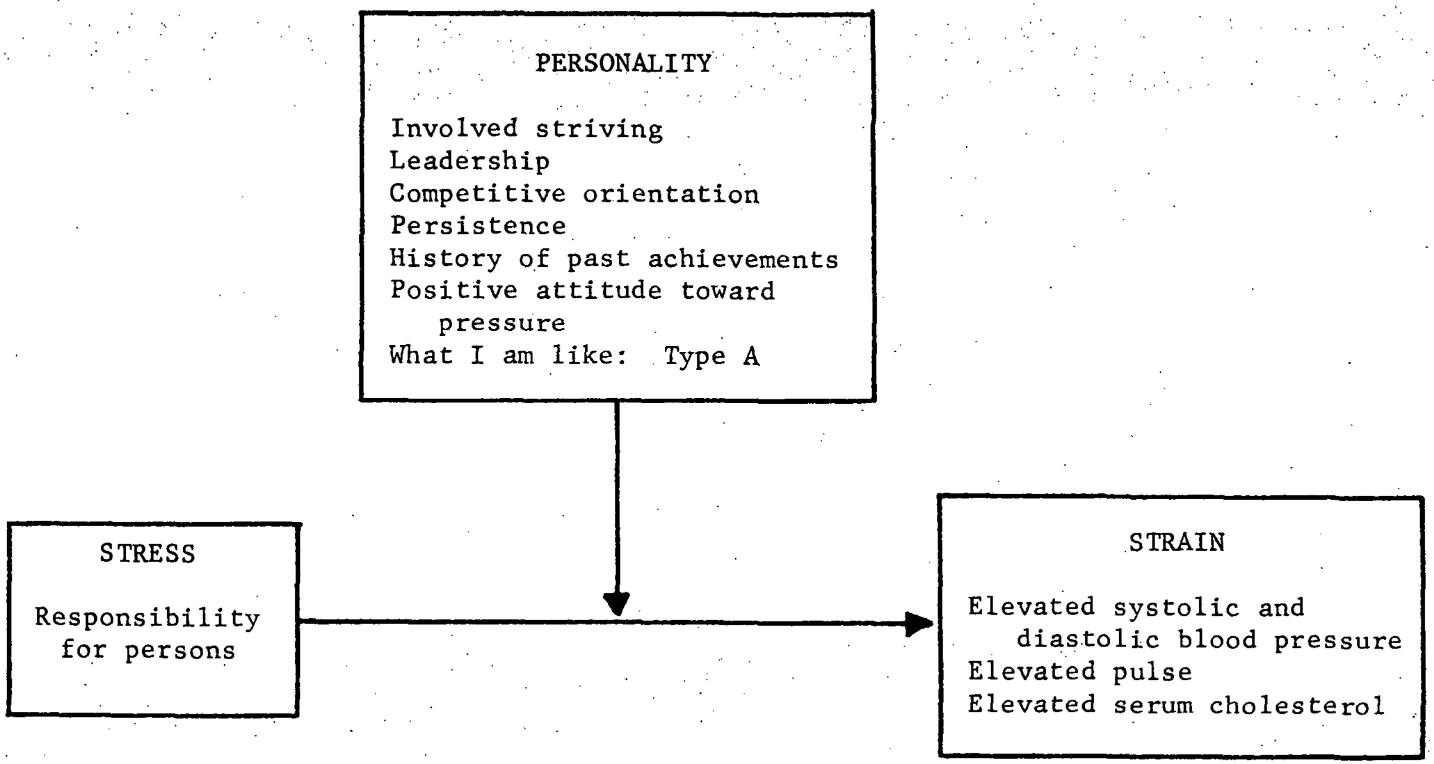

Figure 20. Theoretical interpretation of the conditioning effects of personality on the relationship between responsibility and strain.

as Type A personality and poor relations with one's role senders, would be most marked when NASA personnel spent time dealing with the most external territories of their organization--namely, other directorates, other bases, and non-NASA personnel such as contractors. Less remote territories such as the person's own branch, other branches, and other divisions are expected to produce less marked interactions with personality. The following findings bear directly on these predictions.

Leadership

Table 123 examines the role of Leadership as a conditioning personality measure. The independent variable is the percent of time the person reports spending in communication with each of the six organizational territories just described. These territories are listed in the left column of the table. The dependent variables are cholesterol, glucose, and cortisol sera levels.

An examiniation of the data in the table shows that the percent of time in communication with other territories is positively and significantly correlated with all three of these strains (r's = .19, .50, and .38 respectively; p's $<$ n.s, .01, and .01) but only if the person is high on Leadership (Type A) and only if the territories under consideration are other directorates in the organization. The comparable correlations for persons low on Leadership are nonsignificant and quite small (r's = -.16, -.05, and -.09 respectively).

Persistence

The data in Table 124 show a similar pattern. This time the conditioning personality measure is Persistence. Again, the strongest conditioning effect of personality is on the relationship between

TABLE 123

THE EFFECT OF LEADERSHIP ON THE CORRELATION BETWEEN REPORTED PERCENT OF TIME SPENT COMMUNICATING WITH PERSONS IN DIFFERENT TERRITORIES OF THE ORGANIZATION AND MEASURES OF PHYSIOLOGICAL STRAIN

Territory/Strain	Leadership: Low N=73	Leadership: Medium N=62	Leadership: High N=63	$r_{low} < r_{high}$, p<
Own branch office				
Cholesterol	.17	-.10	.10	n.s.
Glucose	-.04	-.02	-.18	n.s.
Cortisol	.11	.05	.06	n.s.
Other branches				
Cholesterol	-.15	-.17	-.23	n.s.
Glucose	-.03	.06	-.20	n.s.
Cortisol	-.08	-.07	-.20	n.s.
Other divisions				
Cholesterol	-.20	.00	-.22	n.s.
Glucose	-.11	.05	-.10	n.s.
Cortisol	.11	.18	.00	n.s.
Other directorates				
Cholesterol	-.16	.42[1]	.19	.025
Glucose	-.05	.06	.50[1]	.005
Cortisol	-.09	.02	.38[1]	.005
Other bases				
Cholesterol	.02	.07	.05	n.s.
Glucose	-.03	.18	.12	n.s.
Cortisol	.05	-.08	.05	n.s.
Non-NASA employees				
Cholesterol	.13	-.09	-.07	n.s.
Glucose	.06	-.17	.02	n.s.
Cortisol	.02	-.13	-.08	n.s.

[1] $p < .01$.

TABLE 124

THE EFFECT OF PERSISTENCE ON THE CORRELATION BETWEEN REPORTED PERCENT OF TIME SPENT COMMUNICATING WITH PERSONS IN DIFFERENT TERRITORIES OF THE ORGANIZATION AND MEASURES OF PHYSIOLOGICAL STRAIN

Territory/Strain	Persistence: Low N=76	Medium N=55	High N=70	$r_{low} < r_{high}$, p<
Own branch office				
Cholesterol	.06	.06	.01	n.s.
Glucose	.11	-.22	-.14	.10
Cortisol	.10	.09	-.02	n.s.
Other branches				
Cholesterol	-.15	.06	-.31[1]	n.s.
Glucose	-.06	-.11	-.08	n.s.
Cortisol	-.13	.16	-.20	n.s.
Other divisions				
Cholesterol	-.18	-.19	-.06	n.s.
Glucose	.09	.00	-.09	n.s.
Cortisol	-.07	.23	-.06	n.s.
Other directorates				
Cholesterol	.22	.05	.17	n.s.
Glucose	.04	.31[1]	.29[1]	.10
Cortisol	-.04	-.07	.34[2]	.01
Other bases				
Cholesterol	-.03	.06	.15	n.s.
Glucose	.06	.07	.14	n.s.
Cortisol	.02	-.11	.06	n.s.
Non-NASA employees				
Cholesterol	-.01	-.11	.08	n.s.
Glucose	.21	.12	.08	n.s.
Cortisol	.07	-.08	-.14	n.s.

[1] $p < .05$.

[2] $p < .01$.

reported percent of time communicating with other directorates and glucose and cortisol. Persons high on Persistence show positive and significant correlations between time spent communicating with other directorates and glucose ($r = .29$, $p < .05$) and cortisol ($r = .34$, $p < .01$). The comparable coefficients for persons low on Persistence are non-significant and close to zero (r's = .04 and -.04 respectively).

Leadership and Persistence (which correlate .44) are essentially the only two personality measures which show these conditioning effects. The other measures of Type A personality show only a random pattern of results. The other measures of Type A, however, correlate higher with Leadership and Persistence than the latter two measures correlate with one another (see Table 14). Therefore, it is not clear why <u>only</u> Leadership and Persistence serve as conditioning variables in the above two tables. Nevertheless, the sets of results in these two tables are consistent with one another.

<u>Relations with Role Senders</u>

Now let us turn to some additional data using the same independent and dependent variables. This time, however, the conditioning variables are the quality of relations the person has with his role senders. Table 125 presents some rather unexpected and surprising findings. The same triple interaction effect is present in that the strongest positive correlations between contact with other territories and strain is found only where it is contact with other directorates and only for persons high on the conditioning variable--but having a high score means that the person reports having good relations with his immediate superior. For these people, the correlations between percent of time spent communicating with other directorates and level of cholesterol,

TABLE 125

THE EFFECT OF RELATIONS WITH SUPERIOR ON THE CORRELATION BETWEEN REPORTED PERCENT OF TIME SPENT COMMUNICATING WITH PERSONS IN DIFFERENT TERRITORIES OF THE ORGANIZATION AND MEASURES OF PHYSIOLOGICAL STRAIN

Territory/Strain	Relations with Superior: Poor N=74	Medium N=58	Good N=68	$r_{poor} > r_{good}$, p<
Own branch office				
Cholesterol	.09	.09	-.06	n.s.
Glucose	.09	-.11	-.25[1]	.025
Cortisol	.08	.10	-.13	n.s.
Other branches				
Cholesterol	-.19	-.10	-.22	n.s.
Glucose	-.02	-.14	-.05	n.s.
Cortisol	-.08	.00	-.14	n.s.
Other divisions				
Cholesterol	-.24	-.05	-.07	n.s.
Glucose	-.16	.14	.15	n.s.
Cortisol	.21	.00	-.22	.01
Other directorates				
Cholesterol	.00	.12	.35[2]	n.s.
Glucose	-.02	.14	.43[2]	.025[3]
Cortisol	-.02	-.05	.43[2]	.025[3]
Other bases				
Cholesterol	.15	-.05	.05	n.s.
Glucose	.07	.14	.07	n.s.
Cortisol	-.09	.05	.17	.10
Non-NASA employees				
Cholesterol	.04	-.12	.03	n.s.
Glucose	.01	.01	-.12	n.s.
Cortisol	-.12	-.06	.01	n.s.

[1] $p < .05$.

[2] $p < .05$, two-tailed.

[3] Two-tailed.

glucose and cortisol are .35, .43, and .43 (all $p < .05$ using a two-tailed test of significance). The comparable coefficients for persons reporting good relations with their superior are .00, -.02, and -.02 respectively. Thus, the pattern of findings is exactly the opposite of what was predicted. According to predictions, the person who does not have the supportiveness of his superior should be the person who should suffer the most from contact across organizational boundaries, but just the opposite appears to be the case.

Table 126 presents similar data this time using relations with one's work group or peers as the conditioning variable. Again exactly the same pattern of findings occurs. Finally, Table 127 shows a similar, but not as striking, pattern of the same results with relations with one's subordinates serving as the conditioning variable.

What explanations are there for these results? For one thing, the findings are not due to any significant association between these measures of supportive relations and the two Type A measures which also produce similar conditioning effects--Leadership and Persistence. The correlation between these Type A measures and relations with superior and work group range from .01 to .09. Relations with Subordinates is correlated .30 ($p < .01$) with Leadership and .16 ($p < .05$) with Persistence. However, relations with subordinates acts as a weak conditioner of the relationship between stress from alien territory and physiological strain. One possible explanation is that people who report such good relations suffer some sort of contrast effect (John R.P. French, Jr., personal communication, 1971) whereby their interactions with persons outside their proximal role set appear to be, by contrast, very nonsupportive and consequently very

TABLE 126

THE EFFECT OF RELATIONS WITH WORK GROUP ON THE CORRELATION BETWEEN REPORTED PERCENT OF TIME SPENT COMMUNICATING WITH PERSONS IN DIFFERENT TERRITORIES OF THE ORGANIZATION AND MEASURES OF PHYSIOLOGICAL STRAIN

Territory/Strain	Relations with Work Group: Poor N=76	Medium N=68	Good N=58	$r_{poor} < r_{good}$, p<
Own branch office				
Cholesterol	.12	.24[1]	-.24	n.s.
Glucose	.07	.06	-.39[1]	n.s.
Cortisol	.18	-.13	-.01	n.s.
Other branches				
Cholesterol	-.27	-.22	-.04	n.s.
Glucose	.04	-.18	-.13	n.s.
Cortisol	-.01	.00	-.22	n.s.
Other divisions				
Cholesterol	-.15	-.20	.03	n.s.
Glucose	-.08	-.01	.13	n.s.
Cortisol	-.02	.27	-.27	n.s.
Other directorates				
Cholesterol	.03	-.03	.40	.025
Glucose	-.01	.03	.54[2]	.005
Cortisol	-.06	.04	.34[2]	.025
Other bases				
Cholesterol	.19	.09	.14	n.s.
Glucose	-.07	.20	.22	.10
Cortisol	.00	.02	.13	n.s.
Non-NASA employees				
Cholesterol	.04	-.12	.04	n.s.
Glucose	.03	-.11	.03	n.s.
Cortisol	-.21	.08	-.04	n.s.

[1] $p < .05$.

[2] $p < .01$.

TABLE 127

THE EFFECT OF RELATIONS WITH SUBORDINATES ON THE CORRELATION BETWEEN REPORTED PERCENT OF TIME SPENT COMMUNICATING WITH PERSONS IN DIFFERENT TERRITORIES OF THE ORGANIZATION AND MEASURES OF PHYSIOLOGICAL STRAIN

	Relations with Subordinates			
Territory/Strain	Poor N=60	Medium N=57	Good N=76	$r_{poor} < r_{good}$, p<
Own branch office				
Cholesterol	.11	-.30[1]	.21	n.s.
Glucose	-.07	-.03	-.16	n.s.
Cortisol	.19	-.23[1]	.08	n.s.
Other branches				
Cholesterol	-.20	-.22	-.09	n.s.
Glucose	-.09	-.12	.02	n.s.
Cortisol	.08	-.05	-.23[1]	n.s.
Other divisions				
Cholesterol	-.18	.00	-.19	n.s.
Glucose	.00	-.11	.07	n.s.
Cortisol	.28	.01	-.16	.01
Other directorates				
Cholesterol	-.07	.52[2]	-.01	n.s.
Glucose	.03	.28[1]	.31[2]	.10
Cortisol	-.34	.33[2]	.30[2]	.005
Other bases				
Cholesterol	.13	.20	-.02	n.s.
Glucose	.00	-.07	.27[1]	.10
Cortisol	-.05	.00	.00	n.s.
Non-NASA employees				
Cholesterol	.02	.05	-.05	n.s.
Glucose	.18	-.09	-.15	.05
Cortisol	-.17	.02	.00	n.s.

[1] $p < .05$.

[2] $p < .01$.

great sources of stress. There is some data which are relevant to this hypothesis since each respondent was asked to indicate the extent to which each organizational territory constituted a source of stress. However, an inspection of these data showed that for persons reporting good relations with their role senders, there is no relationship between the amount of directorate level stress they report and their level of cholesterol, glucose, or serum cortisol. The correlations tend to be close to zero, randomly distributed with regard to sign, and non-significant. This not only makes the contrast effect explanation suspect but also suggests that the measures of percent of time in contact with different territories and amount of stress from different territories are unrelated to one another. As a matter of fact, the amount of time one spends in contact with other directorates is only correlated .34 with the amount of stress one reports from the directorate, and that is the highest correlation between the two types of measures of contact with other organizational boundaries. Thus, either or both measures may be of suspect reliability and validity.

A second possibility is that people who report good relations with their role senders are actually biasing their responses by denying that anything bad is occurring with members of their immediate role set. This possibility has already been demonstrated earlier in this chapter. If this is true, then such persons might be expected to manifest their strain physiologically since they deny it verbally. To test this out, an examination of the data was made to see if either of the two Crowne-Marlowe subscales produced results similar to those in the above three tables when they were substituted as conditioning variables. In fact, one of the subscales, Deny Bad Self, did show similar conditioning effects as shown in Table 128.

TABLE 128

THE EFFECT OF DENY BAD SELF, CROWNE-MARLOWE SUBSCALE, ON THE CORRELATION BETWEEN REPORTED PERCENT OF TIME SPENT COMMUNICATING WITH PERSONS IN DIFFERENT TERRITORIES OF THE ORGANIZATION AND MEASURES OF PHYSIOLOGICAL STRAIN

Territory/Strain	Deny Bad Self			$r_{low} < r_{high}$, p<
	Low N=85	Medium N=43	High N=71	
Own branch office				
Cholesterol	.00	.07	.07	n.s.
Glucose	-.04	-.09	-.15	n.s.
Cortisol	.14	-.21	.07	n.s.
Other branches				
Cholesterol	-.08	.07	-.27	n.s.
Glucose	-.09	.13	-.09	n.s.
Cortisol	-.17	.28	-.09	n.s.
Other divisions				
Cholesterol	-.22	.25	-.29	n.s.
Glucose	-.01	.14	-.08	n.s.
Cortisol	.01	.19	.07	n.s.
Other directorates				
Cholesterol	-.06	.03	.36[2]	.005
Glucose	.05	.05	.46[2]	.005
Cortisol	.14	.02	.22[1]	n.s.
Other bases				
Cholesterol	.08	.02	.07	n.s.
Glucose	.25	-.10	-.02	.05
Cortisol	-.03	-.27	-.05	n.s.
Non-NASA employees				
Cholesterol	.14	-.18	-.04	n.s.
Glucose	-.04	-.04	-.02	n.s.
Cortisol	-.04	.02	-.13	n.s.

[1] $p < .05$.

[2] $p < .01$.

Examining the table, only the percent of time in contact with other directorates shows consistently positive correlations with serum cholesterol ($r = .36$, $p < .01$), serum glucose ($r = .46$, $p < .01$), and serum cholesterol ($r = .22$, $p < .05$) for persons with high scores on Deny Bad Self. However, Deny Bad Self is only correlated .16 ($p < .05$) with good relations with one's superior, .11 (n.s.) with good relations with one's work group, and .06 (n.s.) with good relations with one's subordinates.

While these correlations are in the expected direction, they are quite weak. Thus, denial, as measured by Deny Bad Self, can hardly be said to account for the conditioning effects of relations with different role senders on the correlation between stress from alien territories and physiological strain. Deny Bad Self also fails to correlate with Leadership ($r = .05$, n.s.) and with Persistence ($r = .01$, n.s.) which are the two Type A personality measures which were shown to condition the territorial stress-strain relationships.

As an alternative interpretation of these findings, it may be that interaction with other directorates produces additional work for peers, superior, and subordinates. Such a situation may be particularly stressful for the focal person if he has good rather than poor relations with members of his immediate role set since he may be highly motivated to help reduce their work load rather than contribute to it. Unfortunately, there is no way to test this latter possibility with the current data.

<u>Other Conditioning Effects of Personality on the Relationship Between Stress from Other Organizational Territories and Strain</u>

As part of the analyses, the conditioning effect of personality on the relationship between reported <u>stress</u> from alien territories and strain was examined. The territories range from those close to the person's branch to those most remote including the person's own branch, other branches, other divisions, other directorates, other bases, and non-NASA employees respectively. The average correlation between reported stresses from each of these territories is low ($\bar{r}$ = .30; the intercorrelation matrix is presented in Appendix XVIII). In other words, each territory represents a somewhat independent source of stress.

The interaction effect of the Type A personality variables and these measures of stress from different organizational territories on strain is contrary to what might be theoretically predicted. Essentially, the conditioned stress-strain relationships tend to be inverse rather than positive. The findings, presented in Appendix XIX, will only be summarized briefly here since the data represent weak, suggestive trends.

The interaction effects of personality and stress from different territories on four measures of strain will be examined. These four measures of strain--serum cortisol, serum cholesterol, systolic blood pressure, and the number of cigarettes smoked for persons who smoke--are the four dependent variables for which trends in the data appear. The only significant relationship among these four measures of strain is a .17 ($p < .05$) correlation between serum cortisol and systolic blood pressure. Therefore, these are four relatively independent strain measures.

Lest one get the impression that the findings about to be presented represent a large number of independent replications of the same phenomena, it should be pointed out that the Type A measures which show conditioning effects are all significantly correlated with one another (see Table 14) with coefficients ranging from .21 to .62. Since many of the significant correlations between stress from different levels of the organization and serum cortisol are just beyond statistical significance (r's ranging from .27 to .32), it is possible that the replications across Type A personality measures represent an artifact of low to moderate intercorrelations a) among the personality measures, and b) among the ratings of stress from the different levels of the organization. All Type A personality measures are positively rather than inversely intercorrelated with one another, and the same is true for the measures of stress from different levels of the organization. Thus, negative correlations between stress and cortisol cannot be said to be due to some artifact of inverse correlations among different measures of stress. These points merit consideration as the findings are now presented.

The Interaction Effect of Personality and Stress from Alien Territories on Serum Cortisol

The data indicate that persons who have high scores on Involved Striving, Leadership, History of Past Achievements, Range of Activities, Competitive Orientation, Persistence, and the What I am Like Type A measure show inverse correlations between the extent to which they report that different levels of the organization are sources of stress and serum cortisol. The inverse correlations are particularly evident when the dependent variable is the amount of stress from the branch, from other branches, and from non-NASA personnel. Persons who are low on the above personality measures show a random pattern of non-significant positive and negative correlations between stress and cortisol.

Three personality measures do not show such conditioning effects. These are Sense of Time Urgency, Environmental Overburdening, and Positive Attitude Toward Pressure. Interestingly enough, all three of these measures have to do with deadline pressures. However, these measures do not correlate significantly higher with one another than with the other measures so their lack of effect does not appear to represent any shared characteristic unique to the three measures.

Findings Dealing with Serum Cholesterol

These findings are almost the mirror image of those just presented for serum cortisol. Cholesterol is inversely correlated with the amount of stress reported from different levels of the organization, but this time only for persons scoring low rather than high on the following personality measures of Type A: Involved Striving, Leadership, Sense of Time Urgency, History of Past Achievements, Range of Activities, Competitive Orientation, and Persistence. The negative correlations are strongest when the source of stress is either the division or the directorate. For persons who score high on these same measures of Type A, the correlations tend to be positive, and the magnitude of their coefficients is not as great (they are low and non-significant).

As was true for cortisol, Environmental Overburdening and Positive Attitude Toward Pressure, show no trends as conditioning variables. In addition, the same is true for the What I am Like measure of Type A.

Findings Dealing with Systolic Blood Pressure

There is a tendency for higher inverse correlations to exist between stress reported at the directorate and base level, than at other levels, and systolic blood pressure for persons scoring low rather than high on the following measures of Type A: Involved Striving, Leadership, Sense of Time Urgency, Range of Activities, Competitive Orientation, Persistence, and What I am Like Type A. For persons high on these measures of Type A, the correlations between stress and strain tend to be close to zero. Again, there are no visible trends in the data for the personality measures of Environmental Overburdening and Positive Attitude Toward Pressure. In addition, History of Past Achievements joins this latter group of measures. Diastolic blood pressure shows no identifiable pattern of relationships to the interaction of stress and personality.

Findings Dealing with Cigarette Smoking

Turning to findings using the number of cigarettes the person smokes given that he smokes as a measure of strain, one again finds inverse correlations between territorial stress and strain. The pattern of findings tends to be similar to that reported for serum cholesterol and systolic blood pressure. Cigarettes smoked are negatively correlated with stress reported primarily from the branch, division, and directorate, and particularly for persons who, again, score low on the following measures of Type A: Involved Striving, Leadership, Sense of Time Urgency, History of Past Achievements, Competitive Orientation, and Persistence. Again, Environmental Overburdening and Positive Attitude Toward Pressure show no conditioning effects. This time Range of Activities is added to this latter list.

Four Characteristics of These Findings

There seem to be four rather noticeable characteristics of the data just examined. First, an analysis of these data by John R. P.

French, Jr. (personal communication, 1971) shows that when one counts up the number of significant correlations between territorial stress and strain found for persons scoring low, medium, and high on the Type A personality measures, the following distributions of plus and minus coefficients appear. For persons scoring low on the Type A measures, 23 out of the 24 significant correlations, or about 96 percent, are negative. For persons scoring high, 18 out of the 21 significant correlations, or about 86 percent, are negative. However, for persons scoring in the middle group on personality, only 5 out of the 10, or 50 percent, are negative. Since there are only three-fourths of the number of tests for the middle group as were performed for highs and lows (due to small sample sizes, there is no middle group when number of cigarettes smoked is used as a measure of strain) one should expect three-fourths as many significant correlations, or about 17 such correlations for the medium group. However, as noted above, there are less than this number, and half of these are positive and half are negative. Unlike the case for the high and low Type A groups, the findings for the middle group represent more of a chance pattern of relationships. This suggests that inverse correlations between stress and strain are most prominant for extreme responders on the personality measures.

Second, territorial stress tends to be inversely correlated with cholesterol, systolic blood pressure, and number of cigarettes smoked for Type B persons while serum cortisol shows no such relationship. On the other hand, serum cortisol tends to be inversely related to territorial stress for Type A persons. As noted before, there are only negligible correlations between the four measures of strain examined here. Therefore, it is statistically possible for cortisol to show a unique relationship to territorial stress which is quite different from that of the other three strain measures--as is the case with these data.

Third, the conditioned effects between territorial stress and strain tend to be strongest for stress from other divisions and directorates indicating that stresses from more distant territories within rather than outside the base have the most profound effect on the individual. Table 129 gives some insight into why stress from

TABLE 129

AVERAGE PERCENT OF TIME REPORTED SPENT COMMUNICATING WITH DIFFERENT ORGANIZATIONAL TERRITORIES (n=207)

Territory	Percent	S.D.
Own branch	47.20	24.02
Other branches	13.24	11.84
Other divisions	9.41	10.53
Other directorates	12.09	12.48
Other bases	3.60	5.35
Non-NASA employees	13.74	14.06

territories beyond the base may have no effect on strain. The table presents the average percents of time people at Goddard spend communicating with various territories of the organization. It is apparent that persons communicate the least (only 3.6 percent of the time) with <u>other</u> bases, and therefore, while they may experience stress from communicating with this distant organizational boundary, it may be so infrequent as to have little effect. The same argument, however, cannot be offered with regard to communication with non-NASA employees since they are communicated with about as much as persons from other branches and directorates.

A fourth characteristic of these findings is that Environmental Overburdening and Positive Attitude Toward Pressure, both of which have to do with deadlines and overload, do not serve as conditioning variables. It is hard to say why this is so since Sense of Time Urgency, which also has to do with overload, does appear as a conditioning variable in three of the four analyses performed. It is possible that the above two personality measures, in this case, are really environmental measures rather than personality measures and thus show no conditioning effects. If Environmental Overburdening and Positive Attitude Toward Pressure are stress measures, however, they should correlate more highly with measures of stress from other divisions and directorates than they should with other Type A personality measures. However, both personality measures correlate only -.13 to -.04 with the above measures of stress and correlate .38, on the average, with the other Type A measures of personality making the above explanation also highly implausible.

The magnitude of the conditioned relationships between reported territorial stress and strain is not very high, and the presence of inverse relationships is certainly counter to what might be expected. It may be that the findings are solely due to chance. On the other hand, there is a consistency to the pattern of the above findings which makes them hard to ignore. There does not appear to be any explanation for this set of results. Nevertheless, the findings are included here, since future research at NASA installations will be using the same measures of stress, personality, and strain and will subsequently provide an opportunity to see whether or not these results are merely due to chance.

The Conditioning Effect of Crowne-Marlowe Scales on the Relationship Between Stress from Organizational Territories and Strain

One additional personality measure also has a conditioning effect on the relationship between boundary stress and strain. This is Overconformity to Norms which was derived from the Crowne-Marlowe measure of social desirability. The findings, presented in Table 130, show that for persons with high scores on Overconformity to Norms, the correlation between territorial stress and serum cholesterol changes from near zero to positive as the source of stress comes from succeedingly more distant territories within the organization (r's range from -.01, n.s., up to .37, $p < .01$). For persons with low scores on

TABLE 130

THE EFFECT OF OVERCONFORMITY TO NORMS ON THE CORRELATION BETWEEN REPORTED BOUNDARY STRESS AND SERUM CHOLESTEROL

Stress from	Overconformity to Norms			$r_{low} < r_{high}$, p<
	Low N=72	Medium N=72	High N=57	
Own branch	-.07	.07	-.01	n.s.
Other branches	-.18	.13	.14	.05
Other divisions	-.10	-.14	.32 [1]	.01
Other directorates	-.12	-.06	.30 [1]	.01
Other bases	-.05	.01	.37 [2]	.01
Non-NASA employees e.g., contractors	.00	-.18	.15	n.s.

[1] $p < .05$.

[2] $p < .01$.

Overconformity to Norms the comparable correlations are low and negative (r's range from -.18 to -.05 and are non-significant). For stress from non-NASA employees the pattern of correlations is similar with such stress being correlated .15 with cholesterol for persons high on the personality measure and being perfectly uncorrelated .00 for persons low on the personality measure (the difference between the two coefficients is non-significant).

No similar interaction effects of personality and stress are found for Deny Bad Self, the other Crowne-Marlowe scale in this study. The above findings suggest that persons who feel strongly motivated to conform to norms of the social system they are in are likely to experience elevated cholesterol as they experience stress from distant organizational territories because such stress, per se, is an indicator that they are not able to meet the wishes of others. In other words, they are not able to conform to norms of the organization which probably include meeting the demands of other role senders. Thus, such stress runs counter to a strong need to conform and prevents satisfaction of that need. On the other hand, persons low on this need to conform have, in effect, a buffer between the stress of contact with other organizational territories and possible reactions via elevated cholesterol.

The Conditioning Effect of Relations with Role Senders on the Correlation Between Stress from Organizational Territories and Strain

Table 131 presents data showing that persons who report poor rather than good relations with their subordinates show positive correlations between the amount of stress they report from different organizational territories within NASA and pulse rate (the r's range

TABLE 131

THE EFFECT OF RELATIONS WITH SUBORDINATES ON THE CORRELATION BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND PULSE RATE

Source of Stress	Relations with Subordinates			$r_{Poor} > r_{Good}$, p<
	Poor N=60	Medium N=57	Good N=76	
Own branch or office	.20	.04	.01	n.s.
Other branches	$.36^{2}$	.12	-.05	.01
Other divisions	.19	-.08	.03	n.s.
Other directorates	.18	.04	-.02	n.s.
Other bases	$.28^{1}$	$.26^{1}$	.04	.10
Non-NASA employees e.g., contractors	.02	.06	.11	n.s.

[1] $p < .05$.

[2] $p < .01$.

from .18, n.s., to .36, $p < .01$). For persons reporting good relations with their subordinates, stress and pulse rate are uncorrelated (r's range from -.05 to .04). There is no interaction between relations with subordinates and stress from non-NASA employees. In Table 131 the two strongest interaction effects deal with stress from other branches and from other bases.

The pattern of these findings is repeated when the conditioning variable is changed to either relations with one's work group or with the superior as shown in Tables 132 and 133.

Together these findings indicate that elevated pulse rate, as a potential reaction to organizational stresses, may be prevented by the presence of good working relations with members of the person's role set.

TABLE 132

THE EFFECT OF RELATIONS WITH WORK GROUP ON THE CORRELATION BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND PULSE RATE

Source of stress	Work Group			$r_{Poor} > r_{Good}$, p<
	Poor N=76	Medium N=68	Good N=58	
Own branch or office	.04	.10	-.03	n.s.
Other branches	.16	.16	-.16	.05
Other divisions	.03	.24[1]	-.05	n.s.
Other directorates	.11	.13	-.10	n.s.
Other bases	.34[2]	.31[1]	.09	.10
Non-NASA employees e.g., contractors	-.03	.06	.06	n.s.

[1] $p < .05$.

[2] $p < .01$.

TABLE 133

THE EFFECTS OF RELATIONS WITH SUPERIOR ON THE CORRELATION BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND PULSE RATE

Source of stress	Superior			$r_{Poor} > r_{Good}$, p<
	Poor N=74	Medium N=58	Good N=68	
Own branch or office	-.03	.06	.24[1]	.10
Other branches	.10	.02	.00	n.s.
Other divisions	.04	.08	.06	n.s.
Other directorates	.02	.13	.01	n.s.
Other bases	.28[1]	.20	-.04	.05
Non-NASA employees e.g., contractors	.06	.06	.09	n.s.

[1] $p < .05$.

Type A Personality Measures as Conditioners of the Relationship Between Deadline Pressures from Different Organizational Territories and Strain

It was pointed out earlier that Type A personality measures condition the relationship between subjective quantitative work load, including time under deadline pressures, and measures of strain including glucose, blood pressure, serum cortisol, and heavy smoking. As part of the study persons indicated the extent to which such deadline pressures came from different territories of the organization (see item 23, Appendix VI). The use of this measure of stress uncovers some additional conditioning effects of personality.

Table 134 presents data showing that persons with high scores on Competitive Orientation tend to show positive correlations between reported deadline pressures from more distant levels within the organization and serum cholesterol. These correlations become progressively more positive as the level of the organization from which the deadline pressure emanates becomes more distant (r's increase from -.16 up to .36). For persons with low scores on Competitive Orientation the pattern of findings tends to be somewhat the opposite; the correlations between deadline pressures from organizational territories and serum cholesterol tend to become more negative. No interaction between personality and deadline pressures from non-NASA employees occurs.

Since the correlation coefficients change from negative to positive for persons with high scores on Competitive Orientation, and tend to do the opposite for persons with low scores, it is possible that this effect is due to an inverse correlation between reported deadline pressures from proximal as opposed to distal parts of the

TABLE 134

THE CONDITIONING EFFECT OF COMPETITIVE ORIENTATION ON THE CORRELATION BETWEEN SOURCES OF DEADLINE PRESSURES AND SERUM CHOLESTEROL

Source of deadline pressures	Competitive Orientation			$r_{Low} < r_{High}$, p<
	Low N=67	Medium N=69	High N=64	
Subordinates	-.23	.18	-.02	.10
Colleagues	.01	.19	-.16	n.s.
Self	-.01	.04	-.15	n.s.
Immediate superior	-.18	.21	-.11	n.s.
Higher superiors in the division	-.14	-.06	.02	n.s.
Head of directorate	-.30[1]	-.04	.09	.025
Heads of other directorates	-.29[2]	.11	.22	.005
Head of the base	-.18	.14	.26[1]	.01
Other bases	-.12	.08	.36[1]	.005
Non-NASA employees e.g., contractors	-.19	-.04	.05	.10

[1] $p < .05$.

[2] $p < .01$.

organization. An inspection of the interitem correlations between these measures of source of deadlines, presented in Table 135, shows, however, that the items are positively correlated with one another with few exceptions and those exceptions have coefficients no greater than .05 in absolute magnitude. Therefore, the change in correlations does not derive from the interrelations among the different measures

TABLE 135

INTERITEM CORRELATIONS BETWEEN SOURCES OF DEADLINE PRESSURE[1]

Source	a	b	c	d	e	f	g	h	i
a. Subordinates	--								
b. Colleagues	.33	--							
c. Self	.12	.20	--						
d. Superior	.23	.21	.15	--					
e. Higher superiors in dividion	.12	.12	.16	.42	--				
f. Head of directorate	.08	.02	-.05	.24	.45	--			
g. Heads of other directorates	.14	.03	-.01	.24	.40	.65	--		
h. Head of base	-.05	.01	-.03	.16	.32	.70	.68	--	
i. Other bases	.03	-.01	.02	.11	.30	.43	.49	.59	--
j. Non-NASA employees	.08	.09	.13	.05	.18	.00	.21	.06	.20

[1] N ≦ 200.

of sources of deadline pressures, and the pattern of results apparently reflects the more stressful nature of dealing with deadlines from more distant organizational territories.

This pattern of findings also shows up when three other Type A personality measures are used as the conditioning variables. The Type A measures are Leadership, Range of Activities, and Environmental Overburdening. Their conditioning effects, which are not as striking as those presented in the above table, are presented in Appendix XX. These three additional measures of Type A do not appear to have any particular conceptual characteristics in common to differentiate them from the other measures of Type A. Furthermore they correlate .48 with the Competitive Orientation measure which is not much higher than all the Type A Sales cluster correlate with one another (r = .41). Thus, psychometrically, it is unlikely that they form any special cluster of personality measures. Since they only show weak replications of the initial finding using Competitive Orientation as the conditioning variable, it is likely that their effects reflect only the intercorrelations between themselves and the Competitive Orientation measure rather than independent findings.

Overall these findings again show that strain is greatest for Type A persons under deadline pressures Furthermore, as the source of pressure becomes more distant from the home territory (branch) of the person, the strain increases.

<u>The Conditioning Effect of the Crowne-Marlowe Scales on the Relationship Between Deadline Pressures from Different Organizational Territories and Strain</u>

Data were previously shown which indicated that persons with high scores on Overconformity to Norms, a scale derived from the Crowne-Marlowe, showed a positive correlation between amount of overall stress reported from different organizational territories and serum cholesterol. Furthermore, this relationship increased with stress from more distant territories within NASA. For persons low on the measure there was no stress-strain relationship. Now a similar effect is found for this same personality measure conditioning the relationship between the extent to which different territories are sources of deadline pressures and the number of cigarettes smoked among smokers. These findings are presented in Table 136.

There is one significant interaction effect in the table between Overconformity to Norms and deadline pressure from the head of the base ($p < .025$). For persons high on Overconformity to Norms, deadline pressures from the head of the base and number of cigarettes smoked are correlated .60 ($p < .01$), but for persons low on this personality measure, the stress and strain are unrelated ($r = .-04$, n.s.).

The other scale derived from the Crowne-Marlowe, Deny Bad Self, also shows very similar conditioning effects. The findings are presented in Table 137. For persons with high scores on Deny Bad Self, the relationship between deadline pressures reported from the head of the base and number of cigarettes smoked among smokers is .54 ($p < .05$); the same correlation for persons with low scores on Deny Bad Self is .00 (the interaction is significant at $p < .025$).

These findings suggest that persons who have high general needs for social approval are likely to respond to deadline pressures, particularly pressures from the head of their base in the case of

TABLE 136

THE EFFECT OF OVERCONFORMITY TO NORMS ON THE CORRELATION BETWEEN SOURCES OF DEADLINE PRESSURES AND NUMBER OF CIGARETTES SMOKED[1]

Source of Deadline Pressure	Overconformity to Norms: Low n=30	Overconformity to Norms: High n=20	$r_{low} < r_{high}$, p<
Subordinates	.34	-.15	n.s.
Colleagues	-.09	-.32	n.s.
Self	.03	.25	n.s.
Superior	.17	.10	n.s.
High level superiors in the division	-.05	.25	n.s.
Head of directorate	.09	.39	n.s.
Heads of other directorates	.11	.17	n.s.
Head of the base	-.04	.60[2]	.025
Other bases	-.01	.11	n.s.
Non-NASA employees	.02	-.38	n.s.

[1]Smokers only.

[2]$p < .01$.

TABLE 137

THE EFFECT OF DENY BAD SELF, CROWNE-MARLOWE SCALE, ON THE CORRELATION BETWEEN SOURCES OF DEADLINE PRESSURE AND NUMBER OF CIGARETTES SMOKED[1]

Source of Deadline Pressure	Deny Bad Self Low N=29	Deny Bad Self High N=23	$r_{Low} < r_{High}$, p<
Subordinates	.32	-.11	n.s.
Colleagues	-.17	-.19	n.s.
Self	.19	-.08	n.s.
Superior	.17	.12	n.s.
Higher level superiors in the division	.11	.05	n.s.
Head of directorate	.10	.37	n.s.
Heads of other directorates	.14	.14	n.s.
Head of the base	.00	.54[1]	.025
Other bases	-.01	.14	n.s.
Non-NASA employees	-.05	-.22	n.s.

[1] $p < .05$.

NASA (in the case of other nationally spread organizations, it might be the head of the particular factory or agency in that geographical area), by smoking heavily. The deadline pressures, perceived to come from powerful organizational figures, may threaten these people's needs to maintain the social approval of others since such deadlines may present the possibility of future failure to meet role demands as the pressures increase. Under such circumstances, these people, who are characterized by their use of denial to defend their esteem and their tendency to overconform to social norms, may react by increasing the amount of smoking they do. For the person low on these needs, such deadline pressures may fail to have the same effect.

Summary of Findings on the Effect of Conditioning Variables on the Relationship Between Organizational Boundary Stress and Strain

Kahn et al. (1964) pointed out that contact with territories on the periphery of the organization and distant territories within the organization are sources of psychological strain for the individual. In this section of the results these findings have been extended to show that for persons high on Type A personality traits, high on need for social approval, and for those who report poor working relations with members of their role set, these strains are particularly accentuated. Figure 21 summarizes these findings.

The conditioning effects of personality and relations with role senders depends, to some extent on the measure of subjective territorially-linked stress that is being used--time spent in communication with distant organizational territories, stress from different territories, and, more specifically, the deadline pressures from such territories. The personality variables which condition these territorial stress-strain relationships include Leadership, Persistence, Environmental Overburdening, Positive Attitude Toward Pressure, Competitive Orientation, Overconformity to Norms, and Deny Bad Self. Relations with superior, work group, and subordinates also serve as conditioning variables. The related strains include serum cortisol, serum cholesterol, serum glucose, systolic blood pressure, pulse rate, and number of cigarettes smoked among smokers.

