Modeling the Stress–Strain Relationship in Work Settings

Meni Koslowsky

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MODELING THE STRESS–STRAIN RELATIONSHIP IN WORK SETTINGS

Stress is a popular topic in the literature of both occupational and health psychology, but its empirical definition is seldom accurate or generalizable. Meni Koslowsky presents here for the first time a way of modeling stress– strain that will enable researchers to both assess examples from the literature and correctly define and use the model in their own investigations. All stages from construction of the model to data analysis are covered, along with possible pitfalls.

Modeling the Stress–Strain Relationship in Work Settings discusses and evaluates various competing models in the literature, and suggests a synthesis which allows the reader to identify and measure stressors, moderators, mediators and strain reactions. The book identifies the critical variables and explains how various new techniques can be applied to these data. This enables investigators to develop and test models for describing stress phenomenona in their own settings. *Modeling the Stress–Strain Relationship in Work Settings* will be an essential research tool for all those who assess stress and strain in their working lives.

Meni Koslowsky is Associate Professor of Psychology at Bar-Ilan University, Israel. His previous publications include *Commuting Stress: Causes, Effects and Methods of Coping* (with A. N. Kluger and M. Reich) (1995).

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‘To my wife, children, and grandchildren: Over the years, discussions with each one of them have been a source of inspiration for me.’

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INTRODUCTION

'Stress' is a word that conjures up negative images both in the popular literature and the scientific one. It is used by researchers not only as a stimulus (and sometimes, erroneously, as a response variable) but as a process that links variables, inside and outside the individual, to produce a reaction that is psychologically, and, often, physically debilitating. Recent advances in research methodology, in general, and modeling, in particular, have allowed researchers better to test and refine their individual theories linking the relevant variables in the process. Although researchers often have case-controlled or retrospective data to help them make inferences about associations between pairs of variables in specific situations, integrative procedures and more broadly based conclusions about process and linkages among variables is, generally, lacking. The purpose of this book is to identify the critical variables in the stress–strain process and explain how multivariate techniques such as multiple regression analysis and structural equation modeling can be applied to such data.

How important is the stress issue in organizational and everyday life? Who is influenced or changed in same way by stressors in the organization and at home? Well, it is hard to give a very objective and precise answer to the question; nevertheless, some rough indications are available. In a 1992 article, Sullivan and Bhagat (1992) estimate that about 10 per cent of the gross national product could be the cost to the American people. Landsbergis and Vivona-Vaughan (1995), using data gleaned from several studies, estimate that the costs of illness resulting from stress may be more than $100 billion. And the problem is increasing. The proportion of workers who reported 'feeling highly stressed' doubled in the years 1985 to 1990 (Spielberger and Reheiser 1994). In a survey study conducted by Northwestern National Life, nearly 70 per cent of a sample of 600 workers reported that job stress affected their productivity (Sullivan and Bhagat 1992).

What are some of the more important effects of stress? One way of examining this issue is to see what investigators in the field can tell us about some of the more common ailments that affect Western workers. Cardiovascular disease (CVD) is the leading cause of death in the United Sates and hypertension is said to afflict more than 50 million people (Landsbergis *et al*. 1995). Back problems, depression, anxiety, absenteeism are all typical symptoms and complaints of workers. Although today it is an accepted fact that a host of physical (diet, exercise, smoking, and so on) and genetic issues are often involved, the importance of stressors at work and home can no longer be ignored. Statistical and epidemiological analyses indicate that all the physical factors explain only a portion of the variance in coronary heart disease and other physiological and psychological symptoms. Stressors appear to be a logical villain in this picture and are increasingly being included in medical and public health studies. Of course, in many cases, they probably interact with physical ailments to make the situation worse. In summarizing some the epidemiological literature in the field, Theorell and Karasek (1996) found that sixteen out of twenty-two studies have confirmed an association between stress and CVD.

Many occupations have been associated with stress and, of course, many studies have tried to identify the stress in these occupations. Teachers, policemen, soldiers, and students are among the most popular groups that have participated in stress studies. However, in a sense, all of us are potential victims of this negative stimulus. For example, in a localized study of commuters in the Seattle metropolitan area, Spyridakis *et al*. (1991) reported that nearly 60 per cent of commuters experienced stress associated with their journey. What are the links between stressors and their responses? What moderates these links? If someone were interested in studying stress in a particular work setting, how should they go about it? These subjects form some of the topics in the next few chapters.

I have divided the book into roughly two sections. The first section, about two-thirds of the book, deals with some of the modeling schemes that have been suggested in the field and identifies variables that have been found to play a key role in stress models. The second section examines some of these issues by applying multivariate techniques to these models. In addition, a broad review of methodological problems that have been encountered in the past and methods for solving some of them are presented. The information on variable identification, step-by-step presentation for applying the methodology, and the necessary cautions for doing such analyses can enable investigators to develop and test models for describing stress phenomena in their own settings.

THE STRESS SETTING

There are many environments where stress plays a role in determining functioning, performance, or health. The literature is replete with studies that have examined the various settings using different measures and assumptions for the relationships among the cause and effect variables. For example, the workplace, the home, social settings, vacations or leisure outings are all places where an individual confronts stressors that have meaningful consequences for the individual and their surroundings. Although these effects are, generally, assumed to be negative, the opposite can also be true. Indeed, studies have shown that workers' productivity sometimes increases as a result of stress. In this regard, Anthony *et al*. (1993) write that 'a moderate amount of stress can help to stimulate employees to work longer, harder, and better' (p. 527). Although some discussion of the benefits of stress will be included here, the emphasis will be on the negative effects. The next chapter focuses on some of the theories, empirical findings, and conclusions, focusing especially on common themes, that can be drawn from the field at the present time.

Although the emphasis in the book is on work-related factors that influence negative reactions, many different types of nonwork stressors and moderators can be identified. In particular, life structure changes such as loss of a spouse, divorce, or marriage, all may cause strain reactions. Referred to as 'acute' or 'macro' stressors, they will also be discussed below. However, more mundane and everyday variables involving the family, spouse, and age of youngest child are all potential moderators which interact with stressors that already exist in the workplace. A worker who has to take care of an elderly parent or sick child may be more sensitive to stimuli such as organizational demands or overload. Moreover, the concept of spillover may be relevant here, too. For example, a stressful family situation may show a spillover phenomenon so that what happens in one domain influences the other. A pending divorce may affect a worker's productivity and behavior. When relevant, such nonwork factors will be cited and their influence shown.

Although it is well recognized that stressors play a role in individual functioning, it is often difficult to isolate the cause of specific negative emotional or behavioral reactions at the job or at home. Thus, an investigation of the stress–strain linkage requires the collection and measurement of a series of variables within, as well as outside, the specific domain of interest. For example, if we are interested in studying stress at home, information concerning relationships with children, parents, spouse or partner, and so on is obviously important. However, what happens at work, or on the way to work, may also be important. An imperious boss or a difficult commute from work to home are potential stressors that need to be

considered, even when the focus of the research is the home environment. As the task of collecting all the relevant data in the field often turns into an overwhelming enterprise, the researcher, in the past, has made a tactical decision concerning which subset of variables in the proposed model should be studied. Distinctions between work and nonwork settings, though useful as a starting point, must be flexible, as variables from one domain are likely to impact on the other. Below I will present an example of stressors in a specific workplace setting. The purpose is to show that the researcher's perspective often determines what data are collected and what data are analyzed. Drawing accurate inferences from any specific situation requires that the researcher understand this limitation. In the last chapter this issue will be discussed further.

An example of the stress–strain linkage in the workplace

The work environment has many potential sources of stress and the responses vary widely from the emotional to the behavioral. In many cases, productivity and efficiency, both on the individual and organizational level, may be affected. A proper understanding and analysis of the antecedents and consequences is the first step in minimizing and, perhaps, preventing any deleterious effects. A case presented by Tosi *et al*. (1994) provides a good illustration of the types of factors affecting various individuals and, in turn, the organization, that must be considered in analyzing stressors in a particular situation. The authors describe in some detail the interactions among the personnel of a particularly busy resort restaurant; sometimes, especially during the summer months when the outside temperature is relatively high, the indoor temperature may be even higher. An environmental stimulus such as temperature, especially in a relatively closed environment, can be the trigger for a host of negative reactions. Yet, it is the individual with their background, methods of coping, and other personal variables that interact with the group and environmental stimuli to produce an individual reaction.

In a later chapter, I will discuss in greater detail some of the categories of stressors, including environmental, organizational, and individual ones, that have been identified in the literature. For the present purposes, I have taken some liberties and drawn implications from the restaurant setting relevant to the present book but not explicitly stated by Tosi *et al*. The reactions are typical and reasonable, emanating from individual variables (personality, attitudes), co-workers, and the environment.

An understanding of an ordinary workday in the restaurant is necessary in order to appreciate the stressors that are at play. In particular, a restricted, hot working area leads to a

difficult environment where workers are bumping into each other (figuratively, as well as literally). As the stress experienced by workers increases, one can expect affective reactions such as burnout or dissatisfaction to increase and job performance to decrease. Three groups of workers are readily identified, each of whom interacts with the others. Waiters, busboys, and cooks have clearly defined jobs, and in order for the restaurant to run smoothly their work must be co-ordinated. However, when a trouble spot emerges, the consequences can be far ranging. In particular, the relationship between each group and the other two groups is a potential source of stress and, besides providing some uncomfortable moments for all those involved, is likely to have financial implications for the restaurant and worker alike.

Different complaints can be heard by each of the groups. Thus, if a waitress gets a cold, rather than hot, platter or just simply a sloppily arranged one from a cook in the kitchen, the waitress may become angry, as her tip, which is to a great extent a function of the quality of the service provided, is likely to be affected. To minimize the problems here, waitresses can be seen playing up to or 'sweet-talking' the cooks. By 'reading' the situation in the kitchen correctly and identifying those in the kitchen who work most efficiently and are most eager to cooperate, the waitress can provide better-quality service and maximize her tips. The latter behavior is an example of coping and, in more theoretical terms, weakens the link between stress and its consequences.

Similarly, cooks have complaints about the waitresses. In particular, the orders written by hand are often illegible or illogical (today many eating establishments use automated equipment for this part of the job and have probably reduced the impact of this source of stress). In order to minimize wasted time, mistakes (both by the cook and the waitress), and frustration orders must be communicated correctly. Cooks appear to be the locus of control in the situation and waitresses must bend to some of their demands if they want to succeed. Finally, busboys have their own set of issues that often lead to negative reactions. This is best illustrated by the number of incidents of hostility and even friction between busboys and waitresses. In particular, a busboy may react with outright anger when he feels that a tip from a customer was not reported accurately by the waitress and he is being cheated out of his just compensation. As the earnings of the former is a function of the tips left by customers and as the waitress is the one who has the last interaction with the customer, a trustful relationship is critical if the two are to work together harmoniously without recriminations. If trust is lost, working together becomes difficult, if not impossible. On the other hand, the busboys may work harder for a waitress who is trusted or who has given more than the usual 10 per-cent tip.

Interestingly, the waitress is the one most likely to manifest public emotional reactions. It is not unusual for a waitress to be seen crying and comforted by all the other employees, many of whom represent groups who are also sources of stress. Although pressure is experienced

by everyone during a particularly busy time, some, but not all, of the waitresses seem particularly affected by the situation.

Later in the book, the various types of variables at play in this and similar situations will be explained and analyzed. Table 1.1 summarizes the stressors and introduces some of the terms that will be used throughout the book. A cursory analysis shows us some clues as to the links that are often involved in stressful situations. First, the stressors at work may

Table 1.1 Categories and examples of relevant stress variables in the restaurant example

A	Objective stressors	heat, crowded environment, demands (orders) by customers
B	Subjective stressors	communication among workers, trust, interpersonal conflicts
C	Reactions	frustration, hostility, crying, anger, performance decrement
D	Intervening variables (moderators/mediators/coping)	Gender, personality, time of day, expressing feelings openly, use of computerized orders

include a conflict between different groups of workers who must satisfy different demands that are made by the organization. Reactions described here include frustration, hostility, weeping, unwillingness or reluctance to work with certain people, lowered performance levels and the resultant implications for pay. Gender, personality, the time of day or season, the home environment, methods used for relaying information from one to the other serve as potential intervening variables that may very well enhance the negative reactions. Coping techniques may include the emotional help provided by others during difficult moments, the use of computerized orders, the removal of obstacles (such as dealing openly with bad feelings) are all potential methods for reducing personnel problems and improving efficiency.

It may be appropriate here to distinguish between two terms in the literature, one of which is used quite frequently – 'distress' – and the other – 'eustress' – which is rarely applied in the stress literature. Although both are descriptive of the effects of stress rather than its cause, they connote, in the former case, a negative outcome and, in the latter case, a positive one. A particular stressor such as organizational demands may indeed lead to distress such as exhaustion, frustration, physical ailments, or poor performance, but for another worker the same demand may bring about eustress, a type of fulfillment or satisfaction of a job well done despite the obstacles encountered. Ironically, prolonged inactivity at work is highly undesirable and probably a source of distress. As Kahn and Byosiere (1991: 576) argue so eloquently, every working man (or woman) wants to *work* and be active; indeed, many types

and intensities of stimuli are expected and, often, welcomed. Moreover, stressors sometimes have a facilitating effect on the individual's coping behavior. They may shock the person out of their complacency and motivate search and seek behavior so as to fight or block the negative stimuli in the environment (Weiss *et al*. 1982). It is obvious that the stress–strain link is quite complex and is difficult, if not impossible, to predict without information about the individual. Although two workers may each be exposed to the same stressor, the response is individualistic and, as we will see throughout the book, personal variables, cognitive (subjective) processes, moderators, and mediators all play a critical role in determining the nature and severity of the effects.

2

THEORIES OF ORGANIZATIONAL STRESS

THE STRESS LITERATURE

Books and professional journal articles in the field of stress probably would fill a small library; moreover, there are probably as many models of the process as there are investigators. This has led to a confusion and the lack of coherent inferences that would enable theoreticians to build and refine their approach and has prevented practitioners from applying the knowledge on negative reactions to stress to their organization. Why has this occurred here, perhaps more than in most other areas of industrial/ organizational (I/O) psychology? I would like to offer a few explanations for this phenomenon. One of these is that many researchers have just looked at a part of the picture; that is, their interest was focused on examining a few variables, no more and no less. Besides the lack of an overall model, this approach has another major deficiency: the more specific the analysis, the less likely it is to produce any meaningful inferences to other situations. A larger study allows not only for an understanding of the significant stressors and strain reactions, but it also provides relative information on which variables are important and which are not. It is this latter information that would allow practitioners to focus their evaluation tools and intervention techniques more efficiently.

The need for a comprehensive, integrative approach to the study of stress was emphasized by Levi (1990). Levi argued that the multitude of stressor–response studies yielded a wealth of information, but in bits and pieces (1990: 1143) and provided little understanding of any underlying model or concept. Analysis of stressors requires a close examination of the situation (and the stressors that exist there), the individuals involved, and the relevant modifiers (here, I would like to suggest a broader term, 'intervening variables', so as to include not only moderators but also mediators). Levi also pointed out correctly that till recently a great deal of the research in I/O psychology has focused on what we might call 'total quality control' and its relationship to stress. That is, how do stressors affect the functioning

of the company, how is the bottom line reduced if workers are always under stress and, how is this linked to the organization's overall productivity? The present book's emphasis is on the individual worker and, unlike the stressor variable which can have many sources outside the individual, the reactions or consequences are discussed from the individual's perspective rather than that of the organization.

Many researchers, aware of the large variety of studies in the field, have tried to focus on generalizations that are theoretically very useful, but have little practical use for the organizational psychologist in the field. Moreover, such models are often descriptive and do not take the investigator through the different stages from data collection to model development and testing. For example, Frese and Zapf (1988) supplied general categorical names for the types of causal models in the field: 'trait,' 'method,' 'stress perception,' and 'multitrait-multimethod models.' They differ in the type of variables and the methods used for measuring them. Thus, in the trait approach, each stressor is measured from three sources: individual, group, and observer. An underlying assumption here is that convergent validity should exist among the three sources. In the method model, the data collection technique is critical, and if questionnaires are used to measure stress and strain, then the assumption is that other data collection techniques will not necessarily yield the same results. In the perception model, subjective stress is measured by a questionnaire, whereas objective stress indicators are obtained from observers or from the group. Finally, the multitrait-multimethod approach assumes a combination of trait and method models. When questionnaire data are used to collect all the data for determining the associations between stressors and strain, there is both a true component and an artifact that can be attributed to common method variance. In the last case, the goal of the researcher should be to tease out one type of variance from the other.

With the dual goal of providing a conceptualization of the stress–strain process that incorporates some of the new ideas in I/O psychology and also provides guidelines for examining these issues in a practical setting, I have decided to be quite focused in the issues that are presented in the book. Before discussing the specifics of the model, let us see how other researchers have described the setting that produces stress.

SPECIFIC MODELS OF THE STRESS–STRAIN PROCESS

Perhaps the simplest theoretical approach to the stress–strain process can be seen in the ideas put forward by researchers such as Katz and Kahn (1978), Israel *et al*. (1989), and Israel and Schurman (1990). These researchers emphasize a multivariate approach that includes a temporal sequence of stressors, perceptions, immediate or intermediate effects, and enduring

health outcomes. Each of the categories can be further sub-divided into subcategories of various types of variables. For example, stressors include psycho-social factors, work–family conflicts, and environmental stimuli. They act independently and, often, are additive in their effects. In addition, buffers that may reduce the effects of stress act at various points. They include social support, personality factors, demographics, relaxation responses, and genetic concerns.

This configuration assumes that a sequence of events and stimuli, independently and in interaction with each other, lead to the various consequences. For example, if a stimulus is not perceived as stressful, it will, generally, not have much of an impact. Although perception is a critical stage and is, generally, necessary for negative consequences to occur, indirect links can still be seen at several points. A worker may not be aware of a loud noise and not perceive the external stimulus as stressful but it will, nevertheless, produce a negative impact on the worker's hearing. The benefits of such models are quite clear: they allow the researcher to categorize the elements in the process so they can be investigated systematically, to test the existence of the various links, and to determine the contribution of each link towards explaining strain outcomes.

Israel *et al*. (1996) argue that such frameworks provide a method for planning and implementing interventions. One way that this manifests itself is simply by the fact that the investigator, after identifying the critical link, may try to weaken it and, thus, decrease the chance that a negative outcome will result. Also, it is likely that an appreciation and understanding of the possible outcomes will lead the investigator to consider that 'the effects of an intervention be evaluated on multiple outcomes rather than solely focusing on one disease category' (p. 265). This would prevent the possibly embarrassing conclusion from many field studies that report an improvement in one strain area (for example, a behavioral consequence such as lateness) without considering the possible lingering psychological effects. Such effects are quite important and may lead to other forms of strain in the future.

Table 2.1 provides a summary of the theoretical formulations in the field and their major features. I have tried to identify those characteristics that differentiate the models from each other rather than simply use the definition supplied by its advocates.

Macro and micro stressors

One of the least elaborate but, nevertheless, quite meaningful approaches for understanding the stress–strain association was discussed by Kanner *et al*. (1981). They divided stressful stimuli into two main categories: major life events and daily hassles, or macro stressors vs. micro stressors. The former refer to (relatively) critical events that require some active readjustment, including marriage, divorce, bereavement, leaving home for the first time,

Table 2.1 Major and minor stress models

A	*Major models*	*Distinguishing features*
	1 Micro-/macro-stressors	Macro-stressors affect strain directly and indirectly through micro-stressors
	2 P–E fit	Discrepancy score between person (abilities, values) and environment (demands and supplies) variables is determined
	3 Demand strain model	Interaction between job demands and decision latitude, especially control
B	*Minor models*	
	1 Effort–reward	Imbalance between extrinsic (work pressure) or intrinsic (personal coping pattern) effort and reward in terms of low status control (low promotions prospects, job insecurity)
	2 Lifestyle incongruity	Difference between an individual's consumption level and the norm for their occupational class

and so on. The latter events, according to the authors, refer to more minor events such as strained relationships, deadlines, running the rat race, and fighting traffic. Such routine and daily hassles tend to build up and are potential stressor stimuli. They may be the direct cause of poor functioning.

Similar in concept is the distinction between acute and chronic stressors. An acute stressor is an event that is transitory or temporary in nature; its impact, however, may be long lasting. In contrast, a chronic stressor 'exists' more or less permanently as part of the working environment. Often referred to as 'daily hassles' (Delongis *et al*. 1982), they may be the result of major events or independent of them; in the latter case, they may just be typical of minor annoyances that we all experience during the workday. However, if they break a certain threshold, their effects can be seen in individual psychological distress reactions. According to Carayon (1995), the distinctive feature of chronic stressors, as compared to acute ones, is that the former's impact can only be gauged by examining it over time. The value of the stressor at a specific moment in time may not be indicative of anything unusual. Thus, a worker who has to confront an intolerant boss every time they perform poorly may not feel being particularly victimized; however, after being subjected to this potentially stressful situation many times, the supervisor's behavior could become quite insufferable and cause the worker to be moody or tense, sometimes even without confronting the supervisor. Thus, it isn't only the specific reaction by the supervisor that causes distress, but its constancy can

begin to wear a worker down. Carayon reported that the duration of the chronic stressor, as well its intensity, was predictive of negative reaction.

But what exactly is the relationship between major and minor stressors? The interaction between the two can be visualized in many ways. A recent study by Pillow *et al*. (1996) tested various alternative schemes including the following three possibilities: one type of stressor causes the other type; both cause other strain reactions but do not affect each other; and a non-recursive or reverse causation effect. Their hypothesis was that an individual may very well experience psychological distress as a result of some major life event such as divorce or bereavement; however, along with this negative stressor, the day-to-day coping with life following bereavement or divorce was particularly difficult. Examples of such so-called minor and indeed chronic stressors accompanying bereavement or divorce were feelings of loneliness or having to fend for oneself in running a household. (The word 'minor' is obviously a relative term here; the victim may think the new problems in life are anything but minor.) Using structural equation modeling, Pillow *et al*. found, as they hypothesized, that major life events have both a direct influence on strain reactions and an indirect effect through minor stressors. The latter are acting as mediator variables. In the chapters on structural equations and regression analysis, I will discuss how the technique can be used for deciding whether a mediator variable is present.

Person–environment models

One of the more popular perspectives on the relationship between stressors and psychological/physical functioning has been the person–environment (P–E) approach. Various forms and shapes of environmental/personal models have appeared in the literature over the years (for example, Caplan 1983; Dohrenwend and Dohrenwend 1974). The basic concept involved can be expressed in the following way. Stress is said to exist if there is a lack of correspondence between the personal characteristics of the worker and the environmental demands. This lack of correspondence is viewed as the cause of negative strain reactions. According to Lazarus (1991), a critical element in the model is the employee's appraisal of the lack of correspondence, and it is this independent variable that triggers the negative reactions. (As we will discuss below, this aspect of the model has wide implications and has been one of the reasons that other investigators have not accepted it – for instance, Siegrist (1996)).

The first comprehensive formulation of the P–E fit, as proposed by French *et al*. (1982), posited that either the lack of correspondence between environmental supplies and personal values (S–V) or between environmental demands and individual abilities (D–A) was the

stimulus that would have negative reactions. In their 1982 study, French *et al*. measured environment and person variables on eight job dimensions and operationalized fit by using difference scores between the two types of variables. However, Edwards and Van Harrison (1993) pointed out several methodological problems with this approach and, by relaxing some of the fit constraints, showed that their suggested three-dimensional model of environment, person, and strain raised the explained variance between independent variables and strain from. 2.4 to 5.9 per cent. Although their conclusions were consistent with those of French *et al*. in many cases, Edwards and Van Harrison identified relationships that were just not detected by the first authors. For example, job dissatisfaction, depression, and irritation were now found to be positively related to the environmental component and negatively related to the person component. French *et al*. had been more general and had simply shown that when the deviation in fit between the two independent variables increased, the various strain (dependent) measures increased.

Edwards and Cooper (1990), in trying to explain the popularity of the P–E explanation, have offered the notion that it has some intuitive appeal as it tries to combine both individual (values or abilities) factors with features of the work environment (supplies or demands). Edwards and Cooper suggested that the distinctions between S–V and D–A are very important, as the first type has been shown to affect psychological well-being and job satisfaction and the second influences performance. According to Edwards and Cooper, researchers who obscure the differences between these two types of fit measures are inexact, as they are likely to obtain inconsistent and even conflicting results. There are several features of the P–E model that are quite distinctive and will be important in our discussion below. First of all, the fact that not all individuals react similarly to each environmental stressor is an important part of the formulation and is an advance over the macro and micro stressor approach which does not explicitly include individual variables as part of the model. (Individual researchers, of course, have also analyzed personal variables as part of their examination of the interrelationship between micro and macro stressors.) Second, the methodology for obtaining the fit measure may influence the obtained relationships. The literature contains discrepancy, interactive, and proportional calculations of P–E fit. Moreover, regardless of which formula one uses to determine fit, the P and E components must refer to the same domain, otherwise the result is likely to be meaningless. Edwards and Cooper maintain that fit must be determined from commensurate measures. They cite the following example to illustrate this concept: if the environmental variable refers to workload, than the personal variable would have to be something that approximates it, such as desired work-load.

Although not required by the model, but occurring more frequently here than in some of the alternative formulations, operational definitions of P–E rely on subjective stressors for determining the independent variable (Landsbergis *et al.* 1995). For example, perception plays an important role in P–E fit calculations as reviewed by Caplan (1983). Others, such as Cummings and Cooper (1979), who discuss the discrepancy between preferred and actual states, and McGrath (1976), who defines stress as a state when perceived environmental demand threatens to exceed the person's capabilities, have also used subjective indicators as part of the stressor variable.

P–E theory in a nonwork setting

One of the tenets of the P–E fit model is that social support may affect actual strain. Thus, the individual is said to experience strain if an imbalance between demands and response capabilities exists and the failure to meet these demands is perceived as leading to negative consequences. The stressed individual, according to this model, responds to perceptions rather than actual stimuli. The links in this formulation are affected and perhaps broken if social support and ego defense mechanisms are functioning and provide the individual with a feeling that they will be able to cope with the situation. Thus, salient others who are sought by the individual during moments of crisis can buffer (or moderate) the effects of stressors. In other cases, the individual may set up protective barriers through repression or projection techniques that prevent the full effects of stressors from being felt.

Taking an example that was discussed previously, let us see how P–E theory would handle personal loss. Bereavement or divorce can be viewed as a stressor from several different perspectives. First, each is associated with removal of part of an individual's support network. Thus, if an individual perceives that it will be more difficult to confront or cope with problems of all types in the future, such awareness may be sufficient to produce strain. Later in the book, social support will be presented as a potential moderator in many stress–strain linkages.

In the P–E model, the work environment and the home may each have an effect on the other. Thus, the researcher must consider specific features of the individual's life and surroundings. Among the most prominent of these are one's spouse or significant other, family members, and trusted friends. One conceptualization says that married people (or those with a close relationship with a significant other) may react differently to stressors at home than at work and the resources that exist in one part of life may not be used to advantage in other aspects of life, also. Another way of understanding the relationship between work and family is to invoke the concept of spillover. According to this rather basic approach in social psychology, attitudes, values, and ways of behavior experienced or expressed in one domain

either affect or are affected by similar stimuli in the second domain. An individual who is satisfied with marital life is also expected to be satisfied with work. The implications for stress are clear. Although stressors are ever present in one's environment, people are not expected to respond in the same way all the time. However, according to the spillover concept, the individual who experiences stress at home may respond negatively, not only at home but also at work and vice versa.

This implies that consequences of stress are in both directions. Dual or reciprocal links are said to exist (in structural equation terms, this is referred to as a nonrecursive relationship). Besides being expected to bring some of the stressors on the job to the individual's home (and vice versa), some of the coping methods, as we shall see later, can also be brought from one domain to the other. Empirically, the findings have supported a spillover approach to stress. However, the strength of the spillover may not be equal. For example, in one well-controlled study, spillover from work made a much greater contribution to the prediction of family strains than spillover from family did for work states (Leiter and Durup 1996). Moreover, the specific strains affected may be different. Leiter and Durup found that emotional exhaustion was the central aspect at home affected by the work domain stressors; in contrast, the family domain may affect personal accomplishment. It seems that the two domains of life are indeed interconnected. In the introduction to their chapter on nonwork factors on stress, Gutek *et al*. (1988) consider the concept of circularity to be an essential premise in understanding the relationship between the job and home. This is the approach followed here, also.

The Karasek job strain model

Arguably, the most commonly cited approach in the field of stress and its effects on both psychological and physical health is the Karasek job strain model (Karasek 1979; Karasek and Theorell 1990; Kristensen 1996). Briefly, the model has recently been defined in a succinct fashion as the 'interaction between job demands – defined as the psychological stress involved in accomplishing the workload – and – decision latitude – the worker's potential control over his or her task and his or her conduct during the work day' (Meijman *et al*. 1995). In some ways, this model was a narrowing and specification of the P–E formulation discussed above. In particular, by invoking the concept of job control, Karasek began to examine an area that would become the focus of numerous research studies on a host of different types of strain measures (for example, Frese 1989; Wall *et al*. 1996). Here, the interaction of two dimensions must be considered: job decision latitude and psychological demands. Strain is highest when job demands are high, and job latitude is low and lowest when the values are reversed. The former concept is associated with concepts such work overload and the latter with job control

or autonomy. The characteristics of the specific stressors will all be discussed in a later chapter. In the Karasek model, strain cannot be predicted without knowing the individual's level on each of the variables.

Karasek argues that different combinations of demand and control have different consequences. Clearly, the worst off are individuals whose jobs make high demands of them but where they have little control. Symptoms ranging from simple tension to cardiovascular complaints are potential effects. Low demand and low control may not produce particularly negative outcomes but are associated with a loss of interest in work activities. Low demand and high control can lead to passivity and boredom. The best of all worlds, and one which can be expected to lead to stress levels that have positive features (such as increased motivation), occurs when demand is high and control is high.

Wall *et al*. feel that researchers have not operationalized the concept adequately. They argue that job decision latitude, when it is measured by a more general concept (including commonly used scales of related but different perspectives such as the opportunity to learn new things, to develop skills, to exercise a high level of skill, to show creativity, to use one's abilities and to express variety), does not interact with demands whereas job control does. It would appear that in this model, demands are actually the stressor and control acts as a moderator. The graphs shown by Wall *et al*. are typically used to illustrate a moderating effect. Thus, demands were negatively associated with job satisfaction and positively associated with depression for low levels of control. For moderate or high levels of control the relationship was relatively flat. In a later chapter, I will expand on the concept of control and place it within the theoretical context of uncertainty. There it will be shown that control can also be considered as a mediator.

There is one other important aspect concerning the Karasek control model of strain. It has been one of the main psycho-social predictors of physical health outcomes, especially hypertension, cardiovascular disease, and high blood pressure (for example, Schnall *et al*. 1990; Theorell 1990). Why has it been adopted by so many researchers in the field of health and strain outcomes? Landsbergis *et al*. (1995) feel that it is simple to grasp and apply in diverse settings and, as compared to competing formulations such as the person–environment fit model, objective stressors, rather than perceptions, tend to be used as the independent variable or predictor. The goal of the researcher, argue the authors, is to try to find objective measures for the demand variable. Although it is true that the objective indicator takes precedence with the demand–control model, it is often measured through self-report questionnaires that are, of course, subjective appraisals of the situation. In response, Landsbergis *et al*. argue that measures of demand are not directly assessing stress (there is little reason to assume that the subject is aware that stress is being measured), so that it is

possible to argue that a more or less objective measure was obtained. I think the argument has some merit and that studies which distinguish between self-report of objective conditions within an organization and evaluations of stress are probably not measuring the same construct. Furthermore, there is little reason to assume that there will automatically be an inflation in correlation as an artifact of the common method variance (this issue will be discussed in greater detail later in the book).

Effort–reward model

The models that have been mentioned till now are probably the basic conceptualizations in the field, with the last two serving as the theoretical basis for much of the empirical research on stress. Several other more limited models have been suggested over the years. I am using the term 'limited' for several reasons: first, sufficient research has not yet been accumulated to allow for critical evaluations of the accuracy of hypotheses; second, they are just minor offshoots or modifications of the basic models already mentioned; or third, the formulation is an attempt to explain a specific population with a set of linkages and concepts borrowed from existing models. Landsbergis and Vivona-Vaughan (1995) discuss some of these in a very general fashion. In some of the historical description of the field, Johnson (1996) has also mentioned some of the developmental changes in models till the present time. Moen (1996) offers a life course model, specifically designed to understand the dynamics of one of the critical transition points in an individual's life, retirement.