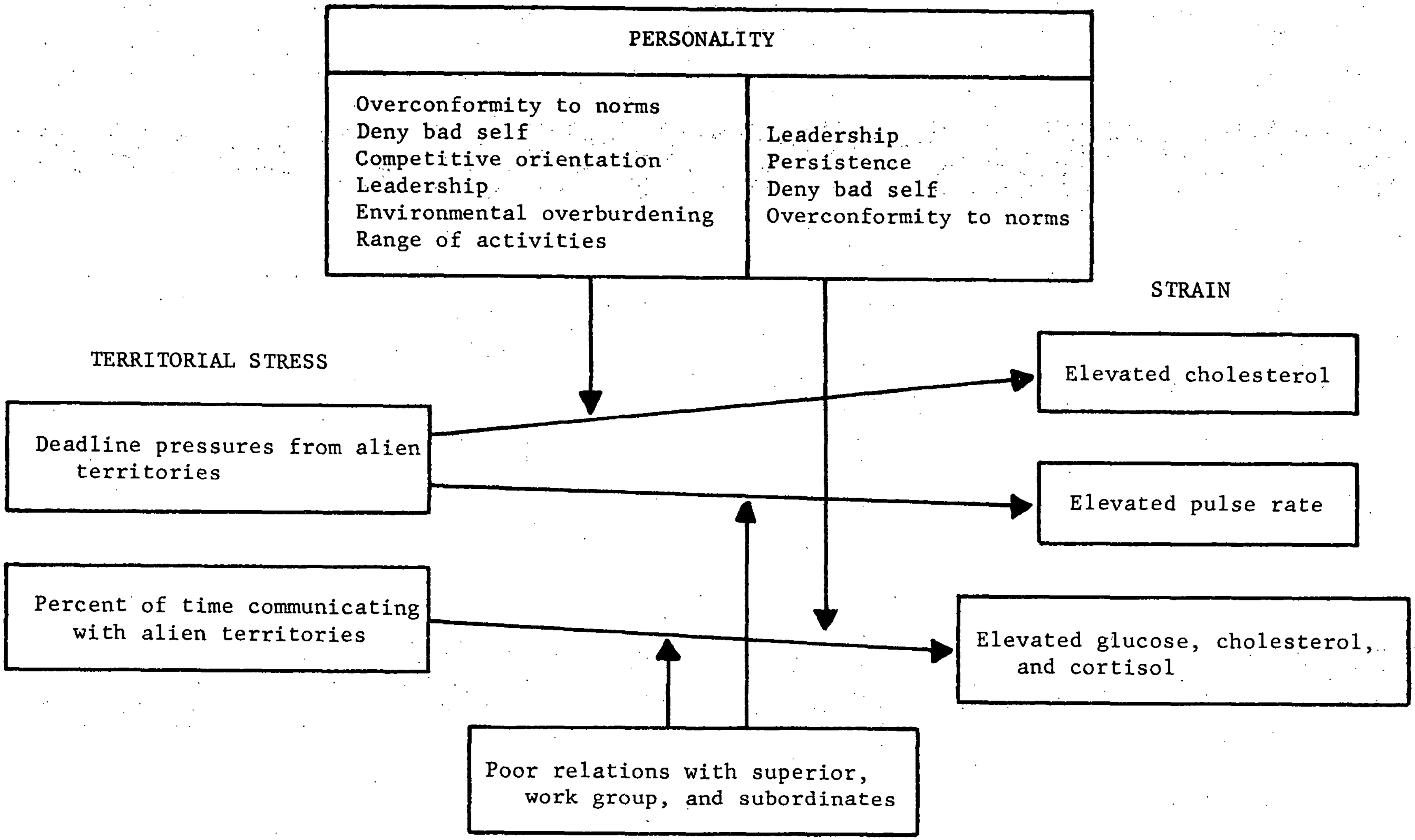

Figure 21. Theoretical interpretation of the effect of conditioning variables on the relationship between organizational territorial stress and strain.

The Conditioning Effect of Personality on the Relationship between Stress and Whether a Person Is a Smoker or Not

In Chapter III evidence was presented to show that smokers differed from non-smokers and ex-smokers. Smokers are more Type A with regard to personality and report the most stress in their job environment. In this section data are reported on the conditioning effects of personality on the relationship between job stress and whether the person is a smoker or not.

Table 138 presents the first and only set of findings dealing with role ambiguity as the stress. There is a tendency for persons who have low scores on the Type A measures in the table to show an _inverse_ relationship between being a smoker and experiencing role

TABLE 138

THE EFFECT OF TYPE A PERSONALITY MEASURES ON THE CORRELATION BETWEEN ROLE AMBIGUITY AND BEING A SMOKER[1]

Personality Measure	Level of Personality			$r_{low} < r_{high}$, $p<$
	Low	Medium	High	
Positive Attitude Toward Pressure	-.38[2]	-.12	.00	.05[3]
Persistence	-.21	-.11	.03	n.s.
Competitive Orientation	-.21	.00	-.05	n.s.
Range of Activities	-.19	-.16	-.04	n.s.
Leadership	-.17	-.13	.00	n.s.

[1]Pearson rather than biserial correlations are used. Even with dichotomous variables, such as smokers versus non-smokers, the Pearson r is to be preferred since the biserial correlation is only an estimate of Pearson r and frequently a very "poor estimate" (Nunnally, 1967). As Nunnally notes, the biserial correlations "definitely should not be used to determine the correlation between sets of empirical data" (p. 124).

[2]$p < .05$, two-tailed.

[3]two-tailed.

ambiguity (r's range from -.38 to -.17). Thus, Type B persons who smoke seem to have low ambiguity. For Type A persons, the comparable coefficients are close to zero. However, none of the interaction effects are acceptably significant. In light of this last point and of the fact that the findings fail to make any sense, they are probably due to chance. No such findings occur when the strain is number of cigarettes smoked.

The next set of findings explores the conditioning effect of personality on the relationship between measures of subjective quantitative work load and being a smoker. Our first findings here concern the conditioning effects of Emotional Dependency on the relationship between office activities and whether a person is a smoker or non-smoker. The findings are presented in Table 139. Being a smoker is

TABLE 139

THE EFFECT OF EMOTIONAL DEPENDENCY ON THE CORRELATION BETWEEN REPORTED OFFICE ACTIVITIES AND BEING A SMOKER

Stress	Emotional Dependency Low N=72	Medium N=50	High N=76	$r_{low} < r_{high}$, p<
Number of outgoing phone calls	-.12	.07	.31[2]	.005
Number of incoming phone calls	-.06	.05	.27[1]	.025
Number of office visits	.08	.21	.38[2]	.05
Percent of time in self-initiated office visits and meetings	-.13	.15	.24[1]	.05
Percent of time in other-initiated office visits and meetings	-.10	.33[1]	.27[1]	.025

[1] $p < .05$.

[2] $p < .01$.

positively correlated with reporting large numbers of outgoing and incoming phone calls, and office visits, but only if the person is high on Emotional Dependency. When we use percent of time measures of office activities, we find a similar pattern of data. Reporting a high percent of time in self- and other-initiated office visits and meetings is positively correlated with being a smoker, but only if the person is high on Emotional Dependency (r's = .24 and .27 respectively). These stresses are unrelated to whether a person smokes or not for persons with low scores on Emotional Dependency (r's = -.13 and -.10 respectively). For persons in the middle personality group, the correlations tend to be of intermediate rank in strength across all the measures of stress in the table. No such findings occur when the strain is number of cigarettes smoked among smokers.

Similar findings occur when Environmental Overburdening is substituted as the personality measure. These data are presented in Table 140. Being a smoker is positively correlated with the

TABLE 140

THE EFFECT OF ENVIRONMENTAL OVERBURDENING ON THE CORRELATION BETWEEN THE ESTIMATED FREQUENCY OF OFFICE ACTIVITIES AND BEING A SMOKER

Estimated Number of	Environmental Overburdening Low N=77	Medium N=54	High N=69	$r_{low} < r_{high}$, p<
Self-initiated phone calls	-.08	-.04	.16	.10
Other-initiated phone calls	-.08	.05	.15	.10
Office visits	.14	.20	.42[1]	.05
Self-initiated meetings	.07	-.06	.33[1]	.10
Other-initiated meetings	.08	-.08	.07	n.s.

[1] $p < .01$.

number of office visits and the number of self-initiated, but not other-initiated meetings persons report attending if the person scores high on Environmental Overburdening (r's = .42 and .33 respectively, both $p < .01$). Furthermore, there are non-significant trends in the same direction with regard to the correlations between self- or other-initiated phone calls and whether the person smokes or not (r's = .16 and .15, n.s.). Similar relationships were reported earlier using number of cigarettes smoked among smokers as the measure of strain. For persons scoring low on Environmental Overburdening, the correlations between these stresses and whether the person smokes or not are low and nonsignificant (r's range from -.08 to .14). However, the only interaction effect which approaches the acceptable .025 level of significance is the set of correlations dealing with number of office visits although three of the other interactions are significant at p .10.

Since Emotional Dependency and Environmental Overburdening are completely unrelated to one another (r = .00), these last two tables represent independent sets of findings. An examination of the other personality variables further shows that there are no similar interaction effects when other Type A measures are substituted.

In an earlier section examining the conditioning effects of personality on the relationship between subjective measures of overload and strain, Emotional Dependency showed no conditioning effects on the relationship between work load and number of cigarettes smoked. Thus, similar findings <u>do not</u> occur when one substitutes the number of cigarettes smoked for smoking per se as the measure of strain. On the other hand, there was a positive correlation between the number of cigarettes smoked, given that the person smoked, and estimated number of incoming ($r = .36$) but not outgoing phone calls ($r = .12$) for persons high on Environmental Overburdening. For persons scoring low on Environmental Overburdening the correlations were non-significant and negative. Thus, self-initiated phone calls tend to be positively correlated with whether the person smokes or not, and with how much he smokes among smokers only for persons with high scores on Environmental Overburdening.

A third finding also deals with overload as a stress. Table 141 presents the conditioning effect of Competitive Orientation on the relationship between deadline pressures from different role senders and being a smoker. There are significant interaction effects due to the conditioning personality variable Competitive Orientation. When

TABLE 141

THE EFFECT OF COMPETITIVE ORIENTATION ON THE CORRELATION BETWEEN DEADLINE PRESSURES FROM ROLE SENDERS AND BEING A SMOKER

Source of Deadline Pressures	Competitive Orientation Low N=67	Medium N=69	High N=64	r $r_{low} < r_{high}$, p<
Subordinates	-.12	-.14	.25[1]	.025
Colleagues	.00	-.08	.11	n.s.
Self	.01	.00	.10	n.s.
Immediate superior	-.12	.25	.27[1]	.025
Higher superiors in the division	-.02	.17	.33[2]	.025
Head of directorate	-.01	.20	.32[2]	.05
Heads of other directorates	-.01	.34[2]	.11	n.s.
Head of the base	-.04	.17	.14	n.s.
Other bases	-.06	.20	.23	.10
Non-NASA employees	-.09	.28[1]	.00	n.s.

[1]$p < .05$.

[2]$p < .01$.

the sources of deadline pressures are subordinates, immediate superior, higher superiors in the division, and the head of the directorate, there is a positive correlation between amount of deadline pressure from the source and being a smoker for persons high on Competitive Orientation (r's range from .25 to .33). For persons low on this personality measure of Type A the comparable correlations are non-significant (r's range from -.12 to -.01). For persons falling into the middle group on Competitive Orientation, the coefficients tend to be of intermediate magnitude. Thus, the higher the person scores on Competitive Orientation, the more likely being a smoker will be associated with reporting certain role senders as sources of deadline pressures. There are no similar effects when number of cigarettes smoked is substituted for being a smoker.

Tables 142 and 143 present two other Type A personality measures which show similar conditioning effects. For persons with high scores on Leadership and Positive Attitude Toward Pressure, deadline pressures, particularly from the immediate superior and levels of the organization up to the heads of other directorates, tend to be positively associated with being a smoker (r's range from .14 to .31). For persons low on these Type A measures the comparable correlation coefficients are close to zero (r's range from -.09 to .19). Since the significance of the interaction effects is low generally these data only represent trends supporting the pattern of findings presented in Table 141.

Table 144 presents some findings which are similar to those just discussed. The independent variable is a measure of the extent

TABLE 142

THE EFFECT OF LEADERSHIP ON THE CORRELATION BETWEEN DEADLINE PRESSURES FROM ROLE SENDERS AND BEING A SMOKER

Source of Deadline Pressure	Leadership			$r_{low} < r_{high}$, p<
	Low N=73	Medium N=62	High N=63	
Subordinates	-.02	-.14	.18	n.s.
Colleagues	.05	-.24	.19	n.s.
Self	.13	-.08	.03	n.s.
Immediate superior	.19	.09	.14	n.s.
Higher superiors in division	.15	.03	.30[1]	n.s.
Head of directorate	.03	.19	.29[1]	.10
Heads of other directorates	.01	.10	.28[1]	.10
Head of base	.06	.17	.08	n.s.
Other bases	-.01	.19	.21	n.s.
Non-NASA employees	-.09	.14	.09	n.s.

[1] $p < .05$.

TABLE 143

THE EFFECT OF POSITIVE ATTITUDE TOWARD PRESSURE ON THE CORRELATION BETWEEN DEADLINE PRESSURES FROM ROLE SENDERS AND BEING A SMOKER

Source of Deadline Pressures	Positive Attitude Toward Pressure: Low N=71	Medium N=61	High N=70	$r_{low} < r_{high}$, p<
Subordinates	-.13	.17	.00	n.s.
Colleagues	.07	.02	.07	n.s.
Self	-.02	-.01	.00	n.s.
Immediate superior	.10	.00	.28[1]	n.s.
Higher superiors in division	.14	.11	.23	n.s.
Head of directorate	.08	.17	.20	n.s.
Heads of other directorates	-.09	.06	.31[2]	.025
Head of base	.04	.19	.08	n.s.
Other bases	.09	-.02	.22	n.s.
Non-NASA employees	-.11	-.01	.24[1]	.025

[1] $p < .05$.

[2] $p < .01$.

TABLE 144

THE EFFECT OF RANGE OF ACTIVITIES ON THE CORRELATION BETWEEN STRESS FROM DIFFERENT ORGANIZATIONAL TERRITORIES AND BEING A SMOKER

	Range of Activities			
Territory	Low N=82	Medium N=51	High N=66	$r_{low} < r_{high}$, $p<$
Own branch	-.03	-.12	.08	n.s.
Other branches	-.13	.26	.34[2]	.005
Other divisions	-.10	.11	.15	.10
Other directorates	-.10	-.05	.28[1]	.025
Other bases	-.28	-.08	.11	.025
Non-NASA employees e.g., contractors	-.14	-.07	.15	.05
Overall stress	-.18	-.03	31[2]	.005

[1]$p < .05$.

[2]$p < .01$.

to which different territories of the organization are a source of stress for the individual, and the dependent variable is again whether the person smokes or not. Persons with high scores on Range of Activities show a positive correlation between stress from different organizational territories and being a smoker (r's range from .08 to .34). However, persons who score low on this Type A measure tend to show inverse relationships between the amount of stress they report from various parts of the organization and being a smoker (r's range from -.03 to -.28). The last row in the table represents a summary measure of overall stress reported from all levels or territories of the organization. For persons high on Range of Activities, the correlation between such stress and being a smoker is .31 ($p < .01$) while the same correlation is -.18 (n.s.) for persons low on Range of Activities.

Appendix XX presents the conditioning effects of four additional Type A measures: Leadership, Environmental Overburdening, Positive Attitude Toward Pressure, and Sense of Time Urgency. These four personality measures show weak, but similar, conditioning effects on the relationship between reported stress from different organizational territories and being a smoker or not. In general, there are weak trends in the same directions, as noted earlier, when number of cigarettes smoked among smokers is substituted for being a smoker per se (see Appendix XIX).

The final set of findings in this section deals with the conditioning effects of Type A personality measures on the relationship between the index and factor measures of subjective work load and being a smoker. Table 145 presents the effect of Competitive Orientation on this relationship. High scores on the subjective quantitative overload factor and being a smoker are positively correlated ($r = .34$, $p < .01$) for persons high on Competitive Orientation but are uncorrelated ($r = .01$) for persons low on this Type A measure. However, Competitive Orientation shows no conditioning effect when the stress is the subjective quantitative work load index. Being a smoker is positively correlated with this latter measure of stress for all three levels of the personality trait (r's = .22, .14, and .25). There are no similar effects when number

TABLE 145

THE EFFECT OF COMPETITIVE ORIENTATION ON THE CORRELATION BETWEEN INDICES OF SUBJECTIVE WORK LOAD AND BEING A SMOKER

Subjective Work Load Measure	Competitive Orientation Low N=67	Medium N=69	High N=64	$r_{Low} < r_{High}$, p<
Quantitative overload factor	.01	.10	.34[2]	.05
Quantitative work load index	.22	.14	.25[1]	n.s.
Qualitative overload factor	-.26	-.04	.10	.025
Qualitative work load index	.07	.06	.17	n.s.

[1] $p < .05$.

[2] $p < .01$.

of cigarettes smoked by smokers is the measure of strain.

The main difference between the subjective quantitative overload factor and the work load index is that the former asks the person how much pressure his work load constitutes while the latter asks how much work load there is. Therefore, it is likely that the former measure is a reflection of psychological strain due to quantitative work load stress (the factor correlates .22 with job-related threat, but is unrelated to job satisfaction, r = .10, and self-esteem, r = .01; the index is unrelated to threat, r = -.02, but is positively correlated with job satisfaction, r = .18, and self-esteem, r = .16).

The presence of interaction effect only for the factor measure suggests that Competitive Orientation conditions only the relationship between being a smoker and experiencing <u>strain</u> but not stress due to work load. Such a process is depicted in the model in Figure 22.

Personality

↓

Subjective stress ⟶ psychological strain ⟶ smoking

Figure 22. Theoretical model of the relationship between personality, stress, and strain.

In this model psychological strain is an intervening variable linking subjective stress and smoking. Whether the person smokes or not as a response to psychological strain, according to the model, will depend on the individual's personality since different types of people may show different behavioral responses to psychological strain.

One more interaction effect appears in Table 145, and this one does reach acceptable significance at $p < .025$. The subjective qualitative overload factor is negatively correlated with being a smoker ($r = -.26$) if the person has a low score on Competitive Orientation, but the factor is positively correlated ($r = .10$) with being a smoker if the person has a high score on the personality measure. Since the subjective qualitative overload factor seems to measure stress due to competition, it appears that persons who are low on Competitive Orientation and who report high stress from competition are likely to be non-smokers, while persons who are high on this Type A measure and report high stress from competition are likely to be smokers. Perhaps people who do not enjoy competition, those low on Competitive Orientation, cope with the stress of competition in ways other than via smoking. When the subjective qualitative work load index is substituted as the measure of stress, no conditioning effects occur although persons with high scores on Competitive Orientation, compared to those with low scores, are more likely to be smokers if they report high subjective qualitative work load.

The above pattern of findings is essentially replicated in Tables 146 through 149. In these tables the measures of stress and

TABLE 146

THE EFFECT OF HISTORY OF PAST ACHIEVEMENTS ON THE CORRELATION BETWEEN INDICES OF SUBJECTIVE WORK LOAD AND BEING A SMOKER

Subjective Work Load Measure	History of Past Achievements			$r_{Low} < r_{High}$, p<
	Low N=82	Medium N=51	High N=64	
Quantitative overload factor	.00	.16	.35[2]	.025
Quantitative work load index	.19	.24	.23	n.s.
Qualitative overload factor	-.22[1]	-.22	.17	.01
Qualitative work load index	.06	.27[1]	.12	n.s.

[1] $p < .05$.

[2] $p < .01$.

TABLE 147

THE EFFECT OF INVOLVED STRIVING ON THE CORRELATION BETWEEN INDICES OF SUBJECTIVE WORK LOAD AND BEING A SMOKER

Subjective Work Load Measure	Involved Striving			$r_{Low} < r_{High}$, p<
	Low N=80	Medium N=51	High N=69	
Quantitative overload factor	.03	.03	.25[1]	.10
Quantitative work load index	.25[1]	.09	.12	n.s.
Qualitative overload factor	-.24[1]	-.11	.06	.05
Qualitative work load index	-.12	.25	.17	.05

[1] $p < .05$.

TABLE 148

THE EFFECT OF PERSISTENCE ON THE CORRELATION BETWEEN INDICES OF SUBJECTIVE WORK LOAD AND BEING A SMOKER

Subjective Work Load Measure	Persistence			$r_{Low} < r_{High}$, p<
	Low N=76	Medium N=55	High N=70	
Quantitative overload factor	.02	.16	.28[1]	.10
Quantitative work load index	.21	.17	.18	n.s.
Qualitative overload factor	-.27[1]	-.21	.17	.005
Qualitative work load index	-.06	-.05	.27[1]	.025

[1] $p < .05$.

TABLE 149

THE EFFECT OF LEADERSHIP ON THE CORRELATION BETWEEN INDICES OF SUBJECTIVE WORK LOAD AND BEING A SMOKER

Subjective Work Load Measure	Leadership Low N=73	Leadership Medium N=62	Leadership High N=63	$r_{Low} < r_{High}$, p<
Quantitative overload factor	.05	.07	.34[2]	.10
Quantitative work load index	.18	.14	.28[1]	n.s.
Qualitative overload factor	-.14	-.07	.03	n.s.
Qualitative work load index	-.06	.23	.13	n.s.

[1] $p < .05$.
[2] $p < .01$.

the dependent variable are the same but the following four personality variables are substituted: History of Past Achievements, Involved Striving, Persistence, and Leadership. These four measures correlate from .45 to .56 with Competitive Orientation and correlate with one another from .35 to .62 (the specific inter-cluster correlations have been presented in Table 14). The following characteristics are generally repeated in each of the four tables: a) Type A personality conditions the relationship between the subjective quantitative overload factor and being a smoker but does not condition the relationship between the subjective quantitative work load index and being a smoker; b) the factor is positively correlated with being a smoker for persons high on the Type A measure and is unrelated for persons low on the Type A measure; c) the qualitative overload factor is negatively correlated with being a smoker for persons low on Type A and nonsignificantly but positively related to being a smoker for persons high on Type A; and d) persons with high scores on the Type A measures show positive associations between the subjective qualitative work load index and being a smoker while persons with low scores on Type A show associations close to zero between the index and being a smoker. Again no significant interactions occur when number of cigarettes among smokers is substituted for being a smoker.

Interpreting the Findings on the Conditioned Effects of Stress on Being a Smoker

Having concluded a presentation of the findings dealing with the conditioning effects of personality on the relationship between stress and being a smoker versus a nonsmoker, some interpretations of the findings will be presented. There are different interpretations of the data which can be made although some, as will be argued here, are less plausible than others.

The first interpretation of such findings is that stress for some types of individuals, particularly Type A persons, leads them to become a smoker. It is unlikely that job stress leads the person to become a smoker since if stress, particularly high work load, led to smoking, the interval of causation between stress and becoming a smoker would be rather small--perhaps only a few minutes, an hour, or even a day. Research reviewed earlier, however, points out that most smokers decide to smoke in their early teens. Nevertheless, it is possible that some people who were Type A eventually took up smoking after prolonged exposure to a high stress job, and that persons who were Type B, after similar exposure, gave up smoking. The fact that many of the same conditioning effects are present when number of cigarettes among smokers is substituted for being a smoker, as in the case of territorial stress-strain relationships, lends some support for this interpretation particularly if the decision to start to smoke and the decision to smoke more once one smokes are interrelated to the same antecedant mechanisms. However, while Type A personality conditions the relationship between territorial stress and both whether a person smokes and how much they smoke, this is not the case when the stress is subjective quantitative work load. In the latter case the only smoking behavior which is related to the stress is whether, not how much, the person smokes.

A second interpretation of the data is that persons who are Type A or who score high on certain personality measures such as Emotional Dependency tend to smoke <u>and</u> to be in high work load positions. Persons who are Type B or low on Emotional Dependency may tend to be nonsmokers and tend to end up in low work load positions. In such a case either the organization or the individual would be selecting the person into such low or high stress environments. The characteristics of the person would lead him to decide to smoke or not independently of the nature of the stress, but the coincidence of being high on stress and being a smoker would produce the conditioned stress-smoking effects just reported for persons high on the appropriate personality measures.

An examination of data presented earlier in Chapter III on the relationship of personality to stress and smoking indicates the extent to which this latter interpretation can be supported. Data presented earlier in Table 72 show that Type A personality is positively correlated with measures of subjective quantitative work load (Emotional Dependency, however, is unrelated to subjective measures of work load). However, there are practically no significant relationships between being a smoker and personality (see Table 79), although there is a positive correlation ($r = .27$) between Emotional Dependency and heavy cigarette smoking. Thus, while Type A persons tend to be found in high subjective work load environments, they are not more likely than Type B persons to be smokers. Thus, it is unlikely that the conditioned relationships between subjective work load and being a smoker are due to the fact that Type A persons are more likely to be smokers prior to entering the job.

In summary, persons who score high on Type A measures of personality and who report high stress, particularly in the form of subjective quantitative work load, are likely to be smokers. Some evidence suggests that persons who score low on the Type A measures are less likely to be smokers given that they also experience high subjective work load. The mechanisms by which such associations occur are not clear. However, the findings are consistent with the expectation that Type A persons should, in particular, show positive associations between stress and risk factors in coronary heart disease, and therefore these results merit further attention.

Person-Environment (P-E) Fit as a Predictor of Strain

In this section we continue our focus on the conditioning effects of personality characteristics on the relationship between stress from the job environment and strain. In this analysis, however, an attempt is made to use relatively commensurate measures of person and environment rather than somewhat noncommensurate measures of personality and job environment. The use of commensurate dimensions allows one to compute P-E fit scores for each individual along a single person-environment dimension and predict from these scores to strain. The procedures for computing such scores will be described shortly.

As noted earlier, in reviewing the literature on P-E fit, P can be defined as a need and E as the presence or absence of supplies to meet that need, or P can be defined as an ability and E as job demands which utilize the ability. In any case, the relationship between P-E fit and strain should be represented by two hypothetical curves. These curves are presented in Figure 23. Curve A is U-shaped. In this curve, strain is lowest when there is the minimum amount of discrepancy between P and E. On the other hand, when P becomes greater than E, strain increases, and when P becomes less than E, strain also increases. A good example of such a potential relationship between P-E fit and strain might be the fit between how much work the person is able to do (P) and how much the job demands (E) and its effect on strain. In this case, if E is less than P, the person might experience boredom. On the other hand, as E begins to exceed P, the person might experience fatigue.

The second curve, B, illustrates the case where having too little of something you want ($P > E$) produces strain, but having an excess amount has no effect. For example, a person might require a minimum amount of food and any food in excess of that

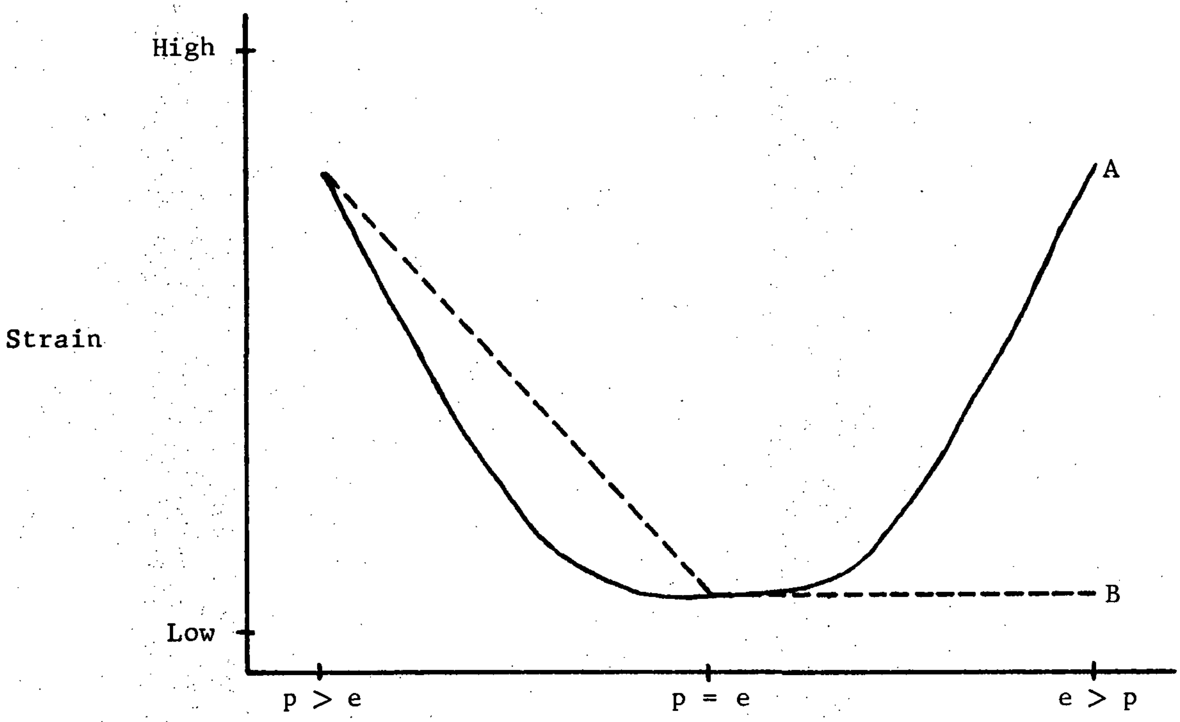

Figure 23. Two hypothetical P-E fit curves.

amount might contribute little to reducing strain. This type of P-E fit curve would asymptote out after an acceptable level of fit has been reached.

No specific predictions have been made as to which type of curve will be represented by specific relationships between P-E fit and strain in this study. Nevertheless, the shape of the curves will be examined to see if different-shaped curves tend to go with certain types of P-E fit and not with others.

Now the method of analyses used to test the explanatory power of P-E fit will be described. First, a series of one-way analyses of variance were carried out using as the independent variables clusters of items measuring characteristics of the job environment (E) and commensurate characteristics of the person (P). The P cluster and E cluster for each independent variable were commensurate in that they used almost identical wording and identical format. The E cluster items were phrased in terms of the extent to which the variable was present in the environment (for example, "the amount of time you have") while the P cluster items were phrased in terms of the extent to which the person would like each variable or job aspect to be present in the environment (such as, "the amount you would like"). All together eleven clusters of the P-E fit items were constructed (see Chapter 2 for a description of the criteria used to construct the clusters; the item content is presented in Appendex X). These eleven clusters cover occupational stress related to the following areas:

1) Role ambiguity,

2) Quantitative work load,

3) Qualitative work load,

4) Complexification,

5) Utilization of abilities,

6) Participation,

7) Opportunity to advance,

8) Responsibility for persons,

9) Responsibility for things,

10) Relations with superior, and

11) Relations with subordinates.

Since the items were originally measured on 5-point scales, a person could have a score ranging from 1 to 5 on the item measuring the extent to which E was present in the person's environment and a 1 to 5 score on the item measuring P, how much the person wanted of E. P-E fit scores were obtained by simply subtracting the E item from the P item for each variable. The three sets of scores--P, E, and P-E fit--can be summarized by the following matrix.

		P				
		1	2	3	4	5
	1	0	1	2	3	4
	2	-1	0	1	2	3
E	3	-2	-1	0	1	2
	4	-3	-2	-1	0	1
	5	-4	-3	-2	-1	0

P scores are represented by column headings, and E scores are represented by row headings. P-E fit scores are represented as values in the cells. Each cell value is equivalent to the subtraction of its P column number minus its E row number. Thus, cell values equal to zero represent the case where P = E, cell values greater than zero represent the case where P > E, and cell values less than zero represent the case where E > P.

When scores were obtained for each of the eleven P-E fit clusters listed above, it was apparent that few persons had average scores beyond the range -3 to +3. Thus, to increase cell size at the extreme of the distribution, the range of scores for each P-E fit cluster was re-scaled from ± 4 to $\pm$ 3. Even when this was done, it was apparent from the distribution of P-E fit scores that most people either reported perfect P-E fit or wanted more rather than less than they had of E. Thus, they wanted more work load, utilization of abilities, participation, opportunity for advancement and responsibility than they had. On the other hand, they reported more role ambiguity than they preferred and found relations with their immediate superior better than they required (this probably does not mean they <u>wanted</u> poorer relations with their superior than they had). The actual frequency distributions of the P-E fit scores for each P-E fit cluster may be found in Table 150. Figure 24 presents the average frequency distribution of P-E fit scores across all eleven P-E fit clusters and illustrates the same type of skewedness.

This skewed distribution means that any test of the effects of the interaction of P and E on strain in an ordinary two-way analysis of variance would be difficult to perform since a large number of cells would have no observations in them. As an alternative, each main effect, that is the effect due to E and the effect due to P,

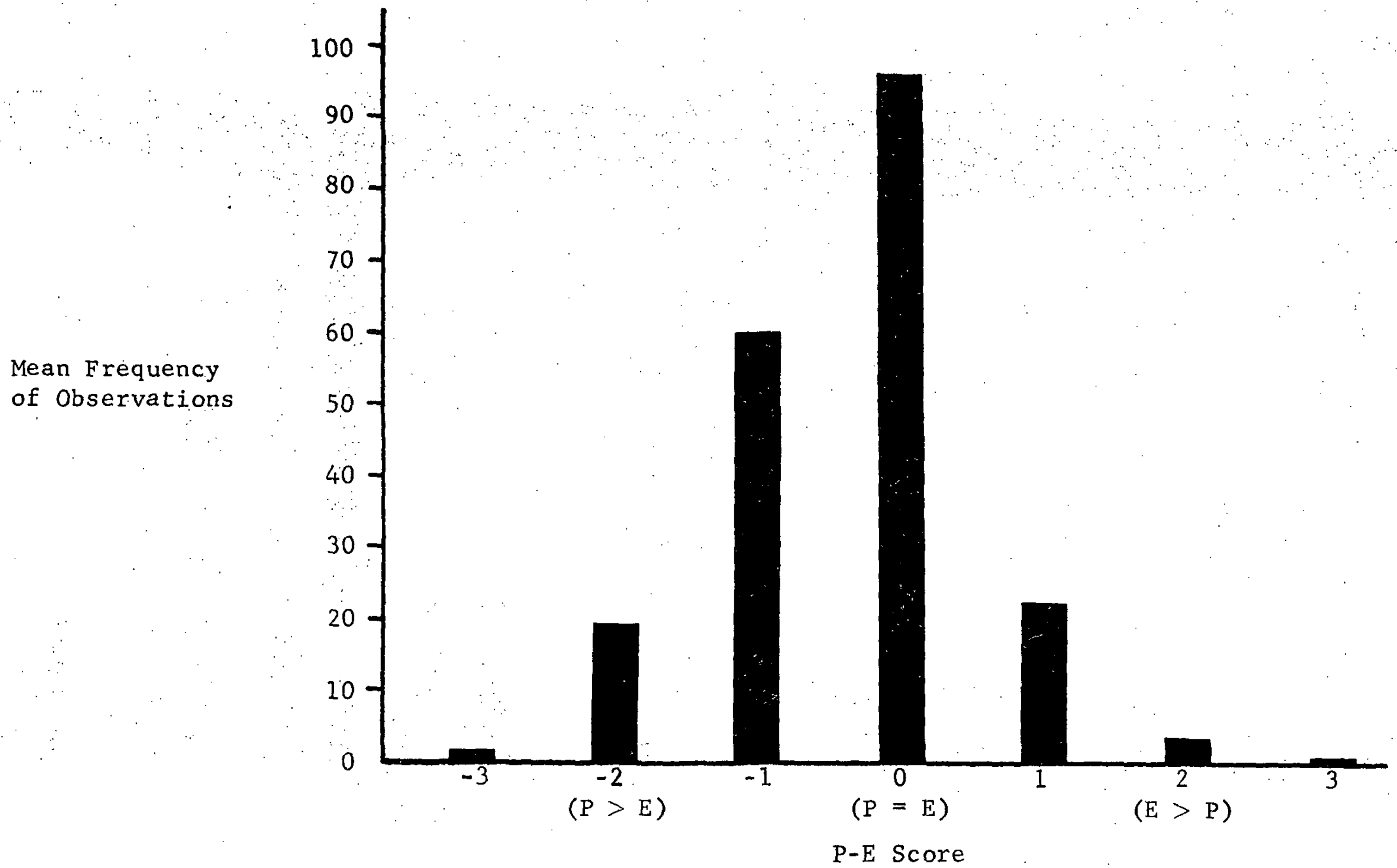

Figure 24. Distribution of the average frequency of P-E fit scores observed across the eleven P-E fit clusters.

can be separately tested in a one-way analysis of variance. Then each PXE interaction effect can be tested by treating the P-E fit score as an independent variable predicting to strain in another one-way analysis of variance. This essentially involves a comparison of the mean strain values between groups who have scores of -3, -2, -1, 0, +1 and so on in the above matrix for each P-E fit cluster. In other words, the mean values of the dependent variables within diagonal strips of cells running from upper left to lower right in the matrix are computed and then compared for differences. This procedure is analogous to testing for interaction effects in a two-way analysis of variance in that any effect due to an interaction will be identified by the analysis process. This procedure has been followed in this analysis.

P-E Fit and Psychological Strain

Examining the percent of variance accounted for in the psychological dependent variables shows that the P-E fit clusters yield an average eta (overall index of percent of variance accounted for; see Nunnally, 1967, pp. 133-136) of .20. The P clusters yield an average eta of .14, and the E clusters yield an eta of .25. Although P-E fit explains significantly more of the variance in our measures of psychological strain than does P alone ($t = 3.09$, $p < .01$), E explains significantly more of the variance in psychological strain than does P-E ($t = 5.41$, $p < .001$). This global look at the P-E fit analyses suggests that it is the interaction of factors in the person with factors in the environment, as well as the absolute level of factors in the environment and in the person, which affect psychological strain.

With this perspective on the contribution of P-E fit in mind, let us turn to the specific findings relating the P-E fit clusters to psychological strain. Table 150 presents those findings using job satisfaction as the measure of strain.

In the table P-E fit scores are represented by values ranging from -3 to +3 at the top of the table. Minus scores represent cases along the P-E fit continuum where P is greater than E; these would be instances of deprivation with regard to E. Plus scores represent cases along the continuum where E is greater than P; these would be instances of excess of E with regard to P. The zero represents the category of perfect P-E fit. Nine out of the elevent P-E fit clusters in the table show significant relationships with job satisfaction. The magnitude of these relationships is quite high with seven of the eleven findings significant at $p < .001$.

Now let us examine the pattern of the findings to see which types of hypothesized P-E fit curves are represented by the data. Note that in each cell in the table the mean job satisfaction score is presented in the upper half of the cell with the cell size just below in parentheses.

In the case of role ambiguity, the highest satisfaction resides among those persons reporting perfect P-E fit. Persons reporting more or less ambiguity than they prefer show decrements in satisfaction. Thus, in this case the P-E fit curve is U-shaped. Overall, there is a tendency in the Goddard sample to report too much rather than too little ambiguity compared to what the person would prefer.

TABLE 150

RELATIONSHIP BETWEEN P-E FIT CLUSTERS
AND OVERALL JOB SATISFACTION:
0 = (P=E), <0 = (P>E), >0 = (E>P)

P-E Fit Cluster	P-E Fit Score							F	p<
	-3[1]	-2	-1	0	1	2	3		
Role ambiguity			2.50 (6)[1]	2.69 (75)	2.54 (98)	2.31 (23)	2.11 (4)	3.44	.001
Quantitative work load	2.42 (6)	2.65 (88)	2.54 (104)	2.13 (8)				3.11	.05
Qualitative work load		2.65 (21)	2.66 (148)	2.22 (30)	1.89 (6)	1.58 (2)		10.91	.001
Complexification		2.41 (6)	2.59 (37)	2.56 (129)	2.56 (35)			.21	n.s.
Utilization of abilities	2.05 (6)	2.28 (18)	2.48 (70)	2.68 (98)	2.70 (4)			5.07	.001
Participation	2.60 (2)	2.28 (28)	2.49 (89)	2.73 (85)	2.62 (3)			5.88	.001
Opportunity to advance	2.57 (9)	2.33 (39)	2.44 (87)	2.79 (61)	3.00 (9)			9.25	.001
Responsibility for persons		2.30 (13)	2.42 (59)	2.65 (119)	2.71 (14)	2.22 (2)		3.59	.01
Responsibility for things		1.87 (5)	2.37 (49)	2.65 (136)	2.56 (14)			7.03	.001
Relations with superior			2.98 (4)	2.66 (135)	2.34 (56)	2.26 (11)		7.55	.001
Relations with subordinates			2.39 (9)	2.60 (177)	2.28 (13)			2.92	.10

[1] n for cell.

With regard to quantitative work load, no one reports more work than they want, and, indeed, there is a tendency to want more work than one already has. In light of earlier comparisons of the incidence of various types of job stresses at Goddard and in a national study (Kahn et al., 1964), this finding is quite surprising. If anything, one might have suspected that the Goddard sample, which reported such high work load, would have reported a need for less quantitative work load. Instead they want more work than they have. One possibility is that our sample has insatiable needs for more work which they then seek out and which would account for the high amounts of work load they report. Another possibility is that it is socially desirable to ask for more work and never admit that you are overworked. However, there is no relationship between the quantitative work load P-E fit measures and either Crowne-Marlowe subscale (eta = .16, n.s. with Deny Bad Self; and eta = .12, n.s. with Overconformity to Norms).

Qualitative work load shows a similar pattern. The majority of respondents want more, rather than less, qualitative work load, and the more they want, the more they tend to report high job satisfaction. Here again there is no relationship between P-E fit and the Crowne-Marlowe subscales (eta = .10 for Deny Bad Self, and eta = .11 for Overconformity to Norms). Still, it is this writer's impression that there are norms against admitting that there is too much or too difficult work at NASA (the subjective qualitative overload factor, for example, correlates -.22, $p < .01$, with a high score on Deny Bad Self; the subjective qualitative work load index, the E measure, is uncorrelated with Deny Bad Self, $r = .04$). On the other hand, preliminary interviews at NASA indicated that the people who reported a lot of work also enjoy it. This may indicate that the NASA group is a population preselected for its high motivation to work.

Complexification, the next P-E fit measure in the table, is the only cluster unrelated to job satisfaction. Continuing down the table, we see that as the need for utilization of abilities decreases, the reported amount of job satisfaction increases. In this case, the P-E fit curve appears to asymptote as the opportunity for utilization begins to exceed the need for it. Thus, additional utilization beyond what the person wants may add little to his satisfaction.

Satisfaction is again highest for persons reporting perfect fit between the amount of participation they have and the amount they want. Most people who report poor fit tend to report fewer opportunities for participation than they would like, and their satisfaction is relatively low. There is some evidence of a U-shaped curve here although the cell sizes in the extreme categories are too small to reach any conclusion about the curve's shape.