I have chosen two formulations, the effort–reward model and the life-time incongruity explanation, as they are somewhat different from the usual approaches and try to answer some criticisms leveled at the other models. According to Siegrist (1996), several questions can be directed against supporters of the P–E model. Specifically, does it matter what components of the job environment are contributing to the lack of correspondence? If perceived misfit is the critical stressor, why don't workers simply change one of the components here; that is, either move to another environment or change their cognitions. This is a method for coping that doesn't seem to be considered by P–E advocates. Similarly, the Karasek strain model, by trying to obtain only objective characteristics associated with a stressor, may not be able to explain adequately some of the observed physiological arousal in stressful situations. Siegrist argues that personal modes of coping when confronted with limited control can make a difference in how the individual reacts to negative stimuli.

According to Schwartz *et al*. (1996), the effort–reward model is more sociologically based and posits that the combination of high effort and low reward is likely to cause an imbalance

that is experienced as the stressor variable. The formulation considers effort as both extrinsic and intrinsic. The former refers to workload and includes potentially negative stimuli such as background noise or increase in job demands. The latter refers to the need for control, a coping style or personality trait that is relatively stable over time. Rewards include the usual concern about wages and fringe benefits, as well as job stability, promotion prospects, and, even, self-esteem. Accordingly, a worker with a demanding job who has attained a high level of achievement but has not been rewarded with an expected promotion could be expected to experience a negative reaction.

In addition, Siegrist, the main advocate of this model, has also introduced 'status control' as a new variable that is likely to play a critical role in explaining the effects of stressors in the modern organization. As part of the reward side, the variable refers to the degree an individual feels they have mastery or self-esteem over their social roles or interpersonal relations. This should be contrasted with Karasek's emphasis on task control, where, according to Siegrist, few fundamental threats are involved. The relevant threats in the effort–reward model include forced occupational change, forced relocation, downward mobility, and lack of promotional prospects. Thus, low occupational status control accompanied by high effort is potentially stress-producing. Similarly, an employee who is aware that downsizing or a forced relocation is about to occur regardless of the effort that has been put into the job is a prime candidate for distress. Positive predictions from this model were reported from several studies that examined the association between effort–reward imbalance and both myocardial infarction and cardiovascular risk factors (Siegrist *et al*. 1992; Siegrist 1991).

Although I feel that the effort–reward model has something new to offer over the other stress models, some of the ideas have already appeared before in other areas of social/industrial psychology. Many of the features here overlap with the inequity formulation originally proposed by Adams (1965). According to Adams, an individual experiences feelings of inequity when their ratio of outcomes to effort is perceived as unfair when compared to that of others. Thus, for an individual who works overtime and does not get rewarded, whereas a colleague working less gets a promotion, feelings of inequity may very well exist. How does this manifest itself? The employee has many courses of action that they may decide to pursue. For example, effort could be decreased so as to try to restore equity. In other cases, the inequity builds up and the individual who still feels that they are being treated unfairly may experience stress, which could be followed by anxiety or dissatisfaction, measures commonly used in a typical stress setting. Actually, Siegrist's formulation is considerably more complex, especially on the reward side, which includes the concept of status control. Nevertheless, it is interesting that he does not seem to cite the Adams work as a progenitor of some of these ideas, even though the rationale in both processes is quite

similar. A future researcher may want to compare predictions afforded by both models to determine the added value of the Siegrist effort–reward model.

Lifestyle incongruity

In a sense this model also has a modern ring to it, as the stressor is determined by examining the relationship of the individual to their relevant norm group. Here, however, a socioeceonomic focus is used for explaining the stress level and the norm for the individual's occupational class. The model assigns primary importance to the difference between an individual's consumption and their means and resources, and the stressor can be readily identified here as it entails a relatively objective set of criteria involving broad measures of income and measures of expenditures and possessions. Lifestyle incongruity has been found to be a precursor of various types of negative reactions including increased blood pressure (Dressler 1990). Of all the models presented here this one has the least need for any perceptual input. The individual will experience strain simply when they go out to buy another material good and see quickly that there is no money to pay for it.

Implicit stress theory

One final word about stress theories is necessary. Till now we have examined process models leading from stressful stimuli with quite varied sources to individual strain. Some investigators took a slightly different approach and examined the worker's reaction as if they were an observer of the dynamics in the organization. With implicit stress theory, the goal is to identify the assumptions people make about the relationship between stressors, strain, and outcomes (Fernandez and Perrewe 1995; Westman and Eden 1991). Thus, observers may have a biased impression of managers in high-stress situations as compared to their counterparts in low-stress situations. The former manager is perceived as less effective by raters since it is difficult to imagine that a high-stress environment can produce high performance. Also, in stressful situations, managers express attitudes that are more negative and manifest higher burnout levels. The empirical work in this area is beginning to build up and it may be possible in the future to see what effect such implicit stress theories have on the other models presented here.

A summary of the theoretical models

From the models discussed above, as well as many similar ones in the field, it is difficult to decide which model is relevant in a particular setting. As each model has its adherents and

studies till now have both supported as well as contradicted hypotheses, the choice is a difficult one. The many available alternatives with their unique requirements in terms of data collection may not be particularly useful to the practitioner if the concern is either to examine one specific setting or to study a certain stress–strain link. This difficulty in model development occurs not only because there is a lack of agreement among theorists but also because the application often does not fit perfectly into the formulation. For example, if one does not have a specific piece of datum such as a measure of control (either task control or status) in a situation, is it still possible to do the analysis according to the model's specifications? The answer is probably a qualified 'yes', but the findings in such a case may not be as valid and links may not be as meaningful.

Many techniques for analyzing the linkages suggested in a specific formulation are available and have been applied in the literature; however, few investigators have described in detail how a model should be tested. Usually a theoretical overview is presented and, if there are empirical data, some form of multivariate analysis is applied, but the reader is generally required to consult a statistics book for understanding the output. The present book will delineate the steps involved in collecting the stressors, strain measures, and intervening variables, so as to illustrate some common techniques for analyzing the linkages. At the end it is hoped that the reader will be provided with the basic knowledge for interpreting results if they decide to do the analysis instead of using the services of a professional statistician.

THE PRESENT MODEL

The model that will be presented does not take a revolutionary approach to the field nor does it include variables that others have not considered previously. Instead, I have reorganized the stressors and set up new categories where individual stressors fall. As for strain outcomes and intervening variables, they stay pretty much the same and are culled from studies that did not necessarily take a theoretical position one way or the other. In trying to combine the various perspectives that have been offered in the literature, it is possible to identify several major variables or characteristics where most, if not all, models agree. These include a stressor variable, some form of intervening variable, and an outcome measure that will be referred to as 'strain' if it is a function of the stressor. Of course, it is recognized that any type of linkages model between stressor and strain will be able to explain only a portion of organizational behavior; nevertheless, the major test here is whether there is a reduction in unexplained variance of the strain or outcome measure. In addition, some possibilities for data exploration will be shown; of course, the proper cautions will have to be followed but, in a practical

situation, such unhypothesized linkages may provide important clues even if not accompanied by theory.

The model also applies some of the new thinking in I/O psychology for categorizing independent variables. The use of a multilevel approach allows the investigator to consider stimuli whose origin is beyond the individual. In the present context, stress stimuli can be visualized as coming from three sources: (1) extra-organizational factors, (2) organizational factors, and (3) individual factors. It is interesting to note that nearly every model discussed above includes variables from these different levels as part of their formulation. Thus, a P–E discrepancy score may involve a comparison between an individual variable and an organizational measure or the fact that an extra-organizational variable affects some work-related variable and then both impact on some outcome. I have simply formalized what is already in common usage in the field.

Although adequate for many research purposes, focusing on causes from one level, such as the individual, is inadequate and is, probably, one of the major causes for poor or inconsistent results in previous studies. Neglecting potentially relevant sources at so-called higher levels provides the researcher with only a part of the picture. As delineated by Klein *et al*. (1994) and Rousseau (1985), a multilevel analysis provides a better description of the actual links that produce various types of outcomes or, in the present case, strain reactions. The model, therefore, includes both intra-organizational (individual and company) and extra-organizational (national, cultural, and economic) levels. Each level encompasses a source of stress, as well as a potential series of relevant moderators and mediators. Figure 2.1 shows the various elements of the model and the links between them. A brief discussion of each level and how it plays a role in determining strain reactions will be presented below. The more detailed discussion of each stressor source is reserved for the relevant chapters.

Specific model components

The model includes some of the features usually associated with structural equations. Although I have taken some liberties in the figure, it does identify the major variables in the model and the links among them. The circle/ oval represents an underlying or common factor. The stressor variable that influences perceived stress consists of influences that are derived from three sources (individual, organizational, and extra-organizational). The strain that is considered the outcome measure also consists of three variables: psychological, physiological, and behavioral. ‘Behavioral’ also includes performance, as both refer to measures that people do and can be observed. In the figure, strain can occur as a direct result of perceived stress and as an indirect result of stress.

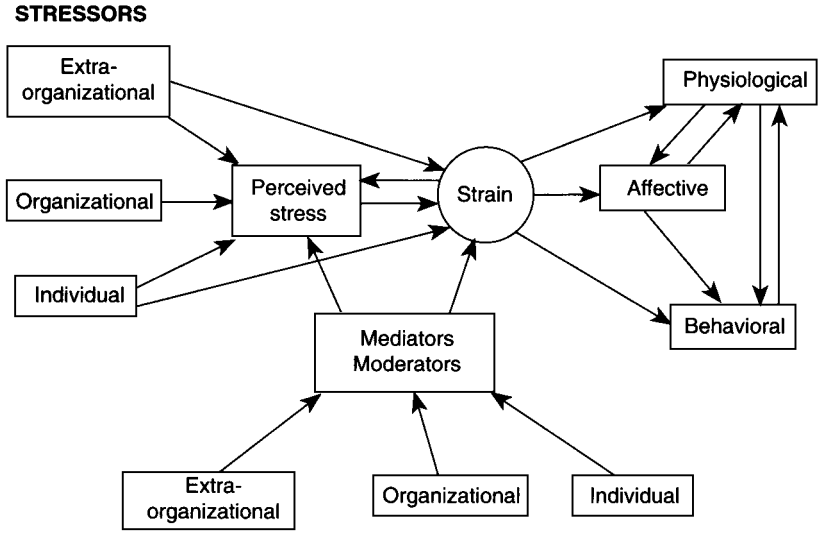

Figure 2.1 A general stress–strain model

Mediators and moderators are linked to perceived stress and strain to indicate that, at each stage, one or both may be present. Let us take an example to illustrate the action of these intervening variables. If a person with a conscientious personality, the moderator, works in a firm where difficult scheduling and productivity demands exist, this combination of variables may explain a greater percentage of perceived stress or the strain reaction than would be explained by the stressor (demands) alone. Furthermore, coping techniques, which I consider a mediator variable in the model, may be hypothesized as influencing the link between stressor and perceived stress or between perceived stress and strain. For example, time management is a coping technique that can be hypothesized as reducing or eliminating either one of the links.

The figure also gives prominence to the notion that the source of moderators and mediators may be organizational or extra-organizational factors, as well as individual ones. Sullivan and Bhagat (1992) argue that group and organizational (the model here combines these two sources) moderators must be considered in understanding the relationship between stress and job satisfaction and the relationship between stress and performance. Among the moderators that they suggest are social support and cohesiveness at the group level and technology at the

organizational level. The amount of empirical research on intervening variables beyond the individual level is quite scarce; most of the time the intervening variables are individual ones.

Finally, there is one other issue concerning the links between the strain measures that needs to be discussed. The figure depicts that each of the strain measures is either a cause or effect of the other two measures. Overall, this chain of events seems to describe the outcome of stressors on the individual. Nevertheless, there still may be a temporal component in many situations. For example, a job stressor may affect job satisfaction, an affective measure, before it influences performance, a behavioral measure. In other words, the strain measures influence each other sequentially with the psychological state preceding the behavioral one. It is possible to consider the first of these outcomes as an intermediate strain measure and the second one as an ultimate measure. In several examples from the literature (for example, Hendrix *et al*. 1985), an intermediate strain outcome was viewed as the direct effect and stress as the indirect effect. I have adopted this approach in explaining some of the mediating effects of certain strain measures. Although researchers have often done analyses assuming that the cause–effect link went in one direction only, and even if significant findings were reported, it is difficult to say that the link in the reverse direction does not exist. Unless the analysis was done controlling for a reciprocal relationship, it may be better to assume both possibilities, as depicted in the graph.

The multilevel approach

As stress research has several unique features, two aspects of the multi-level approach must be emphasized here. The first concerns the type of organizational environment which is conducive to the influence of certain levels and not to others. The second entails the nature of stress research which generally affects individuals considerably more than the two other levels of analysis (organizational or extra-organizational). Usually, observed behavior in an organizational setting is in response to many stimuli at different levels. For example, an organization that has decided to downsize is likely to generate quite a bit of stressors in the environment. Just the mere rumor of layoffs can engender quite a tense atmosphere within an organization. Workers who may be satisfied with their jobs or whose personalities are not particularly likely to respond negatively to adverse working conditions may very well experience strain if their jobs are threatened. Moreover, an individual in a job position that is not easily replicated in other organizations may experience heightened strain as the number of job opportunities or alternative employment possibilities are limited. The variable of job opportunities serves, in this case, as a moderator.

The degree to which indicators beyond the individual play a role in stress at the individual level is determined, to a large extent, by the organizational structure. Weick (1996) termed situations which are not defined by any other indicators beyond the individual level as ‘weak’

situations. This is clearly evident where performance standards and behavior–reward contingency are not specified by senior management and workers' psychological and behavioral reactions are determined by the specific characteristics of the job that is performed. Furthermore, a high level of interpersonal conflict or job competition may also create a weak situation, so that rules or regulations that are in force become secondary and do not determine strain reactions in any way. Finally, a workplace undergoing a change or crisis is also a case of a weak situation. In the latter, work goals and tasks are ambiguous and unstructured, roles and functions are overlapping, insufficient feedback is provided to subordinates (Sagie *et al*. 1996; Sagie and Koslowsky 1996), and the worker is likely to experience stress on the job. Here, too, behavior is not determined by leaders, management, or by other higher-level authorities or rules. Thus, the vague and ineffective organizational indicators force or push workers into disregarding certain stimuli and focusing on others.

Conversely, in 'strong' situations higher-level indicators, such as national culture, religious ethics, organization rules, leader instructions, or peer expectations, are definitive and clarify the situation. They provide a guide for the employee regarding expected behaviors and attitudes. Hence, stressors may exist simply because the culture of the organization fosters it rather than as a result of any specific component of the job. A good example of this can be found in the high-tech industries where it is important to achieve or innovate all the time. A worker may indeed not feel any particular stress from the job itself but, when asked, report that they are constantly 'under stress.' Here, the organizational culture requires performance standards that are relatively high. If the worker feels that these are not being met, strain is likely to result.

In a recent article by Sagie *et al*. (1996) that applied the multilevel analytical approach to work values in an organizational setting, the authors noted that the influence, at each level, tends to be from stimuli at the same level as the response or from stimuli at levels higher than the response. For example, organizations in different locations competing with each other in global markets and shared technology tend to develop common work values. High-tech firms all around the world appear to have a similar informal, hardworking, and independent spirit. In such settings, an individual's work value will be determined not only by his or her personal, attitudinal, or demographic characteristics but by organizational or, perhaps, inter-organizational, factors.

Some thoughts on organizational outcomes

Although the book's focus is on the individual's, rather than the organization's, response to stressors, it is recognized that organizations are themselves under stress in many situations. For example, a newspaper that has not modernized with the latest computer technology and still uses some of the older techniques of printing may not be competitive and may find it quite

difficult to remain profitable. The company may feel extraordinary pressure to adopt the latest techniques or face rather quick extinction. The dynamics of strain in such an organizational context are more appropriately discussed in other management or business contexts where the focus is likely to be more on structure and flexibility in coping with outside forces and less on the stress–strain link.

As compared to the individual levels of analysis, work outcomes at the organizational level are more global. They include financial results, profitability, morale, pride, and overall performance, which can be attributed to the combined contributions of the diverse groups and individuals within the organization. Of course, reciprocal links are possible and these outcomes may also influence stressors at the individual level. Thus, it would not be surprising to see that as overall performance decreases, stressors, at the individual level, increase and begin to impact on individual performance, also. One of the problems in doing multilevel research is identifying the appropriate moderators and mediators, at the individual level and beyond. As some of the concepts involved in multilevel analysis are now becoming more accepted in the general I/O literature, it is expected that stress investigators will also begin to develop formulations that are appropriate for understanding the effects at levels beyond the individual.