Opportunity to advance seems to represent another insatiable need. One is fairly well satisfied if there is as much opportunity as one wants, but satisfaction is even greater if there is more opportunity than is needed. On the other hand, having less opportunity than one wants is associated with low job satisfaction. In the Goddard sample, cases of poor P-E fit are more likely to be represented by too little rather than too much opportunity to advance.

With regard to responsibility both for persons and for things, most people report too little rather than too much responsibility.

Responsibility for persons shows an asymptoting curve for job satisfaction. Too much responsibility leads to increased job satisfaction but the increase in satisfaction is small once the amount of responsibility for persons begins to exceed the amount the person reports he would like to have. Too little as well as too much responsibility for things, that is for projects, budget, and equipment, is associated with dissatisfaction rather than satisfaction.

With regard to relations with one's immediate superior, most people who report poor fit tend to report better relations with their superior than they say they would like. As noted earlier, this probably means the quality of relations exceeds their expectations and probably does not imply that they want poorer relations with their superior.

Most of the sample (177 out of 190 respondents or about 81 percent) reports perfect fit with regard to relations with subordinates. Almost as many persons report relations with subordinates which exceed what they would like as report relations which are not as good as they would like.

Perfect P-E fit both for relations with superior and relations with subordinates tends to be associated with high satisfaction. There are only four people out of the total sample of respondents who report poorer relations with their superior than they want, and these four have the highest satisfaction scores, but the cell size is too small to be taken seriously. In the case of relations with subordinates, there is a U-shaped curve relating P-E fit to satisfaction--persons with poor P-E fit have the lowest mean satisfaction scores.

Now additional findings using job-related threat as a measure of strain will be examined. This measure of psychological strain is moderately correlated with job satisfaction ($r = .44$, $p < .001$), and therefore, one should expect to find a set of findings similar to those just described. For the most part, as will now be shown, this is the case. The data are presented in Table 151.

Eight out of eleven, or over 72 percent, of the findings are significant at at least $p < .05$. Over one-third of the findings are significant at $p < .001$. Thus P-E fit is significantly related to job threat. Again the more specific findings will be examined.

Role ambiguity, rather than showing a U-shaped curve this time, appears to asymptote as amount of ambiguity relative to need decreases. Job-related threat is lowest for persons reporting perfect fit or a slight need for more knowledge. On the other hand, threat steadily increases as the amount of information in the job environment exceeds the need for it. This latter state might be described as an over-abundance of certainty, a lack of unpredictability, and the increased presence of the bureaucratic structure in the organization with its well-defined rules and highly prescribed role behaviors.

Quantitative work load P-E fit has a U-shaped curve with low threat occurring at the center of this particular P-E fit distribution and high threat found at the ends. Since everyone either reports perfect P-E fit or wants more quantitative work load, it appears that threat is lowest for persons who are slightly underloaded. This phenomenon may represent a scaling artifact where the true zero point should be at -1.

TABLE 151

RELATIONSHIP BETWEEN P-E FIT CLUSTERS AND JOB-RELATED THREAT:
0 = (P = E), <0 - (P > E), >0 = (E > P)

P-E Fit Cluster	P-E Fit Score							F	p<
	-3[1]	-2	-1	0	1	2	3		
Role ambiguity			2.44 (6)[1]	2.45 (74)	2.64 (98)	2.82 (23)	2.98 (4)	4.70	.001
Quantitative work load	2.94 (6)	2.58 (88)	2.46 (103)	2.99 (8)				3.21	.05
Qualitative work load		2.68 (21)	2.43 (147)	2.86 (30)	3.22 (6)			6.75	.001
Complexification		2.87 (6)	2.45 (37)	2.54 (129)	2.63 (34)			1.13	n.s.
Utilization of abilities	3.06 (6)	2.73 (18)	2.61 (70)	2.48 (98)	2.31 (14)			2.64	.05
Participation	3.64 (2)	2.85 (28)	2.61 (89)	2.40 (84)	1.29 (3)			9.30	.001
Opportunity to advance	2.40 (9)	2.78 (39)	2.60 (87)	2.40 (61)	2.39 (8)			2.98	.05
Responsibility for persons		2.71 (13)	2.66 (59)	2.48 (118)	2.42 (14)			1.84	n.s.
Responsibility for things		2.59 (5)	2.68 (49)	2.50 (135)	2.51 (14)			1.09	n.s.
Relations with superior			2.16 (4)	2.43 (135)	2.79 (55)	2.84 (11)		6.46	.001
Relations with subordinates			3.03 (8)	2.50 (177)	2.83 (13)			4.87	.01

[1] n for cell.

The same is true for P-E fit with regard to qualitative work load. Again, the lowest threat appears at -1 rather than 0 on the P-E fit distributions. The distribution of threat scores along the qualitative work load distribution continuum is also U-shaped although it appears that threat tends to be worse for qualitatively overloaded rather than underloaded persons.

Complexification P-E fit again shows no significant relationship to threat. With regard to utilization of abilities, job-related threat is highest for persons reporting substantially less opportunity for utilization of their skills and abilities than they would like (scale value = -3) and it is lowest for persons who report an excess of opportunity (scale value = 1). The P-E fit curve for participation also descends in the same manner with the least threat occurring where there is the most opportunity to participate regardless of need.

The P-E fit curve for opportunity to advance shows a pattern where low threat is present for persons reporting either an excess of opportunity or perfect P-E fit. Then, as opportunity becomes less than the need to advance, job-related threat increases. The cell in which P-E fit = -3 (where need is greatest relative to opportunity), however, shows a low threat score. The small sample size of the cell, however, may account for its deviance from the pattern set up by the preceding four cells in that row of the table.

Both responsibility for persons and for things have non-significant P-E fit curves. Both curves, however, show a trend for threat to be highest where responsibility is less than the person wants.

Finally, relations with immediate superior and relations with subordinates have significant P-E fit curves. Persons reporting perfect P-E fit regarding relations with their superior tend to report the lowest job-related threat. An exception is the -1 cell where the four persons in that cell who want better relations than they now have report higher satisfaction, but the sample size is too small to be taken seriously. P-E fit for relations with subordinates shows a U-shaped curve, as it did for satisfaction, with the lowest job-related threat occurring for persons who report perfect P-E fit.

There are no significant findings to report using job-related self-esteem as a measure of psychological strain. This has been a common finding in other sections where the relation of stress to strain has been examined. It may be that self-esteem, in and of itself, is not an indicator of strain since it technically measures the evaluation of a person about himself rather than some affective state. As shown in Table 15, the estimated reliability of the self-esteem measure is high (.89) and cannot account for the lack of significant findings using this measure. At any rate, no sound explanation can be offered for the lack of findings dealing with self-esteem.

This completes the findings relating P-E fit to measures of psychological strain. Overall, the data present clear support for the notion the P-E fit does explain additional and significant amounts of variance in job satisfaction and job-related threat. There seems to be a variety of P-E fit curves--some U-shaped, some asymptotic, and others suggesting the presence of relatively unsatiable needs. It seems that the shape of such curves may depend on the person-environment dimension under study. In the case of a P-E fit dimension such as work under- and overload, the shape of the curve may also depend on the population under study. It appears that the population in this study likes its work and is largely willing to take on more work. This might not be the case on the floor of an assembly line however.

P-E fit and Physiological strain.

The average eta for P-E fit and our measures of physiological strain (which include the number of cigarettes the person smokes per day, given that he smokes) is .12. By comparison, analyses using just the P scores of the clusters yields an eta of .14, and the eta using just the E scores is .12. All of these values are quite low.

It has been noted that difference scores such as P-E are inherently less reliable than their components (Cronbach and Furby, 1970, for example). Thus, the low eta values of the P-E fit analysis could be due to attenuation. However, corrections for attenuation, when carried out increase the etas negligibly and do not affect the pattern of relationships.

Now a more specific look at the data will be presented. Overall, the results are quite negative. Only one out of 77 tests, or 1.3 percent of the findings, is significant at $p < .05$. Another finding is significant at $p < .10$. These two findings and related data are presented in Table 152.

The first finding in the table shows that P-E fit for role ambiguity is related to systolic blood pressure. The pattern of mean blood pressure values in each of the P-E fit cells appears somewhat random, however, and it is best to accept this as no more

TABLE 152

SELECTED RELATIONSHIPS BETWEEN P-E FIT CLUSTERS
AND MEASURES OF PSYCHOLOGICAL STRAIN:
0 = (P = E), <0 = (P > E), >0 = (E > P)

P-E Fit Cluster	Strain	P-E Fit Score							F	p<
		-3	-2	-1	0	1	2	3		
Role ambiguity	Systolic blood pressure (Hg. mm)			125.67 (6)[1]	129.09 (75)	134.41 (97)	128.44 (23)	127.03 (4)	2.86	.05
Role ambiguity	Diastolic blood[2] pressure (Hg. mm)			80.82 (5)	81.78 (73)	84.03 (93)	82.20 (21)	80.42 (4)	1.33	n.s.
Responsibility for persons	Cholesterol[2] (% mg.)		202.67 (12)	197.44 (54)	187.46 (115)	180.74 (11)			2.28	.10
Responsibility for things	Cholesterol[2] (% mg.)		183.62 (5)	193.27 (40)	190.26 (126)	193.53 (22)			.23	n.s.

[1]n for cell.

[2]age corrected.

than a chance finding. The data using diastolic, rather than systolic, blood pressure as the measure of strain, presented in the next row of the table, shows no significant relation.

The second finding in the table indicates a relationship between responsibility for persons P-E fit and age-corrected serum cholesterol level. This finding is significant at $p < .10$ ($F = 2.28$).[1] The pattern of the cholesterol values, however, does follow the pattern found when job satisfaction and job-related threat were used as measures of strain. Specifically, strain, as measured by any of these three indicators, increases as the amount of responsibility for persons decreases relative to how much responsibility the person would like. The next row in the table presents the same type of data except that here P-E fit with regard to responsibility for things is examined. This P-E fit measure is unrelated to serum cholesterol ($F = .23$).

As an initial part of the P-E fit analyses, each physiological strain was examined against each <u>single item</u> pair of P-E fit measures. With one exception, the findings were overwhelmingly non-significant. However, the exception merits a bit more attention since it deals with the findings on responsibility and serum cholesterol which have just been presented, and subsequently supports the possibility that those findings may represent more than just chance.

The data are as follows. Sixty-seven P-E fit scores representing 67 pairs of items were examined in relation to serum cholesterol

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[1]When cholesterol is not corrected for age, the P-E fit relationship is significant at $p < .05$ ($F = 2.62$).

levels. Of these, 6 item pairs, or 9 percent, showed significant ($p < .05$) relationships with serum cholesterol. The data for these six item pairs are presented in Table 153. Two of the significant P-E fit relationships in the table deal with responsibility. The curve for item 70AB in the table shows that too much as well as too little responsibility for the work of others is associated with high serum cholesterol. Thus, there is a U-shaped relationship between P-E fit and cholesterol. The curve for item 73AB is also U-shaped showing that too much as well as too little responsibility for carrying out projects and assignments is associated with high serum cholesterol. Item 70AB is part of the responsibility for persons cluster, while item 73AB is part of the responsibility for things cluster.

Two of the remaining four items in the table deal with quantitative overload and particularly time. Item 35AB demonstrates a U-shaped relationship between P-E fit with regard to the amount of time the person spends in meetings and serum cholesterol. Persons who report spending too little or too much time in meetings have the highest serum cholesterol values compared to persons reporting perfect fit. Item 36AB presents a rather jagged P-E fit, cholesterol curve. However, it too appears U-shaped if you compare the average cholesterol of all persons reporting perfect fit with the average cholesterol of all persons reporting either too little or too much time relative to what they want. Persons reporting deficiencies of time have an average cholesterol of 198.40 mg./100 ml.; persons reporting perfect fit have an average cholesterol of 187.68 mg./100 ml.; and persons reporting an excess of time available have an average cholesterol of 191.87 mg./100 ml.

TABLE 153

SELECTED RELATIONSHIPS BETWEEN P-E FIT ITEMS AND SERUM CHOLESTEROL (mg./100 ml.)

P-E Fit Item	P-E Fit Score							F	p<
	-3	-2	-1	0	1	2	3		
35AB. The amount of time you spend in meetings	222.00 (2)[1]	196.29 (24)	187.58 (82)	186.16 (75)	219.80 (10)	205.00 (6)		3.04	.05
36AB. The amount of time you have		211.50 (2)	195.12 (8)	187.68 (74)	201.01 (72)	175.71 (38)	184.53 (6)	3.58	.01
45AB. The number of other people on which your mission accomplishments depend	156.00 (2)	206.55 (20)	181.94 (52)	194.18 (104)	175.38 (13)	191.60 (5)		3.22	.05
70AB. The responsibility you have for the work of others		232.33 (3)	195.33 (21)	187.98 (116)	186.02 (41)	204.73 (15)		2.62	.05
73AB. The responsibility you have for carrying out projects and assignments			213.62 (16)	188.18 (142)	183.36 (33)	212.75 (4)		4.60	.005
89AB. The extent to which your superior has confidence in you and trusts you				190.20 (119)	185.67 (57)	207.75 (20)		3.64	.05

[1] n for cell.

Item 45AB in the table deals with fit regarding the number of other people on which the focal person's mission accomplishment depends. The pattern of mean cholesterol values over the different levels of P-E fit appears neither U-shaped nor linear. Instead it is quite jagged and may represent a chance pattern of findings.

The final item in the table, 89AB, deals with the extent to which the superior has trust and confidence in the focal person. This item is from the relations with superior index. On this item people either report perfect P-E fit or report that their superior has more trust and confidence in them than they would like. If one combines the categories with poor fit, there is a slight tendency for them to show a higher mean cholesterol than the perfect P-E fit category (191.40 vs. 190.26 mg./100 ml.) although this difference is quite negligible. If the categories are not collapsed, we obtain a U-shaped curve.

Overall, five out of these six items show U-shaped curves. Is the U shape a characteristic of relationships between P-E fit and cholesterol? To test this out, the shapes of curves for the other 61 non-significant P-E fit analyses of single items were examined. The curves were categorized as one of the following five types: a) jagged approximations of a straight and horizontal line, b) U-shaped, c) inverted U-shaped, d) ascending, and e) descending straight lines or asymptotes. Twenty out of the 61 curves turned out to be U-shaped. By chance we should expect only 20 percent of the curves to be U-shaped. As it turned out, 33 percent of them were so shaped. Thus, the frequency of U-shaped curves appears to be somewhat greater than one would expect by chance.

P-E Fit in Summary

This completes the analyses regarding the interaction of P and E to effect strain. Overall, the measures of P-E fit appear to have the most explanatory power when dealing with measures of psychological strain rather than physiological strain. Practically all of the P-E fit clusters show significant relationships with job satisfaction and job-related threat. The result is somewhat the opposite when measures of physiological strain are examined. Why might there be this difference between the two types of strain?

The following argument seems to offer a plausible explanation. Our measures of psychological strain are general rather than specific. The respondent is asked to consider a multitude of specific aspects of his job and consider how they affect his satisfaction and feelings of threat--global measures of strain. On the other hand, our measures of physiological strain are highly specific and differentiated. The mechanisms which regulate serum cholesterol are specific and may be quite different from those which regulate serum cortisol or pulse rate. If one represents stress by a dart aimed at a target, then one is more likely to hit or make contact with a broad, highly undifferentiated target, such as is represented by job satisfaction, than to hit a very finite and narrow target, such as is represented, for example, by serum cholesterol or glucose. Thus, to increase the chances of linking poor P-E fit with physiological strain, the range and number of physiological indicators of strain must be expanded. The same argument, incidentally, was made earlier for finding first-order links between job stress and physiological strain.

Variables Which Condition the Relationship between Stress and Strain: A Review of the Findings

This is a brief summarization of the main theoretical findings from this chapter. The general findings are as follows:

1. There is one significant conditioning effect of personality on the relationship between role ambiguity and strain. Serum cortisol is positively correlated with high role ambiguity, but only for persons reporting poor relations with their subordinates.

2. Subjective quantitative work load is negatively related to job satisfaction and positively related to job-related threat and risk factors in coronary heart disease including serum glucose, systolic and diastolic blood pressure, serum cortisol, and heavy cigarette smoking for persons with high scores on most Type A personality variables. The same holds true for persons with high scores on Flexibility. On the other hand, subjective quantitative work load and strain are positively correlated for persons with low scores on Leadership and Competitive Orientation. In these cases it is argued that such persons, who tend to avoid leadership and competitive situations, feel particularly uncomfortable when job demands place them in high environmental press situations.

3. In addition, persons who report high subjective quantitative work load and who also are Type A tend to be smokers rather than non-smokers. It is presently unclear whether being a smoker, per se, is an effect of the interaction of stress and personality or precedes the interaction in some time sequence.

4. Poor relations with members of the person's role set, including his superior, work group, and subordinates produces a positive correlation between subjective quantitative work load measures and serum glucose, pulse rate, systolic and diastolic blood pressure, and heavy smoking.

Good relations with members of the role set seems to act as a buffer between such stresses and all of these physiological strains by reducing these stress-strain relationships to zero.

5. On the other hand, cigarette smoking is inversely correlated rather than uncorrelated with subjective work load for persons who report good relations with their role set. Supporting analyses show that this inverse relationship is due to pressures for conformity to norms which may require that the person should smoke less under heavy work load since smoking may interfere with getting the job done. It is unlikely that the inverse relationship between work load and smoking is due to underreporting biases with regard to the number of cigarettes smoked. For one thing, the same effects do not hold when a measure of denial is substituted as the conditioning variable. Secondly, the effects do hold when physiological correlates of smoking --pulse rate and systolic blood pressure--are substituted as measures of strain.

Findings 4 and 5 point out the importance of good relations and group norms as environmental conditions which may contribute to the person's physical health particularly under conditions of heavy job stress. These findings provide support for prescriptive organizational theories which place emphasis on the importance of supportive relations among members as a key to better well-being among organizational members.

6. Type A personality conditions the relationship between subjective qualitative work load and being a smoker (the correlation is positive) but does not condition the relationship between this stress and other measures of strain. This further points up the value of distinguishing between subjective quantitative and subjective qualitative work load.

7. The importance of conceptual specificity is further reiterated in the findings dealing with the conditioned relationships between responsibility and strain. Type A personality produces a positive correlation between responsibility for persons and strains including systolic and diastolic blood pressure, pulse rate, and serum cholesterol. On the other hand, no conditioning effects of personality are present when the stress is responsibility for things.

8. Persons with high scores on the Type A personality measures show positive correlations between stress associated with relatively distant territories within the organization and strains including serum cortisol, systolic blood pressure, serum cholesterol, pulse rate, serum glucose, and cigarette smoking. In addition need for social approval exerts similar effects as a conditioning personality variable.

9. Persons who are high on Type A and report stress from distant territories within the organization tend to be smokers. This type of finding has been discussed in item 3 above.

10. Poor interpersonal relations also produce positive correlations between stress associated with contact across distant boundaries within the organization and strain--specifically elevated pulse rate.

11. Most of the significant interaction effects reported on deal with stresses measured by specific items rather than indices made of several items. In some cases where only index measures of the stress were present, such as for participation, utilization of abilities and utilization of leadership, no conditioning effects of personality on the relationship between stress and strain are reported. The single item measures have more objective referents in that they usually ask the respondent "what percent" or "how many" such events occurred rather

than "the extent to which" each event is present in the job. The person may be able to respond more reliably to the former type of measure thus increasing the possibility that associations between such measures and strain will be found.

12. Using person-environment fit measures along commensurate dimensions also indicates that person and environment interact to produce strain. However, practically all of the findings indicate that poor P-E fit is associated with high psychological rather than physiological strain. The exception is the relationship between poor fit on responsibility for others and high serum cholesterol. It is suggested that the measures of psychological strain are more global than measures of physiological strain, and therefore, they are more easily related to the stress of poor person-environment fit. One further implication of these findings is that the range of physiological variables needs to be expanded to search for additional relationships between P-E fit and strain.

13. Ponderal index is unrelated to any of the interactions between personality and subjective environment reported on here. In a review of the literature in Chapter 1 it was pointed out that the role of ponderal index and related measures of stature and build are disputed as risk factors in coronary heart disease. The consistent lack of findings for ponderal index raise some question about its validity as a measure of strain.

Overall these findings provide broad support for the model of stress, personality, and strain interrelationships depicted in Figure 1. There are a substantial number of findings showing that the relationship between subjective stress and strain is, in part, a function of a) the personality of the individual, and b) the nature of the working relationships the organizational member has with his role set.

Chapter 5

Differences in Stress, Personality, and Strain Among Administrators, Engineers, and Scientists

In this section we return to one starting place for this study--the suggested occupational differences in the prevalence of coronary heart disease at NASA. In the previous chapters attempts have been made to identify and describe various forms of stress and to explore the relations between these stresses and risk factors associated with coronary heart disease. In doing so, consideration has been given to the role of personality as an important variable conditioning the effect of stress on strain.

Now an examination will be made of occupational differences in stress, personality, and strain, and in the relationships among these major categories of variables. Where there are such occupational differences, attempts will be made to tie these findings in with the research presented in preceding chapters. In this way we shall see whether or not occupational differences in levels of strain associated with coronary heart disease, if such differences exist, can be explained on the basis of findings dealing with the relationships between stress, personality and strain.

First occupational differences in stress will be presented. Next, differences in personality will be examined. Then differences in strain and in the relationships between stress and strain among the different occupational groups will be considered. As noted previously, practically all of the persons who volunteered to provide us with objective work load data are administrators. Therefore no findings on differences in objective quantitative work load can be presented. Only subjective stress will be considered in this chapter with the possible exception of variables such as the person's organizational status, government salary level, or global job environment based on the personnel roster.

Occupational Differences in Stress

Occupational Differences in Role Ambiguity

There are no significant differences in role ambiguity among the three occupational groups ($F = 2.24$, n.s.). Examining the mean values shows that administrators and engineers report the most ambiguity (3.02 and 3.11 respectively) while scientists report the least (2.84).

Occupational Differences in Subjective Work Load

Table 154 presents the mean estimated number of office activities per week for each of the three occupational groups. Regardless of whether the number of phone calls or the number of meetings and office visits is being considered, administrators report the highest frequency of all such activities, and scientists report the lowest frequency for all such activities except office visits. Compared to the scientists, administrators report over three times as many outgoing and incoming phone calls, over 1.5 times as many office visits, over twice as many self-initiated meetings,

TABLE 154

OCCUPATIONAL DIFFERENCES IN ESTIMATED NUMBER OF OFFICE ACTIVITIES PER WEEK

	Occupation				
Activity, # of	Administrator N=58	Engineer N=94	Scientist N=47	F	p<
Outgoing phone calls	46.17	28.84	14.79	20.34	.001
Incoming phone calls	57.79	32.00	17.78	24.18	.001
Office visits	19.88	12.70	12.96	4.50	.05
Self-initiated meetings	6.24	3.97	2.60	6.56	.005
Other-initiated meetings	5.78	3.90	3.30	5.97	.005

and over 1.5 times as many other-initiated meetings. The differences across the three groups are all statistically significant (p's range from $< .05$ to $< .001$).

In Table 155 similar data are presented concerning the person's estimated percent of time spent in various office activities. The administrator reports spending the most time on phone calls and office visits and meetings while the scientist reports spending the least time, and the engineer falls in the middle. Thus, with regard to time spent working alone, it is the scientist who reports having the most time (56.6 percent of his time) compared to the engineer (38.4 percent) and the administrator (32.4 percent). All of the differences in the table across occupational groups are significant at $p < .001$--but, since they

TABLE 155

SELF-REPORTED ESTIMATE OF THE PERCENT OF TIME SPENT IN VARIOUS OFFICE ACTIVITIES BY OCCUPATION FOR A 5-DAY WORK WEEK

Activity	Occupation			F	p<
	Administrator N=58	Engineer N=94	Scientist N=47		
Other-initiated phone calls	12.6	9.4	5.7	16.65	.001
Self-initiated phone calls	8.8	7.8	5.2	9.46	.001
Other-initiated office visits and meetings	23.6	19.9	14.2	9.53	.001
Self-initiated office visits and meetings	19.3	15.6	10.5	8.24	.001
Working alone	32.4	38.4	56.5	19.86	.001
Working with others[1]	67.6	61.6	43.5	--	--

[1] Computed as 100% - % of time working alone.

are percentages that must add to 100 percent, they are not completely independent of one another.

By combining information on the number and length of phone calls it was possible to determine the average length of phone calls for each occupational group. These data are presented in Table 156. Administrators, while making the most phone calls and spending the most time doing so of the three occupational groups, tend to have brief calls compared to engineers and scientists who tend to have long

TABLE 156

THE ESTIMATED MEAN LENGTH OF TIME SPENT ON EACH INCOMING AND OUTGOING PHONE CALL AS A FUNCTION OF OCCUPATION[1]

Mean time on each	Occupation			F	p<
	Administrator N=58	Engineer N=94	Scientist N=47		
Incoming call	.32	.44	.40	1.90	n.s.
Outgoing call	.29	.49	.40	4.63	.05

[1] Computed as follows: (% of time) / (number of calls), where all measures are respondent's estimates for a 5-day work week.

calls. As can be seen from the table, this is particularly true for outgoing rather than incoming calls. Thus, for administrators the phone appears to be used for rather cursory interchanges. Indeed, such calls may be used primarily to submit a request or acknowledge a request which then is completed in writing (administrative lore has a motto, derived from classic bureaucratic theory, which goes "write it, don't say it!"). On the other hand, scientists and engineers may use the phone for consulting and discussion.

Table 157 presents data on occupational differences on the index measures of subjective quantitative and qualitative work load. Administrators have the highest scores on both the subjective quantitative overload factor and the index while scientists have the lowest scores. Engineers fall in the middle. The subjective qualitative overload factor, which is characterized here as a measure of stress due to competition with other organizational members, is highest for scientists and lowest for administrators. There are no differences between the three groups in the amount of qualitative work load reported.

TABLE 157

OCCUPATIONAL DIFFERENCES ON SUBJECTIVE WORK LOAD INDICES

Overload Measure	Occupation			F	p<
	Administrator N=58	Engineer N=94	Scientist N=47		
Subjective quantitative overload factor	2.45	2.39	2.14	3.47	.05
Subjective quantitative work load index	3.68	3.43	3.14	11.89	.001
Subjective qualitative overload factor	1.77	1.99	2.09	4.03	.05
Subjective qualitative work load index	3.80	3.63	3.72	1.19	n.s.

The data just reported on differences in work load among the three occupational groups also goes along with experiences we have had in early interviews with NASA personnal. First of all, it was quite difficult to schedule interviews with administrators because of the meetings they had to attend. By comparison, it was relatively easy to arrange an interview with a scientist. This is not to say one occupation did more or less valuable work than the other (indeed, we have shown that there are no differences in qualitative work load among the three groups)--only that the quantitative nature of the work made scheduling a problem with administrators. Similarly, it was not uncommon to find that phone calls frequently interrupted interviews with administrators but rarely did so with scientists.

In carrying out the study, a record was kept of how many days had elapsed from the time a questionnaire was handed to a respondent to the time the questionnaire was received in the mail at the Institute for Social Research. This unobtrusive measure of work overload proved to discriminate the administrators from the engineers and scientists. The administrators took an average of 19.9 days to return their questionnaires while the engineers and scientists took 13.1 and 14.5 days respectively to return their questionnaires (F across the three groups = 3.84, $p < .05$).

The final set of findings on subjective work load stresses relates to deadlines. These findings are presented in Table 158. The table presents the mean percents of time each occupational group reports spending under five different levels of deadline pressure ranging from no pressure to extreme pressure. Since all five levels of pressure must add to 100 percent, the data within columns are not completely independent of one another. Nevertheless, the pattern of findings is clear. Administrators spend the least amount of time under no pressure and the most amount of time under moderate through great levels of pressure compared to the other two occupational groups. Engineers are the intermediate group while scientists report the least time under heavy pressures. While the administrator finds only about 15 percent of his time free of deadline pressures, the scientist enjoys over twice that much or 35 percent of his time free from such pressures. These findings are completely in line with our early interviews with these occupational groups at Goddard. The scientists often said that they rarely had any burning deadlines, and that, very often, the most important deadline was the one coming up for presenting a paper at some

TABLE 158

THE PERCENT OF TIME THE PERSON REPORTS SPENDING UNDER VARIOUS LEVELS OF DEADLINE PRESSURE AS A FUNCTION OF OCCUPATION

	Occupation				
Level of Pressure	Adminis-trator N=58	Engi-neer N=94	Scien-tist N=47	F	p<
Relaxed--no pressure at all	15.1	24.1	35.2	9.13	.001
Slight--there is a schedule to be met but only minor problems in doing so	26.7	27.3	26.7	.02	n.s.
Moderate--with some pushing, things get done when needed	36.6	29.5	27.3	3.23	.05
Great--I can just barely meet the schedule	16.5	14.4	7.7	4.43	.05
Extreme--I'm behind on important deadlines	5.2	5.0	3.0	1.24	n.s.

scientific meeting. On the other hand, the administrators told about being faced with many deadlines, many of which were monthly.

Some idea of the source of these deadlines can be obtained by examining the data presented in Table 159. The greatest source of deadline pressure for all three occupational groups, as indicated by the means in the last row of the table, is the person himself. Furthermore, the person, himself, is a greater source of pressure for the scientist than for the engineer or administrator. Thus, the scientist is most driven by forces from within himself and least driven by the external organizational environment. This latter finding is in line with material gathered from detailed interviews with personnel at

TABLE 159

THE EXTENT TO WHICH DIFFERENT ROLE SENDERS CONSTITUTE SOURCES OF DEADLINE PRESSURES AS A FUNCTION OF THE RESPONDENT'S OCCUPATION

Source	Occupation			F	p<
	Adminis-trator N=58	Engi-neer N=94	Scien-tist N=47		
Subordinates	1.8[1]	1.8	1.5	1.55	n.s.
Colleagues	1.7	1.8	1.9	.93	n.s.
Immediate superior	2.7	2.4	2.2	4.40	.05
Higher level superiors with the division	2.5	2.5	2.2	1.75	n.s.
Head of the directorate	2.5	2.0	1.5	9.26	.001
Heads of other directorates	2.1	1.8	1.4	5.44	.01
Head of the base	1.9	1.6	1.4	4.05	.05
Heads of other bases	2.0	1.5	1.6	4.63	.01
Non-NASA employees, e.g., contractors	1.5	2.0	1.5	8.01	.001
One's self	2.8	2.7	3.1	3.25	.05

[1]Ratings on a 4-point scale where 1 = not a source of deadline pressure and 5 = great source of deadline pressure.

Goddard. During those interviews scientists, for example, told about how "the rest of the organization knows it is supposed to leave us alone so we can be creative." This is in sharp contrast to the administrators and engineers who described their jobs in terms of getting things done for other people.

The next greatest source of deadline pressure for all three occupational groups tends to be superiors who are not too far removed in the formal hierarchy from the respondents. Thus, the immediate superior, higher level superiors, and the head of the directorate rank as the top sources of deadline pressures for all three occupational groups. More remote superiors, such as the head of the base and of other bases are lesser sources of pressure. When only NASA personnel are examined as sources of pressure, it is clear that administrators, compared to engineers and scientists, report the greatest amount of pressure from these people.

Overall, these data provide a very consistent picture. The administrators are clearly and consistently the most quantitatively overloaded persons. The time they take to return the questionnaire suggests that this overload is objective as well as subjective. On the other hand, the scientists and engineers, but particularly the scientists, enjoy relative freedom from quantitative overload. With regard to qualitative work load, there does not seem to be any significant difference across the three occupational groups.

Occupational Differences in Utilization

Table 160 presents the measn scores of the three occupational groups on the two measures of utilization: utilization of leadership and of abilities. The latter form of utilization refers to opportunities to use one's educational and technical skills and abilities. There is a clear difference across occupations in the extent to which each type of utilization occurs. Administrators report the most utilization of leadership skills while scientists report the highest utilization of technical abilities. In both cases, engineers are the intermediate group.

TABLE 160

OCCUPATIONAL DIFFERENCES IN UTILIZATION

Utilization of	Occupational Group			F	p<
	Administrator N=58	Engineer N=94	Scientist N=47		
Leadership	3.6	3.0	2.6	21.33	.001
Abilities	3.3	3.2	3.8	10.77	.001

These data suggest that in terms of self-actualization, the scientist has the greatest opportunity. The administrator, on the other hand, has little such opportunity, being heavily involved in administrative duties and responsibilities.

Occupational Differences in Responsibility

There are two measures of responsibility, indices and percent of time. The means for the three occupational groups on these measures are presented in Table 161. With regard to the index measures of responsibility, the three occupational groups differ on responsibility for persons ($F = 22.36$, $p < .001$) but not on responsibility for things ($F = .32$, n.s.). Administrators report the most responsibility for persons, engineers the next most, and scientists the least.

The percent of time measures present somewhat of a similar picture. There are significant differences across all three occupational groups for all five responsibilities presented in the table. As with other such measures, these findings are not independent since all five responsibilities must add to 100 percent. On both the person-oriented responsibilities,

TABLE 161

OCCUPATIONAL DIFFERENCES IN RESPONSIBILITY

Measure	Occupation			F	p<
	Administrator N=58	Engineer N=94	Scientist N=47		
Responsibility for persons	3.59	2.84	2.55	22.36	.001
Responsibility for things	3.10	3.01	3.08	.32	n.s.
% time carrying out responsibility for:					
a) others' work	42.9	27.1	17.1	21.94	.001
b) others' futures	12.1	6.3	6.7	7.08	.01
c) money	11.2	10.8	6.5	4.36	.05
d) equipment	4.4	9.3	12.0	6.52	.05
e) projects	29.6	46.6	72.2	6.83	.01

administrators report spending the most time while engineers and scientists report spending the least. Administrators report spending 42.9 percent of their time in responsibility for others' work. This is over 1.5 times as much time as the engineers report spending and 2.5 times as much as the scientist reports spending. Similarly, the administrators report spending 12.1 percent of their time on responsibilities for others' futures. In contrast, engineers and scientists report spending only 6.3 and 6.7 percent, respectively, of their time carrying out such responsibilities.

With regard to the responsibilities for things, administrators spend slightly more time than engineers on responsibilities for money or budget and 1.7 times as much time as scientists. The pattern reverses, however, with regard to the remaining two types of responsibility in the table. Scientists spend the most time on responsibility for equipment, engineers the next most, and administrators the least. Similarly, responsibility for projects consumes the most time for scientists and engineers while administrators spend less than half as much time as scientists and just less than two-thirds as much time as engineers carrying out such responsibilities.

These findings show that responsibility for persons, linked earlier to heavy smoking, high pulse rate, and diastolic blood pressure, is considerably higher for administrators than for engineers and scientists. Thus, administrators are again shown to be a high stress group.

Occupational Differences in Complexification

Scientists report the highest amount of complexification (3.88) compared to engineers (3.78) and administrators (3.27). The difference across the groups being statistically significant ($F = 11.00$, $p < .001$). This difference probably reflects the fact that the items are oriented toward technological changes and the rapid expansion of information--something which the scientist and engineer may be most troubled by, due to the rate at which knowledge of science and technology are expanding compared to administrative sciences.

Occupational Differences in Participation

As was noted in an earlier section, participation involves certain costs as well as benefits. One of these costs is apparently high work load in terms of the time the person must spend in meetings and other interactions. Thus, it may come as no surprise that administrators, the high quantitative overload group, report the highest opportunities for participation (3.46) while engineers and scientists report the lowest opportunities (3.18 and 3.26 respectively). The differences across the three groups are significant at $p < .05$ ($F = 3.03$).

Occupational Differences in Opportunity to Advance in the Organization

There are no significant differences across the three groups ($F = 1.13$). However, there is a trend since administrators report the least opportunity (2.58), engineers the next least (2.64), and scientists report the highest opportunity (2.80). As pointed out in Chapter 3, it is almost ironic that administrators, who have responsibility for the maintenance of the organization, do not receive at least equal opportunity with engineers and scientists for advancement. On the other hand, since administrators are older than engineers and scientists (44.4 versus 39.0 years respectively), their peak for advancement may already be behind them.

Occupational Differences in Relations with Role Senders

Table 162 presents the mean values for each occupational group on indices of the quality of relations with the immediate superior, work group or peers, and subordinates. Only relations with subordinates shows a significant difference across the three occupational groups although relations with the immediate superior shows an identical and almost significant patterning of the data; administrators report the best relations, engineers report the next best, and scientists report the poorest relations. Relations with the work group does not show any clear trend among the three occupational groups.

TABLE 162

OCCUPATIONAL DIFFERENCES IN RELATIONS WITH ROLE SENDERS

Role Sender	Occupational Group			F	p<
	Administrator N=58	Engineer N=94	Scientist N=47		
Superior	3.65	3.42	3.34	2.70	.10
Work group	3.39	3.42	3.31	.61	n.s.
Subordinates	3.83	3.68	3.54	3.68	.05

It is possible that administrators are more skilled in relating to other people than engineers and scientists since the former group is probably selected, in part, on the basis of that skill. Data in Table 163 provide some support for this hypothesis. As part of the study each

TABLE 163

OCCUPATIONAL DIFFERENCES IN SELF-REPORTED PERCENT OF TIME SPENT WITH VARIOUS ROLE SENDERS

Role Sender	Occupation			F	p<
	Administrator N=58	Engineer N=94	Scientist N=44		
Immediate superior	11.6	8.9	7.9	2.77	.10
Colleagues	14.8	21.5	21.9	3.83	.05
Subordinates	32.6	24.5	15.5	10.13	.001

person was asked to indicate the percent of time he spent communicating with his immediate superior, colleagues, and subordinates. The means for these data for each occupational group are presented in the table. We see that administrators report spending more time with their immediate superior than do engineers and scientists, the least amount of time with their colleagues (synonymous with work group), and the most time with their subordinates. Scientists appear to spend the least amount of time of the three occupational groups with their superior and with their subordinates. The scientists spend the most time with their colleagues.

The obvious implication of these data is that the more time one spends with role senders, the better one's relations seem to be with them. Some support for this tie between amount of time spent with people and the quality of relations one reports having with them is found in the data. Good relations with one's subordinates is positively and significantly correlated with the percent of time the person reports spending with them ($r = .23$, $p < .05$). Relations with the immediate superior and percent of time spent with superior are non-significantly related ($r = .06$). Similarly good relations with work group is uncorrelated with the percent of time reported spent with the work group ($r = .12$). However, the sign of these coefficients is positive and, therefore, is in the expected direction. The data offer weak support for the contention that familiarity, far from breeding contempt, appears somewhat likely to breed good relations with one's role senders. Furthermore, the role requirements of administration seem more likely to ensure that opportunities for getting to know role senders occurs more for administrators than for engineers and scientists.

Occupational Differences in Contact with Other Organizational Territories

As might be suspected, the administrator, because of the coordinative and organizational maintenance function of his role, is more likely to spend time communicating with other parts of the organization than is the engineer or scientist. At Goddard this is indeed the case as shown by data presented in Table 164.

TABLE 164

OCCUPATIONAL DIFFERENCES IN REPORTED PERCENT OF TIME SPENT COMMUNICATING WITH DIFFERENT ORGANIZATIONAL TERRITORIES

Territory	Occupational Group			F	p<
	Administrator N=58	Engineer N=94	Scientist N=47		
Own branch	38.79	45.40	60.75	12.74	.001
Other branches	17.98	12.76	9.21	7.90	.001
Other divisions	10.69	10.37	6.06	3.28	.05
Other directorates	14.83	12.65	8.99	5.35	.01
Other bases	5.63	2.85	2.60	6.07	.005
Non-NASA employees	10.48	15.62	12.74	2.76	.10

The table presents the mean percent of time each of the three occupational groups reports spending in communication with different organizational territories. Administrators spend the least amount of time communicating with persons within their own branch office compared to engineers and scientists and more time than engineers and scientists communicating with other branches, divisions, directorates, and bases. The differences across the occupational groups are all statistically significant, but again note that the rows are not independent of one another.

When it comes to communicating with non-NASA employees, such as outside contractors, engineers report spending the most time while scientists spend the next greatest amount of time of the three groups, and administrators spend the least time. This difference is also in keeping with role requirements at NASA since engineers are most likely to have responsibility for monitoring the quality of work which outside organizations may be performing in conjunction with the engineers' projects.

Overall, it is clear that all three occupational groups report spending the most time communicating within their own branch or home territory and the least time communicating with the most distant territory within NASA, other bases. Overall, too, it is clear that administrators, compared to scientists and engineers, spend the most time in territories other than their own. Thus, administrators are most prone to experience the stress of communicating across organizational boundaries.

Occupational Differences in Stress: Summary

Administrators, compared to engineers and scientists, have the most subjective quantitative work load, the least amount of utilization of skills and abilities, the highest utilization of leadership, the greatest amount of responsibilities for persons, tend to see themselves as having the least opportunity for advancement and recognition in the organization, and spend the most time communicating with other territories of the organization. Engineers tend to fall intermediate between administrators and scientists on the amount of these stresses they report.

On the other hand, administrators report the greatest opportunities for participation in decision-making, the best relations with subordinates and their immediate superior, and the least amount of complexification. Again engineers rank intermediate between administrators and scientists on these measures of job environment.

A number of job stresses have been identified which discriminate between the three occupational groups. For purposes of description, these stresses have been placed in a stepwise multiple regression to obtain an idea of the key job stress measures which differentiate between the occupational groups. For purposes of the regression, occupation was recoded into a bivariate measure: administrators (coded 1) and non-administrators (coded 0 and composed of engineers and scientists). The results are presented in Table 165.

TABLE 165

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT JOB STRESS CORRELATES OF ADMINISTRATIVE VERSUS NONADMINISTRATIVE OCCUPATIONS[1]

Step	Correlate Added	R	Final B
1	Responsibility for persons	.37	.30
2	Estimated number of incoming phone calls	.50	.28
3	Responsibility for things	.55	-.25
4	Utilization of administrative leadership	.58	.27
5	Utilization of abilities	.59	-.11

[1]After step 5 no further measures produced significant ($p < .10$) additions of variance to the regressions.

The most important predictor of administration is high responsibility for persons. This is followed by high reported incoming phone calls and low responsibility for things (such as projects and budget). Next in the regression equation are high utilization of leadership and low utilization of technical skills and abilities. The multiple R for these five predictors is .59 accounting for 34 percent of the variance in occupation.

Occupational Differences in Personality

Table 166 presents each occupational group's mean score on each of the personality measures in this study. The most striking difference,

TABLE 166

OCCUPATIONAL DIFFERENCES IN PERSONALITY

Personality Measure	Occupation			F	p<
	Administrator N=58	Engineer N=94	Scientist N=47		
Flexibility[1]	2.7	2.6	2.5	11.44	.001
Involved Striving	5.2	4.8	5.0	4.12	.05
Positive Attitude Toward Pressure	5.2	4.9	4.8	4.05	.05
Environmental Overburdening	5.6	5.1	5.4	3.89	.05
Leadership	5.0	4.3	4.2	5.50	.01
Competitive Orientation	5.1	4.6	4.6	3.46	.05
Persistence	5.3	5.0	5.3	1.38	n.s.
Range of Activities	4.6	4.4	4.6	.38	n.s.
Sense of Time Urgency	4.4	4.3	4.1	1.07	n.s.
History of Past Achievement	4.7	4.6	4.7	.17	n.s.
What I am Like Type A	3.5	3.3	3.2	3.21	.05
Emotional Dependency	2.8	3.0	3.0	.93	n.s.
Deny Bad Self	1.4	1.4	1.4	.04	n.s.
Overconformity to Norms	1.4	1.4	1.4	.22	n.s.

[1]All measures based on 7-point scales except a) Flexibility and Emotional Dependency, which are based on 4-point scales and b) Deny Bad Self and Overconformity to Norms, which are based on 2-point scales. 1 = low.

in terms of statistical significance, across the groups is on the measure of Flexibility ($p < .001$). Administrators are the most flexible, engineers are second in rank, and scientists are the least flexible (and by definition, the most rigid).

Kahn et al.'s (1964) study of role conflict in organizations showed that Flexible rather than Rigid persons were the most likely to experience subjective role conflict because they were unable to turn away their role senders who were making conflicting demands upon them. Thus, they were under heavy role overload. In this study, administrators, compared to engineers and scientists, have the highest score on Flexibility and the highest scores on the theoretical role conflict index, an index not used in most analyses in this study because of its heavy item overlap with the subjective quantitative overload factor. The conflict scores for the three occupational groups on a four-point scale are 2.2 for administrators, 2.1 for engineers, and 1.9 for scientists ($F = 3.13$, $p < .05$). However, role conflict and Flexibility are nonsignificantly correlated in the total sample ($r = .07$) although the sign of the correlation is positive. Thus, the occupational differences in Flexibility and role conflict index scores are unrelated.[7]

On the other hand, there are positive, but low, correlations between Flexibility and two measures of subjective work load. Flexibility correlates .20 ($p < .05$) with the reported percent of time on phone calls initiated by others and .15 ($p < .05$) with the subjective quantitative

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[7] In the section on coping with stress which follows, it will be shown that administrators, compared to engineers and scientists, are the most likely to report that they cope with role conflict in a manner which Kahn et al. describe as typical of the Flexible person.

work load index. As noted in Tables 155 and 157, administrators have the highest scores on these two measures of work load. This suggests that the occupational differences in reported work load may be partly due to occupational differences in personality. No other measures of work load are significantly correlated with Flexibility.

The next six measures in the table are Type A measures of personality and all differentiate significantly between the three occupational groups. Administrators have the highest scores on Involved Striving, Positive Attitude Toward Pressure, Tendency Toward Environmental Overburdening, Leadership, and Competitive Orientation (p's range from $< .05$ to $< .01$). They also have the highest mean on Sense of Time Urgency although the differences across the occupational groups is non-significant. In addition, administrators have the highest mean score on the global What I am Like Type A personality measure while scientists have the lowest score on that measure. The differences across the occupational groups on this measure is also statistically significant ($p < .05$).

The other measures in the table show non-significant differences across the groups. These measures are Persistence, Range of Activities, History of Past Achievements, Emotional Dependency, Deny Bad Self, and Overconformity to Norms. All of these measures may be considered to be based on characterizations of the Type A personality, and on all but the last of these measures the administrators and the scientists are tied for the highest mean occupational group scores.

Overall, these data show that administrators tend to have the highest scores of the three occupational groups on Type A measures. Engineers and scientists, on the other hand, tend to be characterized by Type B or non-coronary personality traits.

As in the case of stress, a stepwise multiple regression of all personality measures which significantly discriminate between the occupational groups has been carried out. Again, for the purpose of this analysis, the dependent variable is a bivariate one: administrators versus nonadministrators (engineers combined with scientists). The results are presented in Table 167.

TABLE 167

STEPWISE MULTIPLE REGRESSION OF SIGNIFICANT PERSONALITY CORRELATES OF ADMINISTRATIVE VERSUS NONADMINISTRATIVE OCCUPATIONS[1]

Step	Correlate Added	R	Final B
1	Flexibility	.24	.20
2	Leadership	.30	.13
3	Positive Attitude Toward Pressure	.32	.12

[1]After step 3, the following variables did not have beta weights exceeding $p < .10$: Involved Striving, Environmental Overburdening, Competitive Orientation, and What I am Like Type A.

The most important predictor to being an administrator is Flexibility. Two other measures, both of these measures of Type A, also are added in the regression: Leadership and Positive Attitude Toward Pressure. The multiple R is .32 which accounts for just over 10 percent of the variance in occupation.

Occupational Differences in Coping

Little attention has been paid to coping with stress in this study since coping is not a major focus here. However, for the sake of preliminary exploration, some items on coping with stress were included. They are presented here, along with the occupational differences on the items, because they add some further insight into the characteristic behavior patterns and traits of administrators, engineers, and scientists. The items follow the format used in the What I am Like measure of Type A. Two vignette descriptions of fictitious persons are presented, and the respondent is asked to indicate on a five-point scale the extent to which he is like one or the other of the vignettes.

Coping with Role Conflict

The first of the two items which will be examined is as follows:

e.

Dave	Dan
Dave is the type of person who handles the conflicting demands people make on him by telling them about the other work he already has. He hopes they will change their demands.	When Dan gets conflicting demands he usually responds by accepting the demands and then trying to work them all in. He doesn't like conflicting demands any more than most people but can't see any way out.

CHECK ONE BOX.

I'm like Dave	I'm more like Dave than like Dan	I'm halfway between Dave and Dan	I'm more like Dan than like Dave	I'm like Dan
1	2	3	4	5

The mean scores for the three occupational groups are 4.0 for administrators, 3.7 for engineers, and 3.8 for scientists (F across the three groups = 4.18, $p < .05$). Thus administrators, compared to engineers and scientists, are more like Dan, the person who copes with conflicting demands by trying to handle them all, than like Dave, the person who tries to get his role senders to make adjustments in their demands.

Is it just a coincidence that administrators are both Flexible persons and take on, rather than avoid, conflicting demands as a coping style? An examination of the relationship between the above coping item and the Flexibility scale shows that the two correlate .24 ($p < .05$). While the correlation is not high, the finding does provide confirmation of the Kahn et al. findings showing that flexible persons cope with role conflict by trying to meet the demands of the conflicting role senders.

Coping with Work Overload

In this section it is suggested that occupational groups differ in the way in which they cope with overload. It is further suggested that differences in the coping styles are related to each group's ability to maximize its self-esteem through the use of a particular coping style. The item below deals with two such coping styles:

n.

Don	Mike
When Don has more work than can reasonably be done in a set time period, he prefers to do one or two jobs well even if a couple don't get finished.	Mike prefers to handle a situation where he has too much work to do in a set time by sacrificing a bit on quality and doing all the work before him.

CHECK ONE BOX.

I'm like Don	I'm more like Don than like Mike	I'm halfway between Don and Mike	I'm more like Mike than like Don	I'm like Mike
1	2	3	4	5

The basic differences between the coping styles of Don and Mike in the above item is that when both are faced with work overload, Don copes by sacrificing on quantity and works to reduce qualitative overload while Mike copes by sacrificing on quality in order to reduce quantitative overload. As was noted in Chapter 1, French et al.'s (1965) study of university professors and administrators found that professors coped with overload by handling work the way Don does, while university administrators preferred to cope the way Mike does.

The NASA administrators are much like the university administrators while the engineers, and particularly the scientists, are very much like the university professors in the way they handle overload (F across the occupations = 4.42, $p < .05$). The mean score for the administrators is 2.9, for the engineers it is 2.8, and for the scientists it is 2.3. Thus, the administrators tend to sacrifice on quality in order to get all the jobs done whereas the scientists do not.

In the university professor study, it was found that the subjective qualitative overload factor was positively correlated with low self-esteem for professors while the subjective quantitative overload factor was positively correlated with low self-esteem for administrators. From this it may follow that people cope either with qualitative or quantitative overload depending on which one is most important for the maintenance of high self-esteem.

This prediction can be partially tested by examining the relationship between the Don-Mike item and job-related self-esteem for the three occupational groups. Table 168 presents the occupational differences in this relationship.

There are no significant findings to report for either administrators or engineers. For scientists, on the other hand, the more they report being like Mike, that is sacrificing quality in the interest of quantity, the lower is their job-related self-esteem. This suggests that when scientists cope with their work load by sacrificing quality for quantity,

TABLE 168

THE RELATIONSHIP BETWEEN RESPONSES TO THE DON-MIKE ITEM AND JOB-RELATED SELF-ESTEEM FOR DIFFERENT OCCUPATIONAL GROUPS[1]

Occupation	Don ⟵⟶ Mike (Emphasizes Quality) (Emphasizes Quantity)					F	p<
	1	2	3	4	5		
Administrator		1.41 (19)[2]	1.09 (23)	1.27 (9)	.83 (3)	.57	n.s.
Engineer	1.29 (7)	1.20 (37)	1.41 (21)	1.40 (19)	1.12 (5)	.26	n.s.
Scientist	.49 (8)	1.56 (17)	1.18 (14)	2.55 (4)		3.42	.05

[1]Self-esteem is measured as the absolute discrepancy between real- and aspired-self. Thus, a high score indicates low self-esteem.

[2]Cell n.

they may realize that they are not following a model of task performance which they have set as ideal for their self-concept--and consequently they experience low self-esteem. However, this finding says nothing about whether qualitative overload per se produces low self-esteem among scientists but not among administrators and engineers. To test this more specific prediction, findings in Table 169 will now be examined.

These data show no relationship between either the quantitative overload factor or work load index and job-related self-esteem for any of the three occupational groups. On the other hand, the qualitative overload factor is negatively related to high self-esteem for scientists ($r = -.58$, $p < .01$) but not for administrators ($r = -.06$) or engineers ($r = -.18$). These latter findings are quite similar to those from the

TABLE 169

OCCUPATIONAL DIFFERENCES IN THE CORRELATION BETWEEN SUBJECTIVE WORK LOAD AND OVERLOAD MEASURES AND JOB-RELATED SELF-ESTEEM

Subjective Stress Measure	Occupation: Administrator N=58	Engineer N=94	Scientist N=47	$r_{Sci.}$ vs. $r_{Admin.}$ p<	$r_{Sci.}$ vs. $r_{Engin.}$ p<
Quantitative Overload Factor	.11	-.05	.02	n.s.	n.s.
Quantitative Work Load Index	.28[1]	.06	.20	n.s.	n.s.
Qualitative Overload Factor	-.06	-.18	-.58[2]	.005	.01
Qualitative Work Load Index	.13	-.04	.24	n.s.	n.s.

[1] $p < .05$.

[2] $p < .01$.

French et al. university professor study. In that study self-esteem was negatively correlated -.26 with the subjective qualitative overload factor for university professors and uncorrelated -.06 with self-esteem for university administrators. It should be noted that while the overload measures in the two studies are identical, the measures of self-esteem are different.

Since the Subjective Qualitative Overload Factor appears to measure stress from competition, it appears that French et al. really found that professors who feel the stress of competition are likely to have low self-esteem. University professors usually must compete with one another in a "publish or perish" environment, particularly at the large university where the French et al. research was carried out. On the other hand, university administrators are usually removed from such competition since each occupies a unique organizational position in the university hierarchy. Thus, stress of competition may be irrelevant as a source of discomfort for administrators. Professors who have a hard time keeping up with the productive pace of their colleagues, on the other hand, may soon begin to suffer low self-esteem and esteem from others as promotions and other forms of recognition pass by them. As noted earlier, qualitative overload tends to be higher among persons with low scores on Competitive Orientation ($r = -.14$, $p < .05$), suggesting that persons who do not like competition are the one's who are most likely to experience stress from it.

Although the factor measure of qualitative overload does differ in its relationship to self-esteem according to the occupation of the person, the last set of findings in the above table shows that this is not the case for the index measure. Subjective qualitative work load is unrelated to self-esteem for all three occupations, and shows a slight tendency to be positively correlated ($r = .24$) with self-esteem for scientists. This suggests that high qualitative work load, as compared to overload, does not act as a stressor.

Since the professor study was concerned with work overload which is having too much work compared to the amount of work the person would like to have, a better test of the hypothesized relationship between overload and self-esteem is one that makes use of the P-E fit indices of subjective qualitative and subjective quantitative work load Tables 170 and 171 present the two-way analysis of variance tables examining the interaction of occupation and P-E fit with regard to qualitative and quantitative work load as predictors of job-related self-esteem. Ther are no main nor interaction effects in either of these two tables.

TABLE 170

THE EFFECT OF OCCUPATION ON THE RELATIONSHIP BETWEEN QUALITATIVE WORK LOAD P-E FIT AND SELF-ESTEEM[1]

	Occupation[2]		
P-E	Administrator	Engineer	Scientist
$P > E$[4]	.89 (8)[3]	1.98 (9)	----
$P = E$	1.20 (36)	1.18 (67)	1.31 (34)
$P < E$	1.47 (10)	1.39 (9)	1.44 (9)

[1]Self-esteem is measured as the absolute discrepancy of real - aspired self. Thus, a high score indicates low self-esteem.

[2]$F_{occupation} = .97$, n.s.; $F_{P-E} = .07$, n.s.; and $F_{interaction} = .04$, n.s.

[3]Cell size.

[4]This row was omitted from the analysis since the right-hand cell had only one observation in it.

TABLE 171

THE EFFECT OF OCCUPATION ON THE RELATIONSHIP BETWEEN QUANTITATIVE WORK LOAD P-E FIT AND SELF-ESTEEM[1]

	P-E	Occupation[2] Administrator	Engineer	Scientist
P > E	P = E+2[4]	1.12 (13)[3]	1.39 (9)	1.42 (6)
	P = E+1	1.03 (31)	1.22 (57)	1.16 (28)
	P = E	1.55 (8)	1.45 (22)	1.14 (9)

[1]Self-esteem is measured as the absolute discrepancy of real - aspired self. Thus, a high score indicates low self-esteem.

[2]Cell size.

[3]$F_{occupation} = .59$, n.s.; $F_{P\text{-}E} = .13$, n.s.; and $F_{interaction} = .44$, n.s.

[4]That is, P is two scale units higher than E.

These findings indicate that while there is support for a negative relationship between <u>stress from competition</u> and self-esteem for university professors and NASA scientists, there is little support for any relationship between subjective qualitative overload and low self-esteem. On the other hand, it appears that scientists who cope with overload by sacrificing on quality may have low self-esteem because such a coping style is a negatively valued part of their self-identity.

Coping in Summary

While only a small look has been taken at the way people in different occupational groups cope with job stress, the findings suggest that there are differences. Additional research which considers psychological as well as behavioral coping may unfold other styles of dealing with stress which vary from occupational group to occupational group and which are associated with different personality traits such as Flexibility.

<u>Occupational Differences in Person-Environment Fit</u>

To perform these analyses, a bivariate frequency distribution using occupation as one variable and P-E fit as the other variable was obtained, and chi square analyses of the distribution was performed. By keeping all values of P-E fit as separate categories rather than collapsing categories, cells were obtained in all analyses with expected frequencies which were less than 5. Hays (1963) notes that in order to approximate multinominal probabilities with chi square, expected frequency should be greater than 5 where the degrees of freedom in the test exceed 1 (degrees of freedom in these initial analyses ranged from 6 to 8). To avoid this problem, the number of cells in the distribution was subsequently collapsed by comparing the percent of respondents who reported perfect P-E fit (P-E = 0) with those who did not (P-E $\neq$ 0) regardless of whether the person reported P greater than E or vice versa. This latter lumping of poor P-E fit <u>S</u>s together is not as crude as it might seem since, as noted in Chapter 3, the P-E fit distributions in this study are skewed either towards $P < E$ or $P > E$. Thus, the chi square analyses, as performed and presented here have three degrees of freedom (perfect versus imperfect fit for three occupational groups).

Table 172 summarizes the results of these analyses. The table presents the percent of each occupational group reporting perfect P-E fit.

TABLE 172

OCCUPATIONAL DIFFERENCES IN PERCENT OF THE SAMPLE WITH PERFECT P-E FIT

P-E Fit Cluster	Occupation			X^2 [1]	p<
	Administrator N=58	Engineer N=94	Scientist N=47		
Role ambiguity	48	48	54	.49	n.s.
Quantitative work load	34	57	56	13.62	.01
Qualitative work load	64	75	77	2.91	n.s.
Participation	48	46	46	.08	n.s.
Utilization of abilities	55	48	65	3.39	n.s.
Complexification	38	68	60	13.34	.01
Opportunity for advancement and recognition	33	39	53	10.96	.05
Responsibility for persons	66	69	60	.92	n.s.
Responsibility for things	78	67	83	4.72	n.s.
Relations with superior	48	52	48	.24	n.s.
Relations with subordinates	83	83	77	1.01	n.s.

[1] X^2 with d.f. = 3.

The first finding is that there are no occupational differences in the prevalence of P-E fit with regard to role ambiguity. Turning to the findings on work load, there is a difference among occupations with regard to quantitative fit (X^2 = 13.63, $p < .01$) but not with regard to qualitative fit (X^2 = 2.91, n.s.). Only 34 percent of the administrators report good fit on quantitative work load while 57 percent of the engineers and 56 percent of the scientists report good fit. Interestingly enough, the majority of respondents reporting poor P-E fit would like more rather than less quantitative work load than they now have.

There are no occupational differences in either participation or utilization of abilities. This lack of differences in fit is particularly interesting since it was noted earlier that engineers and scientists reported the least opportunity for participation, and administrators reported the lowest utilization of their abilities. Apparently in both instances these occupational groups are content with their states of affairs.

In an earlier section it was noted that there were significant differences across occupations in complexification with the scientists and engineers reporting the most and administrators the least. Yet, only 38 percent of the administrators, compared to 68 percent of the engineers and 60 percent of the scientists, report perfect P-E fit on the measure. Thus, the occupational group which reports the highest complexification also seems to find it at about a preferred level. Out of 36 administrators who report poor P-E fit on this dimension, 32 of them want more complexification rather than less.

P-E fit on opportunity for advancement and recognition also differs significantly across the three occupational groups ($p < .05$). Thirty-three percent of the administrators, compared to 39 percent of the engineers and 53 percent of the scientists, report perfect P-E fit. As noted earlier, scientists report the greatest opportunities for advancement and recognition while administrators report the least opportunity. Thirty-two out of 34 of the administrators reporting poor P-E fit want more opportunity than they have for advancement. Thus, the P-E fit measures show that the group which has the least opportunity for advancement wants the most relative to what it now has. The remaining four P-E fit clusters, responsibility for persons and for things, and relations with immediate superior and subordinates show no differences in the prevalence of perfect P-E fit among the three occupational groups.

Earlier, six single P-E fit items were reported on which showed significant relationships with serum cholesterol. Most of these relationships were U-shaped with high cholesterol present for persons reporting both $P < E$ and $P > E$ and low cholesterol present for persons reporting $P = E$. Because these items had been singled out in the analysis, it seemed important to test for occupational differences in P-E fit on the six P-E fit items. Of the six, only one shows significant differences in the percent of each occupational group reporting perfect P-E fit (X^2 analysis procedures described above were used again here). This item measures P-E fit with regard to the amount of responsibility for the work of others. Seventy-three percent of the administrators, 52 percent of the engineers, and 54 percent of the scientists report perfect P-E fit ($X^2 = 8.47$, $p < .05$). Thus, the groups with the least amount of responsibility for the work of others report the poorest P-E fit. Thirty out of 45 of the engineers (66.7 percent) and 16 out of 23 scientists (69.6 percent) reporting poor P-E fit want more rather than less responsibility for the work of others. Only 15 out of 94 administrators report poor P-E fit and of these, 10 want more rather than less responsibility.

<u>Summary of Occupational Differences in P-E Fit</u>

The occupational groups differ significantly on three out of the eleven P-E fit clusters with regard to the percentage of each group which reports poor P-E fit. In all three cases, it is the administrators who have the poorest fit in terms of quantitative work load, complexification, and opportunity for advancement and recognition. On the other hand, there is some tendency for administrators to have the best fit of all three groups with regard to responsibility for persons.

Occupational Differences in Strain

In this section the mean scores on different measures of strain will be compared across the three occupational groups. Where occupational differences in strain are found, an attempt will be made to see if preceding findings on the relationships between occupational stress, personality, and strain can explain the differences. In this way it will be possible to evaluate the extent to which occupational differences in risk factors in coronary heart disease can be explained by social-psychological models.

Occupational Differences in Psychological Strain

Table 173 presents the mean occupational values for the three measures of psychological strain used in this study. As can be seen from the table, there are no significant differences in job satisfaction, job-related threat, and job-related self-esteem across the three occupations.

Occupational Differences in Physiological Strain

The mean values for physiological strain of each occupational group are presented in Table 174. Note first of all that there are significant differences ($F = 18.56$, $p < .001$) in age across the three occupational groups with administrators being oldest (44.4 years), engineers falling intermediate (39.0 years), and scientists being the youngest group (36.0

TABLE 173

OCCUPATIONAL DIFFERENCES IN MEASURES OF PSYCHOLOGICAL STRAIN

Strain Measure	Occupation: Administrator N=58	Engineer N=94	Scientist N=47	F	p<
Job satisfaction	2.64[1]	2.51	2.56	1.15	n.s.
Job-related threat	2.64[2]	2.64	2.66	.02	n.s.
Job-related self-esteem	1.20[3]	1.29	1.30	.20	n.s.

[1] 4-point scale, 1 = low, 4 = high.

[2] 5-point scale, 1 = low, 5 = high.

[3] Low score is low discrepancy between aspired and real self, and therefore, indicates high self-esteem.

TABLE 174

OCCUPATIONAL DIFFERENCES IN MEASURES OF PHYSIOLOGICAL STRAIN

Strain Measure	Occupation: Administrator N=58	Engineer N=94	Scientist N=47	F	p<
Age	44.42	39.01	35.98	18.56	.001
Percent Smokers	50.00	36.20	31.30	2.26	n.s.
Number of Cigarettes Smoked[1]	31.63	18.76	19.90	5.71	.01
Pulse Rate	76.76	74.07	72.79	1.97	n.s.
Systolic Blood Pressure	134.62	129.40	131.77	3.09	.05
Diastolic Blood Pressure	84.95	82.17	81.47	3.63	.05
Diastolic Blood Pressure[2]	83.94	82.46	82.38	.88	n.s.
Serum Cholesterol	189.95	191.89	186.35	.45	n.s.
Serum Cholesterol[2]	183.77	193.81	193.56	1.99	n.s.
Serum Glucose	98.47	93.13	95.29	1.45	n.s.
Serum Uric Acid	5.71	5.86	5.66	.66	n.s.
Serum Cortisol	14.51	13.54	14.18	.67	n.s.
Incidence of Family History of CHD	1.16	1.03	.89	.84	n.s.

[1]Smokers only. N's for the three occupations = 19, 21, and 10 respectively.

[2]Corrected for age. All other variables are unrelated to age.

years). Thus, when means for some of the physiological variables which are affected by age are presented, so shall their age-corrected[8] means.

[8] Corrections for age have been made by computing the regression of age on the physiological measure. The regression equation was then used to assign to each person an age-corrected score.

The reader is referred back to Table 17 for a list of correlations between age and the psychological variables. Now the occupational differences in strain will be described and then an attempt will be made to explain these differences.

Looking at the findings on smoking, there are no significant differences in the percent of smokers in each occupational group although administrators have the most smokers among them (50.0 percent) compared to engineers and scientists (36.2 and 31.3 percent respectively). Among those who do smoke cigarettes, however, administrators smoke significantly more than the other two occupational groups ($F = 5.71$, $p < .01$). Administrators smoke 31.6 cigarettes per day on the average or about one and a half packs. By comparison, engineers and scientists smoke less than a pack a day (18.8 and 19.9 cigarettes per day respectively). The pattern of these occupational differences in smoking are in line with the McArthur et al. (1958) findings on Harvard alumni. In that study, cited earlier, non-smokers were more likely to be engineers and scientists rather than administrators and managers.

There are no significant differences in pulse rate although administrators have the highest pulse (76.8 beats per minute) compared to engineers and scientists (74.1 and 72.8 beats per minute). Again, the trend is for the scientists to have the lowest mean.

There are, however, significant differences in systolic blood pressure among the three groups ($F = 3.09$, $p < .05$). Administrators have the highest systolic blood pressure (134.6) compared to the engineers (129.4) and the scientists (131.8). Diastolic blood pressure also shows significant differences across the three groups, but these differences drop to non-significance when corrections for age are made (the uncorrected F drops from 3.63 to .88). Nevertheless, there is still a consistent trend present in the data since administrators have the highest age-corrected diastolic blood pressure (84.0) followed by engineers and scientists (82.2 and 81.5 respectively).

The remaining physiological variables show nonsignificant differences across occupational groups. These include serum cholesterol, both uncorrected and corrected for age, serum uric acid, serum cortisol, and serum glucose. Of these latter four variables, glucose is higher for administrators (98.5) than for engineers (93.1) and scientists (95.3).

Finally, one additional variable is included here: number of members of the person's family with a history of coronary heart disease. This measure was described in Chapter 2. As can be seen from the table, there are no occupational differences in the prevalence of family history of coronary heart disease. The mean incidence for the three occupational groups is 1.2 for administrators, 1.0 for engineers, and .9 for scientists (F across the groups = .84, n.s.). These latter findings suggest that heredity (or perhaps the early environment) plays no more than a minor role in accounting for the occupational differences in risk factors of heart disease reported in this study.

The Presence of Heavy Cigarette Smoking Among Administrators: Some Explanations

At this point, a brief restatement of the findings relating stress to cigarette smoking will be made. Then we shall see if administrators, compared to engineers and scientists, are higher on the related stresses.

There are two first-order findings relating stress to the number of cigarettes smoked among smokers. The first finding is a positive association between objective quantitative overload and the number of cigarettes the person smokes. However, since, 21 out of 25 persons on whom there is objective work load data are administrators, there is no possibility of saying anything about the objective work load of non-administrators.

A second finding relating stress to smoking indicates that the amount of time a person reports spending carrying out responsibility for the work of others is positively related to the number of cigarettes smoked, given the person smokes. Administrators report the greatest percent of time spent carrying out this responsibility, followed by engineers, and scientists. Thus, the occupational differences in heavy smoking appear to be related, in part, to the heavy responsibility for the work of others which the administrators report.

This completes the relevant evidence based on first-order relationships between stress and cigarette smoking. Now let us turn to the findings on the conditioning effects of personality on the relationship between stress and smoking as an additional source of explanation for occupational differences. Since the occupational groups do differ significantly on various measures of personality used in the study, it is relevant to carry out this type of search.

There is one main set of findings to summarize here. As reported in Chapter 4, there is a positive correlation between the number of outgoing calls which are reported and the number of cigarettes smoked among smokers--but only for persons who are high on the following personality measures: Involved Striving, Sense of Time Urgency, Environmental Overburdening, and Positive Attitude Toward Pressure. In addition, Environmental Overburdening, itself, is positively correlated with the number of cigarettes smoked ($r = .36$, $p < .01$) as noted in Chapter 3. As it turns out administrators have higher scores than engineers and scientists both on the measures of subjective work load and on all of the above personality measures with the exception of Sense of Time Urgency.

Positive Attitude Toward Pressure, mentioned in the last paragraph, also conditions the relationship between the number of self-initiated meetings the person reports and number of cigarettes smoked. The correlation is positive but only for persons with high scores on Positive Attitude Toward Pressure. As was shown above, administrators also report more such meetings than do engineers and scientists.

These data complete the findings available to explain occupational differences in smoking behavior. They suggest that the differences may be explained, in part, in terms of the greater percent of time administrators spend carrying out responsibility for the work of others, and in terms of the fact their personality attributes predispose them to show positive relationships between certain reported office activities and smoking. Engineers and scientists, on the other hand, do not have very high scores on these measures of stress nor on the personality variables which appear to condition positive relationships between job stress and smoking.

The Presence of Relatively High Systolic Blood Pressure Levels Among Administrators: Some Explanations

First of all, it is possible that blood pressure levels are high among administrators because more of them smoke compared to engineers or scientists. However, as has been noted, the differences in the number of smokers across the three groups is not significant (when being a smoker or not is covaried out in an analysis of covariance, the F for systolic blood pressure across the three occupational groups drops non-significantly from 3.09 to 2.48).

Since smokers among administrators smoke more cigarettes than engineers and scientists, it is also possible that heavy smoking may be related to differences in systolic blood pressure. However, number of cigarettes smoked for smokers is non-significantly correlated with systolic blood pressure ($r = .24$, n.s.) in this sample.

This suggests that while smoking may account for some of the differences across occupation in systolic blood pressure, it by no means accounts for a significant amount of it.

Now additional findings on the relationship between stress and blood pressure will be examined to see what other variables might account for the relationship between occupation and systolic blood pressure. All of these findings make use of conditioning personality variables. The first such finding reported was a positive correlation between the number of outgoing as well as incoming phone calls the person reported and the level of systolic blood pressure for persons with high scores on Persistence. As already noted, administrators report the most outgoing as well as incoming phone calls. However, they do not differ from the other two occupational groups on the Persistence measure, so this is an inadequate explanation of systolic blood pressure differences between the occupational groups.

The next relevant finding reported on was a positive correlation between the percent of time the person reported spending on self-initiated, but not other-initiated, phone calls and systolic blood pressure. This finding holds only for persons who score high on the

California Personality Inventory measure of Flexibility. Administrators report the greatest amount of time spent on self-initiated phone calls compared to engineers and scientists. Furthermore, they also score the highest of the three occupational groups on Flexibility. Thus, these findings suggest that administrators should be higher than engineers and scientists on systolic blood pressure.

The next set of findings on blood pressure is the positive relationship between the percent of time a person reports spending carrying out responsibility for others' futures, a person-oriented responsibility, and systolic blood pressure for persons who score high on any of the following measures of Type A personality: Involved Striving, Persistence, Positive Attitude Toward Pressure, Leadership, and the What I am Like Type A measure. As noted earlier, administrators report spending the most time, compared to engineers and scientists, on responsibilities for others' futures (almost twice as much time as engineers and scientists). With the exception of Persistence, administrators also have the highest scores on all of the conditioning personality measures of Type A just listed.

Occupational Differences in Strain in Summary

The presence of heavier cigarette smoking and higher systolic blood pressure among administrators, compared to engineers and scientists, appears to have its roots in a number of job and personality factors which differentiate these three occupational groups. Greater responsibility for persons and higher scores on Type A measures of personality appear to predispose the administrator to greater strain manifested by such smoking behavior and elevated systolic blood pressure. In this study smoking, itself, is shown not to be one of the explanatory variables accounting for occupational differences in systolic blood pressure. Thus, the occupational differences in these strains appear to be partly accounted for by the interactions of personality and stress.

Occupation as a Conditioner of the Relationship Between Job Stress and Strain

As an additional explanation for why administrators may be at greater risk of coronary heart disease than engineers and scientists in this study, it is conceivable that administrators, above and beyond the personality and job characteristics identified as unique to them, may react differently to stress than engineers and scientists. The category "administrator" is allowed to serve as an umbrella for certain other personality and stress variables which may not have been explicitly measured in this study, and which may serve as conditioners of the relationship between stress and strain.

Analyses have been performed using occupational group as the conditioning variable just as was done with the measures of personality. There are only a few significant findings using occupation as the conditioning variable, and they are now presented.

The first finding, presented in Table 175, shows that there are positive correlations between the percent of time administrators report spending on self-initiated phone calls and three physiological variables: serum cortisol, diastolic blood pressure, and serum glucose (r's = .64, .34, and .33 respectively; p's < .01, .05, and .10 respectively. On the other hand, this stress and these strains are nonsignificantly correlated both for engineers (r's = -.04, -.01, and -.04 respectively) and for scientists (r's = .16, -.09, and -.11 respectively). There is a similar but weaker effect present for the

TABLE 175

THE EFFECT OF OCCUPATION ON THE CORRELATION BETWEEN REPORTED PERCENT OF TIME ON PHONE CALLS AND PHYSIOLOGICAL STRAIN

Stress/Strain	Occupation: Administrator N=58	Occupation: Engineer N=94	Occupation: Scientist N=47	$r_{Admin.}$ vs. $r_{Engin.}$ p<	$r_{Admin.}$ vs. $r_{Sci.}$ p<
Percent of time on:					
Self-initiated phone calls					
Serum cortisol	.64[2]	-.04	.16	.001	.005
Diastolic blood pressure	.34[1]	-.01	-.09	.025	.025
Glucose	.33	-.04	-.11	.025	.025
Other-initiated phone calls					
Serum cortisol	.26	-.14	-.01	.01	.10
Diastolic blood pressure	.07	-.10	-.08	n.s.	n.s.
Glucose	.06	.03	-.17	n.s.	n.s.

[1] $p < .01$

[2] $p < .001$

relationships between percent of time spent on other-initiated phone calls and serum cortisol (r = .26 for administrators, r = -.14 for engineers, and r = -.01 for scientists; all n.s.). Thus, there is an interaction between type of phone call and occupation.

The same pattern of findings occurs when either Persistence or Flexibility is substituted for occupation as a conditioning variable (see Tables 91 and 100 in Chapter 4). For persons with high scores on Persistence, reported time on self-initiated phone calls is positively correlated with serum cortisol and diastolic blood pressure; high Flexible persons show positive stress-strain correlations with all three strains in Table 175. Since administrators have the highest scores trators, compared to engineers and scientists, have the highest scores on Flexibility and Persistence, it is possible that the conditioning effects due to occupation which are presented in Table 175 can be explained by conditioning effects due to Persistence and Flexibility. An analysis carried out to test this prediction, however, shows that the stress-strain correlations in Table 175 are virtually the same after the conditioning effects of Persistence and Flexibility have been statistically removed (see Table XXII-1 in Appendix XXII). This statistical control was accomplished by creating new measures of the dependent variables residualized for the interaction effects of the two personality measures and reported percent of time on self-initiated phone calls. This analysis suggests that there are other factors which are part of occupational differences, and which have not been examined in this study, which condition the relationship between reported time on phone calls and physiological strain.

The second finding deals with the relationship between communicating with other organizational territories and strain. These data are presented in Table 176. Occupation conditions the relationship between reported percent of time spent communicating with other directorates and physiological strain. The percent of time communicating with other directorates is positively and significantly correlated with serum glucose ($r = .56$, $p < .01$) and serum cortisol ($r = .35$, $p < .01$) but only if the person is an

TABLE 176

THE EFFECT OF OCCUPATION ON THE CORRELATION BETWEEN REPORTED PERCENT OF TIME COMMUNICATING ACROSS ORGANIZATIONAL TERRITORIES AND PHYSIOLOGICAL STRAIN

% time communicating with / Strain	Occupation			$r_{Admin.}$ vs.	
	Administrator N=58	Engineer N=94	Scientist N=47	$r_{Engin.}$ p<	$r_{Sci.}$ p<
Own branch					
Serum glucose	-.18	-.15	.24	n.s.	.025
Serum cortisol	-.02	.19	-.16	n.s.	n.s.
Other branches					
Serum glucose	-.16	-.03	-.14	n.s.	n.s.
Serum cortisol	-.10	-.09	-.03	n.s.	n.s.
Other divisions					
Serum glucose	-.03	.01	-.01	n.s.	n.s.
Serum cortisol	-.14	.07	.30[1]	n.s.	.025
Other directorates					
Serum glucose	.56[2]	.10	-.27	.005	.001
Serum cortisol	.35[2]	-.19	.20	.005	n.s.
Other bases					
Serum glucose	.11	-.01	.14	n.s.	n.s.
Serum cortisol	-.22	.11	.18	.025	.025
Non-NASA employees					
Serum glucose	-.11	.16	-.28	n.s.	n.s.
Serum cortisol	.00	-.04	.03	n.s.	n.s.

[1] $p < .05$

[2] $p < .01$

administrator. The respective correlations for engineers and scientists are low and non-significant (r's range from -.27 to .10). The data in the table show that the interaction effect of occupation and percent of time communicating with other territories on these two measures of physiological strain are strongest when the territory is the other directorates rather than other parts of the organization.

Similar effects have been reported when Leadership and Relations with others were used instead of occupation as the conditioning variable (see Tables 123,125 ,126 , and 127 in Chapter 4). Persons with high scores on Leadership or who reported good relations with their role senders showed positive correlations between the reported percent of time spent communicating with other directorates and cortisol and glucose. Since administrators, as previously noted, have the highest scores of all three occupational groups on Leadership and relations with role senders, it is possible that the conditioning effects of occupation in Table 176 are due to the conditioning effects of these other two conditioning variables. A test of this prediction by statistically removing the interaction effects due to Leadership and relations with others showed that the conditioning effect of occupation cannot be explained by these other conditioning variables. The correlations between the reported percent of time communicating with other directorates cortisol and glucose remained virtually unchanged in the re-analysis (see Table XXII-2 in Appendix XXII). Thus, once again the conditioning effects of occupation on the relationship between stress and strain are apparently due to other personality or environmental factors not examined in this study.

One final conditioning effect of occupation also appears in this analysis, and it is presented in Table 177. Administrators who report poor relations with their superior, work group, or subordinates tend to be heavy smokers if they smoke (r's = .59, .54, and .34 respectively; p's $<$ .01, .05, and n.s., N = 19). On the other hand, poor relations

TABLE 177

THE EFFECT OF OCCUPATION ON THE RELATIONSHIP BETWEEN RELATIONS WITH ROLE SENDERS AND NUMBER OF CIGARETTES SMOKED[1]

Poor relations with	Occupation: Administrator N=19	Engineer N=21	Scientist N=10	$r_{Admin.}$ vs. $r_{Engin.}$ p<	$r_{Admin.}$ vs. $r_{Sci.}$ p<
Superior	.59[3]	-.48[2]	-.03	.005	.10
Work group	.54[2]	-.15	-.52	.05	.005
Subordinates	.34	-.40	-.36	.05	.10

[1]For persons who smoke.

[2]$p < .05$

[3]$p < .01$

with role senders is negatively correlated with number of cigarettes smoked for engineers and scientists (r's range from -.52 to -.03). With one exception, as can be seen from the data in Table 177, these inverse correlations are non-significant.

A thorough search of the findings on personality measures which condition the relationship between poor relations with role senders and cigarette smoking failed to turn up any variables which could explain the conditioning effects of occupation. Since administrators report better relations with their superior and subordinates than do engineers and scientists, it seemed possible that the conditioning effect might be a function of the actual quality of relations the person had with role senders. Thus, the sample was divided into persons reporting good and poor relations with each of the three categories of role senders (superior, work group, and subordinates), and this division was used as the conditioning variable. Again, however, no significant relationships or even trends appeared in the data. It may be that these findings can be explained by other conditioning measures of job environment or personality not included in this study since none of the reported findings account for this conditioning effect of occupation.

The Conditioning Effects of Occupation in Summary

The conditioning effects of occupation appear to be unaccounted by conditioning effects of personality variables which have been shown to differ across the three occupational groups. This has been the case for the three sets of findings which appear in this study. These results suggest that there are probably other psychological factors (such as other personality traits and value differences) as well as other possible environmental factors which may account for these effects and which were not tapped in this particular study. The fact that so few additional conditioning effects were discovered using occupation rather than personality as a conditioning variable, however, suggests that greater explanatory power is gained by using specific psychological variables such as personality traits rather than a multidimensional category such as occupational group as a conditioner of stress-strain relationships. This latter point supports the contention presented in Chapter 1 which stated that the specificity of the social-psychological approach to understanding stress-strain relationships would be superior to the more general sociological approach.

Occupation-Environment Fit: A More Global Examination of P-E Fit

In drawing the original stratified, random sample of potential volunteers for the study, administrators were selected from administrative and non-administrative divisions. Similarly, engineers were selected from engineering and non-engineering directorates and divisions (the procedure is described in Chapter 2). These divisions were characterized as administrative or engineering depending on whether the ratio of administrators to engineers was high or low. The ratio was obtained by tallying occupational titles in the Goddard personnel roster. Scientists, as it turned out, were found only in work environments composed primarily of other scientists when these classification procedures were used. These sub-groups were created in order to see whether persons in a specific occupational group would be under more stress and strain when they worked in an occupational environment made up of people, projects, values, and responsibilities <u>different</u> from their own (for example, administrators in engineering environments). Such environments will be called "dissimilar" as compared with "similar environments" in the presentation of findings. Groups in dissimilar environments might be characterized as having potentially poor occupation-environment fit.

Rather than rely solely on the original measures of occupation and environment, we decided to ask the individual to describe both the nature of the job and the organizational environment as it affected his particular job. This alternative method of measuring global job environment has been noted in Chapter 2. Data in Chapter 2 also indicate that there is an adequate degree of overlap between the self-report measure of job environment and the measure used for sampling purposes. The self-report measure of job environment seems most preferable since it represents a view by the person of the environment as <u>he</u> experiences it while the original measure is somewhat crude since it relies on the ratio of administrators to engineers in his division of the organization. A description of the self-report measure, which asks the respondent to indicate what percent of his environment is administrative, engineering, or scientific, appears on page 108. In referring to these two measures of job environment, the personnel roster-based measure of job environment will be called a measure of "objective job environment" while the self-report measure will be called a measure of "subjective job environment."

Using the self-report measure of environment, each of the occupational groups was divided into two subgroups: (a) those persons whose environment was primarily the same as the occupational group they came from (such as administrators in administration), and (b) those persons whose environment was reported to be different than the occupation they came from (such as administrators in engineering). A median split on the percent of environment the person reported similar to his own occupational category was used to create these two subgroups.