Some implications of the multilevel approach for stress research

The sources of stress discussed here may originate in other people or in structures that exist both within and outside the organization. In some cases, it is hard to distinguish between the supervisor and the features of the job. As management is often perceived synonymously with the organization, some workers may attribute specific negative reactions to the former and others to the latter. Within an organization, several different types of relationships may be sources for stressors. Thus, dyads, which are the result of the interaction between two workers or colleagues or even a worker and a supervisor, as well as larger groups, such as departments or a branch office and, in some cases, the informal network across branches or departments, may, at different times, be responsible for the strain reaction manifested by a worker. For example, management may decide to determine which workers are not efficient and are no 'longer pulling their weight'. To accomplish this goal, they have decided to define the criterion as coming late or being absent. The personnel department has hinted to each of the line managers in the factory that in order to produce greater punctuality and timeliness, workers who want to be promoted must live within a half-hour of the plant. For those who travel longer than that, this situation, even if only a rumor, may create a great deal of discomfort. Similarly, the work of competing groups within a firm where performance is, at

least partially, measured by achieving certain goals ahead of the competition may create a pace that certain workers within a specific team find difficult to maintain. As a result, the situation may become stressful. In the first case, the stressor is organization-wide and in the second one it is inter-group.

According to Klein *et al*. (1994) and Rousseau (1985), the inclusion of a multilevel approach helps in answering several issues that could not be readily resolved with the focus on individual antecedent–outcome relationships. Several ambiguities in stress research may be resolved. For example, few researchers have tried to understand why an employee chooses a specific behavior as a response to stress. Part of the explanation is related to what the organization will permit. Thus, if stress causes frustration and makes it difficult for the individual to function effectively, the employee may choose a behavior that is 'acceptable' to the group, organization, and culture rather than one that is not. A worker who experiences stress and must choose between withdrawal behaviors to express their discomfort or anger at the organization may choose lateness and not absence, especially if the former is not sanctioned and the latter is.

Furthermore, the model also assumes antecedents acting as moderators both at the same or different levels. Thus, an analysis may show that an individual who has a certain personality trait (trait anxious), has experienced a chronic stressor (environmental noise), and knows or is cognizant of the fact that few organizational sanctions can be expected if performance is not up to par, has a particularly high likelihood of performing poorly. Each of these antecedents by themselves may not be predictive of a specific strain response, but the combination is. An investigator examining only one of these variables (personality, environment, or organizational policies) may not find a significant relationship between stress and strain and may infer, erroneously, that the observed performance level is not a result of stressors. It is argued here that this may have been the case in some of the studies which yielded weak or no associations between antecedents and strain responses.

As the model now stands, it is difficult to calculate the contribution of each level for explaining strain. Although exact figures and weights require empirical investigation, it is possible to theorize about their relative contribution. In a sense, the distinction made between weak and strong organizations helps us out quite a bit. We can assume that the relative importance of the various levels is determined by the organizational type. In the brief example mentioned before, if performance standards and behavior–reward contingency are not specified at a higher level, then the worker's personal characteristics (including permanent and less permanent ones) or a specific chronic stressor may fill the gap and help determine behaviors that will be manifested.

Similarly, a workplace undergoing a change or crisis is also a case of a weak situation. In the latter, work goals and tasks are ambiguous and unstructured, roles and functions are

overlapping, and insufficient feedback is provided to subordinates (Sagie *et al*. 1995). Here, too, individual behavior is not likely to be determined by leaders, management or by other higher-level authorities or rules. An employee may feel that this would be a ripe time for expressing negative behaviors which were initially stimulated by stressors and which, other under organizational circumstances, would have been suppressed. In a strong situation, the opposite is true. The individual will only manifest behaviors that are permitted by the organization. Individual inclinations or needs for expression as a result of negative stimuli will be suppressed. What are the implications of such suppression? The behavior that is not permitted in the organization may appear outside the workplace. If we go back to an old controversy in I/O psychology concerning the existence of either a spillover or a compensatory relationship among behaviors, then the truth of the latter would indicate that an employee who is frustrated at and cannot express an appropriate reaction at work, may do so at home (for discussion of a similar issue in another context, see Hanisch and Hulin 1990). What is of particular interest here is that an examination of the stress–strain links at home may not reveal any direct sources of stress, and only if the investigator appreciates all the dynamics at work and its implications for the worker can the negative reactions at home be understood.

In accordance with Klein *et al*. (1994), an investigator must make two underlying assumptions in order to consider the dyad or the group as the correct unit of analysis. First, although differences within a dyad or group can be expected, the members are relatively homogeneous in that they all confront the external stimulus similarly. This means that the group members share more in common than they have differences. Second, for several groups coexisting within a common organization, the stressors differ from one group to another. The first assumption indicates that the group, rather than the individual, is the major source of stress. The second assumption denotes that the group, rather than the organization, is the appropriate source.

Often, these assumptions do not hold. This is especially true where the indicators or demands from some higher levels such as the organization or outside environment are prominent and influential and 'overwhelm' the smaller group's needs. Clearly, in 'weak' situations, the group's values, needs, and requirements will be paramount, and they determine what will be perceived as stressful and what will not. Several variables have been shown to increase the level of within-group cohesion and value-sharing. They include low inter-group communication, inter-group competition and conflict, external threat, and isolation from other groups (Shaw 1981; Vecchio 1995: 453–5). Cohesion within a group can be viewed as a means of coping with or warding off outside stressors. By identifying with one's group, it may be easier to ward off noxious stimuli or events; the subjective reaction by group members that together 'we can't get hurt' may be irrational but is often effective in mitigating the effects of stressors.

Ironically, some undesirable negative reactions can be expected from a highly coalesced group. Often as a reaction to some outside stressor, they may act differently from what would be expected of them as individuals. Possible responses by the group include resistance to change, hostility and aggressiveness toward out-group people, stereotyped views of adversaries, shared illusions of invulnerability and unanimity, and self-censorship of deviations from group consensus. This phenomenon, called 'groupthink' by Janis (1982), may yield very poor group decisions, as demonstrated in the cases of the Bay of Pigs fiasco, in which President Kennedy's cabinet recommended an ill-conceived invasion of Cuba, and in the fateful decision to launch the US space shuttle Challenger during unsafe weather conditions (Esser and Lindoerfer 1989).

Sometimes the need for considering the group rather than the individual is dictated by the research design itself. For example, in a recent study by Van der Velde and Class (1995) the authors were interested in studying the impact of role conflict, ambiguity, and organizational climate on organizational stress (actually strain, as used here). All the scores were obtained from the responses of individuals to each of the measures. However, unlike organizational culture, the other variables are meaningful at the individual level. Organizational culture, however, is a unit-level (department or organization) level-variable and an individual's score on this scale has little meaning. So, the authors decided to aggregate the scores on culture at the unit level. Afterwards, the authors assigned the mean score of each respondent's unit to each individual member. The aggregated culture scores were used as input into the regression analysis which was carried out at the individual level. This is not ideal, as the mean culture score is composed of the same respondents that were used in the analysis. Nevertheless, the example clearly illustrates that the influences on the dependent variable may come from different levels and the researcher must make a decision on how best to deal with the various influences.

Organizations do not exist within a vacuum. Although the influence of the cultural environment within which an organization operates is always significant, in a weak situation, the influence of the former is particularly relevant. For example, when confronting increased competition, workers tend to identify with their organization and adhere to their basic work values. As stated before, this is an effective coping mechanism in difficult times. However, if one does not identify with the organization, and the worker feels that change is necessary to become more productive, thoughts of leaving may appear and, if this becomes known, may lead to ostracism by the worker's colleagues. For the latter worker, identifying with a policy that is perceived as wrong is not an effective coping mechanism and, if forced, may lead to poor performance or turnover.

Similarly, difficult economic times such as a recession may cause certain stressors to become more prominent. Continuity or even survival of the firm becomes a motivating force

for workers. For example, Anthony *et al*. (1993) discussed the case of Delta Airlines during the 1982 recession when the company experienced financial difficulties. The generally satisfied employees of Delta identified with the company's plight and showed their commitment to its basic values by purchasing a plane for the Delta fleet from their own resources. As pointed out above, one may speculate that it might have been quite difficult for an employee to refuse to participate in this purchase. Whether this speculation is correct or not, the Delta case illustrates the notion that as the feelings of stress from an outside source increase, common organizational values take hold for coping with the stressor.

Another outside source of stress from extra-organizational effects is the community. For example, noise is a common stressor for people at work or at home. In the next chapter, it will be discussed in some detail. Interestingly, the community has a say in local noise levels, too. What is and what isn't acceptable is a local municipal decision. How much they are willing to tolerate is a popular issue in many city councils. Moreover, survey data show that individuals who live near airports often complain more about airport noise than would be expected from the objective magnitude of the stimulus.

This may also be related to the perceptual issue which plays a role here. Wesler (1989) used perception to explain the outrage expressed by many residents after the decision to reroute flights in the Eastern corridor. The author points out that the actual noise was considerably less than the usual community noises that people encounter every day. The noise did not even reach the minimum levels imposed by the FAA. Staples (1996) infers from the various noise studies in the field that it is necessary to consider psychological, sociocultural, cognitive, and perceptual factors in order to identify stressor effects. This will form an important component of the model in the next chapter.

In conclusion, the present model recognizes that stress and intervening variables have multilevel sources. If strain, which may manifest itself in many ways, is observed in a particular setting, then identifying the links involved may require some detective work. It is not adequate simply to look at the individual and measure some potentially relevant stressors. Rather, it is incumbent on the investigator to gather information on the worker's total environment before trying to gauge the various links in the stress–strain process.

3

STRESSORS

Although researchers have examined stress from many different perspectives, the lack of proper terminology in many investigations has not per mitted exact comparisons to be made between studies (Beehr and Franz 1987). In particular, the terms 'stress' and 'strain' have not been adequately defined, and this lack of clarity has caused confusion in distinguishing between the independent and dependent variables. In a review of articles in organizational behavior, Jex *et al*. (1992) found that in nearly 40 per cent of the articles, stress was used either incorrectly or ambiguously. In some cases, the vague usage has resulted in each respondent interpreting the word as he or she saw fit, either as a cause or effect variable.

According to the more or less accepted modern usage today and the convention that will be adhered to in this book, stress refers to the independent variable, the stimulus part of the equation, and is considered the potential cause variable. Moreover, Jex *et al*. (1992) argue that stress may very well have an affective component associated with it. Following the Lazarus (1966; Lazarus and Launier 1978) formulation, it appears that some individuals include part of the threat implied by the stressor in their evaluation of a stressor. However, this usage is not as popular today. In particular, the present models of stress, as we saw in the second chapter, include a subjective component that is separate from the objective stressor. Strain is the response part of the equation and is, generally, associated with a negative consequence. The links between the stimuli and responses (in most cases, there are more than one of each type of variable) and the various intervening variables form the basis of most stress models. The intervening variables and strain responses classified by various category types will be the focus of several chapters in this book.

SOME CLASSIFICATION RULES

I have divided the discussion of stressors into three groups: individual, group/organizational, and extra-organizational. The first two are discussed in this chapter and the third one in the

next chapter. Although it is impossible to cite every single stressor that has appeared in the literature, as it would take up the entire book, if not more, some of the more relevant and recently discussed stressors, at each level, will be cited. One word of caution is important; in my research for the book, the distinction among variables, both within specific investigators and between investigators, is frequently not precise. This problem exists not only for the stress–strain confusion mentioned above but also for identifying the different categories of stressors. The overlap among certain categories, no matter how precisely defined, is great.

Without doubt, the clearest form of stressors are the extra-organizational ones which are exemplified by environmental stimuli. As mentioned in Chapter 2, competition, economic situation, and even noise are all measures that exist independently of any observer. Often, it is possible to measure the environment without resorting to a self-report by the individual worker. In contrast, distinctions between individual and organizational stimuli are sometimes more difficult to make. For example, is a variable such as work monotony (Melamed *et al*. 1995) organizational or individual? It actually has characteristics of both categories. If the authors have made a distinction between the objective and subjective, and actually measured one at the organizational level and another at the individual level, as Melamed *et al*. did, then it is quite apparent where each variable belongs. Otherwise, if it was measured at the individual level with a self-report, the decision was, generally, clear. There was one major exception to these rules. If a measure of an organization or an environmental situation was obtained through a demographic-type variable, and no clear purpose for distortion was apparent, then the variable was not necessarily classified as individual. If the question was age or education of the subject, again, the category assignment was clear. However, if the subject was asked, 'For what type of organization do you work, service or manufacturing?', the decision would be to classify this measure as an organizational variable.

This classification rule is supported to some extent by a study on the validity of self-report scales. In their comprehensive analysis of these scales, Crampton and Wagner (1994) found that the exclusive use of true 'self-report' (for example, questionnaires) sometimes, and definitely not always, yielded inflated correlations. However, and this is the important point here, if one of the scales was a demographic-type variable, then the observed correlation could be viewed as accurate and representative of results that would have been obtained if an objective scale had been used. Often, investigators of behavioral concepts in organizational research will use self-report scales as a substitute measure, especially when the behavior is difficult to gauge or obtain. As will be discussed later, Crampton and Wagner (1994) showed that, in certain cases, the exclusive use of self-report scales, so-called 'percept–percept studies', distorted findings.

INDIVIDUAL STRESSORS

The literature is replete with stressors at the individual level. Each of our theoretical models in the second chapter contains examples of these types of stressors. For example, in the model of macro and micro stressors, the chronic hassles are typical individual stressors. However, the major life events appear to be outside the individual (for instance, bereavement or divorce). They would seem more like home or nonwork stressors. Both the P–E model and the Karasek demand strain model have obvious individual stressors as part of their formulation. The former considers abilities or values as stressors and the latter considers the control over the task that is available to the individual as a stressor. Also, the efforts reward model uses the notion that if there is an imbalance between individual effort and rewards provided by the organization, stress may be produced. Finally, lifestyle incongruity refers to some type of interaction between an individual's consumption level and a relevant norm group. In any case, it is clear that the individual is one source of stress in each of the major formulations.

It is important to understand that in nearly all models, except, perhaps, the macro and micro stressors one, there is an interaction term involved. As we will see in the next chapter, the concept of interaction often refers to a moderator effect. The term as used in the models is actually quite different. It is not being applied in its statistical sense but rather in its more mundane form. Moreover, in most studies, a moderator is usually considered the secondary variable in an analysis in that it changes the relationship between two existing or hypothesized variables; here, the outcome of the interaction (such as the discrepancy term) *is* the causal variable of interest. Table 3.1 lists some of the categories and examples of individual stressors.

Subjective stressors

Interest in identifying objective stressors in the workplace or at home (for example, Ciocco 1940; McGehee and Owen 1940) dates from before World War II. The work on subjective stressors, and its importance in stress models, is considerably more recent and did not pick up momentum till the 1980s. With the revival of the cognitive revolution in psychology, where the individual's perceptions and self-appraisal of the situation became essential, the emphasis in research turned from outside objective elements to studies that combined either both types of stressors (Melamed *et al*. 1995; Novaco *et al*. 1990) or just used the self-appraisal method. In a sense, all the subjective stressors could be viewed as individual stressors since they emanate from the individual. Although other aspects of the distinction between objective

Table 3.1 Individual stressors

A *Subjective stressors*

1 Perceived stress
2 Pay adequacy
3 Perceived hostile environment

B *Objective employee characteristics*

1 Type
2 Occupational categories
3 Commuting time/distance
4 Business travel
5 Relocation and retirement

C *Job stressors*

1 Job demands
2 Role pressures
3 Responsibility for people
4 Relations with supervisor
5 Overload, underload, and monotomy

and subjective stressors can be suggested (Frese and Zapf 1988), for the present purposes it can be assumed that the former include physical characteristics of the environment or structural features of the organization, whereas the latter involve some type of processing (emotional or cognitive) by the individual. In studies where both types of measures were obtained, subjective stressors were often studied as mediators and, as will be explained later, are said to exist as a response to some objective stimulus. Nevertheless, it is clear that, in many situations, a common mediator such as perceived stress is only a partial explanation of strain variance.

If an author examines a concept using both objective and subjective measures, then it is possible to test the subjective measure as an independent variable as well as a mediator. For example, Melamed *et al*. in their analysis of work monotony examined both objective and subjective measures of the concept. The hierarchical analysis looked at the mediating effects of the subjective indicator. In addition, simple correlations and plots of the subjective variable by outcome were used to show stressor effects. Nearly identical sets of analysis were used to show how an objective measure of commuting impedance (a combination of time and distance) and a subjective measure (a list of items describing difficulties of getting to work) related to several psychological outcomes. Novaco *et al*. (1990) analyzed the subjective commuting measure as an independent variable and as a mediator and found that it exhibited both properties.

The implication is clear. If the objective and subjective stressors are not in a 1:1 correspondence, then each measure contains elements that are not explained by the other. It is for this reason that it may be worthwhile to understand, independently, some of the subjective stressors in the literature. As we will see below, in many situations, subjective stressors are the best indicators of stress, and it would not make sense or it would be difficult to try also to identify the link between the objective measure and the subjective one. Many of the variables listed below acted as stressors and were culled from the recent literature so as to represent, as much as possible, a cross-section of the field. In the few cases where the stressor fits into one of the existing models it was classified as such. In most cases, the authors examined their variables using some other theory from social/ industrial psychology or conducted the study to test a particular issue.

Perceived stress

From the present model's perspective, perceived stress is a mediator variable linking the outside stressor (environmental, organizational, and so on) with other types of strain. Nevertheless, for many researchers this is *the* main stressor used in the study. Thus, dozens, if not hundreds, of papers, research projects, and even personnel decisions are based simply on a self-report of stress in a particular setting. It is the counterpart of some objective stimulus. The argument here is quite simple: the person's perception of the situation *is* the stressor and their reaction is a reaction to this stressor. Unlike stressors whose origin is some personal measure (such as retirement) or job characteristic (description of job functions), perceived stress asks the subject to express an opinion (for example, 'I find that the pace of work is too fast here'). It is possible that such a scale is actually an indicator of personality or anger with the boss rather than a gauge of stress. This is not to imply that perceived stress is less important than objective stressors in a stress model. As a matter of fact, the opposite is true; however, since perceived stress may be confounded with other components, inferences must be made with extreme caution and only after attempting to remove the non-stress components.

Pay adequacy

One variable that is clearly a representative of an objective measure is pay adequacy. This refers to the perception that the individual has concerning the material rewards that they get from the job. It would seem that the perception here is more important than the actual pay received. Indeed, Piltch (1992) found that after controlling for family income, perception of pay adequacy was correlated with mental distress. This variable is a part of the low-status

control discussed by Siegrist (1996) but here it is viewed in isolation without considering the effort side of the equation. Also, the variable is a good example of a subjective measure that is not equivalent to its objective counterpart and may explain additional outcome variance.

Perceived hostile environment

With the advent of equal employment opportunity and specific laws against discrimination, it would seem that organizations would no longer be involved in racial or gender discrimination. However, in many places, a subtle (sometimes, actually, not so subtle) atmosphere exists which makes it difficult for certain minorities to get promoted; jokes about race or gender are commonly made, personal insults are used, and, although officially banned, bias of all types are part of the organizational norms. In a study to examine this issue, Fisher *et al*. (1995) devised a Hostile Environment Inventory to identify the level of abuse within the organization and in what areas. The psychometric features of the scale are listed on p. 70. Research describing what specific strain reactions could be expected from such stressors seems to be the next step in this area.

Objective employment categories

Employee type

The only way in which the following stressors differ from the previous ones is that all measures here have clear objective components that can be ascertained either from individual or from personnel files. Similar to demographics, they represent variables that are not generally thought of as susceptible to distortion. Nevertheless, in all cases the data obtained from an objective source outside the individual would be preferred.

One possible personal or demographic characteristic that may have an impact on strain is whether the worker is part-time or full-time. According to Steffy and Jones (1990), most, but not all, indicators of strain showed differences in favor of full-time employees. The generally greater strain values for the part-time workers may attest to their inability to manage the ebb and flow of their work role as compared to full-time employees. Steffy and Jones speculate that the former group's reactions could be the result of a lower level of training, supervision, social support, and job-pertinent information. Nevertheless, although significant correlations were obtained, it appears that job type, at best, explains only a small portion of strain reaction.

Occupational categories

In the literature, stressful stimuli have been associated with specific occupations. Although it is true that negative stimuli can be found in any occupation, some types of work activity are more likely to lead to negative reactions than others: Nurses (Krausz *et al*. 1995), physicians (Cartwright 1979), police (Kieremeyer and Diamond 1985), and even musicians have been the focus of stress research (Sternbach 1995). A brief examination of some of the issues may help us form some generalizations about which occupations are likely to lead to strain reactions. Task and role ambiguity, discussed below, are major factors for health professionals in that decisions have to be made, sometimes immediately, and the responsibility for others rests on their shoulders. (It is interesting to note, at the other extreme, routine, monotonous work where a worker is largely passive physically – labeled as work 'underload' by Coburn (1979) – may also be source of stress.) In other occupations, the worker may have deadlines, schedules, and appointments that must be met. Following one of the theoretical lines of reasoning mentioned before, the degree to which the worker feels control over such situations would mitigate the stress–strain link. Finally, musicians and others in the performing arts introduce an entirely different set of stimuli into the picture. In his study of musicians, Sternbach lists the potential stressors as the following: all the stimuli that are associated with stage fright, the awareness that a supervisor (that is, the conductor) is constantly scrutinizing one's work, and the high expectations to perform at a near perfect level, especially since comparisons with recordings are easy to make. Many of these issues are, of course, relevant to other occupations also.

Commuting time and mode of transportation

The commuting experience has many potential stressors associated with it. Environmental variables (which will be discussed in later chapter), the long time on the road, and the distance are just some of the possible stressors. In the study by Van Vugt *et al*. (1996), employees were asked to fill out a questionnaire that contained among many other items their preferred mode of transportation (car vs. public transportation) and actual time of the commute to work. The authors found that the use of public transportation was greater if it could be associated with a shorter driving time to work. In order to understand some of the participants' decisions on their mode of transportation, the authors correlated the response to this item with some other questions describing social aspects of the commute. For example, a high preference for public transportation was associated with concern for environmental pollution, whereas flexibility and protection against the weather were each negatively correlated with use of public transportation. It appears that the individual chooses a mode of transportation that is less

stressful for him or her. Some are more interested in their personal needs and others are more socially conscious, but in any case their choice, whether because of time or potential outside stimuli, is a function of least resistance.

Business travel

In a recent newspaper article, Hsu (1997) quoted an epidemiological study reported by the World Bank that showed that business travelers had more psychological symptoms than an equivalent group of businessmen who did not travel. Examination of medical insurance claims from more than 5,000 travelers, who had on average traveled more than three times during the previous year, indicated that this group was three times as likely to report strain reactions as the latter group. Hsu speculated that the dramatic changes in climate, daily routines, and sleep patterns are likely to contribute to this finding. Further research is needed in order to define the stressor variable more precisely, to identify which strain variables are most likely to be affected, and to clarify what moderators affect the relationship between stressor and strain.

Relocation and retirement

Recently, two major life events variables, relocation and retirement, have been analyzed as potential stressors. Job relocation at the request of employers is a feature of many types of jobs. By allowing the employee to face different challenges and experiences, relocation is a method used by employers to groom their employees for higher-level positions later on. Several nonwork variables – including the presence of adolescent children in the family (Brett 1982), whether the spouse has a career (Maynard and Zawacki 1979) – and the adjustment of the spouse to the move (Pinder 1977) – have been found to influence the 'quality of the move.' Using a thirteen-item stress questionnaire, Munton (1990) found that a majority of participants in his study experienced, at least, a moderate amount of discomfort with relocation. Employees whose spouses needed to find a new job after the move had a greater than average negative reaction to the move.

Another individual stressor of prominence that has spawned quite a bit of research recently is the issue of retirement (Moen 1996). Similar in some ways to relocation, retirement is a major life-course transition. Although it is has clear objective features, it also involves a transformation in identity, expectations, preferences, and meaning (Dannefer 1984). Thus, the event can be viewed as both an objective and subjective stressor simultaneously. There are many variables that may influence how retirement affects the individual's strain level. For

example, researchers have been trying to determine the dynamics and timing of retirement and how it affects psychological and physical health. Although some studies have reported a negative effect (for example, McGoldrick 1989), it would seem that early retirement should be associated with positive health outcomes, especially if the worker decided to leave on their own and was not forced to leave.

Interestingly, the relationship between retirement and psychological or physiological health can be viewed in the opposite direction also. Although an individual either decides to retire or is asked to leave, both cases may represent a reaction to an individual's health status. In structural equation terms, this situation provides a good example of a nonrecursive model. A variable that, in some fashion, directly or indirectly, comes back to its source may have practical implications for the retired person. It could mean that for some people both processes are at work or that people differ on the relationship between retirement and strain reaction. Although this has not been investigated yet with structural equations, I would like to offer a possible path for the variables. Although a person may retire (or be let go) because they have been showing certain symptoms or a deterioration in performance, at a later stage the retirement itself can be expected to begin to influence the person's psychological and physiological functioning.

Job stressors

The following stressors, which probably form the bulk of the negative stimuli that are usually studied in the field of stress, have characteristics that overlap with personal, group, and organizational stressors. They have been placed in this category as they more closely resemble features of the job than any other group. For example, workplace stressors could be placed in the organizational category if the two were synonymous, such as would be found if the entire organization were to be found in one place. As this is not true in most cases, I have placed the following stressors in the job category with which they are more closely associated.

Fletcher (1988) felt that a simple stressor–strain model for workers requires the identification of occupational stressors. These include, but are not limited to, work conditions, organizational climate, job mobility, and issues relating to technology such as pacing, cycle time, and so on. Although it is sometimes difficult to distinguish among them, the following list is based loosely on a taxonomy suggested by Tosi *et al*. (1994); however, I have added to the list and made some changes in defining each of the categories.

Before presenting the various categories that are associated with the organization-level stressors, it is worthwhile presenting the view of Baron (1996) to the issue of organizational conflicts and stressors. Baron considers the whole problem as one stemming largely from

interpersonal factors related to individuals, their social relationships, and the ways they think about each other. As is clear from the presentation in this book, it is difficult to separate individual from organizational level sources. Instead, I have decided to place certain categories at one level and others at another level based upon some logical rules. However, I do not feel that this taxonomy is hewed in stone and, as more research is completed in these fields, it may be possible to move some of the stressors up or down the hierarchy. In any case, the descriptions reflect, in several cases, the dual aspects associated with the component.

Job demands

As we have already seen, several theorists and investigators in the field consider job demands as one of the critical sources of stressors in the organization (see, for instance, Karasek *et al*. 1981). In one sense, all stressors (individual, organizational, and extra-organizational ones) include some type of demand placed on the worker. After identifying the demands inherent in their job, the employee's experiences and personal variables come into play and determine whether a demand will be turned into a stressor. In the present context, I would like to use the term in a more narrow sense. A worker's performance, behavior, and, perhaps, even dress are examples of specific, measurable demands that may exist in an organization. They may be formal or informal, written or oral, company-wide or localized within a specific department.

The basic premise in analyzing stressors resulting from demands is that the negative consequences were produced because, rightly or wrongly, the needs of the organization were placed ahead of the needs of the individual. Although variables on the other side of the equation, such as job control, will be discussed in the context of mediators in a later chapter, any job situation requires some form of adaptation on the part of the worker. Whether a demand actually results in strain reactions is dependent on many factors, including its reasonableness, subjective perceptions, and intervening variables.

Role pressures

Role conflict refers to the aspect of the job that may create some type of confusion or lack of direction (Jackson and Schuler 1985). If workers do not know what is expected of them or are told to do different tasks either by the same boss or by two different supervisors, stress may ensue. Similarly, expectations on the part of a supervisor that are difficult or impossible for the subordinate to meet may be an example of role pressure. A good example of this is a manager who may demand that a worker complete a particular task but does not give the worker adequate resources to do so. The fact that the worker has inadequate resources may be

attributed to different causes, such as budgetary or financial problems, underestimate of the amount of work that is really involved, and so on.

Role ambiguity, another aspect of the pressures involved with a job, is a general category that also includes uncertainties of various types but from the perspective of the individual. For the present purposes, these measures are considered as mediators and are likely to influence the impact of objective role conflict on the worker. The chapter on ambiguity will expand on this issue.

Responsibility for people

For some people, the responsibility for others may be a source of stress. Negative reactions here have several explanations: a lack of confidence in workers who are required to perform critical tasks, or the manager's realization that it is they who have control of major decisions (pay, promotion, working conditions, and so on) which could have a critical impact on their own future, as well as on that of the company. The weight of other people's welfare and satisfaction is difficult for some to bear and may lead to various types of strain reactions.

Relations with supervisor

The quality of the relations between the worker and their supervisor (for example, whether they like or respect each another) was discussed by Barnett and Marshall (1991). Their argument was that difficulty in the relationship between a supervisor and worker could lead to uncomfortable feelings and cause distress. Using a sample of 504 subjects, Barnett and Brennan (1995) did not show a significant effect on strain for this variable. Nevertheless, the authors argued that under specific conditions, one should expect the variable to have an influence on the worker's functioning.

An interesting perspective of this stress source involves reactions by management to specific workers' behavior. According to Zohar (1995), a worker confronts many different types of stressors during the day. As these stressors become too difficult to handle, the employee has to decide which ones to focus on. As the sender (perhaps, a manager) sees that certain expectations are not met, they must react in some way. It is here, argues Zohar, that the employee may be likely to confront another stressor. Is the manager's reaction fair? That is, does the manager realize or empathize with the fact that the employee is trying to handle the other stressors in the job? Not that the sender is expected to forget that expectations are not being met. Rather, is flexibility, tolerance, or understanding of the situation shown? Zohar

argues that an employee will experience a stressor if he or she feels that the reaction is unjust or unfair.

In a study to determine the potential negative effects of this variable, Zohar compared two different models. One assumed that the justice stressor is an additional stressor to the repertoire that exists in the organization, and the other is that it acts as a moderator and either enhances or decreases the effects of other stressors. Using a design that included other traditional stressors as well as outcomes, the author showed that a moderate correlation between role justice and role conflict, ambiguity, and over-load do indeed exist. Also, role justice was found to be related to a symptom measure of health and to intention to leave. When a moderated regression analysis was performed, it was clear that only the main effects of role justice were related to outcome and not the interaction term.

Work overload, underload, and monotony

The pace of work contains many features that are potentially stressful. One way of conceptualizing whether a person is working at a threatening or abnormal pace is to examine work performed within a specific time cycle (Cox 1985). Overload can be defined as trying to do too much in a short period of time, and underload as too little. A middle range whose definition has a wide range depending on the individual and situation would be considered not stressful. Another related concept here is role insufficiency, which refers to the fact that the individual may not see how their abilities would allow for completing an assigned task (O'Brien 1982). As few investigations using the last concept have been reported, the following review will focus on overload and underload.

Overload may be conceived of as the demand variable in the job strain model of Karasek. The stressor in this model actually consists of two parts, overload combined with low control. Carayon (1995) labeled the stressor as a chronic one due to the lasting exposure of the individual to the combination of both variables (high overload and low control). Jones *et al*. (1995) defined overload as the 'number or intensity of demands that may be made of employees' (p. 42). The time element is essential, as the demands are considered unreasonable only in relationship to a particular time frame. It is one of the more commonly used stressors in the field and can be expected to affect a host of psychological, physiological, and behavioral symptoms.

A slightly different approach considers overload as performing *repetitive* motor tasks in a short cycle. This viewpoint has a distinct advantage in that it may be possible to assess the various task components (namely, the motor functions, their repetitive nature, and the time frame) in an objective fashion. Nevertheless, whether it is objectively determined or not,

overload cannot be measured in a vacuum. In all cases, it requires a comparison with other individuals or groups and sometimes within the worker themselves. Overload does not always have the same meaning. For example, a healthy worker can be expected to handle many more tasks than a sick one. In order to assess individual overload, a perceived or subjective measure must be obtained. This last measure, generally gauged from a self-report scale, serves as a mediator in our model and is one of the links between stressor stimuli and strain response.

Work underload has been defined as workers functioning below their capacity (Coburn 1979) or doing tasks that are too narrow and one-sided (Gardell 1982). In an organizational framework, workers who are underloaded are performing tasks with no apparent cycle and with no demands on pace such as is found in vigilance, watch-keeping, monitoring, inspection, and guarding – see, for example, Fisher (1993) for an application of these terms. One step further and a concept that was recently operationalized by Melamed *et al*. (1995) is work monotony. It can be seen as a combination of underload and repetitiveness and can be ascertained by examining a job's work conditions. It is an important work concept which affects many types of blue-collar employees and differs quantitatively and qualitatively from most stressors discussed till now. Although the relationship between repetitiveness and stress has been analyzed previously (for instance, Cox 1985), a true objective measure of the concept, where the data were not obtained from subjects but from outside observers, was first tried by Melamed *et al*. In their study, the authors examined two objective components of monotony: repetitive work and underload. Repetitive work was divided into three groups all of which had an identifiable cycle of less than 1 hour. The three groups were short (less than 1 minute), medium (1 to 30 minutes), and long (30 minutes to 1 hour).