For administrators, those who reported less than 80 percent of their environment as administrative were categorized as administrators in non-administrative or <u>dissimilar</u> environments. Those administrators in environments reported as being 80 percent or more administrative were categorized as being in <u>similar</u> environments. Engineers or scientists reporting less than 50 percent of their environment as engineering or science respectively were also classified as belonging to <u>dissimilar</u> job environments. The use of subjective measures of environment allowed us to create a subset of scientists in dissimilar environments--a subset, as noted before, which could not be created using objective measures of environment.

The differences in the cutting points used to determine dissimilar and similar subjective job environments for each of the three occupational

TABLE 178

MEAN REPORTED JOB STRESS FOR PERSONS IN DISSIMILAR AND SIMILAR SUBJECTIVE JOB ENVIRONMENTS

Stress	Environment: Dissimilar N=95	Environment: Similar N=104	F	p<
% reported time in:				
other-initiated phone calls	10.33	8.77	2.79	n.s.
self-initiated phone calls	8.30	6.83	5.37	.01
other-initiated office visits and meetings	22.10	17.51	8.12	.001
self-initiated office visits and meetings	17.13	14.20	3.22	.05
working alone	37.53	43.36	3.50	.05
Estimated number per week of:				
outgoing phone calls	34.66	27.21	3.58	.01
incoming phone calls	40.07	32.96	2.18	n.s.
% reported time communicating with:				
own branch	43.52	50.06	3.73	.05
other branches	11.90	14.73	2.85	n.s.
other divisions	10.23	8.85	.83	n.s.
other directorates	14.00	10.07	5.08	.005
other bases	4.58	2.81	5.41	.005
non-NASA employees	15.67	11.76	4.14	.025
Amount of stress from:				
own branch	2.10	1.79	4.83	.025
non-NASA employees	2.11	1.83	3.77	.05
Non-NASA employees as a source of deadlines	1.89	1.61	5.51	.01
% reported time under great deadline pressure	15.82	11.36	3.81	.05

groups indicate that administrators in dissimilar environments are, on the average, in less of an alien environment than engineers and scientists in dissimilar environments. This is the case because the alien environment of the administrator can range up to 79 percent administrative and still be classified as dissimilar. On the other hand, the alien environment of the engineer and scientist can range only up to 49 percent engineering or scientific respectively and still be classified as dissimilar. Thus, any tests of the prediction that stress and strain will be greater for administrators in dissimilar environments than for administrators in similar environments will be conservative. The tests will be conservative since any effects, if present, should be even greater if the cutting point of 50 percent rather than 80 percent was used for administrators.

Subjective Job-Environment Fit and Stress

These findings are presented in Table 178. Persons in dissimilar job environments are more likely to report heavy work loads compared to persons in similar environments. Thus, they report significantly more time on self-initiated phone calls (8.30 versus 6.83 percent of the time, $F = 5.37$, $p < .01$). There is also a non-significant trend indicating that persons in dissimilar work environments spend more time on other-initiated phone calls as well. Persons in dissimilar job environments also spend significantly more time on other- and self-initiated office visits and meetings, and significantly less time working alone.

Persons in dissimilar environments also report the greatest number of outgoing as well as incoming phone calls per week. However, only the difference in number of outgoing phone calls is statistically significant across the two types of environment.

The next set of findings in Table 178 indicates that persons in dissimilar environments are also characterized by the amount of contact they have with distant organizational territories. Persons in dissimilar environments, compared to those in similar environments, spend significantly less time communicating with members of their own branch and significantly more time communicating with members of other directorates, bases, and non-NASA employees. However, while persons in dissimilar environments spend the least amount of time communicating with their branch, they report the most overall stress from their branch members compared to the stress reported by persons in similar environments ($F = 4.83$, $p < .025$). Since percent of time reported communicating with the branch and stress from it are positively but weakly correlated ($r = .21$, $p < .05$), it is unlikely that persons in dissimilar environments experience the most stress from their branch because they communicate the least with it. Instead, there must be some third common and unidentified environmental factor which jointly accounts for the fact that persons in dissimilar environments communicate least with their branch and experience the most stress from it.

On the other hand, persons in dissimilar environments, compared to persons in similar environments, report spending the most time communicating with non-NASA employees and also report the most stress from these persons ($F = 3.77$, $p < .05$). This is not unexpected since there is a positive correlation between the percent of time spent communicating with non-NASA personnel and the stress derived from them ($r = .28$, $p < .01$). Persons in the dissimilar environments also report non-NASA personnel to be greater shources of deadlines ($F = 5.51$, $p < .01$). No other sources of stress or deadlines differentiate between persons from these two types of environments.

The findings using multi-item indices of stress present a similar picture of the difference between the good and poor fit groups. These results are presented in Table 179. Persons in dissimilar work

TABLE 179

MEAN JOB STRESS INDEX SCORES FOR PERSONS IN DISSIMILAR AND SIMILAR SUBJECTIVE JOB ENVIRONMENTS

Stress	Environment: Dissimilar N=90	Environment: Similar N=100	F	p<
Subjective quantitative work load index	3.55	3.33	7.15	.005
Subjective quantitative overload factor	2.38	2.31	.58	n.s.
Subjective qualitative work load index	3.71	3.70	.01	n.s.
Subjective qualitative overload factor	1.91	1.99	.75	n.s.
Complexification	3.81	3.52	6.77	.005
Relations with:				
Immediate superior	3.45	3.49	.12	n.s.
Work group	3.29	3.47	4.28	.025
Subordinates	3.70	3.68	.04	n.s.
Responsibility for:				
Persons	3.14	2.85	5.06	.01
Things	3.13	2.99	1.68	n.s.

environments have significantly higher scores than persons in similar environments on the subjective quantitative work load index ($F = 7.15$, $p < .005$), and there are nonsignificant trends in the same direction when the subjective quantitative overload factor is used as the measure of stress. On the other hand, the subjective qualitative work load index and overload factor do not differ across the two job environment groups.

Persons in dissimilar environments also report the most complexification ($F = 6.77$, $p < .005$). This suggests that being surrounded by persons with different professional skills rapidly complicates one's work as new parameters and considerations which are often alien to one's formal training must now be incorporated into the work at hand.

While there are no differences between the two job environment groups with regard to relations with one's immediate superior and subordinates, persons in dissimilar environments do report the poorest relations with their work group or peers ($F = 4.28$, $p < .025$). It is not clear why this is the case except that some of the conflicts and stresses of being in a "hostile" job environment may strain relations with colleagues.

Finally, persons in dissimilar job environments have the highest responsibility for persons ($F = 5.06$, $p < .01$), and there is a similar trend with regard to responsibility for things ($F = 1.68$).

When objective global environment, that is, the measure of environment based on the ratio of administrators to engineers in each Goddard division, is substituted for the self-report measure of job environment, none of the findings just reported on are replicated. One stress does appear to be significantly different across the similar and dissimilar environments, but the difference is in the opposite direction from that reported using the self-report measure of job environment. Persons in similar environments report spending less rather than more time working alone (33.68 percent of the time) compared to persons in dissimilar environments (41.81 percent of the time; $F = 4.39$, $p < .05$). In light of the lack of other significant findings, it appears that this relationship could have occurred by chance. At any rate, the objective measure of environment appears to do a poorer job of accounting for differences in reported strain among persons compared to the self-report measure.

The relatively greater power of the subjective rather than the objective measure of global environment in being able to explain variance in job stress and strain may derive from several factors. For one thing, the objective measure is based entirely on data using civil service titles which may not reflect the actual occupational activities of the person. As noted previously in Chapter 2, the person's self-report of his occupation does not correlate beyond .43 with the civil service title for his occupation. Thus, the measure of objective environment could be based on invalid or unreliable measures.

Second, the measure of objective environment was computed using the ratio of administrators to engineers within each <u>division</u>. Even if the civil service job titles are assumed to be accurate, the actual environments of the job may not be limited by the divisional boundaries defined by the formal organizational chart for Goddard. Instead, the environment or larger role set of the person may be defined by patterns of interaction not shown on such a chart.

Third, subjective environment may be the best predictor of job stress and related strain because what affects stress and strain may not be what the environment objectively is, but how the person subjectively experiences or perceives his environment. An analogous instance of this phenomena occurs in the Caplan and French (1968) study of 22 NASA white collar males. In that study, subjectively measured work load was a better predictor of physiological strain (pulse rate and serum cholesterol) than the objective measure of work load. This was the case even though the objective and subjective measures were correlated .64. Similar phenomena are reported by Kraut (1965) who showed that subjective rather than objective role conflict was positively associated with job-related tension.

Subjective Job-Environment Fit and Personality

There are no significant differences between persons in dissimilar and similar job environments on personality measures in this study. This suggests that there must be other factors including traits, motives, and abilities not tapped by the personality measures in this study which account for why some persons end up in dissimilar environments while others do not.

Subjective Job-Environment Fit and Strain

These findings are presented in Table 180. Persons in dissimilar work environments, compared to persons in similar environments, have significantly higher pulse rates (76.21 versus 72.86 beats per minute; $F = 4.92$, $p < .01$) and significantly higher age-corrected diastolic blood pressure (84.21 versus 81.72 mm Hg; $F = 5.72$, $p < .005$). Research by Mrs. Jean Mockbee at NASA (personal communication, 1968) shows a similar pattern of findings with regard to hypertension prevalence among volunteers for yearly health exams at Goddard. However, the findings at NASA Headquarters, also reported by Mrs. Mockbee, show that the prevalence

TABLE 180

DIFFERENCES IN PHYSIOLOGICAL INDICATORS OF STRAIN BETWEEN DISSIMILAR AND SIMILAR SUBJECTIVE JOB ENVIRONMENTS

Strain	Environment: Dissimilar N=90	Environment: Similar N=100	F	p<
Pulse rate	76.21	72.86	4.92	.01
Systolic blood pressure	132.56	130.23	1.67	n.s.
Diastolic blood pressure[1]	84.21	81.72	5.72	.005
Serum cholesterol[1]	188.77	193.06	.86	n.s.
Serum uric acid	5.75	5.81	.14	n.s.
Serum glucose	96.50	93.95	.89	n.s.
Serum cortisol	14.58	13.47	2.28	n.s.
Ponderal index	12.42	12.49	.60	n.s.
Age	39.91	39.81	.01	n.s.
% smokers	40.30	50.00	.42	n.s.
Number of cigarettes smoked per day[2]	23.48	24.28	.04	n.s.

[1]Age-corrected.

[2]Smokers only.

of hypertension is higher in the administrative environment regardless of the occupation of the person. The criteria for hypertension in the Mockbee study have been presented earlier (see page 5).

There are no additional differences between the two job-environment fit groups with regard to any of the other strain variables including the measures of psychological strain, the measures of smoking, and the other physiological risk factors.

The absence of significant findings relating type of job environment to psychological strain may be due to the general nature of these strain measures. These measures of psychological strain cover a wide variety of specific job aspects in their item content. Using the job satisfaction measure as an example, some of these aspects of the job may be sources of satisfaction and others may be sources of dissatisfaction in the same job environment. If this is the case, one source of satisfaction may be cancelled out by another source of dissatisfaction. If this cancelling process occurs in both similar and dissimilar job environments for aspects of the job uniquely associated with each environment, the overall effect could be to cancel out any differences in job satisfaction between the two types of job environments.

The relatively high mean pulse rate and diastolic blood pressure which is found among persons in dissimilar job environments may result from the high responsibility for persons also found in these environments. It was reported in Chapter 3 that responsibility for persons is positively correlated with pulse rate ($r = .22$, $p < .01$) and with diastolic blood pressure ($r = .17$, $p < .05$; $r = .13$ with age-corrected diastolic blood pressure).

The Interaction of Occupation and Job Environment on Stress, Personality, and Strain

The main effects of occupation and of global job environment have been examined with relation to stress, personality, and strain. In this section, the interaction of occupation and job environment will be considered. In this way, it will be possible to see whether being in a dissimilar job environment produces different effects for administrators, engineers, and scientists.

The Interaction Effect of Occupation and Subjective Job-Environment Fit on Stress

The first finding deals with complexification and is presented in Table 181. There is a significant interaction effect of occupation and

TABLE 181

REPORTED COMPLEXIFICATION AS A FUNCTION OF OCCUPATION AND SUBJECTIVE JOB ENVIRONMENT[1]

	Occupation		
Environment	Administrator	Engineer	Scientist
Dissimilar	3.68 (31)[2]	3.83 (44)	3.98 (20)
Similar	2.80 (27)	3.76 (50)	3.80 (27)

[1]$F_{occupation} = 14.03,\ p < .001.$
$F_{environment} = 12.08,\ p < .001.$
$F_{occupation\ x\ environment} = 5.46,\ p < .01.$

[2]Cell size.

environment ($F = 5.46$, $p < .01$). This is probably due to the fact that being in a dissimilar environment has a greater effect on the amount of complexification experienced by administrators (an increase in complexification of .87 points) compared to that experienced by engineers and scientists (who show respective increases of only .07 and .19 points).

A similar interaction effect occurs when objective job environment is substituted for the self-report measure ($F = 10.51$, $p < .005$). These findings are presented in Table 182. Scientists are omitted from this analysis and will be from subsequent analyses using the personnel roster-based measure of job environment, since, as has been noted previously, there are no scientists in nonscientific environments using the objective measure. Administrators show an increase in complexification scores in dissimilar environments; however, engineers show a slight decrease in complexification scores in the dissimilar environments.

TABLE 182

REPORTED COMPLEXIFICATION AS A FUNCTION OF OCCUPATION AND OBJECTIVE JOB ENVIRONMENT[1]

Environment	Occupation: Administrator	Occupation: Engineer
Dissimilar	3.80 (11)[2]	3.57 (25)
Similar	3.08 (45)	3.87 (67)

[1] $F_{occupation} = 3.27$, n.s.

$F_{environment} = 1.79$, n.s.

$F_{occupation \times environment} = 10.51$, $p < .005$.

[2] Cell n.

Overall, these findings indicate that poor job-environment fit is associated with high complexification. However, the effect of poor fit on complexification is worse for administrators compared to engineers and scientists.

The next finding deals with the index on utilization of abilities. As shown in Table 183, there is a significant interaction effect of occupation and job environment ($F = 4.88$, $p < .01$). Administrators in dissimilar environments report higher utilization than administrators

TABLE 183

REPORTED UTILIZATION OF ABILITIES AS A FUNCTION OF OCCUPATION AND SUBJECTIVE JOB ENVIRONMENT[1]

	Occupation		
Environment	Administrator	Engineer	Scientist
Dissimilar	3.44 (31)[2]	3.07 (44)	3.62 (20)
Similar	3.09 (27)	3.42 (50)	3.91 (27)

[1] $F_{occupation} = 11.13,\ p < .001$

$F_{environment} = .89$, n.s.

$F_{occupation \times environment} = 4.88,\ p < .01.$

[2] Cell size.

in administrative environments (3.44 versus 3.09). On the other hand, just the opposite is the case for engineers and scientists who report their lowest utilization in dissimilar environments. These findings suggest that utilization of abilities is generally lower in administrative than in nonadministrative environments. This would be the case if it is assumed that engineers and scientists who are in dissimilar environments are really thinking of such environments in terms of the extent to which they are administrative. This assumption is supported by the fact that the more the environment is reported as being engineering or scientific, the less it is characterized as being administrative (r's = -.66 and -.58 respectively, both $p < .001$). On the other hand, the percent of the environment characterized as being engineering is only weakly, but negatively, correlated with the percent of the environment characterized as scientific ($r = -.19$, $p < .01$).

Table 184 presents parallel effects using the objective rather than the subjective measure of job environment. Administrators again report the lowest utilization of abilities in similar environments while engineers report the lowest utilization in dissimilar or primarily administrative environments ($F_{interaction} = 5.56$, $p < .025$).

TABLE 184

REPORTED UTILIZATION OF ABILITIES AS A FUNCTION OF OCCUPATION AND OBJECTIVE JOB ENVIRONMENT[1]

	Occupation	
Environment	Administrative	Engineer
Dissimilar	3.43 (11)	2.95 (25)
Similar	3.25 (45)	3.38 (66)

[1] $F_{occupation} = 2.07$, n.s.

$F_{environment} = 1.11$, n.s.

$F_{occupation \times environment} = 5.56$ ($p < .025$).

[2] Cell size.

While engineers and scientists report better opportunities for advancement in their respective environments, administrators report better opportunities in dissimilar job environments ($F_{interaction} = 3.22$, $p < .05$). These findings, presented in Table 185, indicate that the best opportunities for advancement and recognition occur, overall,

TABLE 185

REPORTED OPPORTUNITIES FOR ADVANCEMENT AND RECOGNITION AS A FUNCTION OF OCCUPATION AND SUBJECTIVE JOB ENVIRONMENT[1]

	Occupation		
Environment	Administrator	Engineer	Scientist
Dissimilar	2.72 (31)[2]	2.42 (44)	2.77 (20)
Similar	2.42 (27)	2.83 (50)	2.81 (27)

[1] $F_{occupation} = 1.32$, n.s.

$F_{environment} = .18$, n.s.

$F_{occupation\ x\ environment} = 3.22$, $p < .05$.

[2] Cell size.

in nonadministrative environments regardless of the person's profession. A nonsignificant but similar pattern of findings occurs when the objective measure of environment is used ($F_{interaction} = 1.13$, n.s.). These findings are presented in Table 186.

Earlier it was reported that administrators, compared to scientists and engineers, spend the least amount of time communicating with persons in their own branch or office. This time among administrators is taken up with communication with more distant territories of the organization. It was also noted that persons in dissimilar job environments, regardless of occupation, spend the least amount of time communicating with persons in their own branch or office. Table 187 shows that there is also an interaction effect of occupation and environment on percent of time spent

TABLE 186

REPORTED OPPORTUNITIES FOR ADVANCEMENT AND RECOGNITION AS A FUNCTION OF OCCUPATION AND OBJECTIVE JOB ENVIRONMENT[1]

	Occupation	
Environment	Administrator	Engineer
Dissimilar	2.43 (11)[2]	2.27 (25)
Similar	2.59 (45)	2.77 (66)

[1] $F_{\text{occupation}} = .01$, n.s.

$F_{\text{environment}} = 4.13$, $p < .05$.

$F_{\text{occupation x environment}} = 1.13$, n.s.

[2] Cell size.

communicating with the branch ($F = 4.78$, $p < .01$). Administrators in administrative environments, compared to those in dissimilar or non-administrative environments, spend less time communicating with members of their own branch or office relative to the time they spend communicating with more distant organizational territories. Engineers and scientists, on the other hand, spend less time communicating with their own branch when they are members of dissimilar or administrative environments. This may reflect the fact that the administrative environments, which are located in primarily the Administrative and Management Directorate at Goddard, are expected to deal with the organizational maintenance and well-being of the other parts of the organization as well as their own by definition.

When objective environment is substituted for the self-report measure of job environment, administrators in noncommensurate environments again

TABLE 187

REPORTED PERCENT OF TIME COMMUNICATING WITH OWN BRANCH OR OFFICE AS A FUNCTION OF OCCUPATION AND SUBJECTIVE JOB ENVIRONMENT[1]

	Occupation		
Environment	Administrator	Engineer	Scientist
Dissimilar	41.45 (31)[2]	40.32 (44)	53.75 (20)
Similar	35.74 (27)	49.90 (59)	64.67 (27)

[1]$F_{occupation} = 24.85,\ p < .001.$

$F_{environment} = 4.08,\ p < .025.$

$F_{occupation \times environment} = 4.78,\ p < .01.$

[2]Cell size.

report the greatest amount of time communicating with persons in their own branch or office compared to administrators in administrative environments. The interaction, however, is nonsignificant ($F = 2.21$). These findings are presented in Table 188.

The next set of findings deal with the interaction effects of job and job environment on reported relations with the person's role senders. Tables 189 through 191 present these effects on relations with one's superior, work group, and subordinates. The first two tables show significant interaction effects (F's $= 6.35$, $p < .005$; and 3.64, $p < .05$ respectively). In both of these tables engineers and scientists in dissimilar, rather than similar, job environments report poorer relations with their immediate superior and work group. On the other hand, the pattern is reversed for administrators who report better rather than

TABLE 188

REPORTED PERCENT OF TIME COMMUNICATING WITH OWN BRANCH OR OFFICE AS A FUNCTION OF OCCUPATION AND OBJECTIVE JOB ENVIRONMENT[1]

Environment	Occupation	
	Administrator	Engineer
Dissimilar	48.64 (11)[2]	45.24 (25)
Similar	37.33 (45)	45.34 (68)

[1] $F_{occupation} = .08$, n.s.
$F_{environment} = 1.04$, n.s.
$F_{occupation \times environment} = 2.21$, n.s.

[2] Cell size.

TABLE 189

RELATIONS WITH IMMEDIATE SUPERIOR AS A FUNCTION OF OCCUPATION AND SUBJECTIVE JOB ENVIRONMENT[1]

Environment	Occupation		
	Administrator	Engineer	Scientist
Dissimilar	3.89 (31)[2]	3.27 (44)	3.27 (20)
Similar	3.37 (27)	3.61 (50)	3.38 (27)

[1] $F_{occupation} = 2.89$, n.s.
$F_{environment} = .01$, n.s.
$F_{occupation \times environment} = 6.35$, $p < .005$.

[2] Cell size.

TABLE 190

RELATIONS WITH WORK GROUP AS A FUNCTION OF OCCUPATION AND SUBJECTIVE JOB ENVIRONMENT[1]

Environment	Occupation		
	Administrator	Engineer	Scientist
Dissimilar	3.47 (31)[2]	3.24 (44)	3.14 (20)
Similar	3.29 (26)	3.58 (50)	3.41 (27)

[1] $F_{occupation} = .94$, n.s.
$F_{environment} = 2.94$, n.s.
$F_{occupation \times environment} = 3.64$, $p < .05$.

[2] Cell size.

TABLE 191

RELATIONS WITH SUBORDINATES AS A FUNCTION OF OCCUPATION AND SUBJECTIVE JOB ENVIRONMENT[1]

Environment	Occupation		
	Administrator	Engineer	Scientist
Dissimilar	3.87 (31)[2]	3.62 (42)	3.58 (19)
Similar	3.79 (27)	3.73 (47)	3.49 (27)

[1] $F_{occupation} = 3.99$, $p < .05$.
$F_{environment} = .06$, n.s.
$F_{occupation \times environment} = .53$, n.s.

[2] Cell size.

worse relations in dissimilar or nonadministrative environments. The third table, which examines the effect of job and subjective job environment on relations with subordinates, shows no interaction effect ($F = .53$). However, there is a trend parallel to that found in the preceding two tables--administrators in dissimilar environments again report the best relations.

Similar effects are only found for relations with the immediate superior when objective environment is substituted for the self-report measure. However, the interaction is nonsignificant ($F = 2.27$). This finding is presented in Table 192. Administrators in dissimilar

TABLE 192

RELATIONS WITH IMMEDIATE SUPERIOR AS A FUNCTION OF OCCUPATION AND OBJECTIVE JOB ENVIRONMENT[1]

	Occupation	
Environment	Administrator	Engineer
Dissimilar	3.74 (11)[2]	3.11 (25)
Similar	3.62 (45)	3.56 (66)

[1] $F_{\text{occupation}} = 3.36$, n.s.

$F_{\text{environment}} = .75$, n.s.

$F_{\text{occupation x environment}} = 2.27$, n.s.

[2] Cell size.

environments and engineers in similar or engineering environments report the best relations. No similar effects occur when the stress is relations with the work group or subordinates ($F_{interaction}$'s are .44 and .84 respectively, both n.s.).

These interaction effects again show that the administrative environment, regardless of the occupation the person holds in it, tends to be associated with difficult relations with role senders and particularly with the immediate superior. The fact that relations, particularly with the superior, are the worst in the administrative environment may be due to the presence of other job stresses in that environment which contribute to poor relations with role senders and particularly to poor relations with the superior. Evidence reported in Chapter 3 (see Table 56) provides support for this explanation. Poor relations with role senders is positively and significantly associated with two stresses found to be present in the administrative environment: low utilization of abilities and low perceived opportunities for advancement and recognition. Furthermore, the effects of these two predictors of poor relations is greater for relations with the superior and work group (r's range between .33 and .41) than for relations with subordinates (r's range from .16 to .23).

The Effect of Occupation on the Relationship Between Job-Environment Fit and Stress: Summary

These complete the findings dealing with stress and job-environment fit. While the administrator reports higher complexification in non-administrative environments, the non-administrative environment appears to be a place where persons, regardless of occupation enjoy better utilization of abilities, higher perceived opportunities for advancement and recognition, less time having to communicate with other organizational territories, and better relations with role senders--particularly the immediate superior. These findings suggest that while the environment may be a dissimilar one, it may not necessarily represent poor fit in the sense of implying high stress. For the administrator, dissimilar environments represent freedom from many stresses while for the engineer and scientist such environments represent increased stress.

The Interaction Effect of Occupation and Global Job Environment Fit on Personality

Earlier it was reported that there were no personality differences in this study between persons in similar and dissimilar job environments. Personality is also unaffected by the interaction of job and job environment. As noted before, a broader array of trait measures may uncover such interaction effects if they are present.

The Interaction Effect of Occupation and Global Job Environment Fit on Strain

There is one significant interaction effect to be reported here. The findings, presented in Table 193, show that when the objective measure of job environment is used rather than the self report, administrators in nonadministrative, dissimilar environments have a mean pulse of 85.54 beats per minute compared to administrators in commensurate environments who have a pulse rate of 75.13--over 10 beats per minute slower. On the other hand, engineers in dissimilar and similar environments show a negligible difference in pulse rate (73.20 versus 74.54 beats per minute). The interaction effect is significant at $p < .005$ ($F = 8.38$).

A similar but nonsignificant pattern of results also occurs when the self-report measure of environment is used rather than the objective measure ($F = 2.44$). These findings are presented in Table 194.

TABLE 193

MEAN PULSE RATE AS A FUNCTION OF OCCUPATION AND OBJECTIVE JOB ENVIRONMENT[1]

Environment	Occupation: Administrator	Occupation: Engineer
Dissimilar	85.54 (11)[2]	73.20 (25)
Similar	75.13 (45)	74.54 (68)

[1] $F_{\text{occupation}} = 10.15$, $p < .005$.

$F_{\text{environment}} = 4.99$, $p < .05$.

$F_{\text{occupation x environment}} = 8.38$, $p < .005$.

[2] Cell size.

TABLE 194

MEAN PULSE RATE AS A FUNCTION OF OCCUPATION AND SUBJECTIVE JOB ENVIRONMENT[1]

Environment	Occupation: Administrator	Occupation: Engineer	Occupation: Scientist
Dissimilar	80.45 (31)[2]	74.86 (44)	72.60 (20)
Similar	72.52 (27)	73.06 (50)	72.82 (27)

[1] $F_{\text{occupation}} = 2.00$, n.s.

$F_{\text{environment}} = 4.09$, $p < .05$.

$F_{\text{occupation x environment}} = 2.44$, n.s.

[2] Cell size.

Since occupation is not found to condition the relationship between any stress and pulse rate, the effect must be due to some stress variable or personality variable not measured in this study. Indeed the explanation may lie in the types of professional value conflicts which administrators compared to nonadministrators may encounter as employees in dissimilar environments. This study has not explored the nature of such value conflicts, but they have been reported on in the research literature (for example the work of Abramson, 1964; Eiduson, 1962; Pelz, Saunders, & Shepard, 1955). The nonsignificant trend for pulse rate which shows that it is higher for administrators than for engineers and scientists could be due, in part, to this interaction effect.

Differences in Stress, Personality, and Strain Among Administrators, Engineers, and Scientists: A Review of the Findings

This is a brief summarization of the main theoretical findings from this chapter. The general findings are as follows:

1. Administrators, compared to engineers and scientists, generally have more work stress in the form of high responsibility for persons, high subjective quantitative work load--particularly incoming phone calls--, high utilization of leadership skills, and low utilization of skills and abilities which make use of technical knowledge. Administrators also spend the most time communicating with other territories in the organization compared to engineers and scientists.

2. With regard to personality differences, administrators differ most from engineers and scientists on Flexibility; administrators have the highest scores. Administrators also have the highest scores on several measures of Type A personality including Involved Striving, Positive Attitude Toward Pressure, Environmental Overburdening,

Leadership, Competitive Orientation, and the What I am Like Type A measure.

3. The differences in Flexibility among the three occupational groups is accompanied by a difference in coping with role conflict. Administrators cope by confronting conflicting demands rather than refusing to handle them. This finding replicates a similar finding reported in the Kahn et al. (1964) study of role conflict and role ambiguity.

4. There are also differences in how the three occupational groups cope with overload. Administrators prefer to aim for meeting demands for quantity of output while sacrificing on quality; engineers and particularly scientists are more likely to aim for quality, sacrificing somewhat on quantity. These findings indicate that the ways of coping with overload for administrators and non-administrators at Goddard is similar to that reported in the French et al. (1965) study of university administrators and professors.

5. Furthermore, subjective qualitative overload is inversely related to high self-esteem for scientists, but unrelated for administrators also replicating a finding from the French et al. research. In that study subjective quantitative overload was found negatively related with high self-esteem among administrators but not among professors; however, no such findings appear for administrators and nonadministrators in the Goddard sample.

6. Person-environment fit, a measure of stress which takes into account both personality, or need for the environment to have certain attributes, and environmental press, also differs according to occupation. Administrators tend to have the poorest fit with regard to quantitative

work load, complexification, and opportunity for advancement and recognition. They have the best fit, however, with regard to responsibility for persons.

7. With regard to strain, administrators have higher systolic blood pressure and, among the smokers, are heavier smokers. These differences in strain appear to be accounted for by the interaction of high responsibility for persons and Type A personality measures including Involved Striving, Positive Attitude Toward Pressure, Leadership, and the What I am Like Type A measure. In this study occupational differences in blood pressure are not accompanied by statistically significant occupational differences in the prevalence of smokers nor are they related to the amount of cigarettes smoked among smokers. The differences in heavy smoking among the three occupational groups appear to be related to the differences in responsibility for persons among them. As reported earlier, responsibility for persons and number of cigarettes smoked are positively correlated.

8. Only a few additional relationships between job stress and strain appear when occupation rather than personality is used as a conditioning variable. This finding suggests that little additional understanding of the relationship between stress and strain is gained by using broad occupational categories rather than more specific psychological measures of personality as conditioning variables.

9. When global job environment is categorized as being either similar or dissimilar with the person's professional orientation, the latter type of environment, one in which persons of one profession are surrounded by persons of other professions (such as engineers in administrative environments) is associated with high subjective

quantitative work load including phone calls, meetings, and office visits, more time under great deadline pressures, complexification, more responsibility for persons, and poor relations with the work group, and a greater percent of time in contact with distant territories within and outside the organization.

These findings, however, hold only using the person's self-report of the environment. When a measure of the environment based on the ratio of administrators to engineers in each organizational division is used, a measure derived by tallying up occupations according to civil service title, no such findings occur. This suggests that the person's perception of his environment, compared to our somewhat crude "objective" measure of environment, is either a more reliable measure of environment or else that how the person perceives the environment, compared to what the objective environment really is, is a more important predictor of job stress.

10. There are no significant differences in the personality traits measured in this study across dissimilar and similar job environments. A wider range of traits than those included in this study may uncover such differences.

11. Persons in dissimilar job environments have higher pulse rates and higher diastolic blood pressure than persons in similar environments. This, again, only holds when the self-report measure of environment is used as a predictor of strain. These differences in strain appear to be accounted for by the presence of relatively high responsibility for persons which is found in dissimilar environments. The differences in diastolic blood pressure seem to agree with an earlier finding from NASA which suggested that administrators and

engineers in dissimilar environments have a greater prevalence of hypertension than employees in environments similar to their occupation.

12. Although there are differences in stress and strain as a function of whether or not a person is in a similar or dissimilar occupational environment, there are also interaction effects of this global measure of environment and occupation. These findings hold primarily for the self-report rather than objective measure of job environment again indicating either the superior validity of the self-report measure or the fact that perceived rather than objective environment is associated with perceived stress. An examination of these interactions shows that administrators report more stress in similar than in dissimilar job environments while just the opposite is the case for scientists and engineers. This indicates that some stresses are highest in administrative environments regardless of what occupation the person holds in that environment. These stresses include low utilization of abilities, low perceived opportunities for advancement and recognition, more communication with distant organizational territories, and poor relations with the immediate superior. Thus, while an administrator in an engineering environment may be classified as belonging to a dissimilar job environment, this does not necessarily imply that the person will be at greater job stress. If the dissimilar environment is administrative, it is more likely to have high stress than if the dissimilar environment is engineering or scientific in nature.

13. There are no differences in personality, using the measures in this study, as a function of the interaction of global job environment and occupation. It would not be unexpected, however, to find administrators in engineering environments had different personality traits

than administrators in administration and engineers in the two environments, given a wider range of trait measures.

14. Occupation and job-environment fit interact in their effects on pulse rate. This finding is significant when the objective measure of environment is used and is non-significant, but in the same direction when the self-report measure is used. Administrators in dissimilar job environments have considerably higher pulse rates than administrators in similar job environments while there is no difference in pulse rate across environments for engineers and scientists. None of the previous findings in the study can explain this interaction effect, but it does indicate that administrators show more strain than engineers and scientists when put in dissimilar job environments. Interestingly enough, there is a nonsignificant trend for pulse rate which shows that it is highest for administrators compared to engineers and scientists. This trend could be a function of this interaction effect.

15. In Chapter 1 findings were presented (Table 1) which suggested that administrators at NASA had a higher prevalence of coronary heart disease compared to engineers and scientists. If those findings represent the truth, then the research presented here on occupational differences provides some supporting data. Administrators, compared to engineers and scientists, report the most occupational stress, are highest on Type A measures of personality, and show the most strain on risk factors of coronary heart disease. The data presented in this study show that the occupational differences in strain can be explained by relationships between stress, personality, and strain. Thus, regardless of the validity of the data in Table 1, it appears that of the three occupations, administrators have the greatest risk of contracting coronary heart disease. It

should be noted that engineers tend to fall intermediate between administrators and scientists on measures of stress, personality, and strain. In terms of the work engineers do, they represent, in many ways, the midpoint on an ordinal scale running from administration to science--from the purely applied work of administrators which requires the coordination of large numbers of people to the purely basic research of scientists which requires a minimum of such manipulation in getting the task at hand accomplished. The engineer, a combination of science and application, forms an intermediate point. He shows intermediate levels of job stress compared to the administrator and scientist, and perhaps, in this study, he should be consequently viewed as having intermediate risk with regard to coronary heart disease.

CHAPTER 6

Discussion

There is little doubt anymore about the rapid and accelerating rate of change that industrialized society is undergoing. Institutions are being created and dissolved overnight and whole work forces are being rented on short notice. The byword of corporate mergers and corporate leadership successions is increasingly "reorganization." Change in societal norms, values, and life styles is being accompanied by change in the structure of organizational forms. Bureaucracy is being replaced by new structures, structures designed for change. Bennis (Bennis & Slater, 1968) calls these structures <u>temporary organizations</u>, and Toffler (1970) has coined the term "ad-hocracies" to describe them. These new organizations defy description on the conventional organizational chart. Indeed, the chart can barely keep up with their evolving and shifting structure (at NASA, as is the case in other "technology" organizations, it is not uncommon to find a new organizational chart occurring once every six months).

The individual may want to debate the merits of the various types of organizational and societal change that are occurring. That is his prerogative. However, one thing is removed from the arena of debate. Change, itself, is upon us in an intimate and unavoidable way. Even for those who opt to <u>retard</u> change, they will be involved in an act of change and alteration for they will have to intervene and reverse the trend of industrialized society.

The acceptance of turbulence in the environment, as a part of the current state of affairs, means that society must now look increasingly to the physical and social sciences for descriptions of dynamic, functional processes rather than of static co-relationships. It is a goal of this chapter to recognize the increased premium on understanding dynamic, functional relationships in the study of the effects of organizational stress on individual strain.

To demonstrate that we have knowledge of such relationships at our fingertips is going to take no less than active intervention into the stream of behavior. We must be able to demonstrate that we can alter organizational stress and thereby reduce individual strain. If this can be done, we shall then be able to evaluate the extent to which we have a good understanding of the processes by which stress produces strain. Our ability to carry out such an intervention successfully will be one demonstration of whether man can be master of his technological and organizational environment or whether the frightening reverse is the case.

In this chapter, some aids will, hopefully, be provided for those willing to take the next steps toward organizational field experimentation with coronary heart disease prevention programs. Two questions will be asked. First, do the findings from the research described here, and elsewhere in the literature, provide an adequate data base for proposing the initiation of field experiments to reduce human strain in organizations? Second, if the data base is adequate, are there social science technologies available to create the necessary experimental manipulations?

As a point of departure for this chapter, the findings on organizational stress-strain relationships will be used as the data base rather than the findings from other studies which deal with the technologies for changing organizational environments. Indeed, this study's focus on the probable social and psychological causes of coronary heart disease is quite different from the studies which must follow on the probable cures of organizationally-related coronary heart disease. Therefore, certain procedures of experimentation, where they seem warranted, will be proposed, but it must remain for future studies to evaluate their adequacy as means for altering organizational stress and individual strain.

An Examination of the Data Base for Performing Organizational Field Experiments in Coronary Heart Disease Prevention

In this section each of the major stresses examined in this study will be reviewed in terms of their effects on strain and their relationship to supporting or nonsupporting findings in the extant literature. Much of this literature has been reviewed in Chapter 1 and will be briefly referred to here. A specific review of the findings of this chapter will be found in greater detail at the end of Chapters 3 through 5, the three chapters of results.

Findings Involving Role Ambiguity

For the most part the findings in this area are weak. As in previous research (Kahn et al., 1964; Smith, 1957, for example), it has again been shown that role ambiguity is associated with low job satisfaction and other indicators of psychological strain. However, before much use is made of these relationships between job stress and job satisfaction, a conceptualization of satisfaction which differentiates it into types will be needed. As Sales and House's (in press) research suggests, poor intrinsic satisfaction may be a more important factor in coronary heart disease than poor extrinsic satisfaction. This research, however, is still in its infancy, but the specificity of its approach in defining job satisfaction may be worth further attention. Incidentally, an inspection of the Kahn et al. data on job satisfaction shows that most of the items deal with intrinsic rather than extrinsic satisfaction. Our study, however, has used a general measure of job satisfaction rather than one which differentiates between extrinsic and intrinsic factors.

To continue with the findings from this study on role ambiguity, there were no significant first-order relationships between ambiguity and measures of physiological strain. Furthermore, when personality was used as a conditioning variable, it failed to uncover any further relationships between ambiguity and physiological strain. While persons who report poor relations with their subordinates show positive correlations between role ambiguity and serum cortisol, these correlations are not significantly higher than those found for persons reporting good relations.

This is not to imply that role ambiguity is unrelated to physiological strain. Dibner (1958), as noted in Chapter 1, did find that ambiguity was associated with high GSR, a physiological indicator of, among other things, anxiety. At this time, it must be concluded that until further is known about the role of ambiguity as a stress in coronary heart disease, it cannot be considered as a major organizational variable worth manipulating in a coronary heart disease prevention program.

<u>Findings Involving Quantitative Work Load</u>

While previous research has demonstrated a positive relationship between high objective work load and serum cholesterol (Caplan & French, 1968; Friedman, Rosenman, & Carroll, 1957; Horwitz & Bronte-Stewart, 1962; Sales, 1969a, 1969b; for example), no such findings appear in this study. It has been pointed out, however, that the sample of participants in the objective tally of work load in this study represented less than 12% of those who filled out questionnaires, and are unrepresentative of the total sample with regard to occupation and smoking habits. Furthermore, we lack data on the reliability of the tally of their work load kept by their secretaries. Therefore, the negative results in this study may only represent a failure to replicate measurement procedures.

On the other hand, it was shown in this study that heavy cigarette smoking is positively correlated with objective quantitative work load. Furthermore, serum cortisol level was shown to be positively correlated with high subjective quantitative work load; cortisol also showed a nonsignifcant trend in the same direction when objective work load was used as an indicator of stress. However, serum cortisol's role in coronary heart disease, if any, is unknown presently.

The largest number of significant findings dealing with subjective work load as a stress are those in which personality and relations with role senders are used as conditioning variables. The findings using personality as a conditioning variable will be considered first. By and large, they show that self-reports of time spent on the phone and in meetings show different relationships to psychological and physiological measures of strain depending on (a) whether the job activity is initiated by the person or initiated by others in his environment, and (b) the personality of the individual. Persons with high scores on personality measures of Persistence, Involved Striving, Time Urgency, Environmental Overburdening, or Positive Attitude toward Pressure showed positive relationships between the percent of time on self-initiated activities and measures of serum glucose, systolic and diastolic blood pressure, serum cortisol, and heavy cigarette smoking. Thus, Type A persons show positive work load-strain relationships. Persons with low scores on these Type A measures show no such relationships. Furthermore, personality does not condition the relationship between phone calls initiated by others and measures of strain.

High subjective quantitative work load also relates to psychological strain for Type A persons. Persons who score high on the What I am Like Type A measure show low satisfaction and high threat under high work load.

It should be noted that the Sales' Type A personality measures used in this study have an average correlation of .50 with the Jenkins Activity Survey. In addition, the What I Am Like: Type A measure correlates .80 with the Jenkins Activity Survey. The magnitude of these coefficients provide some evidence of validity for the personality measures since the Jenkins has been shown to correlate with the Type A behavior pattern (Jenkins, Rosenman, & Friedman, 1967) and with coronary heart disease in a retrospective study of coronary patients and controls (Jenkins, Zyzanski, & Rosenman, in press). The Jenkins Activity Survey, however, has not yet been shown to relate to coronary heart disease in a prospective study.

As another way of conceptualizing the interaction between personality and quantitative work load in the environment, we have used measures of person-environment fit. In this study, poor P-E fit with regard to the amount of time the person spends and wants to spend in meetings, for example, is associated with high serum cholesterol. Persons who report spending as much time as they want to in meetings have the lowest serum cholesterol.