What are the stressful features associated with these variables? One way of understanding the dynamics here is by understanding the inherent built-in contrast. In one sense, such work has arousal-reducing characteristics, yet as it also contains the opposing requirement to be continuously alert, stress may be experienced and strain ensue (Melamed *et al*. 1995; Thackray 1981). From a demand–strain approach, the demands are quite obvious to the worker but the leeway in response may very well be quite limited. There is little creativity or variety in the stimulus or possible response. The worker knows what is required and must comply, usually within a very narrow range of choices. In any case, it is clear that stress is not only a function of too much work but can also result from a basically passive work environment.

As part of a definition of stress, Elo (1994) developed two scales for determining the presence of stressors in the work environment. One of the two subscales suggested by Elo was monotony; the other one gauged job control. A six-item scale completed by the worker was used to define the former concept. Items included questions on the use of knowledge and skills, on the amount of standard work routines, and on the variety of work. In a study by

Kivimaki and Kalimo (1996), the authors found that the Elo subscales were associated with strain measures. In particular, for young males and older females, as self-reported monotony increased, psychic distress and lack of self-competence increased.

The authors mentioned two major issues that need to be considered by future researchers. I would like to list them, as they have relevance for all stress studies. First, their study was self-report, cross-sectional, which has difficulties in terms of causality inferences, common method variance, and potentially inflated correlations. Second, the fact that the monotony–strain association was true for only certain groups and not clearly hypothesized at the outset requires further work to see if these findings are really stable ones or just characteristic of the subjects in this study. The authors did provide several reasonable *post-hoc* explanations for the expected presence of monotony among young workers and females, but without a replication it is only conjectural.

Are overload and underload opposite concepts or complements?

Why have I compared these two stressors? On the surface, they appear to be opposites. Although this is frequently true, overload and underload are sometimes conceptually and functionally related. An example from a specific occupation often associated with overload will help explain this point. Air traffic controllers are required to perform clearly defined tasks several times in a specific period of time. The work can be more stimulating if new technology and creativity are introduced; however, if the automation is too 'successful,' boredom and distraction become problematic with possible consequences such as frustration and anxiety (Bainbridge 1987; Tattersall and Farmer 1995). The point is quite clear: overload and underload are relative concepts and can change with a change in working conditions. Tattersall and Farmer describe several types of factors that may influence what type of stressor is perceived by the air traffic controller: organizational structure, climate, role, problems at home, and relationships at work. The authors suggested that the workload can be made a more positive experience; that is, neither overload or underload would be present if the work shifts were redesigned, length of duty periods were made more reasonable, and ergonomic changes relating to work stations and tele-communications were modified.

GROUP AND ORGANIZATIONAL STRESSORS

An individual may confront stressful stimuli whose origins are at the group or organization level. Nearly all the individual stressors mentioned above can also be considered as group factors. For example, pay inadequacy may be a stimulus to which a group of workers,

Table 3.2 Group and organizational factors

A	*Group stressors*
	1 Group exposure to individual stresser
B	*Organizational stressors*
	1 Culture
	2 Structure
	3 Introduction of change in working conditions

perhaps an entire department, is exposed. The reactions or strain responses, as will be described below, may also involve the entire group. Table 3.2 summarizes these higher-level stressors.

Group factors

Recent changes in work design and interrelationships among workers have produced potentially additional sources of stress within the organization. In particular, participative decision-making (PDM) has fostered a new era of teams, work groups, self-management, and profit-sharing programs that would indicate that both stressors and strains may not be an isolated individual phenomenon but rather a group one. Thus, examining the critical variables may require the investigator to determine group means or, at least the responses of others, before determining what the linkages are among the critical variables. In a study of employees in large public organizations, Golembiewski *et al*. (1986) showed that burnout, a common strain measure in stress studies, was a response typical of group members rather than of individuals. Thus, if one employee reported burnout, it was likely that the others in the team also reported burnout. Their conclusion was that understanding individual stress factors concerning an individual was not enough; information about the team was necessary.

The trend to look at the team may have implications for study design, also. Data collected from organizations that use some form of PDM may require two different analyses. First, the usual individual analysis with determinations of associations among stressors and strains should continue. Afterwards, a second determination where the unit of analysis is the group needs to be performed. Of course, many more experimental units will be needed in order to get some minimum number of groups for the statistical analysis. However, it may well be worth it; for the practitioner trying to identify all relevant stressors such analyses may reveal aspects of the stress–strain linkage unavailable from a simple individual analysis.

Organizational stressors

One level higher in the hierarchy than the group is the organization. This could be a company, a school, or an institution. In each case, the organization consists of many smaller units, each perhaps with many homogeneous characteristics, which together form a unit that has homogeneous characteristics in relationship to other companies, schools, or institutions.

Culture

Using the concept of hierarchical stress sources, Michela *et al*. (1995) suggested a framework that resembles Figure 2.1. The authors argued that an individual's strain reaction is really a function of influences that are arranged in a specified order. At the lowest level is the individual, above that is the group, followed by the company, and at the top is the industry. The importance of the hierarchy is that all higher levels influence lower levels, so that any strain reaction is a direct result of the level above it and an indirect result of the other levels.

Structure

According to Tosi *et al*. (1994), the structure of an organization has many features that must be taken into account when trying to delineate the stressors that typically confront workers (for example, Parasuraman and Alutto 1981). Four different factors are relevant here: (1) *Level* – the higher up a person is in the organization, the more expectations, time restraints, and role pressures are said to exist. (2) *Complexity* – networks and structures in an organization are often so intricate that activities or behaviors require knowledge and information that is not readily available to the employee. (3) *Change* – organizations undergoing structural change such as a reorganization may make workers uncomfortable or ill at ease until the new lines of command and individual duties are clarified. (4) *Boundary roles* – here the worker may have dual (or even more) obligations or duties to perform. This is not role conflict. The duties of the job are twofold and the worker must respond to all of the demands set by the organization. For example, a teacher who has an obligation to their students may also need to perform organizational tasks such as producing reports or attending meetings, sometimes at the expense of the advice or help they provide to the students.

Landy (1992) discusses the organizational factors from a different perspective. He calls this area the 'psychological architecture' of work and includes within it the task, jobs, and work design as sources of stress. Similar to the argument made here, Landy states that the organization is seen to have 'influence independent and interacting with those that

characterize the task and the job' (p. 122). Organizational structure is either an independent variable or a moderator that involves the activities within a particular job and activities between jobs. A worker may have various difficulties in performing the job assigned to them or there may be conflicts that result from other jobs within the organization that will lead to strain responses.

Introduction of change in work conditions

Although technology has been proposed as a potential moderator in the stress–strain relationship, it is much more clearly perceived as an organizational stressor. Introduction of new and sophisticated machinery such as computers or robots may be a source of considerable stress to workers, especially those with many years' experience with the old system of work. A major reason for the stress here is the lack of experience with the new system resulting in anxiety and fears, sometimes completely out of proportion to reality.

An interesting use of technology as a stressor was illustrated in a study by Schaufelli *et al*. (1995). The researchers who were studying burnout and performance of nurses in intensive care units (ICU) tried to identify the stressor that could be considered as initiating the stress–strain chain. They decided on a very interesting concept – namely, the use of technology in the ICU. Using the percentage of patients who were required to breathe through mechanical ventilation during the course of the study as the measure of stress, the authors argued that a higher value here was an objective indicator of stress. Their findings with this measure showed that the use of technology was directly related to burnout, as well as to objective and subjective performance measures.

From a completely different perspective, an organization can change simply by having relatively large numbers of people leave or join in a relatively short period of time. Downsizing, merging, or a corporate buyout can be viewed as a change that may have a dramatic and sudden impact on the company as a whole and the employee as an individual. It isn't necessarily the loss of the job that is stressful, but the insecurity that it entails. Workers who are aware of a potential layoff or a change in command that could affect their previous routine may respond by changing their attitudes towards the firm as well as behavior and performance. As rumors begin to fly all around, activity level decreases and workers begin to spend a portion of their time discussing the impending change. Attitudes such as job satisfaction or commitment can be expected to deteriorate. Withdrawal behaviors such as lateness and absences that are often not far behind may indicate not only a lower level of attachment to the organization but also an active search on the part of the employee for a new employer.

In a recent longitudinal study of job insecurity among automobile workers, Heaney *et al*. (1994) examined it as a stressor with potentially immediate, lagged, and chronic effects on job satisfaction and physical symptoms. Whereas the immediate job insecurity effect was not consistent, chronic job insecurity (defined as feelings of job insecurity both in time 1 and time 2 in the study) was related both to greater job dissatisfaction and more physical symptoms. It would seem that job insecurity as a temporary stressor may not necessarily be harmful but, over the long run, can have negative consequences. A manager may want to use this fact and try to limit uncertainties about the company as a whole or just individual jobs to as short a time frame as possible. The longer it takes before a situation is clarified, the greater the likelihood that the situation will elicit strain reactions.

STRESS AS A POSITIVE VARIABLE

In all the cases described above, stress has been viewed as a negative stimulus. This refers to fact that stress as a predictor or independent variable is associated with some negative outcome or dependent variable. Taking a somewhat different approach, James and McIntyre (1996) argue that there are circumstances in which the term has beneficial connotations. In particular, individuals (and it seems to me this could be extended to groups or work teams, also) who have a high level of achievement motivation (AM) will perceive certain types of environments as positive and consistent with their needs. According to James and McIntyre, the individual with high achievement needs is likely to 'promote, defend, and reinforce approach of demanding tasks' (p. 438). The implications in the work setting are quite clear. For example, a potential stressor that has its source in the organization, such as the demand that an individual completes a difficult task in a limited time period, may make many workers quite uncomfortable. However, a high AM will perceive this stressor as a positive stimulus and an opportunity to show their mettle.

This concept is consistent with several corollaries of theories that have appeared in the literature in other contexts. James and McIntyre intimate that the positive, enervating effect is the result of a cognitive process enabling the worker to link the stimulus with personal, desirable goals. Certain tasks provide an opportunity of expressing or showing control over a situation (Weiner 1990; 1991). In contrast, the individual who is low on AM will avoid such tasks or experience stress when required to confront them as they may then be held accountable for the success or failure of the task. This situation is just too threatening for the latter person. Although I will expand on the role of personality traits in a later chapter, the attempt by James and McIntyre to combine the concepts of achievement motivation,

perceptual/subjective process, and stress has opened an area of research with great promise. An appreciation of the positive outcomes associated with potential stressors also has wide-ranging practical implications for I/O psychology, including the areas of personnel selection, especially for complex tasks, and understanding a method of coping that certain types of workers may use so as to achieve control and the positive consequences associated with it.

4

EXTRA-ORGANIZATIONAL STRESSORS

The influence of extra-organizational stimuli can be found in the work-place, at home, and in the general environment. They act as independent variables and as moderators on strain measures. As attitudes, behaviors, and expectations within a particular work site are also influenced by factors that are not related to the company, the strain response can be seen as a function of any of these. Let's take the example of a bank. Perhaps more than other types of businesses, the public demands on-time behavior from each branch office. Regardless of individual inclinations or that of management, any type of stimulus or interference that prevents the responsible party from opening the doors at precisely 9:00 am may turn into a stressor. Home chores, personal errands, and traffic are examples of extra-organizational stimuli that may interfere with on-time behavior. Contrast this with high-tech industry, where punctuality is not as essential. Although other potential sources for stress can be identified, such as the need to compete or innovate continuously, they are probably less salient in the banking industry. Table 4.1 shows the origin and provides examples of extra-organizational stressors.

Table 4.1 Origins and examples of extra-organizational stressors

Origin	*Examples of stressors*
Workplace values/expectations	Job security, punctuality
Environment	Noise, density, heat, air pollution, lack of tranquillity
Home and family	Bereavement, marriage, conflict

EXPECTATIONS, VALUES, AND STRESSORS IN THE CULTURE

The individual, group, and organization are subject to forces outside their span of control. I will try to explain some of the sources of stress involved here; some are job related whereas others are not. The expectations and values that a worker confronts are often the source of stress; by not meeting them or having conflicts, different strain reactions may result. Previous researchers have identified many types of cultural values that are transmitted to workers and that influence values, attitudes, and behaviors (MOW 1987; Nord *et al*. 1988; Schwartz 1992). As expectations and goals in these areas are formed and disseminated within the organization, workers strive to realize them. Obstacles or impediments to these goals become stressors.

For example, in a cross-cultural study of work values, Elizur *et al*. (1991) found that job security was found to be most important in Korea but of only marginal importance in China and Israel. In contrast, Chinese respondents reported that a contribution to society was an important value; respondents from other countries ranked it much lower. The implications for strain reactions, however, are quite clear. In a society where job security is paramount, feelings of insecurity are powerful stressors. In a situation where job security is not a salient value, then an individual worker is unlikely to be negatively affected if threatened with a layoff. Nevertheless, it is possible that in the cultures of China and Israel, this phenomenon is only temporary. If downsizing and layoffs are not yet a common occurrence there, then the worker may not be sensitive to these stressors. As they become a more accepted management style, one can expect the threat they contain to become a more prominent feature of the worker's cognitive set, which is likely to become increasingly stressful.

I have already mentioned that the need to be punctual at the start of the workday may contribute to strain reactions in some settings (such as banks) and not in others (for example, some hi-tech firms). The need for punctuality does not only emanate from the level of the organization but is also a variable in the outside culture. In Western countries, time has very specific meanings and implications, so that the concepts of work time, leisure time, and lateness behavior are more clearly defined than those in the Middle or Far East (Manrai and Manrai 1995). Whereas in the United States the workday begins at around 9:00 am and ends at around 5:00 pm, for Southern Europeans the parallel times are 9:30 am to about 7:00 pm or even later (Tosi *et al*. 1994). In one of the most detailed studies of cultural differences and lateness perceptions, Levine *et al*. (1980) found that punctuality in the United States is a more prominent issue than it is in Brazil. In addition, Brazilian subjects, as compared to their counterparts in the States, are more likely to attribute lateness to external causes and much

longer intervals of time elapse before they consider someone late. In a Brazilian work setting, time may have much less of a stressor connotation associated with it. Arriving late for a meeting may not be a source for stress and, on the other hand, is not considered a reaction to stress as it does not serve, in these cultures, as either an avoidance function or a method for restoring equity.

The national culture also plays a crucial role at the other end of the model: the coping mechanisms. Coping, which I have considered a part of the mediating process, can influence the effects that stressors have on outcome variables. Countries or cultures which appreciate the fact that stressors may have deleterious effects on the individual and the organization may be more likely to introduce and support stress prevention and stress management techniques. Cartwright and Cooper (1996) feel that Europeans, for example, have not focused on this issue as much as Americans have. They discuss some of the procedures that decision-makers and political officials, often at levels beyond the organization, need to initiate in order to evaluate the relevant information concerning the effectiveness of stress management techniques and, where appropriate, begin its implementation.

National culture is not the sole extra-organizational source of work values. For example, the Protestant ethic affects work values which influence, in turn, capitalistic activities. Similarly, Coates (1987) observed that the Confucian work ethic – such as hard work, respect for time, and drive to accumulate wealth – has shaped Japanese work values. Homola *et al*. (1987) reached a similar conclusion regarding the influence of the Jewish ethic on American Jews' values, such as diligence and socio-economic achievements. When achieving the goals or aspirations characteristic of the ethnic group is frustrated or blocked, strain reaction is likely. Moreover, ethnic origin (especially for a minority such as Afro-Americans or Hispanics), political orientation (such as worker unions associated with the Socialist party), industry type (like high-tech industry), occupational group (especially among professionals with regulated ethics – for instance, lawyers or physicians), and geographical area (such as Silicon Valley) are other types of information concerning workers that may be important parts of understanding any stress process. For example, it is generally known that in Silicon Valley workers have particularly liberal rules about dress. A worker from the outside who has been assigned to a company there – or, vice versa, a Silicon Valley worker who has been sent to a more traditional firm in the East – may find the new rules as quite unsettling and, till adaptation occurs, attitude and performance may be affected.

What determines whether a given extra-organizational system (such as industry type, ethnic origin, or political orientation) will generate work values that are adopted by the members? Understanding the process of integrating these values may help to explain how potential stressors are developed. Obviously, not all of the culture and mores in the

surrounding society become essential components in an individual's work life. It is suggested here that a system which is perceived by its members as a target to identify with or an object of pride and is characterized as having consistent and relatively stable interpersonal relations is likely to be a source of work values representing obligations and entitlements of members to the system (and each other).

Once these values have been accepted and integrated by the organization, striving to achieve them becomes motivating and their frustration becomes stressful. Work values are created, adopted, and modified through different acculturation processes, such as education systems, literature, tradition, habits, common beliefs, labor laws, and government regulatory practices. The values associated with a specific system become more prominent when the situation is considered a 'weak' one so that other sources of values at the same or a higher level of analysis are not influential. Weak situations, however, allow individuals, groups, and organizations to be exposed to the system's work values (Weick 1996). Within the system, organizations (as well as groups and individuals) are assumed to be homogeneous as they resemble each other more with regards to work values than they resemble counterparts in another system. Of course, not all situations are weak ones; and often several extra-organizational sources of work values may compete, resulting in conflict between work values. Thus, the requirement to be industrious and devoted to the job or organization may conflict with raising a family, which is a critical objective in many societies. Again, as we shall see below, this conflict is a source of stress, and the individual may have to choose one goal over the other or decide to live in a perpetual stress situation with its potential negative consequences.

ENVIRONMENTAL STRESSORS

Perhaps the clearest source of outside stressor is the natural environment, whether at work or outside the workplace. Unlike cultural values, which are transmitted in a relatively subtle way, environmental stimuli are considerably more objective in that nature allows the researcher, in most cases, to measure them. As we have mentioned previously, competition, economic situation, even noise are all measures that exist independently of any worker or observer. Such data are available from government or private sources or, in a more specific case, a measuring device can be used to assess the magnitude of the stimulus.

The environment is replete with potential stimuli that may, under certain circumstances, lead to negative reactions or consequences. As with most stressors discussed in the book, mere exposure may not be adequate to stimulate a negative reaction. Rather, only when a

stimulus has exceeded some threshold value does it have the potential to become a stressor. Similar to chronic stressors discussed previously, such stimuli may have been around for a long time and gone, generally, unnoticed, but when some type of change occurs, either in the stimulus or the exposed individual, psychological, physiological, or behavioral effects begin to manifest themselves.

Several different analyses of the environment have been suggested. Sutton and Rafaeli (1987) identified two sources of physical stressors confronting each worker: intrusions from atmospheric conditions (like temperature); and intrusions from other employees (such as noise from their chatter). Using job overload as the moderator and source of stress, the authors showed that overloaded employees are more likely to concentrate on their jobs and tune out the intrusions from the environment. It appears that the external environment did not interact with overload to produce additional stressor stimulus. Nevertheless, a long list of studies has shown that the environment contains many stimuli that, under certain conditions, are liable to produce negative strain responses.

Noise

The manner in which noise affects people has been investigated in various types of work settings such as assembly lines, busy restaurants, and airports. According to one theoretical approach, noise stimulates a form of arousal that forces individuals to attend to specific features of the environment and not to others (Broadbent 1971). Performance that requires a wide range of cues may be affected, as noise often limits the individual's ability to focus attention and perform accurately or quickly. Researchers also argue that possible performance deterioration in a noisy environment is a function not only of the magnitude of the stimulus but also of its meaning, appropriateness, and degree of control. Thus, a manager who has to make a decision at work would not be affected by outside noise stimuli if the noise is in the background, if it is part of the natural environment, or is not seen as interfering with functioning. As long as it does not conflict with their exercise of control in the situation, the noise stimulus is not likely to be meaningful. It is quite common to see a worker on a factory floor who has become habituated to the various noises put out by the machinery and has learned to function quite well. As a matter of fact, the worker may find it difficult to cope with the lack of noise and is particularly sensitive to any new noise stimulus such as a machine that is not working well. (In this respect, an experience that I had describes the situation quite well. As a child and a student, I grew up in New York City and became quite accustomed to the noises of the city. Whether studying or just relaxing, there seemed to be traffic noises and the

sounds of the elevated subway in my background for most of my youth and adolescence. When I began my first job in a suburban community in Connecticut, my first impression – and, to some extent, the resultant discomfort – was of the quiet and tranquillity that surrounded me. At first, writing, sleeping, and, yes, even thinking seemed to be affected. It took quite a while before I was able to adapt and adjust to the new environment; after the adjustment, the old way seemed difficult to comprehend.)

In situations where the noise is not under the individual's control and has no particular meaning, as occurs from street noise or loud cacophonous sounds in a subway station, the stimulus may be perceived as noxious and a negative reaction is likely, often immediately. At or near airports, especially some of the older ones, travelers are often subjected to noise that seems to interfere with simply talking or just reading a book. Besides noises emanating from airplanes taking off or landing, the environment lends itself to many other related noxious stimuli. Loudspeakers barking out announcements, children running and often screaming, and the accumulated noise of many people in a small area talking and interacting are all possible stimuli that are potential stressors.

Another approach to noise that may have particular relevance for some types of work situations is the contention that only the onset of noise may be annoying and arousing, whereas continued exposure is not particularly disruptive (Poulton 1978; 1979). According to Cohen and Weinstein (1982), this may indicate that some form of adaptation takes place over time and many of the negative characteristics slowly begin to dissipate. More interesting, however, is the occurrence of intermittent noise, which is quite common in certain office settings. For example, in an open office environment, conversations among employees outside one's immediate work area can be overheard, but they occur intermittently. The employee affected by such activity is often powerless to do anything. Trying to attend to other stimuli is often not successful. Here, negative consequences have been attributed to learned helplessness (Broadbent 1971) and cognitive fatigue (Cohen 1978).

From an empirical research perspective, the noise stress literature generally consists of a series of simple univariate correlations without a real attempt at understanding an underlying stress process with multivariate causes. Israel *et al*. (1996) argue that interventions reported in the literature suffer from a similar lack of adequate conceptualization. Attempts to mitigate the negative effects of noise are, generally, local, specific solutions that do not take into account the whole organization and make little use of any form of stress model. Thus, investigators have tested many types of moderators, including personality, general annoyance, and attitudes, in an effort to prevent or control the negative influence of noise. Recognizing that the individual variables were often not adequate to explain who is and who isn't affected by the noise phenomenon, Staples (1996) argued that it is not possible to isolate

moderators from each other as they may very well interact. Furthermore, among several criticisms of the present state of affairs in noise research, Staples felt that two features of the reported studies in this area were often not adequately differentiated. First, what exactly constitutes the annoyance response (the strain reaction referred to by Staples) to noise? Is it really symptomatic of an individual's reaction to a wide range of stimuli (this may be seen as a type of negative affectivity), or is it distinctive to noise stimuli? And second, is the dissatisfaction with noise stimuli in actuality a sensitivity response, not a response to the noxious component of the stimulus?

Several findings from other contexts, particularly the laboratory, are relevant here. Tasks that require vigilance and the monitoring of stimuli in the environment (such as air traffic controllers) may be adversely affected by environmental noise. In the same vein, the cessation of the noise itself does not indicate that its effects are finished. Thus, after leaving a bus or train, a commuter's subsequent behavior at work or at home may continue to be affected by the previous exposure to noise. In contrast, studies have shown that noise which has been present for a considerable period of time and is no longer attended to loses its potential to be a noxious stimulus. For the employee exposed to a noisy environment, this finding is quite important, as it says that it is possible to 'tune out' noxious stimuli and attend only to relevant ones.

Noise and strain responses

What are some of the specific strain responses associated with noise? Studies have shown a wide range of problems typical of those discussed in the present book. In Landy's (1992) article on work design and stress in an organization, noise is seen as a potential precursor of psychological problems, as well as many other dependent variables. Much of the seminal research in this area was actually done about twenty years earlier. Anxiety, depression, and fatigue are among the psychological responses to noise, whereas job satisfaction, commitment, and job involvement are among the attitudinal responses to noise stimuli (Baron 1989). In summarizing one group of studies, Cohen and Weinstein (1982: 54) described insensitivity to the needs of others as one of the main consequences of noise. For example, Page (1977) and Sherrod and Downs (1974) reported that noise was more likely to reduce compliance to requests for verbal aid or offers of assistance. Similarly, in an often quoted study on the effects of traffic noise on residents in nearby buildings, Damon (1977) showed that people who were closer to the origins of the noise were generally found to have more asocial behavior (truancy, crimes, and so on) than those who lived farther away.

However, as the study was carried out in the field, several critical demographic variables were not controlled, making it difficult to draw precise inferences (Cohen and Weinstein 1982).

Can the effects of noise be linked to more behavioral and physical problems, too? The answer seems to be 'yes.' For example, Cohen and Weinstein (1982) have indicated that beginning at decibels above 95, noise begins to affect performance. Physical symptoms that have been associated with loud noise include common ailments (such as colds or headaches) and more serious problems such as high blood pressure and ulcers (Steffy and Jones 1990).

As the most ubiquitous of the environmental stressors, noise seems to be a source of stress that can often be overlooked in a 'stress audit' of a company. It is either a stressor that is found in the background of many work environments or it is intermittent and does not get picked up by the auditor. It seems that an accurate picture of the effects of noise may also require a self-report or a measure of perceived noise. Without this indicator, it is hard to say whether the noise that has been detected was really 'experienced' by the employee. By considering both the physical and perceptual components associated with noise (as in Figure 2.1), one can get a better idea of the direct and indirect effects of the stimulus.

Specific intervention techniques with noise stressors

Israel *et al*. (1996) discussed noise as a physical, non-ergonomic stressor that has been analyzed in several work situations. The intervention techniques have been quite focused and have been designed to implement changes in employee behavior, the environment to which the employee is exposed, and work routines. Examples of such behavioral changes in other settings with noxious environmental stimuli include getting firefighters to wear hearing protection devices (Ewigman *et al*. 1990) and building specially insulated containers for sawmill workers and using rotating shifts so as not to have a worker exposed for too long periods (Fairfax 1989). With the noise stimulus, protective devices or, when necessary, rotation between noisy tasks and non-noisy ones, a degree of relief may also be provided.

By slightly modifying the demand–control paradigm, it is possible to develop a framework for summarizing intervention strategies. The noise has increased the workload expected from the individual, and it is the degree of decision latitude or potential control over their task and conduct during the workday that will determine what wins out. With noise, to control the quality and/or quantity of the exposure is critical. The elimination of an environmental stressor is usually not possible but mitigating its effects is possible. Thus, a commuter driving past a noisy construction site may decide to roll up the windows, turn on

the air-conditioner, or just listen to a musical tape. The noise is still there but its presence has been removed or reduced from the worker's cognitive framework.

Density or crowding

The stressor density and its psychological manifestation, crowding, have been studied more in the laboratory or in artificial settings than in the organization. Epstein (1982), one of the main researchers in the field, suggests a model for understanding the problems identified with density, a physical measure of people per unit space, or crowding, gauged with self-report. In the present context, it is possible to consider the stressor variable as density and the resulting subjective experience as crowding. When other people enter into someone's proximity, activities, level of interpersonal reaction, and spatial location are all affected. If there is enough space for all and interference is not a problem, then the effect is minimal. However, if the number of people in a particular location begins to increase, competition for the available space becomes more pronounced and tasks such as reading, concentrating, even talking to a colleague are, at least, partially thwarted. This is especially apparent in a situation where others in the environment are competing for similar goals. A dense classroom where students are right next to each other may cause negative reactions such as an inability to record the lecture or pay attention, or they may even manifest physical symptoms such as excessive perspiration. In some cases, a dense environment may have a more mundane effect, too. Too many people may make it difficult to find a seat or even stand comfortably.

I myself witnessed this predicament in a classroom situation where students arrived late for a large lecture in an introductory course. The large number of students in a relatively small environment made it hard to find an empty seat. Some students were obviously uncomfortable looking for a place to sit, and one, in particular, made some hesitant movements in different directions. Seated students began to notice the uneven movements and one could begin to sense that an element of uncertainty had entered into the equation. The student who was looking to sit was not sure that there were any unclaimed seats and if there were, whether he would find one. The situation was quite embarrassing, and it was clear that many of the students who were seated were ill at ease and were trying to help the student find a seat. At the end, I asked the student how it felt to be in the situation. His response was quite interesting. Although barely two minutes had passed, he felt that it was an eternity (his words) and the students' involvement only increased the negative reaction. What is important is that the dense environment is itself a non-normal situation and those found in such a situation may not always know how best to deal with the stressors that are present.

I think one of the best ways to illustrate the effects of crowding is to examine some of the stressors in a commuting experience. For many commuters, crowding, pushing, and shoving are an integral part of their daily routine. Researchers argue that such chronic, repeated, and unwanted experiences are particularly stressful. Several irritants can be identified here, all of which make the commute uncomfortable. The violation of spatial norms that in another type of social situation would be considered unacceptable is taken for granted in the train or subway experience. Finally, crowding is a group phenomenon with inherent competition. Commuters, generally, do not cooperate with each other. Each one wants to get on the train, available seats are fought over, and reading a paper may encroach on someone else's space. Although in other contexts it has been shown that cooperation or planning together are the best means for allocating available resources, in commuting environments this is not really practical.

Other environmental variables

Of the variables typically considered as environmental, noise and crowding are probably the ones that have been studied more than any others. Nevertheless, several additional environmental stimuli have been investigated and may very well have a negative effect on the worker. For example, thermal stress (heat and cold), toxic chemicals, or pollution have been found to have a wide range of effects on humans and, in situations where the individual has little control, these effects may be magnified. With each of these stressors, physical functioning may be particularly vulnerable to the effects of the stimulus. Thus, an unheated office in the winter or one without air-conditioning in the summer may cause a person to feel so uncomfortably cold or hot that proper functioning is just not possible. Exhaustion and inability to concentrate on the work at hand are other reasonable expectations in such an environment. In the next few pages, I will try to discuss some of these stressors and examine their impact on various strain measures.

High temperatures

Generally, the body adapts to changes in the core body temperature of about 37 degrees Celsius through self-regulation procedures. If the thermo-regulatory systems fail to restore temperature to normal levels after some perturbations, there is a possibility of physiological damage, including heart damage, blood pressure increases, and muscular rigidity (Bell and Greene 1982). Among the many complicating factors which are relevant for any work situation, and particularly for a worker who spends some or all of their time outside the office,

is high humidity. An immediate impact here is perspiration, loss of water, and the general discomfort of just feeling hot. The worker who must be outside (such as meter readers, policemen, or street cleaners) will eventually show less satisfaction with their work and lower performance output as it gets more humid. A cold day may have similar effects but here the situation isn't the humidity but the need to wear warm, sometimes heavy clothing that may retard performance.

The problem with the research in the area of thermal effects on psychological and performance indicators is the inconsistent findings. At the introduction of high temperatures, some studies showed an orientation or positive arousal effect followed by stabilization or adaptation. However, as arousal intensifies, coping may become more difficult, which, in turn, is followed by performance deterioration as attention is drawn more and more to the thermal stimulus. This reasoning was used by Bell and Greene (1982) to hypothesize that an increase in aggression or other asocial behavior may result. A combination of the heat or cold stimulus with a crowded environment is a nearly perfect description of the conditions inside some subways or trains; though more and more air-conditioning is being introduced in many transportation systems, the ventilation system is often poor and can create a particularly uncomfortable feeling, especially during morning or evening rush hours in the summer. How this feeling of aggression extends over time, including the period after the cessation of extreme cold or heat stimuli, is not clear from the literature and needs to be explored. Future emphasis in this type of research may help clarify the process which leads to some of the psychological and behavioral responses observed after arrival at work or at home.

Tranquillity of the environment

Recently, aesthetic aspects of environments have been the focus of research by some environmental psychologists (Hartig *et al*. 1991; Herzog and Bosley 1992). The argument made by investigators in the field is that certain types of natural environments are associated with tranquillity, serenity, and peace. Even more so, it is possible that an environment may have restorative effects and help to reduce the strains encountered in normal or daily life activities. In particular, the use of proper colors for an office, or on a much larger scale, building a factory or headquarters near a serene setting may have quite a beneficial effect on strain and performance levels.

Although management may very well contend that beautifying or enhancing the quality of offices, perhaps through the use of an interior decorator or even by relocating, is difficult as well as costly, there are indications that many companies are doing just that. The concept is somewhat broader than just introducing a tranquil environment; the introduction of the

proper aesthetic background (such as artwork on the walls or soft, piped-in music) or the use of more natural scenery and views in designing or locating offices may have a restorative effect, too (Hartig *et al*. 1991). The research in this area indicates that people often seek out such environments to help them cope and revive fatigued attention capacity. Thus, an exhausted worker may get a boost in energy levels from such a location. It is possible for an organization near some brook or creek to encourage a walk or stroll or just some contemplative time during the workday. Another potential application may be to use scenes of mountains, fields, or forests, identified by Herzog and Bosley (1992) as tranquil stimuli, as part of the office background. Moreover, with the ubiquitous use of computers, there may be a positive gain, at little cost, in using a serene, natural scene for the so-called 'wallpaper' that appears when the computer is idle. I think it would be much more helpful than some of the active, busy backgrounds that are around today.