Are there other findings from the research literature which support these results? Nowhere is there data which directly suggest that Type A persons are more likely to react to job stress with strain than are Type B persons. However, the research of Friedman, Rosenman, and their colleagues on the Type A behavior pattern (for example, Friedman & Rosenman, 1959, 1960; Rosenman & Friedman, 1961; Rosenman et al., 1966, 1970) may be interpreted as providing support for the findings from this NASA research. Friedman et al. have been quick to point out again and again that they are not measuring personality but behavior, specifically behavior patterns characteristic of a particular type of individual. These behaviors can be recast as representing the interaction between personality and the environment of the person. When this is done, all of their research on the Type A behavior pattern may be said to consist of an outstanding collection of findings which indicate that the interaction of personality and environment are significant predictors of physiological risk factors in coronary heart disease as well as the disease state itself. An examination of the item content of the Jenkins Activity Survey, the paper-and-pencil measure of Type A described above, indicates that it has some items which appear to measure personality, and others which appear to measure environment, and still others which appear to measure behavior. It seems likely that the Activity Scale's ability to differentiate between coronary patients and controls may also be due to the interaction of personality and environment measures within the scale.

Caffrey (1969) also provides support for the interactive effect of person characteristics and environment on coronary heart disease in his study of Benedictine and Trappist monks. Using a discriminant function analysis, Caffrey shows that the highest prevalence of coronary heart disease is among those monks who show all of the following three factors: (1) Type A behavior patterns, (2) living in Type A environments which are defined as environments with high environmental stress (typified by high responsibility and role conflict), and (3) on a high-fat diet. Thus, in Caffrey's study, environment as well as behavior pattern are important factors in predicting to coronary heart disease.

The social supportiveness of members of the role set, as well as personality, has also been shown to be an important conditioner of the relationship between subjective quantitative work load and risk factors in coronary heart disease. High supportiveness, in this study, seems to provide group norms for cutting down on heavy smoking as deadline pressures begin to rise. It is likely that smoking is seen as a behavior which may interfere with getting the work done in highly supportive and cohesive groups Furthermore, involvement in work may be high during these deadline pressures so that members of these groups do not think about smoking as much as they usually do during quieter periods. In contrast to these individuals, persons reporting poor relations with their superior, work group, and subordinates show the expected relationship between smoking and deadline pressures--the more time they report being under such pressures, the more they smoke. Apparently related, but nonsignificant, trends in the data appear when pulse rate and systolic blood pressure, correlates of smoking, are examined among these smokers. Pulse rate and systolic blood pressure tend to be inversely related to deadline pressures in supportive groups but positively related to such pressures in nonsupportive groups.

Additional findings indicate that the presence of supportive relations with role senders can act as a buffer between subjectively reported work load, particularly phone calls, office visits, and meetings, and physiological strain. Among persons reporting poor relations, these stresses are positively correlated with pulse rate, systolic and diastolic blood pressure, as well as serum glucose. The correlations are close to zero between these stresses and strains for persons who report good relations.

Are these findings on the conditioning effects of supportive relations believable or are they just a chance set of findings? While replication will provide some of the answers, research has already been cited on the relevance of supportive work relations and group cohesion as a buffer between the stresses of the organization and the psychological anxieties and tensions of the individual (Seashore, 1954). Literature has also been reviewed in Chapter 1 on the research-based prescriptive theories of organizational behavior which have advocated social supportiveness as a key to job-related mental well-being (for example, Argyris, 1964; Likert, 1961, 1967). Similar literature is also building up around the importance of social support as a key factor in coronary heart disease. Medalie (personal communication, 1971) reports that Israeli men who dislike their superiors are more likely to develop coronary heart disease than men who like their superiors. Groen, Dreyfuss, and Guttman (1968), in a study of Haifa workers, find that those with coronary disease proportionately more often believe their co-workers do not like them or are indifferent to them. Bruhn, McCrady, and du Plessis (1968) find that their coronary patients appear to lack supportive social relations and feel misunderstood by persons close to them. In Japan, Matsumoto (1970) suggests that the lower incidence of coronary heart disease in that country compared to the United States may be due to Japanese social institutions which provide social support for the individual. Finally, rejection by a loved one (Kits van Heijningen & Treurniet, 1966), having a nonsupportive wife (Dean, 1971), and losing next of kin through their death (Parkes, Benjamin, & Fitzgerald, 1969; Rees & Lutkins, 1967) have all been shown to be antecedents of coronary heart disease.

The above findings from the literature indicate that there is already a growing body of research implicating nonsupportive relationships, both at work and in the home, as contributing factors in coronary heart disease. The findings from the Goddard study build on this literature by suggesting that supportive relationships can help individuals cut down on heavy smoking and prevent the elevation of physiological risk factors which, under high stress conditions, might ordinarily be increased.

The magnitude of the correlations between subjective measures of work load and measures of physiological strain among Type A persons range from the .30's to the .40's. The relationships between subjective quantitative work load and smoking among Type A persons occasionally reaches the .50's. Similarly, the conditioned effects of supportive relations on the correlations between deadline pressure and smoking also reach the .40's at their best. Thus, while the previous literature on heavy work load and coronary heart disease leaves no doubt as to the growing body of support for this stress-strain link, we see that the measures of job stress in this study account for only 9% to 16% of the variance in some of the physiological risk factors. Occasionally we can account for 25% of the variance when we are dealing with number of cigarettes smoked among smokers. The number of findings from this study and from the cited literature on overload and heart disease, however, is quite large and consistent. It is the very consistency and profusion of these findings that suggests that work overload and particularly subjective work load is a worthy target of study in a field experiment aimed at reducing the risk of coronary heart disease.

Findings Involving Subjective Qualitative Work Load

There are almost no significant findings relating measures of qualitative work load to measures of physiological strain. The one exception is that Type B persons in low qualitative work load environments tend to be nonsmokers, but these findings are quite weak. There are positive relationships between high reported qualitative work load and psychological well-being suggesting that the presence of such work load is an indication that the organization feels the person is competent to carry out qualitatively difficult tasks. To date, there has been little distinction in the literature on work load and heart disease between quantitative and qualitative work load. However, research on work load, reviewed in Chapter 1, appears to have dealt primarily with quantitative forms of work load. In light of the present state of the research on qualitative work load and coronary heart disease, it seems unlikely that field experiments which attempt to manipulate qualitative work load will significantly alter levels of risk factors in organizational members.

Findings Involving Complexification

In this study, complexification, the rate at which the environment is becoming more complex, is weakly related to high job satisfaction ($r = .16$) and is negatively correlated with the number of cigarettes that smokers smoke ($r = -.35$). This latter finding has been explained in terms of arousal seeking characteristics associated with smokers. It is suggested that such arousal seeking is connected with a perceptual predisposition to underevaluate the amount of stimulation present in the environment, and consequently, arousal seekers would be the most likely to underestimate the amount of complexification they face. The literature relating to this phenomenon is explained at greater length in Chapter 3. These, however, are the extent of the findings relating complexification to risk factors in coronary heart disease.

This lack of findings, however, does not warrant the conclusion that complexification may be unrelated to coronary heart disease. Indeed, there is a growing body of knowledge which suggests that life events, as they happen more frequently, require increased readjustments by the individual. The high rate of readjustment may be a considerable source of physiological strain. Some of the literature examining such events has recently been reviewed and critiqued by French (1971), and additional studies on complexification have been cited in Chapter 1. Indeed, the theme of Toffler's recent and disturbing book, Future Shock, centers on the rate at which change is occurring in society and the breakdown in social and human physiological and psychological systems which it seems to be creating.

It seems likely that future relationships between complexification in the organizational environment and coronary heart disease will be uncovered if further development and validation of measures of complexification are undertaken. Indeed, with predictions about unstable organizational forms replacing bureaucracy, measures of turbulence and complexification may tell us about the rise in new social risk factors in heart disease. In this study, however, only token respect has been paid to this potentially important job stress in the form of one four-item measure.

Findings Involving Utilization

Like preceding studies on utilization (reviewed in Chapter 1), our research indicates that low utilization of either a person's leadership skills or his technical skills and abilities is generally associated with low psychological well-being (low satisfaction, high job-related threat, and low self-esteem). No other findings occur which relate utilization to psychological or physiological strain. However, some findings on having too much as well as too little responsibility and its effect on risk factors in heart disease will be reported on shortly. These latter findings can be considered as examples of the effects of under- and over-utilization of some specific resource of the person, namely, ability to take responsibility, on risk factors in coronary heart disease. Similarly, the effects of poor P-E fit with regard to time spent in meetings on serum cholesterol, reported in the previous section of this chapter, can also be conceptualized as an example of the effects of under- and over-utilization on risk factors in coronary heart disease. Furthermore, the relationships between high subjective quantitative work load and risk factors in coronary heart disease noted earlier may be interpreted as being the effects of the overutilization of the person's ability to handle quantitative work load.

Nearly every finding which shows that some stress produces strain leads, by definition, to its recasting as a finding on the effects of under- or overutilization. Such recasting allows us to make some comparative statements about which types of utilization are the most stressful or strain-producing. Clearly overutilization of the ability to cope with subjective quantitative work load, for example, is more stressful than over- or underutilization of leadership skills and technical abilities if we examine the relationships of these different forms of utilization to physiological strain.

Utilization is a relational concept. That is, it considers, by definition, the ability characteristics of the individual in relationship to the demand characteristics of the environment. Therefore it can be said that the interaction effects of personality, the ability to cope with stress, and environment, the source of stress, on risk factors in coronary heart disease represent findings on the effects of under- or overutilization of certain characteristics of the person by the organizational environment. The same can be said of findings dealing with the effects of person-environment fit. In answer to whether utilization is an important predictor of heart disease, the answer appears to be that it is for specific forms of under- and overutilization.

Findings Involving Responsibility for Persons and for Things

Although a few, weakly interrelated findings from the literature were cited in Chapter 1 which suggested that responsibility for persons may be a greater stress than responsibility for things, it was not expected that the distinction between these two types of responsibility would turn out to be important. While both forms of responsibility were found to be associated with high job satisfaction and low job-related threat, only responsibility for persons was shown to relate to heavy cigarette smoking and high pulse rate and diastolic blood pressure. This latter finding holds despite the fact that smokers, compared to nonsmokers and exsmokers, tend to have more responsibility for both persons and things.

When Type A personality measures were added as conditioners of the relationship between responsibility and strain, it turned out that individuals who report high responsibility for persons also have elevated levels of systolic and diastolic blood pressure, pulse rate, and serum cholesterol if they are Type A. No such relationship exists for Type B persons. Furthermore, personality does not condition the relationship between responsibility for things and the risk factors of coronary heart disease examined in this study. The Type A personality measures include the overall measure of Type A, What I Am Like, as well as specific measures such as Involved Striving, Leadership, Competitive Orientation, Persistence, History of Past Achievements, and Positive Attitude toward Pressure.

Analyses of the P-E fit measures showed that poor P-E fit with regard to responsibility for persons is associated with high serum cholesterol. On the other hand, P-E fit on responsibility for things is unrelated to serum cholesterol or to any other measures of physiological strain.

These findings clearly suggest that distinctions must be made between responsibility for person-related aspects of the job, such as careers and the well-being of others, and impersonal responsibilities of the job, such as for budget or equipment. The strength of these relationships is not striking--they account for 4% to 10% of the variance in the risk factors --but the findings are so consistent as to suggest that field experimentation aimed at reducing responsibility for persons and poor P-E fit with regard to responsibility for persons may produce measurable changes in risk factor levels among participants in such studies.

Findings Involving Stress from Alien Territories

Reported communication with distant territories within the organization is positively related to high subjective quantitative work load. This finding is similar to that found by Kahn et al. (1964). However, no first-order relationships are found between the reported amount of contact with alien territories and measures of psychological or physiological strain. On the other hand, when persons are divided up into those groups of individuals who work in job environments which are dissimilar or alien to their occupation (for example, administrators in engineering environments) and those who work in environments which are similar to their occupation, relationships between alien environment and strain are found. The persons in the alien environments, regardless of their occupations have significantly higher mean pulse rates and diastolic blood pressure levels. These findings are stronger when subjective rather than objective measures of overall job environment are used, and suggest, as one plausible interpretation, that how the person perceives his environment may be more important than what the environment actually is as a determinant of individual strain.

Analyses of the conditioning effects of personality on the relationship between stress from distant organizational territories and strain has also uncovered several findings. Deadline pressures from alien territories are positively correlated with serum cholesterol levels for persons with high scores on Type A measures of Competitive Orientation, Leadership, Environmental Overburdening, and Range of Activities as well as personality measures of conformity and denial of bad attributes about the self. No such correlations exist for persons who are Type B. Similarly, the reported percent of time spent in communication with alien territories is associated with elevated glucose, cortisol, and cholesterol among Type A persons but not among Type B persons. In this latter case, the relevant conditioning personality measures include Leadership, Persistence, Deny Bad Self, and Overconformity to Norms. The positive correlations are generally in the .30's and are particularly striking with regard to contact with other directorates. Directorates at Goddard, the site of the study, form a major set of distinct organizational territories with regard to their primary function in the organization. For example, one directorate has overall responsibility for the administrative workings of Goddard; another is concerned with manned flight; another is concerned with basic scientific research; and so on. Thus, when it comes to identifying the most meaningful division of territories in other organizations, one may wish to examine those criteria for division which divide the territories in a way which makes them as functionally different from one another as possible. It may be that the greatest stress is generated when people communicate with individuals in territories which are the most dissimilar from their own with regard to major functions in the organization.

Overall, there is no existing literature, other than the research by Kahn et al. and the studies of Esser et al. (1965), Goffman (1961), and Roos (1968), which suggests that contact with alien territories is a source of stress. In all of these studies, only psychological strain has been dealt with. However, some of the findings on geographic mobility (Syme et al., 1964a, 1966) and coronary heart disease may be interpreted as evidence of the harmful effects of contact with alien environments. Ardrey (1968) has done much to popularize the notion of territoriality and perhaps such popularization will stimulate social scientists to further examine the relationship between the concept and physiological strain. For now, however, the study reported here is the only one which shows a link between contact with alien organizational territory and risk factors in coronary heart disease. The linkage of five physiological measures of strain to contact with alien territories (diastolic blood pressure, cholesterol, cortisol, glucose, and pulse rate) suggests, however, that the lack of previous findings should serve as no block to further research and even field experimentation dealing with the reduction of stress from alien territories. Indeed, we have identified five dependent variables which could be examined to evaluate the effect of any such experiment.

Findings Involving Relations with Role Senders

These findings have already been discussed in large part in the preceding sections of this chapter. The only first-order correlations between relations with role senders and strain are ones which indicate that persons with good relations report low psychological strain. Such persons tend to have high job satisfaction and low job-related threat. There are no first-order relationships between good relations and physiological strain. However, as noted in preceding sections in this chapter, good relations with role senders act as an important buffer which may prevent the elevation of pulse rate, systolic and diastolic blood pressure, and serum glucose under conditions of high subjective quantitative work load. Under such conditions, as noted before, good relations may even cause people to cut down on their smoking. For persons who report poor relations, however, these job stresses may elevate the levels of these risk factors much as one might expect.

As noted earlier in this chapter, there are a number of studies in the epidemiology literature which now suggest that the loss of social or interpersonal supportiveness may put the person at increased risk of coronary heart disease. To the organizational psychologist, the most exciting aspect of these findings is that they suggest that certain prescriptive models of organization such as those advocated by Argyris, Likert, and Mayo may lead to improved physical as well as mental well-being for organizational members.

Having reviewed the findings in this study and their relationships to other research in the literature, we are now in a better position to make some comparative, summary statements about those organizational stresses which seem to have the most evidence amassed behind them suggesting that they are potential factors in coronary heart disease. Of those which have been examined, subjective quantitative work load, responsibility for persons, contacts with alien territories, and poor relations with others appear to be the prime candidates. In the next section some strategies for reducing these stresses in field experiments will be considered. Both personality, a major conditioning variable of the relationship between these organizational stresses and strain, and occupation will also be examined as important factors influencing the design of a coronary heart disease prevention program in organizations.

Field Experiment Strategies for Coronary Disease Prevention[9]

Before setting off on a prevention program, it will be necessary to consider just what types of results might be realistically expected from such a field experiment. A perusal of the medical literature suggests that roughly 25% of the variance in coronary heart disease incidence can be accounted for by known risk factors such as blood pressure, serum cholesterol, serum glucose, and smoking. In this study we have been able to account for 9% to 25% of the variance in some of these risk factors. Thus,

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[9] This section is based largely on a discussion of prevention programs by John R. P. French, Jr. and Robert D. Caplan in a forthcoming book edited by Alfred J. Marrow.

any field experiment aimed at reducing risk factor levels may be expected to reduce the incidence of coronary heart disease by considerably less than 25% despite the possibility that there may be significant reductions in levels of some of the risk factors.[10] The field experimenter, whether psychologist or organization medical officer, must be aware of these estimates as steps are taken to set up trial prevention programs.

Since every organization will have its own unique set of stresses, each field experiment will have to be tailored to the specifics of the organization in which it is carried out. The uniqueness of stress from one setting to another has already been demonstrated in this study; different occupations and different job environments have their own sets of stresses. Consequently, the first step taken in the design of any prevention program should necessarily be the completion of a diagnostic study of the distributions of stress and strain in the organization. With this information at hand, prevention programs can be concentrated primarily in those organizational units, occupations, and individuals where risk of coronary heart disease is greatest. The survey instruments used in this study could be of help in carrying out this diagnosis.

It will also be important to remember that each organization will have its own special social, economic, and structural constraints. Therefore, any strategies that are discussed here must be considered in light

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[10] There is, of course, the possibility that the reduction of psychological strain might reduce the incidence of coronary heart disease through mechanisms other than the usual risk factors. As the findings of Sales and House (in press) suggest, increasing intrinsic job satisfaction among white collar workers could conceivably reduce coronary heart disease. No relationship has been found between types of satisfaction and the known risk factors in heart disease. It is conceivable, therefore, that job stress reduces job satisfaction, and lowered satisfaction, in turn, increases the risk of disease by other, yet unknown, physiological mechanisms.

of such constraints. For one thing, the strategies, as they are presented here, must be general since it is virtually impossible to anticipate the specific needs of each organization. Second, we shall have to confine our discussion to the white collar organization member as the participant in such a field experiment. Until additional studies on the relationship between organizational stresses and strain among blue collar workers have been carried out, it would be irresponsible to suggest that the same relationships between stress and strain occur for blue collar groups. Indeed, some stresses which have been found to be of negligible importance in this study of white collar workers may be of considerable importance in the blue collar population. Conversely, important stresses among white collar groups may play a trivial role in producing physiological strain among blue collar employees. Research by Sales and House (in press) has already demonstrated that such phenomena can occur. They report that job satisfaction and coronary heart disease, in ecological correlational analyses, are inversely related in white collar jobs but not as highly correlated in blue collar jobs.

An examination of Figure 1 in Chapter 1, the theoretical model of the relationships between environment, the person, and coronary heart disease, indicates some major strategies for reducing strain. These are (1) changes primarily in the nature of the person, (2) changes primarily in the nature of the job environment, and (3) changes in P-E fit and other interactions. To some extent changes in the person may produce changes in the environment and vice versa. Thus, the distinction between the two types of strategies should only be seen as one of degree. Indeed, changes in either the person or the nature of the environment might not be sufficient steps toward prevention in and of themselves. While the person might be given new skills or freedoms, these might be of little use without changes in organizational structure and operating procedure to allow full utilization of these new potentials in the person. Similarly, changes in the organizational environment through the institution of new procedures and structures might be very ineffective if persons were not given special training in how to use the new organizational resources. Despite these considerations, some attempt will be made to consider first those strategies which focus primarily on changes in the person and then those strategies which focus primarily on changes in the person's environment.

Changes in the Nature of the Person: Personnel Procedures

1. Selection and placement. Our research suggests that certain types of persons, particularly those with Type A personality traits, are more likely to react to stress than persons who are Type B. While current selection procedures typically determine the cognitive ability, skill, and training of the individual, there is no reason why persons could not be chosen in terms of their ability to withstand certain types of responsibility, quantitative overload, or contact with other boundaries of the organization. To some extent, the personality measures might, through careful validation procedures involving prospective designs allow one to make such predictions. Certainly, however, the current measures of personality used in this study are not sufficiently validated for such use.

Two points of consideration merit attention, however, in deciding whether or not such a placement strategy would prove worthwhile. First of all, there is a dilemma which must be faced. While the traits which characterize the Type A person tend to mark him as coronary prone, it is unlikely that organizations will be willing to select out of high stress positions persons who are characterized by such traits. What would happen to an organization if those persons who were hard-driving, leadership-oriented, persistent, and who enjoyed competition, for example, were removed from high stress jobs like that of vice-president for sales or production? We do not really know the answer to this question, but it is safe to guess top management's reaction to any such proposal. It would probably be patently turned down as a counter-productive suggestion which would rob the organization of its most accomplishment-oriented persons. Whether this perception is correct or not remains to be seen. It is possible that an organization could actually lose money in the long run, for example, if it insisted on keeping Type A persons in high stress jobs and, as a result, these persons became physiologically disabled and removed from the organization before the investments made in training them were paid off--but this is an empirical question.

The second point for consideration has to do with the time it takes for coronary heart disease to develop. Since the disease takes several years to develop, a more expedient and harmless way of preventing disease through selection procedures could involve a completely different strategy. One could simply place the person in a job situation, monitor the individual's environment and his well-being, and then make some decision about whether he could cope with the environment or not. This strategy would avoid the lengthy process of validating predictive selection instruments, which, at best, will probably be imperfect. If the person is placed in the wrong work environment, he could be moved to another environment for a few months with further assessment carried out. The initial placement, even if bad, would probably not kill the employee. On the other hand, the heavy use of personality measures and other predictive instruments for initial placement might do little to reduce the incidence of coronary heart disease, particularly if the organization deluded itself into believing that the initial placement was a good one.

The upshot of this discussion is that (a) it is probably easier to diagnose a man's susceptibility to stress by watching him perform under stress than by giving him a battery of preemployment tests, and (b) even the use of situational testing or trial periods of work in different environments will be inadequate unless periodically followed up by diagnoses which indicate whether or not the nature of the environment has changed since the person was first placed in it.

The use of continuing diagnoses cannot be overemphasized. It should be noted, however, that any such diagnosis should broaden the number of psychological strain measures used in the study. In this study, psychological strains, unlike physiological strains, were not chosen for their relevance to coronary heart disease. Instead, they were chosen because measures of satisfaction and self-esteem are often used as indicators of psychological well-being. Disease-specific measures of psychological strain need to be developed.

The development of such new measures can be accomplished if a <u>variety</u> of psychological strain measures are used in organizational diagnosis procedures. New, more specific measures of strain might be better indicators of whether the person was at risk of coronary heart disease than measures of job stress. For one thing, such measures, as screening devices for the early identification of high risk individuals, could be briefer than instruments which measure both the person and his environment. Occupational differences in these strains could lead the investigator to search for the contributing environmental effects on these strains.

2. Training. The person could be given special training on how to perform the stressful aspects of his job more effectively with consequently less effort and strain. Overload could be reduced by teaching him short-cuts or providing him with special skills. His relations with others could be improved and his conflicts reduced by providing him with training in interpersonal sensitivity and conflict resolution techniques. Some of the programs which provide this type of training are well known to management although their effectiveness in reducing strain still remains to be demonstrated (Campbell & Dunnette, 1968, review the literature on the effectiveness of sensitivity training in organizations).

Changing the Nature of the Organizational Environment

The changes which need to be considered are of two types: those which alter the characteristics or environment of the immediate job setting and those which modify the wider organizational environment. In some cases, the reduction of stress by changing the immediate work environment may be dependent on making changes in the wider environment. Furthermore, changes in a branch or division of the organization could very well alter the nature of the larger organization. Some of these possibilities will be considered in the following sections.

Changing stress in the immediate job environment. Many of the changes that can be considered have the disadvantage of manipulating one job stress without holding the others constant. In fact, reductions in certain types of stress are likely to produce reductions in other stresses. As has been shown in Chapter 3, many of the job stresses are related to other stresses. For the research scientist who wishes to manipulate just one stress, the confounding of several job stresses may be undesirable. However, for the organizational change agent who wishes to demonstrate that strain can be reduced by reducing job stress, the confounding of several stresses may actually prove to be a boon by raising the probability that strain will be reduced. In some cases, the reduction in job stress may provide benefits to the organization as well as to the individual. For example, reductions in work overload, according to the research of Miller (1960) may reduce the number of errors, omissions, and poor quality decisions which people make. Surely these latter effects are desired goals for superior organizational functioning. While high work load may be to the advantage of the organization in the short run, in the long run it may also be bad for the organization because it may raise feelings of inequity and conflict between employees and employers. Thus, procedures for identifying inequities in work load and for subsequently redistributing the work may provide effective ways of reducing individual strain.

Time and motion study is one of the classic ways in which work redistribution has been carried out. However, it is not unusual to find widespread distrust and dislike of this method for setting work allocation and production rates. An alternative procedure makes use of participation. Those persons whose work load will be effected by such a redistribution are included in the decision making on how the work gets allocated. This procedure has been shown to be successful in a number of settings (Coch & French, 1948; French, Israel, & Aas, 1960; French, Kay, & Meyer, 1966; Morse & Reimer, 1956).

Participation by the employees in discussions with their superiors has produced a number of positive results for the employees as well as for the organization. These results include less ambiguity and conflict, better interpersonal relations, higher productivity and goal setting, less turnover, and higher job satisfaction. As was noted in Chapter 3, reported participation in our own study is positively correlated with low role ambiguity, good interpersonal relations with others, and high job satisfaction. In fact, participation was shown to be an important predictor of job satisfaction and stresses related to job satisfaction in a regression analysis of all subjective measures of job environment on satisfaction. Furthermore, it was shown to be the most important predictor of low job-related threat. Thus, the <u>effective</u> use of participation could reduce a number of job stresses which are related to physiological risk factors associated with coronary heart disease.

The emphasis on the effective use of participation is an important one. French's studies of participation (French et al., 1960, 1966) suggest a number of conditions which may have to exist if participation is to be of value in reducing job stresses. The 1966 study indicates that participation works best when the employee feels supported rather than threatened by his boss. This suggests that attempts to decrease stress by increasing participation should also try to provide a supportive supervisor. His support will directly reduce psychological strain and should effect physiological strain as well. Our own findings indicate that good relations with co-workers may evolve under high participation and provide additional environmental supportiveness for the participation process.

Second, decision-making mechanisms such as participation which involve the use of supportive leadership will also need to incorporate special techniques for problem solving. Maier (1965, for example) discusses a number of such techniques which lead to solutions which integrate more of the knowledge at hand, are more creative, and have greater acceptance among the members. Acceptance is a crucial factor since the quality of the solution may be theoretically brilliant but unacceptable in practice. Such problem-solving techniques can be learned through training programs designed for this purpose.

As a third condition, the participation should not be merely illusory. If management asks the employees for their advice and then ignores it, the process may be correctly perceived by the employees as an attempt at psychological manipulation. The long-range effects of such deception could be to generate distrust of superiors, organizational sabotage, apathy, and turnover.

Fourth, participation in decisions which are trivial to the participators, such as should the company newsletter be on white paper or light green paper?, are liable to have little, if any, effect on the employees. A fifth and related potential principle concerns relevance. If the aim is to reduce the stress of quantitative work load, then participation in decisions on hours of operation for the cafeteria are not likely to have ameliorative effects on strain created by quantitative overload.

Finally, the decisions which people participate in should be perceived as being legitimately theirs to make. If a group does not feel it is deciding on something within its area of freedom, the participants may feel anxious, threatened, even dissatisfied. Since strong norms or widely shared rules develop in organizations about who should decide what, it would not be uncommon to find people feeling that they were overstepping their bounds in making new types of decisions. Thus, increased participation may need to occur at a rate great enough for employees to perceive, yet not at a rate so great that they cringe in fear of the new responsibilities they have been saddled with.

In addition to using participation, one might also change the job environment by institutionalizing certain procedures for reducing stress <u>when</u> it occurs. Persons who suddenly find themselves under conditions of excessive work load or responsibility for persons, for example, could be given the freedom to convene relevant members of their role set who are contributing to these excessive demands. Together the set could work out solutions for resolving the stresses. Kahn et al. (1964) have suggested this type of strategy as a way of reducing role conflict. Similarly, persons could be given the freedom to delegate work to others or to ask for more work or responsibility if they were being underutilized.

Allowing people to work with other members of their role set in participative decision-making processes to redistribute work loads and responsibility would take into account individual differences in P-E fit. It might turn out that some members of the role set had more work than they wanted while others had less. The use of diagnostic surveys or discussion procedures aimed at surfacing these differences in P-E fit could be used to provide the basic data by which the group would begin reallocation of work loads (Mann, 1957, 1968 provides a description of research feedback as a vehicle for organizational development). A strategy of this sort which would recognize individual differences in fit would be desirable particularly in the case of responsibility for persons. We have shown that too little <u>or</u> too much responsibility is associated with high serum cholesterol. Changes which increased or decreased the amount of responsibility for persons for everyone regardless of whether they had too little or too much responsibility could be a bad organizational practice. In essence, it would be trying to fit people into a Procrustean bed at the expense of individual differences in needs, skills, and abilities.

A prevention program which attempted to improve P-E fit need not interfere with organizational productivity and profits. As Carlson (1969) has shown, under conditions of good P-E fit, job satisfaction tends to be positively correlated with high productivity. In the absence of good fit, satisfaction and productivity tend to be unrelated.

Changing the wider environment of the job. It should be recognized that giving people new rights is not always a simple matter. The institution of these new rights and procedures may come up against norms and values well-entrenched in the organizational culture. Furthermore, formal policies and procedures may be in direct conflict with such changes. This means that wider changes in the organization may have to be made. Formal changes in policies regarding communication and lines of authority may have to occur.

If territorial stress is a major problem, reducing the number of different territories or increasing the permeability of their boundaries by formal reorganization may be one solution. Highly flexible, organic organizational structures which would allow for groups and individuals to cope with quantitative and qualitative changes in their environments could be introduced. Such organizational forms have been proposed by Bennis and Slater (1968), Burns and Stalker (1961), Toffler (1970), Likert (1961, 1967), Argyris (1962, 1964), and Katz and Kahn (1966).

An integral part of such organizational forms is the constant monitoring of the quality of organizational life. Thus, diagnosis and action based upon this diagnosis occurs constantly in such organizational forms. Regardless of whether a coronary prevention program involved total reorganization or small changes such as the institution of participation in a small part of the organization on a trial basis, such continued assessment would be necessary. Assessment would be necessary to determine whether introduced changes were continuing to have beneficial effects over the long run. Additional skill training sessions might be necessary from time to time to insure that the quality of changes in operating procedures were kept up to expected levels, but information about the need for continued training could only come as a result of some periodic assessment program.

In Conclusion

The body of evidence which has been examined here indicates that modern organizations have an impact on the physical as well as mental well-being of their members. Many of the stresses are fairly prevalent in studies of national samples, and many of these stresses appear to be linked in one way or another to risk factors in coronary heart disease. However, the fact that coronary heart disease seems to be as much a part of organizational life as are other traits of the organization does not mean that steps cannot be taken to reduce the risk of disease. We are living in turbulent times in which organizational forms as well as many other aspects of the society are changing. There almost seems to be a premium on change. If we are to influence and control that change and its effects, we must take innovative and pioneering steps. Programs of field experimentation involving the coordinated efforts of management, medical personnel, and organizational psychologists can be developed. Indeed, we have sketched some of the possibilities for such experimental programs. Careful evaluation of such experiments can be carried out, and through such experimentation we may be able to make potentially important contributions to management and the medical sciences. We may be able to demonstrate that we understand the <u>processes</u> by which our environment can create and alleviate strain. We may be able to control our environments rather than fall victim to structures and technologies which have moved beyond our control.

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APPENDICES

APPENDIX I

Letter Sent to Potential Volunteers

ISR

INSTITUTE FOR SOCIAL RESEARCH / THE UNIVERSITY OF MICHIGAN / ANN ARBOR, MICHIGAN 48106

March 1969

CORONARY HEART DISEASE AND JOB STRESS AMONG
ADMINISTRATORS, ENGINEERS, AND SCIENTISTS

Dear NASA Employee,

With the cooperation of Dr. Carlos Villafana of the Health Unit, we are asking you to volunteer for the 1969 study on job stress and coronary heart disease. Since 1962, the Institute for Social Research at the University of Michigan has been carrying out studies of work stress in jobs like your own.

The major objective of these studies is to increase scientific knowledge about many factors--both within the person and his work environment--which may serve to promote or prevent coronary heart disease.

Accurate quantitative data can provide a factual basis for improving the fit between a person and his environment--a basis for improving management practices where improvement is needed.

Confidentiality

As with all studies by the Institute, answers of individual persons are kept in strict confidence. No names of any individuals in NASA will be used in reports.

What is required of Volunteers

All volunteers will be asked to fill out a questionnaire describing their work, its stresses, and how they view things. The questionnaire takes a little over an hour and can be filled out at your desk.

The only other requirement is that you give a small blood sample on the day you fill out the questionnaire. This can be done in a few minutes also in your office. We will use the blood sample for cholesterol analyses.

We hope you will volunteer. We are only too happy to provide our volunteers with results of such research as we did at NASA Headquarters and Goddard for 1968.

Sometime between March 17 and April 30, Miss Judy Hrushka will call on you in your office to see if you would like to participate and agree to give a blood sample. She will be glad to answer any questions you might have about the study at that time.

Sincerely,

John R. P. French, Jr.
Program Director
Health in Industry Program

JRPF/tw

APPENDIX II

Instructions for Medical Interviewer

March 13, 1969

Re: Instructions for interviewing the participants at Goddard Space Flight Center

Note: Below is the suggested order in which your "interview" with each volunteer should be carried out. I have also included a number of content statements about the study which you can use to answer questions volunteers may have. The steps in the procedure for obtaining the physiological data are based on our conversations and the suggestions of Stevo Julius, M.D., in the (University of Michigan) Medical School.

I. Introduce yourself indicating that:

A. You are from The University of Michigan's Institute for Social Research.
B. We are carrying out a study of coronary heart disease and job stress among administrators, engineers, and scientists, and that is why you have come to ask the person to volunteer today.
C. The volunteer probably got a letter explaining the study similar to the one you have in your hand (give letter to volunteer to look at--get it back, explaining it is your only copy).
D. The study is being carried out in cooperation with Doctor Villafana and the Goddard Health Unit.
E. The volunteer may have also seen a memo from Mr. Vaccarro, Assistant Director for Administration and Management, encouraging NASA personnel to participate in your study.

II. Would you like to volunteer?

A. <u>What is entailed</u>? Pulse, blood pressure, and a small blood sample will take about 5 minutes. Then we would like you to fill out a questionnaire which takes about an hour.
B. <u>Are you providing results</u>? Yes. It is our policy to provide the people who participate with a research report of our overall findings. We have done this in our past studies at Goddard and at NASA Headquarters.
C. <u>Is this confidential</u>? Yes. NASA will receive only a summary report similar to the type we provide to volunteers at the end of the study. No individual data will ever be shared with NASA, and we use only code numbers to identify our volunteers back in Michigan. When we are done with our research, we will destroy the data.
D. <u>Can't you get someone else? Why me</u>? We have chosen specific types of jobs located in specific units in Goddard such as your own study. That is why we cannot use a random selection of

volunteers. We need to get some overall ideas of the stresses and satisfactions which a person in your type of job faces, so that it is very important that you do volunteer.

E. Can you tell me a little more about the study? We want to discover how we can help people cope with the stresses of their jobs and prevent coronary heart disease. Your participation in the study will enable us to get a picture of what various work environments at Goddard are like.

F. What are you going to do with the blood samples, the pulse and blood pressure? This is a large study based on many volunteers from Goddard. We will use the physiological measures to give us some idea of the relationship between work conditions and stress.

III. Well, would you like to volunteer?

IV. (If no, note on S's card.) If yes, continue.

A. Now I would like to get a measure of your pulse rate. May I have your left arm, please? (Take two pulse readings about 30 seconds apart with the person sitting quietly. If the S begins to talk, indicate to him that you can't listen since you are counting. If the phone rings, take the pulse over again. (Be sure the person has been seated for about a minute before taking the pulse.)

B. Now let's get a measure of your blood pressure.

1) Use left arm resting on table so as much of the arm as possible is above the heart. Take diastolic and systolic readings deflating the cuff at about 3 mm per heart beat. Deflating at a slower rate will tend to produce an abnormally high BP reading.
2) After a 30 second interval repeat the measures of BP.

C. And now we will take a blood sample.

V. Give the volunteer the questionnaire indicating:

A. It is very important that you fill it out and return it to us in this prepaid envelope.

B. The questionnaire takes about an hour to complete. You should fill it out now if possible. Can you do that?

1) Can I take it home if I don't finish or can't do it today?

It would be better if you completed it or worked on it tomorrow here at Goddard rather than taking it home.

C. The questionnaire is self-explanatory so you should have no problems following the directions. When you are in doubt about something use your best judgment.

D. The last part of the questionnaire is aimed at getting some actual measure of your workload during your work days. It is optional but very important. Essentially, we would like your secretary to keep a tally of the number of office visitors and phone calls you have during the day. We'd like her to do this for three days. There are straight-forward instructions for doing the tally, and forms for it in the back of the questionnaire. We have found that it takes almost no additional time from a secretary's work to do this. If you have a secretary, and she would like to volunteer, it will add immeasurably to the study. When you get to the end of the questionnaire, you can read more about it, and then can decide.

E. One more thing. As soon as you have finished with the various parts of the questionnaire including perhaps the tally, return everything to Michigan in the large envelope.

VI. Do you have any other questions?

VII. Thank you for you cooperation. Goodbye.

APPENDIX III

Questionnaire Cover Letter

ISR

/ INSTITUTE FOR SOCIAL RESEARCH / THE UNIVERSITY OF MICHIGAN / ANN ARBOR, MICHIGAN 48106

March, 1969

CORONARY HEART DISEASE AND JOB STRESS
AMONG ADMINISTRATORS, ENGINEERS,
AND SCIENTISTS

To Respondents:

The attached questionnaire is part of a continuing series of studies on coronary heart disease and stress in jobs like your own. This program of research on job stress has been carried on by the Institute for Social Research of The University of Michigan since 1962.

These studies have one main objective. This is scientific knowledge. By use of standardized questions asked of employees in NASA, we are attempting to obtain reliable quantitative data on many factors--both within the individual and in his working environment--which may serve to promote or prevent incidences of coronary heart disease.

These data can provide a factual basis for improving the fit between a person and his environment--a basis for improving management practices where improvement is needed.

We hope that through such studies we can learn more about how to build the type of stimulating work environment in which the health of you, your colleagues, and your organization are maximized.

Confidentiality

As with all studies at the Institute, answers of individual persons are kept in strict confidence. For purposes of reporting the research results, individual data is grouped into meaningful social research categories such as age group or occupational group (scientists, administrators, etc.). No names of any individuals of this organization will be used in reports.

Comments

Space has been provided at the end for suggestions about matters not covered in specific questions. Feel free to add comments or qualifications in the margin as you go along.

We are very grateful for your assistance.

Sincerely,

John R. P. French, Jr.,
Program Director
Health in Industry Program

Form 169

APPENDIX IV

Letters and Instructions Used to Obtain Objective Quantitative Work Load Data

IF YOU HAVE A SECRETARY WHO ANSWERS THE PHONE FOR YOU, ETC., THEN READ THE FOLLOWING. OTHERWISE, OMIT THIS SECTION AND RETURN THE QUESTIONNAIRE IN THE PREPAID ENVELOPE. THANK YOU FOR YOUR COOPERATION.

As you know, the Institute for Social Research in Michigan is doing this study to discover what there is about work's stresses and satisfactions that relate to coronary heart disease incidence. We are using three levels of measures: questionnaire measures such as you have just completed for us, physiological measures taken during a health check-up, and, where possible, actual measures of the work environment.

To get an actual measure of your work, we would like to ask your secretary if she would be interested in volunteering to keep a simple diary of your meetings, office visits, and phone calls on the attached sheets. Many people find a diary like this to be a valuable and enlightening source of knowledge on how they spend their time.

Essentially, your secretary would keep a tally of the number of office visits etc., for three consecutive days. If you would like your secretary to do this, and she would be willing to volunteer, then detach the remaining pages and give them to her. The next sheet is a letter to her about the study. She should read it before making up her mind on whether to volunteer or not. The instructions and forms to be used are also attached to the letter. Feel free to examine these attached materials yourself.

We anticipate that for some people the three days, or some part of them, may be atypical due to come unexpected workload or lack of workload. Nevertheless, should your secretary volunteer, you should carry your work as you always do just as if the tally was not being taken.

PLEASE CHECK ONE:

- ☐ My secretary has volunteered to perform this phase of the research.
- ☐ My secretary has not volunteered, or I do not wish to participate further in this phase of the research.

Thank you for your cooperation. Please return all the forms to us in the enclosed prepaid envelope.

March, 1969

Dear Secretary:

We have asked you to volunteer in a study on the effects of work stresses on coronary heart disease. The research is being carried out by the Institute for Social Research in Michigan with the cooperation of NASA's Medical Department. The part you can play in contributing to this research is very relevant and important.

Your boss has volunteered to be one of many participants in this study. Now, we would like to get an actual account of some of the things he does on his job. We would like you to keep a tally of the number of meetings, office visits and phone calls he has for three days beginning tomorrow. You will only need to make check marks on a form (simple instructions below will tell you exactly how to do so); there is no writing to be done.

The information on the tally sheets will be completely confidential. That is, no one at NASA or anywhere else, except for the staff at Michigan, will ever see this data. Once back at Michigan, the identifying information will be coded and the data destroyed at the end of the study. You may show the tally sheets to your boss if he wants to see them and you want to share them with him. We will leave that up to you. You should not show these sheets to anyone else without his consent, however, so we can be sure the data are kept confidential. If you do decide to show your boss the tally sheets, you should do so only after the third day's observations are over.

We have instructed your boss to carry on his work, should you decide to volunteer, as if the tally wasn't being made. We expect that for some bosses the three days, or some combination of them, may be unusual due to unexpected workload or little workload. You should also carry on as if the tally was not being made and do nothing more than you usually do to influence the daily occurrence of office visitors, meetings, and phone calls your boss has. In other words, you should carry on as usual.

We hope you will volunteer. If you decide to, read the instructions on the next page, and come prepared to begin your tally tomorrow.

☐ I will volunteer for this study.

☐ I do not wish to volunteer.

Thank you,

John R. P. French, Jr.,
Study Director
Health in Industry Program

READ CAREFULLY:

On the next page you will find the instructions. Attached to the instructions are the TALLY SHEETS on which to record your observations. As you read these instructions keep a TALLY SHEET in front of you and refer to it. In this way you will become thoroughly familiar with what you have to do tomorrow and the following two days.

There are three TALLY SHEETS--one for each day. When you have completed all your observations, place them in the attached envelope, seal it, and have your boss put his questionnaire code number in the upper left corner. Have your boss send all the materials back to us in the larger pre-addressed mailing envelope.

Instructions on next page.

Instructions:

HOW TO KEEP THE TALLY

"X" out X one square in the appropriate section of the sheet whenever your boss has a phone call, office visit, or meeting. For example, if your boss has five phone calls between 8 A.M. and 8:59 A.M., you would have five "X's" in the column labeled "Phone calls" for the "8 A.M." time section of the sheet.

1. PHONE CALLS: Any phone call, whether it is incoming or outgoing is counted separately. Even if there are many calls to or from the same person over a short period of time, each is tallied separately. Incoming phone calls are indicated by an "X" in the column labeled "Phone IN"; outgoing calls in the column labeled "Phone OUT." Uncompleted outgoing calls should be counted. However, incoming calls when your boss is not in to answer them or is busy should not be counted.

2. OFFICE VISITS: An office visit is any get-together between your boss and only one other person (if there is more than one other person, that is a meeting. We will talk about meetings in a moment.) It does not matter where this get-together occurs. Count each office visit as it occurs by making an "X" in a box under the "Office visits" column. Greetings and brief private conversations with one other person should each be counted as a separate "Office visit." For example, if someone and your boss talked to each other about 2:15 P.M., you would mark an "X" in the column marked "Office visits" in the 2 P.M. section of the Tally Sheet.

3. Meetings: A meeting is any get-together by your boss with two or more persons. Now we will look at two types of meetings.

TYPE I: MEETINGS BOSS ARRANGED: This is any meeting of two or more persons scheduled, arranged, or called by your boss. For example, if a couple of colleagues and your boss meet at 10:30 A.M. and your boss has asked them to do so, that is a boss-arranged meeting. You would mark an "X" in the 10 A.M. time section of the tally sheet under the column "Meetings, Boss-arranged." Another example is where your boss visits two or more people in another office and he has scheduled the meeting. Brief private conversations and greetings with two or more persons are also counted as meetings.

TYPE II: MEETINGS OTHER ARRANGED: The major difference here is that this meeting was not arranged, scheduled or planned by your boss. It was planned by someone else such as his boss, or two colleagues who dropped by unexpectedly, for example. Even if your boss expects the meeting but others set it up, and your boss meets with two or more of them, then it is OTHER-ARRANGED; and an "X" should be made in the column marked "Meetings, Other-arranged." Again, brief private conversations and greetings with two or more persons can be counted here, too.

4. WHAT IF I AM UNSURE WHO ARRANGED A MEETING?

If you are unsure, place a "?" instead of an "X" in one of the meeting boxes in either column marked "Meeting." You may be able to check later on about who arranged the meeting. At any rate, when unsure, make good use of the "?".

5. IF A MEETING, OFFICE VISIT, OR PHONE CALL RUNS FROM 2:50 P.M. to 3:30 P.M., SHOULD I MARK ONE "X" IN THE 2 P.M. SECTION AND ONE IN THE 3 P.M. SECTION?

No. Mark only one "X" for the start of the meeting, visit, or call. In this instance, the "X" would go in the 2 P.M. section of the Tally Sheet.

6. WHAT IF A PHONE CALL OCCURS IN THE MIDDLE OF A VISIT OR MEETING; OR A VISIT OCCURS DURING A MEETING, ETC.?

To use the first example, you would make an "X" for the phone call. After the call, the meeting or visit would continue but you would not make a new "X" for the meeting or visit unless people had left the room and had come back again.

7. SUPPOSE I AM OUT OF EYE-AND EARSHOT OF MY BOSS. WHAT SHOULD I DO?

If you leave the office, or your boss does, such as for lunch or a break do the following: Mark on the sheet in the column marked "Other" the amount of time for the hour that you were unable to make observations (a rough estimate to the nearest 10 minutes will be fine); such as "40" for 40 minutes, or "10" for 10 minutes. The easiest way to do this is to make a single notation at the end of every hour. These notes will be used in our computations, so they are extremely valuable.

Furthermore, if your boss is absent or you are, or you are unable to continue the tallies, make a note on the sheet letting us briefly know why, e.g., "Out on break" or "too much work to do." We do expect, of course, that practically all our observer secretaries will be able to complete the forms. You should be able to do all this quite well once you have familiarized yourself with the Tally Sheet and the instructions.

8. IN SUMMARY, these are the major distinctions to be made:

A) A visit is with only one other person.

A meeting is with two or more persons.

B) Did the BOSS ARRANGE or did some OTHER ARRANGE the meeting?

Good Luck on your observing. We hope you will be able to do your very best.

Example of

TALLY SHEET

My boss arrived at __________ A.M., P.M. (circle one)
(time)

I am beginning this tally at __________ A.M., P.M. (circle one) **Today's date ____________________**
(time)

Time	Phone IN	Phone OUT	Office Visits (with 1 other person)	Meetings BOSS ARRANGED	Meetings OTHER ARRANGED	Other such as lunch, break, time unable to observe boss, etc
8						
9						
10						
11						
Noon						
1						
2						
3						
4						
5						

It is _____ : _____ A.M., P.M. (circle one), and this tally is ended for today.

APPENDIX V

Intercorrelation Matrices for Subjective Environment Indices

The content for the items on the next pages comes from a variety of sources including Likert (1964), Kahn et al.(1964), Mann (1965), and French et al. (1965).

For each index, the intercorrelations for the original set of theoretically-chosen items are presented. Then, the content of the items is given. Asterisked (*) items are those which were retained in the final index used in the study.

The instructions and format for the items are as follows:

This section deals with various aspects of work. Some questions will ask you to indicate the amount of an aspect present in your job such as the amount of time your have or the amount of secretarial support and clerical resources. Other questions will ask about the extent to which a job characteristic such as demands for high quality work are made in your job. Indicate your answer to each question by checking ✔ one of the answer categories below.

The following categories of the scale are used:

VERY LITTLE	LITTLE	SOME	GREAT	VERY GREAT
(1)	(2)	(3)	(4)	(5)

In a similar manner, also indicate how much of each aspect you would like there to be to meet your demands, needs, and abilities.

CHECK ONE BOX IN EACH LINE:

	Very Little (1)	Little (2)	Some (3)	Great (4)	Very Great (5)
34A. The number of projects and/or assignments you have.	☐	☐	☐	☐	☐
B. The number you would like.	☐	☐	☐	☐	☐
35A. The amount of time you spend in meetings.	☐	☐	☐	☐	☐
B. The amount you would like	☐	☐	☐	☐	☐
36A. The amount of time you have	☐	☐	☐	☐	☐
B. The amount you would like	☐	☐	☐	☐	☐

Item B of each pair was used for another measurement purpose which is explained elsewhere (p. 121). Scoring was obtained by taking the mean of the items on the above 5-point scale. The sample size was about 100 . Thus, $r \geq .19$, $p \leq .05$; and $r \geq .25$, $p \leq .01$.

TABLE V-1

Index: Role Ambiguity

Intercorrelation Matrix

Item	54A	55	66A	67A
55	.36			
66A	.32	.14		
67A	.41	.31	.60	
69A	.28	.43	.54	.52

Item	Content
*54A	The extent to which your work objectives are defined.
55	The extent to which the amount of information available to carry out your job is adequate.
*66A	The extent to which you can predict what others will expect of you tomorrow.
*67A	The extent to which you are clear on what others expect of you now.
*69A	The extent to which you are certain about what your responsibilities will be six months from now.

TABLE V-2

Index: Subjective Quantitative Work Load Index

Intercorrelation Matrix

Item	34A	35A	36A	39A	43A	44A	46A	50A	61A	62A	63A	79A
35A	.42											
36A	-.36	-.30										
39A	.30	.51	-.23									
43A	.68	.40	-.30	.34								
44A	-.39	-.23	.41	-.18	-.54							
46A	.61	.37	-.32	.38	.64	-.42						
50A	.49	.34	-.37	.40	.58	-.44	.48					
61A	.14	.35	-.09	.31	.13	-.08	.33	.34				
62A	.44	.66	-.22	.34	.52	-.32	.38	.39	.28			
63A	-.31	-.49	.34	-.51	-.39	.40	-.36	-.39	-.29	-.46		
79A	.36	.21	-.11	.11	.43	-.23	.57	.46	.25	.22	-.24	
93A	.23	.25	-.14	.12	.14	-.18	.20	.25	.30	.31	.31	.25

(Continued)

Item	Content
*34A	The number of projects and/or assignments you have.
*35A	The amount of time you spend in meetings.
*36A	The amount of time you have.
*39A	The number of conflicting demands you have.
*43A	The work load, the amount of things that need to be done.
*44A	The time to think and contemplate.
*46A	The <u>quantity</u> of work you are expected to do.
*50A	The extent to which you feel you never have any time.
61A	The number of things one really doesn't want to do, certain administrative duties, etc.
*62A	The number of phone calls and office visits you have during the day.
63A	The extent to which you can allocate your time and resources as you want to.
79A	<u>The quantity of work</u> your subordinates expect of you.

TABLE V-3

Index: Complexification

Intercorrelation Matrix

Item	34A	38A	40A	41A	42A	65A
38A	.07					
40A	.36	.34				
41A	.23	.75	.42			
42A	.19	.53	.53	.61		
65A	.26	.48	.18	.46	.23	
68A	-.04	.31	.33	.24	.21	.17

Item	Content
34A	The number of projects and/or assignments you have.
*38A	The rate at which technological developments are occurring in your field.
40A	The extent to which this organization keeps up and sets the pace for other organizations.
*41A	The pace at which the profession, field, or area is developing.
*42A	The rate at which things seem to be getting more and more complex.
*65A	The pace at which scientific knowledge is being elaborated and documented.
68A	The rate of growth of this organization.

TABLE V-4

Index: Role Conflict

Intercorrelation Matrix

Item	39A	45A	61A	99A	16	18
45A	.37					
61A	.31	.14				
99A	.08	.03	.12			
16	.01	.02	-.05	.20		
18	.16	-.03	.15	.02	-.24	
19	-.03	-.12	.06	.33	.69	.53

Item	Content
39A	The number of conflicting demands you have.
45A	The number of other people on which your mission accomplishments depend.
61A	The number of things one really doesn't want to do, certain administrative duties, etc.
99A	The extent to which your subordinates do what you ask them to.
16	The extent to which others in your work group are stimulating, interesting, a source of growth and learning.
18	The extent to which work time is lost because the work group fails to plan and coordinate their efforts.
19	The degree of cooperation in the group.

NOTE: None of the items survived the criteria test. Thus, this cluster was not used.

TABLE V-5

Index: Subjective Qualitative Work Load Index

Intercorrelation Matrix

Item	37A	42A	47A	57A	59A	60A	64A	80A
42A	.09							
47A	.23	.42						
57A	.28	.06	.33					
59A	.35	.15	.06	.29				
60A	.31	.29	.21	.19	.33			
64A	.17	.13	.34	.31	.12	.40		
80A	.02	.17	.51	.30	-.12	.10	.29	
94A	.06	-.02	.28	.31	.02	.33	.42	.32

Item	Content
37A	The amount of pressure to succeed.
42A	The rate at which things seem to be getting more and more complex.
*47A	The quality of work you are expected to do.
57A	The utilization of your skills, talents, and abilities to their fullest.
59A	The amount of pressure to keep up with one's colleagues.
60A	The demands of the job; training or knowledge or talent.
*64A	The difficulty of assignments you get.
80A	The quality of work your immediate superior expects of you.
94A	The quality of work your subordinates expect of you.

TABLE V-6

Index: Utilization of Abilities
Index: Utilization of Leadership

Intercorrelation Matrix

Item	53A	56A	57A	58A	1	2	3	4	5
56A	.28								
57A	.39	.50							
58A	.28	.15	.44						
1	.23	.57	.51	.16					
2	.29	.11	.32	.39	.15				
3	.11	.09	.23	.31	.15	.71			
4	.21	.05	.18	.43	.08	.60	.59		
5	.78	.27	.33	.17	.30	.29	.17	.23	
6	.34	.39	.37	.23	.42	.02	.00	.13	.47

Item	Content
53A	The number of opportunities to advance and move ahead.
*56A	The opportunity to use the skills and knowledge you learned in school.
*57A	The utilization of your skills, talents, and abilities to their fullest.
58A	The amount of say you have in decisions.
* 1	The opportunities to use one's technical skills, e.g., knowledge of the job, general expertness needed in your profession, etc.
2[1]	The opportunities to use one's administrative skills, e.g., assigning the right job to the right man, scheduling the work, following up work that is done and inspecting it.
3	The opportunities to use one's human relations skills, e.g., getting people to work well together, giving recognition, letting people know where they stand.
4	The opportunities to make use of one's institutional leadership skills, e.g., creating and formulating policy, handling matters between your group, department, division, and other groups or organizations.
5	The opportunities to advance and move ahead.
* 6	The opportunity to grow and learn new knowledge and skills.

[1]Items 2, 3, and 4 were found to form a separate index which was then named "Utilization of Leadership." These items are underlined.

TABLE V-7

Index: Responsibility for Persons
Index: Responsibility for Things

Intercorrelation Matrix

Item	70A	71A	72A	73A	74A	75A
71A	.35					
72A	.49	.35				
73A	.25	.46	.36			
74A	.12	.23	.36	.23		
75A	.34	.30	.35	.34	.07	
76A	.49	.38	.47	.23	.19	.43

Item		Content
*P[1]	70A	The responsibility you have for the work of others.
*T	71A	The responsibility you have for initiating assignments and projects.
*T	72A	The responsibility you have for budgets and expenditures.
*T	73A	The responsibility you have for carrying out assignments and projects.
*T	74A	The responsibility you have for equipment and facilities.
	75A	The responsibility you feel toward accomplishing the general goal of your division or directorate.
*P	76A	The responsibility you have for the futures (careers) of others.

[1] Items prefaced by a "P" are part of the Responsibility for Persons Index. Items prefaced by a "T" are part of the Responsibility for Things Index.

TABLE V-8

Index: Opportunities for Advancement and Recognition

Intercorrelation Matrix

Item	51A	53A	5	7
53A	.27			
5	.17	.78		
7	.07	.38	.49	
9	.18	.62	.67	.50

Item	Content
51A	The extent to which there are always new kinds of jobs opening up for a person.
*53A	The number of opportunities to advance and move ahead.
* 5	The opportunities to advance and move ahead.
* 7	The recognition you receive for your work.
* 9	The promotions and advancements you receive.

TABLE V-9

Index: Participation

Intercorrelation Matrix

Item	48A	49A	58A	77A	99A
49A	.57				
58A	.57	.51			
77A	.34	.56	.43		
99A	.26	.30	.26	.27	
11	.30	.43	.32	.36	.38

Item	Content
*48A	The amount of say or influence you feel you have over how your work group is run.
*49A	The overall amount of control you exercise over what happens on your job.
*58A	The amount of say you have in decisions.
*77A	The amount of authority you have to carry out your responsibilities.
99A	The extent to which your subordinates do what you ask them to do.
*11	The extent to which you can discharge your responsibilities.

TABLE V-10

Index: Relations with Immediate Superior

Intercorrelation Matrix

Item	79A	80A	81A	82A	83A	84A	85A	86A	87A	88A	89A	90A	91A
80A	.61												
81A	.35	.35											
82A	.37	.55	.69										
83A	.30	.30	.41	.46									
84A	.53	.56	.29	.38	.27								
85A	.35	.43	.13	.19	.14	.41							
86A	.39	.51	.16	.33	.28	.53	.45						
87A	.36	.39	.22	.39	.39	.44	.41	.74					
88A	.22	.16	.27	.18	.24	-.10	.07	-.05	.04				
89A	.37	.51	.16	.28	.24	.58	.54	.46	.41	-.23			
90A	.29	.42	.47	.68	.44	.53	.37	.58	.58	-.10	.55		
91A	.25	.29	.24	.25	.42	.33	.47	.24	.42	.11	.52	.49	
92A	.26	.38	.07	.19	.35	.32	.67	.39	.39	.12	.53	.33	.56

(Continued)

Item	Content
79A[1]	The quantity of work your immediate superior expects of you.
80A	The quality of work your immediate superior expects of you.
81A	The quantity of work your immediate superior does.
82A	The quality of work your immediate superior does.
83A	The administrative skill and ability of your immediate superior.
*84A	The extent to which your superior delegates responsibility to you.
*85A	The extent to which you know what your immediate superior thinks of you, how he evaluates your performance.
86A	How friendly and easy to approach your superior is.
*87A	The extent to which your superior is willing to listen to your problems.
88A	The extent to which your superior insists on reviewing every decision, paper, etc.
*89A	The extent to which your superior has confidence in you and trusts you.
*90A	The extent to which you can trust your superior and have confidence in him.
*91A	The extent to which your superior encourages the persons who work for him to work as a team.
*92A	Your immediate superior's frankness about your performance.

[1]Even though Items 79A and 80A correlated with the asterisked items, it was decided to leave them out of the cluster on purely theoretical grounds in order to make the content of the cluster similar to the "consideration" dimension of Halpin and Winer (1957). Item 86A was omitted due to a clerical error early in the analyses. It was decided that the expense of correcting this error (correcting computer tape and regenerating output) justified leaving the omission as is.

TABLE V-11

Index: Relations with Work Group

Intercorrelation Matrix

Item	12	13	14	15	16	17	18
13	.58						
14	.41	.67					
15	.41	.48	.54				
16	.40	.44	.57	.50			
17	.48	.51	.64	.61	.63		
18	-.40	-.01	-.24	-.10	-.14	-.17	
19	.41	.55	.69	.53	.55	.61	-.23

Item	Content
	IN THE QUESTIONS BELOW, WORK GROUP MEANS ALL THOSE PERSONS WHO REPORT TO THE SAME IMMEDIATE SUPERIOR AS YOU DO.
*12	The extent to which persons in your work group pay attention to what you're saying.
*13	The extent to which persons in your work group are friendly and easy to approach.
*14	The extent to which persons in your work group seem to work together well, offer each other support on job-related problems.
*15	The extent to which the people in your work group are stimulating, interesting, a source of growth and learning.
*16	The extent to which persons in your work group are willing to listen to your problems.
*17	The extent to which others in your work group encourage each other to give their best effort, to work as a team, emphasize a team goal. . . .
18	The extent to which work time is lost because the work group fails to plan and coordinate their efforts.
*19	The degree of cooperation in the group.

TABLE V-12

Index: Relations with Subordinates

Intercorrelation Matrix

Item	93A	94A	95A	96A	97A	98A	99A
94A	.63						
95A	.47	.45					
96A	.29	.36	.66				
97A	.40	.47	.55	.58			
98A	.37	.44	.59	.71	.60		
99A	.35	.47	.53	.62	.57	.65	
100A	.42	.54	.38	.46	.53	.60	.60

Item	Content
*93A	The quantity of work your subordinates expect of you.
*94A	The quality of work your subordinates expect of you.
*95A	The quantity of work your subordinates do.
96A[1]	The quality of work your subordinates do.
*97A	The extent to which your subordinates have trust and confidence in you.
*98A	The extent to which you have trust and confidence in your subordinates.
*99A	The extent to which your subordinates do what you ask them to do.
*100A	How friendly and easy to approach your subordinates are.

[1] Item 96A was inadvertently omitted in construction of this index.

TABLE V-13

Index: Subjective Quantitative Overload Factor
(French et al., 1965)

Intercorrelation Matrix

Item	C	H	I	K	L
H	.55				
I	.53	.59			
K	.18	.16	.10		
L	.49	.52	.55	.18	
N	.54	.58	.73	.23	.57

Item	Content
*C	Being torn by conflicting demands.
*H	Not being able to allocate one's time and resources as one would wish to.
*I	Overwhelming work load; too many things need to be done.
*K	Having to do things one really doesn't want to do, certain administrative duties, etc.
*L	Not enough time to think and contemplate.
*N	The feeling of never having any time.

Scoring: Based on the following system.

Rate the following items on the extent to which they are a source of pressure for you on your job. Use the following 4-point scale for your ratings. Place one number to the left of each item.

1 Not a source of pressure on my job.

2 Hardly a source of pressure on my job.

3 Somewhat a source of pressure on my job.

4 Great source of pressure on my job.

TABLE V-14

Index: Role Conflict Theoretical Cluster

Intercorrelation Matrix

Item	A	C	D	E	F	G
C	.28					
D	.24	.19				
E	.03	.03	.05			
F	.01	.11	.06	.25		
G	-.03	.37	.03	.09	.36	
K	-.02	.18	.10	.16	.06	.15

Item	Content
*A	The pressure of "having to get along" with people.
*C	Being torn by conflicting demands.
*D	Difficulties in handling subordinates, secretaries, etc.
E	Differences in political, social, and economical views.
F	People "short-circuiting" the system, going over one's head to superiors.
G	Differences of opinion between oneself and one's superiors.
K	Having to do things one really doesn't want to do, certain administrative duties, etc.

<u>Scoring</u>: See Subjective Quantitative Overload Factor (p. 606).

TABLE V-15

Index: Subjective Qualitative Overload Factor
(French et al., 1965)

Intercorrelation Matrix

Item	B	J
J	.20	
M	.50	.37

Item	Content
*B	The pressure to succeed.
*J	Not measuring up to the demands of the job; lack of training or knowledge or talent.
*M	Pressure to keep up with one's colleagues.

<u>Scoring</u>: See Subjective Quantitative Overload Factor (p. 606).

APPENDIX VI

Other Measures of Subjective Work Environment

14. Of your total work time, about what proportion do you normally spend in the following types of environment? (If it fluctuates, strike an average.) Place your answers in <u>Column A</u>. Enter nearest 5-10%. FILL ALL SPACES.

	Percent of time A
A. On phone calls placed by yourself	_____%
B. On phone calls initiated by others	_____%
C. Office visits or meetings which you initiate or schedule	_____%
D. Office visits or meetings which are scheduled or initiated by others	_____%
E. Working alone	_____%
F. Other ______________________________ (Specify)	_____%
TOTAL (should add to 100%)	_____%

20. <u>Estimate</u> the number of each you usually have in a typical 5 day work week.

A. ________ Incoming phone calls

B. ________ Outgoing phone calls

C. ________ Office visits with one other person

D. ________ Meetings arranged by yourself with more than one person

E. ________ Meetings arranged by someone else which involve more than one person

21. Of the total amount of time you spend communicating with other people (either by phone, in person, or in writing), what proportion of the time do you normally spend communicating with each of the following types of persons? (If it fluctuates, strike an average.) Enter the nearest 5-10%.

	Percent of time
A. Persons in your own branch or office	_____%
B. Persons in other branches or offices in your division . .	_____%
C. Persons in other divisions in your directorate.	_____%
D. Persons in other directorates at your base or center . .	_____%
E. NASA employees at other bases or centers	_____%
F. Persons not directly employed by NASA such as contractors and persons from other government agencies and industry	_____%
G. Other ______________________ (Specify)	_____%
TOTAL (should add to 100%)	_____%

22. Now indicate the amount of stress you experience in communicating with each of these types of persons. Use the following 5-point scale for your ratings. Place one number to the left of each item below.

1 Not a source of stress
2 A little source of stress
3 Somewhat a source of stress
4 A great source of stress
5 A very great source of stress

_____ Persons in your own branch or office.
_____ Persons in other branches or offices in your division.
_____ Persons in other divisions in your directorate.
_____ Persons in other directorates at your base or center.
_____ NASA employees at other bases or centers.
_____ Persons not directly employed by NASA such as contractors and persons from other government agencies and industry.
_____ Other (rate only if you specified other persons in the question above).

23. Rate the following items on the extent to which they are a source of time pressure for you. That is the extent to which they create feelings of urgency and impose deadlines. Use the following four-point scale for your ratings. Place one number to the left of each item.

__1__ Not a source of deadline pressure.

__2__ Hardly a source of deadline pressure.

__3__ Somewhat a source of deadline pressure.

__4__ Great source of deadline pressure.

A. ________ My own subordinates.

B. ________ My own colleagues.

C. ________ My immediate superior.

D. ________ Higher level supervisors within my division.

E. ________ The head of this directorate.

F. ________ The heads of other directorates at this base or center.

G. ________ The head of this base or center.

H. ________ Superiors at other bases or centers (such as Headquarters).

I. ________ Contractors and other non-NASA employees.

J. ________ Myself.

K. ________ Other ____
(Specify)

25. Technical and administrative jobs sometimes involve working under time pressures -- results are needed urgently, there are deadlines to be met, etc. In a typical month about what proportion of your time is spent working under the following amounts of pressure? Place your answers in Column A. Enter nearest 5-10%. FILL ALL SPACES.

	Percent of time A
A. Relaxed-- no pressure at all	____%
B. Slight pressure -- there is a schedule to be met but only minor problems in doing so	____%
C. Moderate pressure -- with some pushing, things get done when needed	____%
D. Great pressure -- I can just barely meet the schedule.	____%
E. Extreme pressure -- I'm behind on important deadlines.	____%
TOTAL (should add up to 100%).	____%

JOB RESPONSIBILITIES

29. Rate the following types of responsibilities in terms of the proportion of time you spend on each. (If this varies, strike an average.) Enter nearest 5-10% under the column marked "Percent"

	Percent
A. RESPONSIBILITY FOR MONEY, BUDGET	______
B. RESPONSIBILITY FOR THE WORK OF OTHERS	______
C. RESPONSIBILITY FOR EQUIPMENT	______
D. RESPONSIBILITY FOR PROJECTS, ASSIGNMENTS . . .	______
E. RESPONSIBILITY FOR OTHERS' FUTURES	______
TOTAL (should add to 100%)	________

APPENDIX VII

Conceptual Definitions of the Sales Personality Clusters
(Sales, 1969, pp. 41-44)

a. "Involved Striving." Tendency of the subject to report a "relentless striving" for achievement, for advancement, and for accomplishment. Reported tendency in the subject toward a high degree of ego-involvement in the tasks in which he is engaged. A reported unwillingness of the subject to take lightly the goals for which he is pushing himself or the way in which his goal-directed energy is expended.

b. "Persistence." Reported tendency of the subject to continue working on tasks until they are completed. Reported tenacity.

c. "Competitive Orientation." Reported tendency of the subject to involve himself in competitive situations, both against others and against various standards of excellence. An expressed desire for and liking of competition. A reported strong desire to win.

d. "Range of Activities." Reported past and present tendency of the subject to immerse himself in a wide variety of different activities and/or groups. Expressed tendency of the individual toward multiple involvements.

e. "Positive Attitude toward Pressure." Reported positive attitudinal reactions of the subject to environmental pressures (including responsibility, deadlines, and quantitative overload). Reported tendency of the subject to enjoy pressure or to find it exciting.

f. "Environmental Overburdening." The reported presence of the subject in an environment in which he experiences chronic objective quantitative role overload. Reported exposure of the subject to constant deadlines, deadline pressures, and job responsibility.[1]

g. "Sense of Time Urgency." Expressed chronic subjective feelings of a lack of time, often accompanied by a feeling of being overburdened. Reported feeling of a paucity of time.

h. "Leadership." Reported tendency in the subject to take a sensitive role in interpersonal situations. Expressed past history of leadership positions. Propensity of the subject to see himself as one who takes the initiative and organizes others during group activity.

i. "History of Past Achievements." Reported tendency of the subject to have attained a variety of valued goals in his life.

---

[1] It should be noted that, although the conceptual definition given here refers to objective quantitative role overload, the personality test used in this dissertation measures only an individual's belief that he is exposed to such overload. A belief of this sort, of course, is strictly speaking subjective quantitative role overload.

APPENDIX VIII

The Sales Clusters :

Interitem Correlation Matrices and Item Content

Instructions to the Subjects for the Sales Questionnaire

"In this questionnaire you will find about 50 self-description questions. There are, of course, no 'right' answers to these questions. Any answer which describes the way you feel or act is the right one to give. Please be as honest and open as possible.

"Each statement in the questionnaire has seven lines under it. One of these lines (the one on the far left) is labeled 'very true of me.' One of them (the one on the far right) is labeled 'not at all true of me.' You should place a check or an X on the left-most line if the statement in question is very true of you, and you should place a mark on the right-most line if the statement is not at all true of you. If the statement is somewhat true of you, place a mark somewhat toward the left-most line; if the statement is somewhat untrue of you, place a mark somewhat toward the right-most line. If the statement is neither true nor untrue of you, place a mark on the middle line (the one labeled 'neither very true nor very untrue of me'). Remember that you may use all seven of the response categories.

"In answering the various questions, please work as rapidly as possible. 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."

Scoring for each of the clusters was based on the mean of the items. Each item was presented on a 7-point scale such as the following one:

2. I'm more of a leader than a follower.

____	____	____	____	____	____	____
Very true of me			Neither very true nor very untrue of me			Not at all true of me

The intercorrelation matrices and item content for each cluster follow. Underlined items are reverse scored.

TABLE VIII-1

Index: Involved Striving

Intercorrelation Matrix

Item	5	10	13	21	24	29	30
10	-.52						
13	.32	.54					
21	.17	-.22	-.37				
24	-.36	.38	.59	-.44			
29	-.34	.29	.38	-.40	.58		
30	.44	-.24	-.35	.26	-.34	-.39	
47	.32	-.21	-.37	.29	-.31	-.40	.36

Item	Content
<u>5</u>.[1]	Most of the time I take things pretty easy.
10.	Sometimes I feel I shouldn't be working so hard but something drives me on.
13.	In comparison to most people I know, I'm very involved in my work.
21.	I'm usually not considered much of a self-starter.
24.	In general, I approach my work much more seriously than most of the people I know.
29.	I guess there are people who can be nonchalant about their work, but I'm not one of them.
<u>30</u>.	In general, I can either take my work or leave it alone.
<u>47</u>.	During my work week, I often relax and take things easy for hours at a time.

[1] Underlined items are reverse scored.

TABLE VIII-2

Index: Persistence

Intercorrelation Matrix

Item	7	11	19	26	28	33	35
11	.49						
19	.28	.38					
26	.39	.44	.34				
28	.56	.53	.37	.60			
33	.57	.54	.52	.70	.66		
35	.33	.31	.30	.34	.40	.42	
45	-.27	-.29	-.16	-.34	-.38	-.35	-.36

Item	Content
7.	I hate giving up before I'm absolutely sure that I'm licked.
11.	It <u>really</u> annoys me to have to leave something unfinished.
19.	When I start out to do something, I almost never stop until I've finished it.
26.	Whenever something I'm working at turns out to be difficult, I keep working at it for a long time before giving up.
28.	Achieving the things I set out to do is of extremely great importance to me.
33.	Whenever I've set some goal for myself, I keep working until I've achieved it.
35.	I tend not to give up easily.
45.[1]	When I have a lot of trouble on a problem, I generally give up and go on to something else.

[1]Item is reverse scored.

TABLE VIII-3

Index: Competitive Orientation

Intercorrelation Matrix

Item	4	14	22
14	-.09		
22	.73	-.21	
25	.76	-.11	.92

Item	Content
4.	By nature, I'm a pretty competitive person.
14.[1]	I'd dislike being interviewed for a job.
22.	I have accomplished a significant number and variety of things, far more than most of my acquaintances have.
25.	I find competition stimulating and enjoyable.

[1]Item 14 was dropped because of low correlations with other items in the index.

TABLE VIII-4

Index: Range of Activities

Intercorrelation Matrix

Item	20	27
27	.53	
42	.33	.44

Item	Content
20.	I do a great many more and different things than most people I know do.
27.	I engage in quite a variety of activities.
42.	I've been a member of a lot of groups and clubs.

TABLE VIII-5

Index: Positive Attitude Toward Pressure

Intercorrelation Matrix

Item	8	12	15	32	37	38	40	44
12	.42							
15	-.22	-.37						
32	.35	.47	-.33					
37	.66	.49	-.38	.44				
38	-.10	-.15	-.01	-.13	-.04			
40	-.58	-.35	.41	-.35	-.73	.14		
44	-.36	-.39	.38	-.33	-.45	.14	.52	
49	.34	.43	-.42	.34	.42	-.07	-.32	-.60

Item	Content
8.	I enjoy working against deadlines.
12.	I thrive on challenging situations. The more challenges I have, the better.
<u>15</u>.[1]	I generally don't take on more than I can easily handle.
32.	I enjoy being asked to give all I've got, being stretched to my limit.
37.	I find deadlines exciting and, in a way, enjoyable.
38.[2]	When I'm working on something at home, I almost never set any sort of deadline for myself.
<u>40</u>.	I can't stand working against deadlines.
<u>44</u>.	I wouldn't mind having a job in which I was never held responsible for anything.
49.	I don't think I could tolerate a position with no responsibility.

[1] Underlined items reverse scored.

[2] Item 38 was dropped due to low intercorrelations with other items in the index.

TABLE VIII-6

Index: Environmental Overburdening

Intercorrelation Matrix

Item	17	34
34	-.36	
48	-.37	.41

Item	Content
17.[1]	My work demands an extraordinary amount of time of me.
34.	Several days a week I seem to have a lot of time--often hours on end--on my hands.
48.	The things I have to do often take up only a small part of the time I have available.

[1]Item reverse scored.

TABLE VIII-7

Index: Sense of Time Urgency

Intercorrelation Matrix

Item	1	3	18	36	39
3	-.42				
18	.59	-.45			
36	.41	-.32	.53		
39	.46	-.40	.68	.62	
43	.44	-.43	.59	.59	.67

Item	Content
1.	There's virtually never enough time for me to do all I have to do.
3.[1]	Most of the time I don't feel much time pressure in the things I do.
18.	It seems as if I need thirty hours a day to finish all the things I'm faced with.
36.	It seems as if I always am faced with some dead-line or other.
39.	It's virtually impossible for me to get out from under the time pressures which face me.
43.	Sometimes it seems as if the pressures on me never let up.

[1]Item is reverse scored.

TABLE VIII-8

Index: Leadership

Intercorrelation Matrix

Item	2	6	9
6	.49		
9	.38	.69	
41	.61	.64	.58

Item	Content
2.	I'm more of a leader than a follower.
6.	I'm almost always asked to be a leader of groups I belong to.
9.	I've often been asked to be an officer of some group or groups.
41.	When I participate in an activity, I almost always take some sort of leadership role.

TABLE VIII-9

Index: History of Past Achievements

Intercorrelation Matrix

Item	16	22
22	.46	
46	.64	.66

Item	Content
16.	Compared to most people I know, I've achieved a great deal.
22.	I have accomplished a significant number and variety of things, far more than most of my acquaintances have.
46.	My achievements are considered to be significantly higher than those of most people I know.

APPENDIX IX

Other Measures of Personality:
Intercorrelation Matrices and Item Content

Asterisked (*) items were retained in the final indices.

Index: What I am Like Type A (WAM)

Intercorrelation Matrix

Item	C	G	H
G	-.07		
H	-.30	.23	
I	.24	-.32	-.26

Item Content and Scoring:

c.

Ed

Ed never gives much thought to how much time there is. He takes things as they come. Ed feels he doesn't work as well under deadline pressures anyway, and could do without them.

Jim

Jim is the kind of person who never seems to have enough time to handle all the demands people put on him. Nevertheless, he prefers deadline pressures, and feels he works better under them.

CHECK ONE BOX.

I'm like Ed	I'm more like Ed than like Jim	I'm halfway between Ed and Jim	I'm more like Jim than like Ed	I'm like Jim
1	2	3	4	5

What I Am Like Cont'd.

*g. **John**

John is the kind of person who constantly strives to advance on his job. This often means taking on extra job assignments, but John doesn't mind that.

Dick

Dick thinks that his present position in the organization is quite satisfactory. He doesn't feel a need to get ahead. As it is, he has enough work to do without seeking more.

CHECK ONE BOX.

I'm like John 5	I'm more like John than like Dick 4	I'm halfway between John and Dick 3	I'm more like Dick than like John 2	I'm like Dick 1

* * * * * * * * *

*h. **Bill**

Bill can't understand how some people can be so slow in getting in reports and other documents. It irritates him. If it were he, he would work all night to get the job in on time.

Mike

Mike feels that there are limits to the amount of time one can spend on a job. He doesn't become annoyed if something is late in arriving at his desk. His feeling is that if one puts in his eight hours, he is doing his best.

CHECK ONE BOX.

I'm like Bill 5	I'm more like Bill than like Mike 4	I'm halfway between Bill and Mike 3	I'm more like Mike than like Bill 2	I'm like Mike 1

* * * * * * * * *

*i. **John**

John doesn't like to feel that he is being compared to others when he does his work. For him, a job is a job, and the less involved one is in getting ahead, the more agreeable relations can be with one's colleagues.

Dick

Dick feels that his job is just like participating in sports back at school. There is lots of opportunity for recognition. Dick also feels that one can likewise be competitive in striving ahead of colleagues.

CHECK ONE BOX.

I'm like John 1	I'm more like John than like Dick 2	I'm halfway between John and Dick 3	I'm more like Dick than like John 4	I'm like Dick 5

Index: Repressors - Sensitizors

Intercorrelation Matrix

Item	F	J
J	.27	
L	.30	.32

Item Content and Scoring:

*f. **Mike**

Mike has been thinking about the fact that he isn't as skilled at his work as he would like to be. He sometimes gets those feelings of being less than the best.

Bill

Bill is satisfied with how he does. He doesn't spend time, anyway, thinking about it, and really doesn't have feelings one way or the other on the matter.

CHECK ONE BOX.

I'm like Mike	I'm more like Mike than like Bill	I'm halfway between Mike and Bill	I'm more like Bill than like Mike	I'm like Bill
5	4	3	2	1

* * * * * * * *

*j. **Mike**

Sometimes Mike gets a headache or his stomach growls, or his palms feel sweaty, or he has chills. These are probably just nervous tension.

Dan

Dan never feels uncomfortable. He hasn't had a headache for almost as long as he can remember. Perhaps he is the type of guy who doesn't get nervous or perhaps his job is like that.

CHECK ONE BOX.

I'm like Mike	I'm more like Mike than like Dan	I'm halfway between Mike and Dan	I'm more like Dan than like Mike	I'm like Dan
5	4	3	2	1

Repressors - Sensitizors Cont'd.

*1. Ed

Sometimes someone goes over Ed's head to his boss, or has an argument with Ed, or his boss criticizes him. When Ed is at home at the end of those days he still keeps thinking about work although he wishes he wouldn't.

John

John runs into situations where someone causes a problem for him, his boss tells him he did something wrong, or there is an argument. He never gives it much thought, however, and by the time he gets home, forgets all about it.

CHECK ONE BOX.

I'm like Ed	I'm more like Ed than like John	I'm halfway between Ed and John	I'm more like John than like Ed	I', like John
5	4	3	2	1

* All items were retained for the index although the significant correlation between items j and l did not replicate in an analysis of the second half of the sample.

TABLE IX-1

Index: Emotional Dependency
(Sampson, 1960)

Intercorrelation Matrix

Item	8	13	18	22
13	-.08			
18	.19	-.37		
22	.30	.05	-.18	
25	.29	-.17	.53	.25

The following item format and scoring were used:

35. In this section, we have listed a few more things that tell 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. Then go to the four boxes on the right, and put a check in the box that best applies to you.

If you feel it is VERY TRUE, check the 1st box.
FAIRLY TRUE, check the 2nd box.
NOT VERY TRUE, check the 3rd box.
If you feel it is NOT TRUE AT ALL, check the 4th box.

	Very true	Fairly true	Not very true	Not true at all
1. I often wish people would be more definite about things.	☐	☐	☐	☐

Item	Content
8[1]	I like to have people to lean on when things are going badly for me.
13	I am very seldom discouraged when things go wrong.
18	I often complain about my sufferings and hardship.
22	When I have a problem I almost always seek help from others in dealing with it.
25	I usually tell my friends about my difficulties and misfortunes.

[1] Underlined items retained in final index.

Flexibility-Rigidity Scale (Gough, 1957)

The item format and instructions are identical to those for the Emotional Dependency measure (see p. 533).

Item	Content
1.	I often wish people would be more definite about things.
2.	It is annoying to listen to a person who cannot seem to make up his mind as to what he really believes.
3.	I like a well-ordered life with regular hours.
4.	It is hard for me to sympathize with someone who is always doubting and unsure about things.
5.	I often start things I never finish.
6.	Our thinking would be a lot better off if we would just forget words like "probably," "approximately" and "perhaps."
7.	I never make judgments about people until I am sure of the facts.
9.	A strong person will be able to make up his mind even on the most difficult questions.
10.	For most questions, there is just one right answer, once a person is able to get all the facts.
11.	I like to have a place for everything, and everything in its place.
12.	I don't like to work on a problem unless there is the possibility of coming out with a clearcut answer.
14.	It bothers me when something unexpected interrupts my daily routine.
15.	Most of the arguments or quarrels I get into are over matters of principle.
16.	I am known as a hard and steady worker.
17.	I don't like things to be uncertain and unpredictable.
19.	Once I have my mind made up I seldom change it.
20.	I think I am stricter about right and wrong than most people.
21.	I am in favor of a very strict enforcement of all laws, no matter what the consequences.
23.	I always see to it that my work is carefully planned and organized.
24.	The trouble with many people is that they don't take things seriously enough.
26.	I set a high standard for myself and I feel others should do the same.
27.	People who seem unsure and uncertain about things make me feel uncomfortable.

Crowne-Marlowe Clusters

The following format was used:

ABOUT YOURSELF

34. 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 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 make sure you have answered all the questions.

	TRUE	FALSE
a. Before voting I thoroughly investigate the qualifications of all the candidates.	☐	☐

The items are as follows:

<u>Cluster I. Deny Bad Self</u>.

- f. I sometimes feel resentful when I don't get my way.
- l. There have been times when I felt like rebelling against people in authority even though I knew they were right.
- s. I sometimes try to get even, rather than forgive and forget.
- w. There have been occasions when I felt like smashing things.
- ab. There have been times when I was quite jealous of the good fortune of others.
- ad. I am sometimes irritated by people who ask favors of me.
- af. I sometimes think when people have a misfortune they only got what they deserved.

<u>Cluster II. Overconformity to Norms</u>.

- a. Before voting I thoroughly investigate the qualifications of all the candidates.
- b. I never hesitate to go out of my way to help someone in trouble.
- g. I am always careful about my manner or dress.
- h. My table manners at home are as good as when I eat out in a restaurant.
- m. No matter who I'm talking to, I'm always a good listener.
- p. I'm always willing to admit it when I make a mistake.
- q. I always try to practice what I preach.
- t. When I don't know something I don't at all mind admitting it.
- aa. I never make a long trip without checking the safety of my car.

APPENDIX X

Interitem Correlation Matrices for P-E Fit Measures

Each item listed on the following pages is followed by the letters "AB." This indicates that the item has two components: an A component which asks the individual to indicate to what extent some aspect of work is present in his job environment, and a B component which asks him the extent to which he would like that aspect present in his environment. B is subtracted from A to compute a P-E fit score. The general format for the items has already been given on the first page of Appendix V. The sample size for the correlations is generally about 100. Thus, $r \geq .19$, $p \leq .05$; and $r \geq .25$, $p \leq .01$.

TABLE X-1

Index: Role Ambiguity P-E Fit

Item Intercorrelation Matrix

Item	54AB	66AB	67AB
66AB	.45		
67AB	.58	.64	
69AB	.34	.54	.51

Item	Content
54A	The extent to which your work objectives are defined.
B	The extent to which you would like them defined.
66A	The extent to which you can predict what others will expect of you tomorrow.
B	The extent to which you would like to predict this.
67A	The extent to which you are clear on what others expect of you now.
B	The extent to which you would like to be clear on others' expectations.
69A	The extent to which you are certain about what your responsibilities will be six months from now.
B	The extent to which you would like to be certain.

TABLE X-2

Index: Subjective Quantitative Work Load
P-E Fit

Item Intercorrelation Matrix

Item	34AB	35AB	43AB	44AB[1]	46AB	50AB
35AB	.29					
43AB	.59	.22				
44AB	-.33	-.14	-.38			
46AB	.37	.29	.47	-.20		
50AB	.43	.25	.51	-.47	.26	
62AB	.20	.39	.21	-.30	.09	.30

[1]Reverse score item.

Item	Content
34A	The number of projects and/or assignments you have.
B	The number you would like.
35A	The amount of time you spend in meetings.
B	The amount you would like.
43A	The workload, the amount of things that need to be done.
B	The workload you would like.
44A	The time to think and contemplate.
B	The time you would like.
46A	The quantity of work you are expected to do.
B	The quantity you would prefer.
50A	The extent to which you feel you never have any time.
B	The extent to which you would like to feel this way.
62A	The number of phone calls and office visits you have during the day.
B	The number you would like to have.

TABLE X-3

Index: Complexification P-E Fit

Item Intercorrelation Matrix

Item	38AB	40AB	41AB
40AB	.07		
41AB	.09	.22	
65AB	.33	-.07	.37

Item	Content
38A	The rate at which technological developments are occurring in your field.
B	The rate you would like.
40A	The extent to which this organization keeps up and sets the pace for other organizations.
B	The extent this organization ought to.
41A	The pace at which the profession, field, or area is developing.
B	The pace at which it ought to.
65A	The pace at which scientific knowledge is being elaborated and documented.
B	The pace you would like it to be elaborated at.

TABLE X-4

Index: Subjective Qualitative Overload
Index: P-E Fit

Items 47AB and 64AB are the only two items in this index. They correlate .40.

Item	Content
47A	The quality of work you are expected to do.
B	The quality you would prefer expected.
64A	The difficulty of assignments you get.
B	The difficulty you would like.

Index: Utilization of Abilities P-E Fit

Items 56AB and 57AB are the only two items in this index. They correlate .60.

Item	Content
56A	The opportunity to use the skills and knowledge you learned in school.
B	The opportunity you would like.
57A	The utilization of your skills, talents, and abilities to their fullest.
B	The utilization of skills you would like.

Index: Responsibility for Persons P-E Fit

Items 70AB and 76AB are the only two items in this index. They correlate .43.

Item	Content
70A	The responsibility you have for the work of others.
B	The responsibility you would like to have for the work of others.
76A	The responsibility you have for the futures (careers) of others.
B	The responsibility you would like to have.

TABLE X-5

Index: Responsibility for Things P-E Fit

Item Intercorrelation Matrix

Item	71AB	72AB
72AB	.39	
75AB	.21	.31

Item	Content
71A	The responsibility you have for initiating assignments and projects.
B	The responsibility you would like to have.
72A	The responsibility you have for budgets and expenditures.
B	The responsibility you would like to have.
75A	The responsibility you feel toward accomplishing the general goal of your division or directorate.
B	The responsibility you would like to feel toward the goal.

TABLE X-6

Index: Advancement and Recognition P-E Fit

Items 51AB and 53AB are the only two items in this index. They correlate .30.

Item	Content
51A	The extent to which there are always new kinds of jobs opening up for a person.
B	The extent to which such jobs should be available.
53A	The number of opportunities to advance and move ahead.
B	The number of opportunities you would like.

TABLE X-7

Index: Participation P-E Fit

Item Intercorrelation Matrix

Item	48AB	49AB
49AB	.72	
58AB	.64	.64

Item	Content
48A	The amount of say or influence you feel you have over how your work group is run.
B	The amount of say and influence you would like.
49A	The overall amount of control you exercise over what happens on your job.
B	The amount of control you would like.
58A	The amount of say you have in decisions.
B	The amount you would like to have.

TABLE X-8

Index: Relations with Immediate Superior P-E Fit

Item Intercorrelation Matrix

Item	84AB	85AB	89AB	90AB	91AB
85AB	.36				
89AB	.57	.54			
90AB	.52	.31	.45		
91AB	.36	.37	.31	.56	
92AB	.28	.55	.48	.30	.46

Item	Content
84A	The extent to which your superior delegates responsibility to you.
B	The extent to which you would like him to.
85A	The extent to which you know what your immediate superior thinks of you, how he evaluates your performance.
B	The extent to which you would like him to.
89A	The extent to which your superior has confidence in you and trusts you.
B	The extent to which you would like him to.
90A	The extent to which you can trust your superior and have confidence in him.
B	The extent to which you would like to.
91A	The extent to which your superior encourages the persons who work for him to work as a team.
B	The extent to which you would like him to encourage teamwork.
92A	Your immediate superior's frankness about your work performance.
B	The frankness you would like from him.

TABLE X-9

Index: Relations with Subordinates P-E Fit

Item Intercorrelation Matrix

Item	93AB	94AB
94B	.25	
97B	-.07	.34

Item	Content
93A B	The quantity of work your subordinates expect of you. The quantity you would like them to expect.
94A B	The quality of the work your subordinates expect of you. The quality you would like them to expect.
97A B	The extent to which your subordinates have trust and confidence The extent you would like them to.

TABLE X-10

AVERAGE INTERITEM CORRELATION AND ESTIMATED RELIABILITY FOR EACH

P-E FIT CLUSTER

Cluster	Average	Estimated Reliability	Number of Items
Role Ambiguity	.52	.81	4
Subjective Quantitative Work Load Index	.32	.77	7
Complexification	.29	.62	4
Subjective Qualitative Work Load Index	.40	.57	2
Utilization of Abilities	.60	.75	2
Responsibility for Persons	.43	.60	2
Responsibility for Things	.31	.57	3
Advancement and Recognition	.30	.46	2
Participation	.67	.86	3
Relations with Immediate Superior	.43	.82	6
Relations with Subordinates	.18	.40	3

TABLE X-11

CORRELATIONS BETWEEN P-E FIT CLUSTERS

Cluster	a	b	c	d	e	f	g	h	i	j
a. Role Ambiguity										
b. Subjective Quantitative Work Load Index	.03									
c. Complexification	.13	.02								
d. Subjective Qualitative Work Load Index	.49	.14	.23							
e. Utilization of Abilities	.52	.06	.17	.52						
f. Responsibility for Persons	.21	.35	.22	.34	.34					
g. Responsibility for Things	.47	.34	.33	.49	.50	.54				
h. Advancement and Recognition	.50	.08	.21	.21	.36	.18	.41			
i. Participation	.53	-.01	.30	.52	.52	.33	.53	.45		
j. Relations with Immediate Superior	.46	.05	.24	.50	.35	.24	.44	.18	.33	
k. Relations with Subordinates	.28	-.05	.44	.36	.50	.20	.37	.41	.53	.36

APPENDIX XI

Job Satisfaction Measure

28. Rate the following items on the extent to which they represent aspects of your work which are <u>more satisfying</u> to you on this job <u>than they would be on other available jobs</u> you could be in. Use the following 4-point scale for your ratings. Place one number to the left of each item.

__1__ <u>Not</u> better than on other available jobs.

__2__ <u>Hardly</u> better than on other available jobs.

__3__ Somewhat better than on other available jobs.

__4__ A great deal better than on other available jobs.

a. ______ The status and importance of my position in this organization.

b. ______ The extent to which other people working on similar problems can read about what I am doing; my opportunities for publication.

c. ______ The extent to which I can structure my work as I like it.

d. ______ My salary.

e. ______ The competence of those I work with.

f. ______ The extent to which I can put out a lot of work in a short amount of time.

g. ______ The support, understanding, and cohesiveness of the people I work with.

h. ______ The security of my job.

i. ______ The extent to which people in my work group are stimulating, interesting, and a source of growth and learning.

j. ______ The importance of the problems I work on to the overall goal of this organization.

k. ______ The amount of recognition I receive.

l. ______ The opportunities I have to be creative and innovative to discover and invent new ways of doing things.

m. ______ The opportunities I have to help and be of service to others.

n. ______ The complexity of the work that faces me.

o. ______ The challenging problems I have to work on.

p. ______ The responsibilities which have been given me for supervising the work of others.

q. ______ The responsibilities which have been given me for planning, coordinating, and carrying out projects, assignments.

r. ______ The time I spend thinking and contemplating.

s. ______ The opportunities I have for utilizing my knowledge, skills, and abilities to their fullest.

t. ______ The extent to which I handle relationships with other persons in a skilled manner.

u. ______ The quantity of work I have done.

v. ______ The quality of work I have done.

w. ______ The amount of success I experience on this job.

<u>Scoring</u>: A mean of all items answered was obtained.

APPENDIX XII

Job-Related Threat Measure

30. Now indicate how well you think you will be able to meet your own needs for good health, feelings of pride and self worth, freedom from tension and anxiety, security, and so forth, if these aspects of your job keep up the way you have indicated.

CHECK ONE BOX IN EACH LINE: Aspect:	If this aspect keeps going as it is, I'll be able to meet my own needs for good health, feelings of self worth, etc. very poorly 1	2	neither poor/well 3	4	very well 5
A. The amount of work to be done.	☐	☐	☐	☐	☐
B. The quality of work demanded.	☐	☐	☐	☐	☐
C. Your immediate superior's relationships with you . . .	☐	☐	☐	☐	☐
D. Your subordinate's relationships with you	☐	☐	☐	☐	☐
E. The amount of recognition you receive	☐	☐	☐	☐	☐
F. The opportunity for you to develop skills, talents, and abilities to their fullest . .	☐	☐	☐	☐	☐
G. The responsibilities you have for others' careers.	☐	☐	☐	☐	☐
H. The responsibilities you have for mission, project, or job accomplishment.	☐	☐	☐	☐	☐
I. The responsibilities you have for budget and expenditures . .	☐	☐	☐	☐	☐
J. The responsibilities you have for equipment and facilities .	☐	☐	☐	☐	☐
K. The resources you have available for effectively carrying out your responsibilities.	☐	☐	☐	☐	☐
L. The rate at which the organization and profession is getting complex.	☐	☐	☐	☐	☐
M. The amount of support you receive from your work group .	☐	☐	☐	☐	☐
N. The extent to which you have to work with other organizations, divisions, bases.	☐	☐	☐	☐	☐
O. The conflicting demands you face	☐	☐	☐	☐	☐

CHECK ONE BOX IN EACH LINE:	If this aspect keeps going as it is, I'll be able to meet my own needs for good health, feelings of self worth, etc.				
	very poorly		neither poor/well		very well
Aspect:	1	2	3	4	5
P. The extent to which you are clear on what others expect of you	☐	☐	☐	☐	☐
Q. The overall amount of control you have over your job	☐	☐	☐	☐	☐

Scoring: The mean of the answered items is taken.

APPENDIX XIII

Job-Related Self-Esteem Measure

32. The following scales run continuously from one labeled extreme to the other with varying degrees being indicated by spaces (___).

Please mark <u>both</u> an <u>X</u> indicating your present picture of yourself <u>and</u> an <u>O</u> for your aspired picture of yourself. Place your marks in the middle of the spaces (___); not on the boundaries. USE BOTH AN <u>X</u> AND AN <u>O</u>.

a.	Not admired by others	_|_|_|_|_|_|_|_|_|_|_ or, this characteristic is not a part of my picture of myself ___.	Admired by others
b.	Not trusted by others	_|_|_|_|_|_|_|_|_|_|_ or, this characteristic is not a part of my picture of myself ___.	Trusted by others
c.	Administrative ability	_|_|_|_|_|_|_|_|_|_|_ or, this characteristic is not a part of my picture of myself ___.	Non-administrative
d.	Hard working	_|_|_|_|_|_|_|_|_|_|_ or, this characteristic is not a part of my picture of myself ___.	Easy going
e.	Value myself high	_|_|_|_|_|_|_|_|_|_|_ or, this characteristic is not a part of my picture of myself ___.	Value myself low
f.	Careless	_|_|_|_|_|_|_|_|_|_|_ or, this characteristic is not a part of my picture of myself ___.	Methodical
g.	Intellect high	_|_|_|_|_|_|_|_|_|_|_ or, this characteristic is not a part of my picture of myself ___.	Intellect low
h.	Self-confidence	_|_|_|_|_|_|_|_|_|_|_ or, this characteristic is not a part of my picture of myself ___.	Lack self-confidence

i.	Liked	___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ or, this characteristic is not a part of my picture of myself ___.	Unliked
j.	Technically skilled	___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ or, this characteristic is not a part of my picture of myself ___.	Technically unskilled
k.	Non-inventive	___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ or, this characteristic is not a part of my picture of myself ___.	Inventive
l.	Awkward with others	___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ or, this characteristic is not a part of my picture of myself ___.	Skillful with others
m.	Competent	___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ or, this characteristic is not a part of my picture of myself ___.	Incompetent
n.	Technically uninformed	___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ or, this characteristic is not a part of my picture of myself ___.	Technically knowledgeable
o.	Non-creative	___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ or, this characteristic is not a part of my picture of myself ___.	Creative

33a. On this scale rate your overall level of self evaluation or self-esteem on the job; that is, how high or low you presently evaluate your total picture of yourself as a ____.
(write your job title in here)

(Use an X)

b. High ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ Low

Scoring: The mean absolute difference score of completed items a through o is calculated. The scales are eleven units in length. Item 33a is a single-item measure of self-esteem.

APPENDIX XIV

Comparison of 24 Serum Cholesterol Samples Analyzed by Both Brooks' and Block's Laboratories

TABLE XIV-1

COMPARISON OF 24 SERUM CHOLESTEROL SAMPLES ANALYZED BY BOTH BROOKS' AND BLOCK'S LABORATORIES[1]

Sample #	Laboratory Brooks	Laboratory Block
040	102[2]	130
057	216	230
082	148	166
093	250	232
098	135	134
101	150	163
130	127	138
192	166	182
231	137	166
248	164	182
259	170	182
271	190	206
275	112	130
279	153	158
285	220	218
294	205	222
296	159	163
298	184	200
302	156	168
307	148	152
316	190	194
319	180	182
322	187	200
333	144	152
$\bar{X}$	166.4	177.1
S.D.	34.26	30.24

[1]t test of the difference = -5.23, $p < .001$; $r = .97$ between the two sets of samples.

[2]mg/100 ml.

APPENDIX XV

Measures of Some Health-Related Variables

8. CHECK ONE OF THE STATEMENTS BELOW:

A. I smoke . . . . ______

B. I used to smoke but have stopped . . . . ______

C. I never have smoked as a habit . . . . . ______

IF YOU SMOKE, COMPLETE THE FOLLOWING ITEMS IN THIS BOX.

9. On the average how many cigarettes do you smoke per day? . . . ______

10. How many cigars on the average? . . . . ______

11. How many pipefuls of tobacco on the average? . . . . ______

12. Have you participated in an NASA health exam during the last year? (CHECK ONE)

______ Yes ______ No

13. Have you made use of the health services for other reasons, e.g., to get an aspirin for a headache, take care of a cold, a sore muscle, or other discomfort?

______ Yes ______ No

If you answered YES, answer the following question. Otherwise skip this next question and go on to the one after it.

16. How many times last year did you use the health services? (If you are unsure, make a best estimate) ______________ times.
(fill in)

15. Have any of the following members of your side of the family ever had some form of coronary heart disease such as a heart attack or high blood pressure as diagnosed by a physician? (CHECK AS MANY AS APPLY)

______ My father

______ My mother

______ Sister(s)

______ Brother(s)

______ Aunt(s)

______ Uncle(s)

______ Niece(s)

______ Nephew(s)

______ Myself

______ No one in my family that I know of

16. What is your height (stocking feet): ______ feet and ______ inches.

17. Weight (office clothes, no heavy coat and without shoes): ______ lbs.

APPENDIX XVI

Relationships between Two Measures of Responsibility

TABLE XVI-1

RELATIONSHIPS BETWEEN TWO MEASURES OF RESPONSIBILITY[1]

Reported percent of time carrying out responsibility for	Index: responsibility for Persons	Things	$r_1 - r_2 \neq 0$, $p <$
Work of others	.56[4]	.07	.001
Others futures	.29[3]	.05	.05
Budget	.28[3]	.36[3]	n.s.
Equipment	-.07	.16	.10
Projects	-.66	-.23[2]	.001

[1] $n \cong 100$.

[2] $p < .05$.

[3] $p < .01$.

[4] $p < .001$.

APPENDIX XVII

Sources of Relief from Stress

20. Rate the following items on the extent to which they are a source of relief from the stresses of your job. Use the following 4-point scale for your ratings. Place one number to the left of each item.

___1___ Not a source of relief from the stresses of my job.

___2___ Hardly a source of relief from the stresses of my job.

___3___ Somewhat a source of relief from the stresses of my job.

___4___ Great source of relief from the stresses of my job.

a. ______ Having a snack or beverage.

b. ______ Taking a day off.

c. ______ The time I have on the way to and from work.

d. ______ Taking a tranquilizer.

e. ______ Losing my temper, throwing something, crumpling up a piece of paper.

f. ______ Isolating myself from other people for a couple of minutes to relax, such as closing my office door, going to the rest room, taking a walk down the hall, etc.

g. ______ Taking a vacation.

h. ______ Day dreaming

i. ______ Chewing some gum or eating candy.

j. ______ Smoking a cigarette, cigar, pipe.

k. ______ Swearing to myself.

l. ______ Chatting with a colleague or subordinate.

m. ______ My family, wife, children, etc.

n. ______ My off-work activities, hobbies, etc.

o. ______ Chatting with my immediate superior.

p. ______ Getting a drink of water.

q. ______ The work breaks I take.

r. ______ Other ____
(specify)

APPENDIX XVIII

Intercorrelations between Territorial Source of Stress Items

TABLE XVIII-1

INTERCORRELATIONS BETWEEN TERRITORIAL SOURCE OF STRESS ITEMS[1]

Source of Stress	a	b	c	d	e
a. Own branch					
b. Other branches	.24[2]				
c. Other divisions	.17	.56			
d. Other directorates	.05	.30[3]	.51[4]		
e. Other bases	.06	.25[3]	.30[3]	.39[4]	
f. Non-NASA employees	.14	.32[4]	.30[3]	.44[4]	.40[4]

[1] N = 100; Appendix VI; item 21 presents the format for these measures.

[2] $p < .05$.

[3] $p < .01$.

[4] $p < .001$.

APPENDIX XIX

The Conditioning Effect of Type A Personality Measures on the Relationship between Territorial Stress and Strain

TABLE XIX-1

THE EFFECT OF INVOLVED STRIVING ON THE CORRELATION BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND MEASURES OF PHYSIOLOGICAL STRAIN

	Involved Striving										
	Low (N = 80)				Medium (N = 51)			High (N = 69)			
Source of Stress	Co[1]	Ch[2]	SBP[3]	Ci[4]	Co	Ch	SBP	Co	Ch	SBP	Ci
Own branch	.15	-.07	.06	-.32	.06	.13	.11	-.33[5]	-.14	.06	.24
Other branches	-.03	-.16	-.05	-.21	-.22	.13	.04	-.22	.12	.20	-.12
Other divisions	-.18	-.17	-.22	-.40	-.11	-.10	.10	-.18	.25[5]	.17	.04
Other directorates	-.02	-.21	-.17	.02	-.03	.10	.15	-.03	.20	-.02	-.08
Other bases	.22	-.30	-.31[5]	-.16	-.04	.14	.01	-.02	.21	-.10	-.16
Non-NASA personnel	-.04	-.30	-.10	-.23	.06	.00	.24	-.35[5]	-.03	-.19	-.25

[1] Cortisol.

[2] Cholesterol.

[3] Systolic blood pressure.

[4] Number of cigarettes for persons who smoke. There is no middle personality group due to the small sample size.

[5] $p < .05$

TABLE XIX-2

THE EFFECT OF LEADERSHIP ON THE CORRELATION BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND MEASURES OF PHYSIOLOGICAL STRAIN

	Leadership										
	Low (N = 73)				Medium (N = 62)			High (N = 63)			
Source of Stress	Co[1]	Ch[2]	SBP[3]	Ci[4]	Co	Ch	SBP	Co	Ch	SBP	Ci
Own branch	.00	-.07	.09	.28	.15	.13	.17	-.35[5]	-.19	-.10	.11
Other branches	-.07	-.13	-.03	-.30	-.33[5]	.17	.18	-.15	.06	-.08	-.02
Other divisions	-.14	-.26[5]	-.15	-.48[5]	-.06	.33[5]	.21	-.28	-.04	-.07	.12
Other directorates	-.01	-.28[5]	-.07	-.23	-.06	.18	-.06	-.02	.20	-.02	-.01
Other bases	.17	-.28[5]	-.17	.25	.13	.12	-.08	-.11	.15	-.12	-.28
Non-NASA personnel	-.03	-.23[5]	.02	-.24	-.01	-.02	.09	-.35[5]	-.09	-.23	-.21

[1]Cortisol.

[2]Cholesterol.

[3]Systolic blood pressure.

[4]Number of cigarettes for persons who smoke. There is no middle personality group due to the small sample size.

[5]$p < .05$.

TABLE XIX-3

THE EFFECT OF SENSE OF TIME URGENCY ON THE CORRELATION BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND MEASURES OF PHYSIOLOGICAL STRAIN

	Sense of Time Urgency										
	Low (N =72)				Medium (N = 67)			High (N = 65)			
Source of Stress	Co[1]	Ch[2]	SBP[3]	Ci[4]	Co	Ch	SBP	Co	Ch	SBP	Ci
Own branch	.18	-.13	.10	-.08	-.12	.07	.11	-.18	.18	-.03	.20
Other branches	-.24[5]	-.09	-.11	-.22	-.20	.26	.22	-.09	.00	.09	-.11
Other divisions	-.27[5]	-.26[5]	-.10	-.60[5]	-.17	.22	.07	-.07	.16	.05	.10
Other directorates	.03	-.13	-.10	-.48[5]	-.13	.09	.02	.04	.18	-.02	.07
Other bases	-.13	-.21	-.24	-.13	.05	.00	-.03	.01	.07	-.21	-.17
Non-NASA personnel	-.08	-.37[5]	-.06	-.51[5]	-.11	-.02	.08	-.21	-.01	-.15	-.19

[1] Cortisol.

[2] Cholesterol.

[3] Systolic blood pressure.

[4] Number of cigarettes for persons who smoke. There is no middle personality group due to the small sample size.

[5] $p < .05$.

TABLE XIX-4

THE EFFECT OF HISTORY OF PAST ACHIEVEMENTS ON THE CORRELATION BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND MEASURES OF PHYSIOLOGICAL STRAIN

	History of Past Achievements										
	Low (N = 86)				Medium (N = 51)			High (N = 64)			
Source of Stress	Co[1]	Ch[2]	SBP[3]	Ci[4]	Co	Ch	SBP	Co	Ch	SBP	Ci
Own branch	-.04	-.14	.03	.26	-.04	.08	.15	-.13	.01	.07	.07
Other branches	-.18	-.16	.02	-.01	-.38[5]	.34	.15	-.08	.01	.03	-.15
Other divisions	-.19	-.13	-.11	-.03	-.01	.21	.30[5]	-.22	.02	-.05	-.17
Other directorates	.00	-.06	-.04	.14	-.18	.09	-.18	-.02	.08	.04	-.09
Other bases	.02	.12	-.28	-.30	.22	-.04	-.14	-.08	-.08	-.02	-.04
Non-NASA personnel	-.09	-.12	-.03	-.59[5]	-.08	-.05	-.04	-.30[5]	-.16	-.06	.12

[1] Cortisol.

[2] Cholesterol.

[3] Systolic blood pressure.

[4] Number of cigarettes for persons who smoke. There is no middle personality group due to the small sample size.

[5] $p < .05$.

TABLE XIX-5

THE EFFECT OF ENVIRONMENTAL OVERBURDENING ON THE CORRELATION BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND MEASURES OF PHYSIOLOGICAL STRAIN

	Environmental Overburdening										
	Low (N = 77)				Medium (N = 54)			High (N = 65)			
Source of Stress	Co[1]	Ch[2]	SBP[3]	Ci[4]	Co	Ch	SBP	Co	Ch	SBP	Ci
Own branch	-.24	-.08	.06	-.07	.13	.21	.14	-.02	-.14	.00	.22
Other branches	-.27	-.04	.21	-.26	-.13	.09	.11	-.11	.08	-.14	-.08
Other divisions	-.11	.18	.21	-.07	-.12	.06	-.05	-.22	-.12	-.13	-.18
Other directorates	.00	.11	.18	-.25	-.07	.03	-.11	-.05	-.05	-.18	-.06
Other bases	.08	-.04	-.10	-.27	.15	.10	.01	-.11	.06	-.36[5]	-.11
Non-NASA personnel	-.20	-.01	-.12	-.26	-.19	.02	.01	-.07	-.33	-.06	-.23

[1] Cortisol.

[2] Cholesterol.

[3] Systolic blood pressure.

[4] Number of cigarettes for persons who smoke. There is no middle personality group due to the small sample size.

[5] $p < .05$.

TABLE XIX-6

THE EFFECT OF POSITIVE ATTITUDE TOWARD PRESSURE ON THE CORRELATION BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND MEASURES OF PHYSIOLOGICAL STRAIN

	Positive Attitude Toward Pressure										
	Low (N = 71)				Medium (N = 61)			High (N = 70)			
Source of Stress	Co[1]	Ch[2]	SBP[3]	Ci[4]	Co	Ch	SBP	Co	Ch	SBP	Ci
Own branch	-.32[5]	-.12	-.11	.22	-.07	-.06	.12	.02	.06	.13	.15
Other branches	-.11	.12	.21	-.06	-.26	.05	.03	.03	-.07	.14	-.10
Other divisions	-.27	.23	.15	-.26	-.02	-.02	.04	-.16	-.16	-.09	.02
Other directorates	-.13	.23	.14	.01	.07	-.03	-.11	.08	-.13	-.07	-.05
Other bases	-.06	.16	-.11	-.18	.12	-.19	-.10	-.04	.02	.27[5]	-.14
Non-NASA personnel	-.26	.09	-.00	-.44[5]	-.12	-.14	-.01	.09	-.28	.01	-.20

[1] Cortisol.

[2] Cholesterol.

[3] Systolic blood pressure.

[4] Number of cigarettes for persons who smoke. There is no middle personality group due to the small sample size.

[5] $p < .05$.

TABLE XIX-7

THE EFFECT OF RANGE OF ACTIVITIES ON THE CORRELATION BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND MEASURES OF PHYSIOLOGICAL STRAIN

	Range of Activities										
	Low (N = 82)				Medium (N = 51)			High (N = 66)			
Source of Stress	Co[1]	Ch[2]	SBP[3]	Ci[4]	Co	Ch	SBP	Co	Ch	SBP	Ci
Own branch	.02	-.03	.17	.40[5]	.04	.09	-.01	-.27[5]	-.14	-.07	-.14
Other branches	-.30	.01	-.08	-.08	.01	.19	.33[5]	-.13	.03	.08	-.15
Other divisions	-.16	-.18	-.10	-.10	-.12	.20	.27[5]	-.18	.13	.07	-.11
Other directorates	.00	-.14	-.17	.05	-.34[5]	.07	.13	.13	.20	.03	-.10
Other bases	.11	.02	-.28	-.24	.03	-.19	-.02	-.02	.10	-.03	-.08
Non-NASA personnel	-.01	-.13	-.13	-.39[5]	-.08	-.22	.06	-.35[5]	-.03	-.03	-.13

[1] Cortisol.

[2] Cholesterol.

[3] Systolic blood pressure.

[4] Number of cigarettes for persons who smoke. There is no middle personality group due to the small sample size.

[5] $p < .05$.

TABLE XIX-8

THE EFFECT OF COMPETITIVE ORIENTATION ON THE CORRELATION BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND MEASURES OF PHYSIOLOGICAL STRAIN

	Competitive Orientation										
	Low (N = 67)				Medium (N = 69)			High (N = 64)			
Source of Stress	Co[1]	Ch[2]	SBP[3]	Ci[4]	Co	Ch	SBP	Co	Ch	SBP	Ci
Own branch	.11	-.04	.10	.14	-.06	.08	.17	-.27[5]	-.16	-.12	.16
Other branches	-.09	-.02	.00	.01	.03	.19	.17	-.39[5]	-.05	-.03	-.15
Other divisions	-.04	-.03	.02	-.14	-.09	.07	-.02	-.31[5]	.01	-.02	-.07
Other directorates	.02	-.20	-.06	.27	.10	.12	-.11	-.14	.13	.01	-.16
Other bases	.08	-.24	-.23	-.20	.15	.03	-.17	-.04	.14	-.05	-.16
Non-NASA personnel	-.10	-.18	-.03	-.25	-.11	-.21	-.08	-.17	.08	-.06	-.22

[1] Cortisol.

[2] Cholesterol.

[3] Systolic blood pressure.

[4] Number of cigarettes for persons who smoke. There is no middle personality group due to the small sample size.

[5] $p < .05$.

TABLE XIX-9

THE EFFECT OF PERSISTENCE ON THE CORRELATION BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND MEASURES OF PHYSIOLOGICAL STRAIN

	Persistence										
	Low (N = 76)				Medium (N = 55)			High (N = 70)			
Source of Stress	Co[1]	Ch[2]	SBP[3]	Ci[4]	Co	Ch	SBP	Co	Ch	SBP	Ci
Own branch	.15	.04	.05	.00	-.20	.00	.27	-.17	-.13	-.10	.15
Other branches	-.12	-.01	.02	-.06	-.05	.04	.16	-.29[5]	.08	.02	-.12
Other divisions	-.02	-.07	-.20	-.56[5]	-.08	.07	.11	-.30[5]	.08	.14	.05
Other directorates	-.01	-.25[5]	-.32[5]	-.14	-.01	.25	.17	-.04	.11	.09	-.01
Other bases	.23	-.26[5]	-.32[5]	.08	.08	.24	.05	-.07	.14	-.08	-.21
Non-NASA personnel	.15	-.30[5]	-.11	-.27	-.33[5]	-.08	.11	-.24	.00	-.11	-.24

[1]Cortisol.

[2]Cholesterol.

[3]Systolic blood pressure.

[4]Number of cigarettes for persons who smoke. There is no middle personality group due to the small sample size.

[5]$p < .05$.

TABLE XIX-10

THE EFFECT OF WHAT I AM LIKE: TYPE A ON THE CORRELATION BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND MEASURES OF PHYSIOLOGICAL STRAIN

	What I am Like: Type A										
	Low (N = 83)				Medium (N = 36)			High (N = 85)			
Source of Stress	Co[1]	Ch[2]	SBP[3]	Ci[4]	Co	Ch	SBP	Co	Ch	SBP	Ci
Own branch	.04	-.01	.24	.00	.10	-.30	-.10	-.22[5]	.06	.00	.28
Other branches	.01	.07	-.07	.02	-.40[5]	-.09	-.10	-.21[5]	.09	.21[5]	-.17
Other divisions	.01	-.01	-.17	-.13	-.21	-.01	.10	-.27[5]	.07	.08	-.04
Other directorates	.10	.02	-.13	.22	-.05	-.18	.12	-.13	.14	-.02	-.22
Other bases	.21	-.14	-.16	.20	.08	.41[5]	-.26	-.16	-.14	-.10	-.54[6]
Non-NASA personnel	.12	-.05	-.02	-.10	-.14	-.19	.01	-.36[6]	.15	-.13	-.34

[1]Cortisol.

[2]Cholesterol.

[3]Systolic blood pressure.

[4]Number of cigarettes for persons who smoke. There is no middle personality group due to the small sample size.

[5] $p < .05$.

[6] $p < .01$.

TABLE XIX-11

THE EFFECT OF COMPETITIVE ORIENTATION ON THE RELATIONSHIP BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND JOB SATISFACTION

Source of Stress	Competitive Orientation Low N = 67	 Medium N = 69	 High N = 64
Own branch	-.04	-.04	-.00
Other branches	-.09	.01	-.07
Other divisions	.12	-.10	-.09
Other directorates	.17	.10	.02
Other bases	.20	.02	-.00
Non-NASA personnel	.07	-.16	.09

TABLE XIX-12

THE EFFECT OF INVOLVED STRIVING ON THE RELATIONSHIP BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND JOB SATISFACTION

Source of Stress	Involved Striving Low N = 80	 Medium N = 51	 High N = 69
Own branch	.05	-.12	-.12
Other branches	-.02	-.17	-.04
Other divisions	.04	.06	-.19
Other directorates	.19	.12	-.05
Other bases	.17	.12	-.04
Non-NASA personnel	-.07	.11	-.06

TABLE XIX-13

THE EFFECT OF WHAT I AM LIKE: TYPE A ON THE RELATIONSHIP BETWEEN THE EXTENT TO WHICH DIFFERENT LEVELS OF THE ORGANIZATION ARE SOURCES OF STRESS AND JOB SATISFACTION

	What I am Like: Type A		
Source of Stress	Low N = 83	Medium N = 36	High N = 85
Own branch	.17	-.26	-.13
Other branches	.10	-.08	-.18
Other divisions	.22	-.04	-.22
Other directorates	.15	.09	.06
Other bases	.27	-.11	-.05
Non-NASA personnel	.07	-.17	-.04

APPENDIX XX

Additional Conditioning Effects of Type A Measures on the Relationship between Sources of Deadline Pressure and Serum Cholesterol

TABLE XX-1

THE CONDITIONING EFFECTS OF LEADERSHIP ON CORRELATIONS BETWEEN SOURCES OF DEADLINE PRESSURES AND SERUM CHOLESTEROL

Source of Deadline Pressures	Leadership			$r_{low} < r_{high}$
	Low N = 73	Medium N = 62	High N = 63	p <
Subordinates	-.16	.13	-.01	n.s.
Colleagues	.06	.06	-.10	n.s.
Self	-.09	.05	-.13	n.s.
Immediate superior	.08	.26	-.06	n.s.
Higher superiors in the division	-.15	-.05	.04	n.s.
Head of directorate	-.24[1]	.07	.08	.05
Heads of other directorates	-.12	.06	.23	.05
Head of the base	-.04	.19	.19	.10
Other bases	.08	.27[1]	.09	n.s.
Non-NASA employees e.g. contractors	-.16	.06	-.16	n.s.

[1] $p < .05$

TABLE XX-2

THE CONDITIONING EFFECTS OF RANGE OF ACTIVITIES ON CORRELATIONS BETWEEN SOURCES OF DEADLINE PRESSURES AND SERUM CHOLESTEROL

Source of Deadline Pressures	Range of Activities			$r_{low} < r_{high}$
	Low N = 82	Medium	High N = 66	p <
Subordinates	-.04	.01	.02	n.s.
Colleagues	.06	.09	-.17	.10
Self	-.05	.01	-.12	n.s.
Immediate superior	.04	.28	.02	n.s.
Higher superiors in division	-.09	-.18	.11	n.s.
Head of directorate	-.17	-.07	.18	.05
Heads of other directorates	.02	-.16	.30[1]	.05
Head of the base	.02	.15	.22	n.s.
Other bases	.22[1]	.06	.14	n.s.
Non-NASA employees e.g. contractors	-.13	-.17	-.04	n.s.

[1] $p < .05$

TABLE XX-3

THE CONDITIONING EFFECTS OF ENVIRONMENTAL OVERBURDENING ON CORRELATIONS BETWEEN SOURCES OF DEADLINE PRESSURES AND SERUM CHOLESTEROL

Source of Deadline Pressures	Environmental Overburdening			$r_{low} < r_{high}$
	Low N = 77	Medium N = 54	High N = 65	p <
Subordinates	.00	-.14	.08	n.s.
Colleagues	.05	.12	-.11	n.s.
Self	.06	-.06	-.21	.10
Immediate superior	.11	.22	-.03	n.s.
Higher superiors in the division	-.16	-.01	.05	n.s.
Head of directorate	-.01	-.01	-.02	n.s.
Heads of their directorates	-.05	.15	.18	.10
Head of the base	.04	.17	.20	n.s.
Other bases	.18	.06	.20	n.s.
Non-NASA employees e.g. contractors	-.34[1]	.01	.07	.01

[1] $p < .05$

TABLE XX-4

THE EFFECT OF LEADERSHIP ON THE CORRELATION BETWEEN STRESS FROM DIFFERENT ORGANIZATIONAL TERRITORIES AND BEING A SMOKER

Territory	Leadership: Low N = 73	Leadership: Medium N = 62	Leadership: High N = 63	$r_{low} < r_{high}$ p <
Own branch	.07	-.12	.02	n.s.
Other branches	.07	.12	.18	n.s.
Other divisions	-.12	.08	.19	.05
Other directorates	-.20	.14	.25[1]	.005
Other bases	-.27[1]	.11	.07	.05
Non-NASA employees e.g., contractors	-.04	.06	.04	n.s.
Overall stress	-.11	.12	.13	.10

[1] $p < .05$.

APPENDIX XXI

Additional Conditioning Effects of Type A Personality on the Relationship between Stress from Different Organizational Territories and Being a Smoker

TABLE XXI-1

THE EFFECT OF ENVIRONMENTAL OVERBURDENING ON THE CORRELATION BETWEEN STRESS FROM DIFFERENT ORGANIZATIONAL TERRITORIES AND BEING A SMOKER

Territory	Environmental Overburdening: Low N = 77	Medium N = 54	High N = 65	$r_{low} < r_{high}$ p <
Own branch	.00	.04	-.07	n.s.
Other branches	.07	.00	.26[1]	n.s.
Other divisions	-.10	-.03	.26[1]	.05
Other directorates	.00	-.09	.19	n.s.
Other bases	-.13	-.03	.07	n.s.
Non-NASA employees e.g. contractors	-.02	-.05	.06	n.s.
Overall stress	-.05	.00	.15	n.s.

[1] $p < .05$.

TABLE XXI-2

THE EFFECT OF POSITIVE ATTITUDE TOWARD PRESSURE ON THE CORRELATION BETWEEN STRESS FROM DIFFERENT ORGANIZATIONAL TERRITORIES AND BEING A SMOKER

Territory	Positive Attitude toward Pressure			$r_{low} < r_{high}$
	Low N = 71	Medium N = 61	High N = 70	p <
Own branch	-.08	.14	-.11	n.s.
Other branches	.10	.04	.21	n.s.
Other divisions	-.06	.04	.18	.10
Other directorates	-.03	-.07	.19	.10
Other bases	-.12	-.04	-.09	n.s.
Non-NASA employees e.g. contractors	-.07	-.04	.04	n.s.
Overall stress	-.07	.07	.11	n.s.

TABLE XXI-3

THE EFFECT OF SENSE OF TIME URGENCY ON THE CORRELATION BETWEEN STRESS FROM DIFFERENT ORGANIZATIONAL TERRITORIES AND BEING A SMOKER

Territory	Sense of Time Urgency: Low $N = 72$	Medium $N = 67$	High $N = 65$	$r_{low} < r_{high}$ $p <$
Own branch	-.03	-.10	.03	n.s.
Other branches	.00	.05	.28[1]	.10
Other divisions	-.02	-.06	.22	n.s.
Other directorates	.13	-.21	.22	n.s.
Other bases	-.18	.01	-.16	n.s.
Non-NASA employees e.g. contractors	.10	.10	.06	n.s.
Overall stress	.03	-.08	.14	n.s.

[1] $p < .05$.

APPENDIX XXII

Conditioning Effects of Occupation, Controlled for Personality, on the Relationship between Stress and Strain

TABLE XXII-1

THE EFFECT OF OCCUPATION ON THE CORRELATION BETWEEN REPORTED PERCENT OF TIME COMMUNICATING WITH OTHER DIRECTORATES AND RESIDUALIZED PHYSIOLOGICAL STRAIN[1]

Strain	Occupation			$r_{Administrator}$ Versus	
	Administrator N = 57	Engineer N = 91	Scientist N = 47	$r_{Engineer}$, $p <$	$r_{Scientist}$, $p <$
Serum glucose	.56[2]	.10	-.27	.005	.001
Serum cortisol	.35[2]	-.20	.19	.005	n.s.

[1]Residualized for the main and interaction effects of Leadership, Relations with others, and Percent of time communicating with other directorates.

[2]$p < .01$.

TABLE XXII-2

THE EFFECT OF OCCUPATION ON THE CORRELATION BETWEEN REPORTED PERCENT OF TIME ON SELF-INITIATED PHONE CALLS AND RESIDUALIZED PHYSIOLOGICAL STRAIN[1]

	Occupation			$r_{Administrator}$ Versus	
Strain	Administrator N = 57	Engineer N = 89	Scientist N = 45	$r_{Engineer}$, $p <$	$r_{Scientist}$, $p <$
Serum cortisol	.64[3]	-.03	.19	.001	.005
Diastolic blood pressure	.35[2]	.02	-.06	.025	.025
Serum glucose	.35[2]	.01	-.04	.025	.025

[1]Residualized for the main and interaction effects of Flexibility, Persistence, and Percent of time on self-initiated phone calls.

[2]$p < .01$.

[3]$p < .001$.