Air pollution and toxic fumes

Additional environmental stressors that may be relevant to several topics in this book are air pollution and toxic fumes. Pollutants in the air are well-known potential health hazards that appear to be particularly prominent in some jobs, including outdoor work and mining activities, and in certain industries, such as chemical plants. The commuter during the rush hour is also liable to be exposed to all types of substances in the air. Toxic fumes that are spewed in the air have been linked to such ailments as headaches, nausea, vertigo, and, over the long run, may be responsible, at least partially, for many chronic diseases (Evans and Jacobs 1982; Hedge *et al*. 1992; Strahilevitz *et al*. 1979).

In their comprehensive article on the social-psychological aspects of environmental psychology, Darley and Gilbert (1985) presented the view that for an organization, and perhaps for the individual, immediate gain may not always be the best course of action. Thus, profits for the company may increase temporarily when a pollutant is introduced by a large company (often in a manufacturing process), but eventually society, if not the organization itself, begins to realize that the sum of all the negative consequences to the natural surroundings, good-will, and employee health may not be worth the short-term gain. The implications for workers in such situations are quite clear. However, on the other side of the equation is the organization's responsibility to make sure that the employee is not damaged in their course of work, either physically or psychologically. A worker in a setting where there is a little choice but to continue working for the present employer (for example, an individual who has developed a unique skill) may experience quite a bit of stress knowing that the substances in the work environment are harmful and little control over their influence is available.

A lesser concern, but nevertheless a legitimate issue in many places, particularly where climatic conditions such as smog or air inversions are common, is to try to have the employees avoid going outdoors or driving an automobile. A situation can be created where not only is the worker's health temporarily impaired but also an antipathy to working in the particular environment is created. In such a case, it would seem that the employer must find a way to reduce the exposure for their employees so that normal or close to normal functioning can continue.

There is another type of job setting which may have grave implications over the long term. This is the situation where the employee does not really comprehend all the potential dangers inherent in a specific job; nevertheless, the employer, especially with the new civic and public responsibility that is part of the modern organization, has an obligation to the worker beyond just providing a job and fair pay. Good examples are occupations which involve exposure to potentially hazardous substances, such as is found among medical or health workers or in the chemical industry, especially where toxic chemicals are involved. Here, worker awareness, greater knowledge of the specific hazard, and methods to reduce exposure are effective training devices for minimizing the threat inherent in such jobs. Recent examples of such problems that have been treated with some of these suggested solutions include hospital workers exposed to ethylene oxide (Lamontagne *et al*. 1992) and construction workers exposed to lead (Holness and Nethercott 1988).

I have merely touched briefly on the issue of safety at work. Much more can be said about the topic, as hazardous conditions are a primary source for negative stimuli. Its effects are psychological and physical, with the latter being the more obvious consequences of an unsafe environment. Although some of the general model features for occupational safety– outcome links are similar to those of the stress–strain linkage formulation (Israel *et al*. 1996), the emphasis of the former is considerably more on objective rather than subjective independent and dependent variables. This book will refer to safety issues in connection with a few topics such as coping techniques, but for a more comprehensive understanding of the various stress implications in such environments, the reader is referred to the recent review article by Israel *et al*. (1996).

HOME AND FAMILY STRESSORS

Many different types of nonwork stressors can be identified. In particular, life structure changes outside of the job or organization may all cause strain reactions, often not because of the losses involved, the impact of which can be expected to dissipate over time. As discussed in a previous chapter, major life stressors such as marriage, bereavement, divorce, or breaking up with a significant other are often considered among the more significant events in a

person's life and each can be quite stressful. Loss can have an indirect impact on strain, because minor hassles become more prominent as they become more difficult to deal with. In addition, the worker who has experienced such a loss can be viewed as a victim, as it is they who must react to the stressor, and in some ways develop new modes of functioning. Of course, in a divorce or where a partner leaves, two people are actually involved and one can posit that the effects are mutual. If two workers are involved, it is likely, especially if the relationship was a meaningful one, that two parties will experience the effects of stress.

Perhaps just as important from a worker's perspective is the loss of a source of support that the significant other provided. The companion is no longer available to mitigate the effects of negative stimuli, whether from work or outside it, by serving as a source of support either emotionally (providing intimacy or attachment), instrumentally (by provision of aid or assistance), or informationally (giving advice or guidance) (Helgeson 1993). Of course, it is recognized that, in some cases – especially from a work–family conflict perspective – the loss of a significant other may reduce conflicts and remove a source of stress; some of the conflicts between home and work may indeed decrease.

On the other hand, a spouse or family can provide support to the worker. Hegelson argues that researchers consider the emotional component provided by the other party as the most essential variable. The whole process can be viewed as a succession of stages. In the first stage, a person perceives and is reassured (often by the mere presence of the significant other) by the fact that there is someone there who will help if a stressful stimulus appears on the scene. The stimulus, especially if it comes from the job, may be chronic but the emotional support is also continuous. If the stressor continues at an unabated level so that the emotional support does not provide relief, a transition phase is entered to try to deal with the stimulus using new tactics. However, this phase is also quite stressful and is characterized by confusion and doubt. When stress is already present, uncertainty can heighten strain reactions. The individual now seeks assistance or information from someone who can guide them through this difficult period. In some cases, the spouse or companion can serve this function. Often, however, an outside expert is needed. If the individual consulted is a trusted companion, not necessarily a paid expert, the instrumental and informational support provided here is no less important. Again, the loss of such an individual can also leave a person in difficult straits and its effects may be similar to that of the spouse's or companion's absence. If stress is viewed as an excess of demands over abilities (or skills) to cope, than providing a source of informational support allows the individual to meet the requirements of the situation and reduce the effects of stress.

Another way of looking at the home and work is to try to understand the link between pressures that can be expected from one source on the other. Greenhaus and Beutell (1985) recognize three types of incompatibility between the home and work dimensions. First, time

spent in one role domain may leave little time in the other domain; here guilt or a spouse can be assumed to stimulate the stressor. Second, strain experienced in one area may affect the other domain (that is, so-called 'spillover' effects can be expected). Third, behavior that is permissible in one domain is not possible in a second area; for example, a father screaming at a child who has misbehaved is not unusual, but at work this would be completely inappropriate.

Several studies testing the concept of time resources were reviewed by Burke and Greenglass (1987). For example, women who are highly involved in their work role would be expected to find more conflict with home maintenance and parental roles. It would appear that by spending too much time or effort on the job, the worker (women, in this case) will find many of the tasks associated with the home difficult to complete. It is also likely that the reverse may be true. With an individual who spends a great amount of time at home (perhaps the children are young and there is a need to care for them), then time at work may be affected. This conflict in time may manifest itself not only in actual hours lost but also in the quality of hours at work. For example, someone who has come in to work tired may find it difficult to work effectively. Here, the stressor may be the simple routine chores in a job, which are difficult to cope with if one is tired and has difficulty in concentrating.

Keita and Jones (1990) argued that the interaction between work and home is a major source of stressors for the individual. If one assumes that role ambiguity serves as an antecedent of strain response, then the dual roles of employee and husband (or wife) may indeed cause the husband (or wife) to have negative reactions. It is quite easy to conjure up a situation where the husband is expected to join the wife in a particular activity at home or at a concert. At the same time, the husband may be expected to work overtime to finish a project. If ground rules have not been set up previously, 'ambiguity' in home and work roles come to the fore and may result in strain. Where the various parties have decided the ground rules beforehand, what the situation is clarified and not likely to lead to strain. The problem may be a function of the ambiguity that exists in a given situation.

Recently, one of my students and I have looked at the concept of work– family conflict as a potential stressor. We argued that behaviors such as lateness may be influenced by the worker's resolution of the conflict in this area. As a potential response to stress, lateness can be viewed as a direct result of the stressor, or as an indirect effect through attitudinal variables such as dissatisfaction or low level of commitment to the job or organization. We speculated that the source of the conflict is the need for the worker to choose between two situations: one where the job takes the highest priority, and the other where the family responsibility does so. Often this choice process is quite difficult to make, especially if the two alternatives are equally attractive.

To test this proposition, demographic, attitudinal, and behavioral data collected from a sample of workers in a large industrial company were examined. It was hypothesized that parents whose children at home were in need of greater supervision and care (as measured by age of youngest child) were most likely to be late into work. The significant correlation supported the hypothesis; namely, the younger the child, the more often the parents were late to work. As the study's purpose was to examine some of the personality antecedents of lateness, not the effects of stressful stimuli, very little exploration of the underlying reason for the association was possible; see Bercovits and Koslowsky (1997) for more details about the study; also, lateness will be discussed in the section on behavioral responses to stress.

The following scenario is suggested for explaining the results and may be worth testing. Borrowing some of the concepts from the P–E formulation, one can posit a discrepancy score between demands of the family and those of the job. A young child in a family requires special care during the day such as a babysitter, daycare, or errands. These demands can be compared with the organization's requirement to be punctual. If the worker wants to satisfy both demands there may be, in some circumstances, a conflict that could result in stress. Here, lateness would be viewed as a by-product of such a conflict, especially if the worker has chosen the child's needs over those of the organization. To determine if there is actually stress, it may be necessary to calculate a score that measures the value of each demand. If both are valued equally, stress can be assumed, with typical strain consequences such as job dissatisfaction, and low levels of commitment leading to behavioral consequences also. This type of study would require the examination of potential paths leading from the conflict to the response.

5

STRESS ASSESSMENT INSTRUMENTS

It is considerably easier to identify potential stressors in the general case than in a particular setting. Thus, the stress researcher may know what to look for, but how does he or she actually measure the stressful stimuli? That is, what instruments are available to the practitioner and what are some of their psychometric properties? In the next few pages, several popular assessment procedures – some derived from Jones and Dubois' (1987) review of instruments – will be presented. The purpose of this section is to illustrate some of the scales that have been used with some degree of success; that is, each one was used either to describe a stressful situation or to predict other strain outcomes.

It should be made clear that in many cases the investigator will need to develop their instruments so as to gauge the specific stressors that are at play in that organization. However, as the literature in the field gets richer, there is a clear advantage to applying existing instruments. Such scales can be used for comparison purposes, and inferences drawn concerning the degree of stress in a particular setting are considerably more accurate. Also, replications, a procedure generally frowned upon in the social sciences, requires that previous instrument be applied again.

SOME SPECIFIC SCALES

Below I have listed several self-report scales that, for all intents and purposes; are subjective in nature (that is, they are completed by the worker whose level is the subject of inquiry) and have served as the independent variable, predictor, or stressor in different studies. They often exist as the only predictor scale in the study and do not have any measure of an outside stimulus, 'demographic' or description of the organization that could be used as a more or less objective indicator. It should also be pointed out that this is only a sample of scales in the literature and, indeed, there are probably hundreds more. Table 5.1 summarizes some of the important features of the scales discussed below. I have tried to choose some general scales

Table 5.1 Some commonly used stress scales

Scale	*Item characteristics*	*Number of items*	*Stress/strain confusion*
A *General scales*			
1 Social Readjustment Rating Scale	Life events	43	N
2 Home Factors Inventory	Organizational/life/health	162	Y
3 Work Environment Scale	Quality of worklife	90	N
4 Hostile Environment Inventory	Hostile behaviors	54	N
5 Job Stress Survey	Frequency/intensity of work stimuli	30	N
6 Barnett Job Experience Scale	Positive/negative job experiences	32	N
7 Occupational Stress Evaluation Grid	Individual/organizational/ sociocultural	7X3 Grid	Y
B *Specific scales*			
1 Police Stress Survey	Stressors in police environment	60	N
2 Teacher Stress Survey	Stressors in teaching	60	N
3 Teacher Stress Inventory	Stressors in teaching	49	Y

as well as some more specific ones that should meet the needs of researchers in a variety of situations.

Social Readjustment Rating Scale

Any survey, albeit brief, must include one of the earliest and most popular scales in the stress field; namely, the Social Readjustment Rating Scale (SRRS) (Holmes and Rahe 1967). The forty-three items describe potential life events that may be responsible for strain reactions. Associated with each item is a scale score that represents the difficulty in adapting to (or coping) with that particular event. The higher the score, the more difficult it was for the worker to adapt. Thus, a value of 100 was assigned to death of a spouse, and 11, the lowest value, was assigned to minor violations of the law. Over the course of a year, scores on the major life events experienced by the individual would be accumulated and, if they exceeded certain values, implications would be drawn. For example, a value of 300 indicated a major life crisis was imminent or already present and negative consequences or costs would ensue.

Although the rationale for the scale was quite revolutionary at the time it was first introduced, it suffered from several shortcomings which have been examined empirically and reviewed critically by several investigators (Brett 1982; Kahn and Byosiere 1991). For example, the value for each item in the scale was determined by examining health records and charts which showed how frequently specific psycho-social factors or stressors were present when individuals experienced certain illnesses or ailments. The more frequently a stressor–ailment combination was observed, the higher the value assigned to the stressor. Nevertheless, the assumption that the stressor–strain link occurs in only one direction was not shown, and it could very well be that an individual suffering from strain may be more vulnerable to some of the stressors that appear in the Holmes and Rahe scale.

In Brett's (1982) study of the effects of job transfer on the individual, the author expected that workers who change jobs more frequently would have a higher level of job dissatisfaction (a strain measure). Job transfer is associated with many different types of items in the Holmes and Rahe study, such as change in responsibilities at work (value of 29), change in work hours or conditions (value of 20), and change in social activities (value of 18). Nevertheless, when compared with a group that did not undergo job transfers, no significant differences in job dissatisfaction were observed.

Over the years, several attempts either to focus on specific aspects of the Holmes and Rahe scale or to improve on it have been attempted. For example, Naismith (1975) developed a scale that dealt only with the work environment, whereas Dohrenwend *et al*. (1982) tried through the use of the PERI Life Event List to answer some of the criticisms leveled against the original instrument. My evaluation of scales that focus on life or work events is that they have some interesting features, not the least of which is their face validity, but the trend today of using mutidimensional scales should be preferred. These latter scales often do not follow just one line of theoretical research, are more eclectic, and probably have a better chance of predicting various strain measures. Also, the general nature of the scale has some disadvantages as it does not consider job-specific stressors. Among the instruments that will be discussed below are several very specific ones that were designed to measure stress in only one area, such as among policemen or teachers. Such scales do not purport to be generalizable and, if developed properly, may very well gauge stressors in one specific occupation or environment better than a general stress instrument.

Human Factors Inventory (HFI)

Jones and Dubois (1987) discussed the next two scales listed below in some detail. The Human Factors Inventory (HFI) is a 162-item survey that assesses various aspects of occupational stress (Jones 1983; Jones and Dubois 1987). It contains six scales: job stress, job dissatisfaction, organizational stress, stressful life events, life and health risks, and accident

risks. The reported reliabilities are quite high (the upper .80s to the low .90s). As the scale has been examined on considerably more than 100,000 people, it has quite an extensive series of norms. A brief description of the scales, as presented by Jones and Dubois (1987), follows:

1 *Job stress:* It examines stress from the individual level in such areas as frustration, boredom, irritability, nervousness, and burnout. Physical signs include headaches, stomach upsets, backaches, chest pains, and so on. Examples of items are: 'I experience too much pressure on the job' and 'I feel burned out from my job'.
2 *Job dissatisfaction:* Affective evaluation in areas such as job, pay, promotional opportunities, and co-worker relationships is obtained. Examples of items include: ' I am satisfied with my job' and 'I am paid adequately for my job'.
3 *Organizational stress:* This scale assesses the employee's perceptions of organizational stress in areas such as poor productivity, interpersonal conflicts, and departmental tensions. Sample items include: 'The staff turnover is high' or 'My department is understaffed'.
4 *Stressful life changes:* The scale measures the amount of stressful life changes in the past twelve months. Changes include such events as taking on debt, an illness, injury, or death of a loved one.
5 *Life and health risks:* This scale measures lifestyle and health habits that increase the risk of unnecessary injuries, illness or premature death. Examples of such items include: 'I get a thorough physical examination each year' and 'I get approximately eight hours sleep at least four nights a week'.
6 *Accident risks:* Four human factors that contribute to the increased likelihood of an accident occurring are inability to cope, poor safety attitudes, tendency to worry about job performance, inability to manage time. Sample items include: 'Are you always safety conscious?' or ' Do you feel fatigued during the workday?'

In addition to these scales, the HFI contains two specialty scales: the technostress scale and the distortion scale. The first scale is used for obtaining a measure of stress that is related to the video display terminals (VDTs) that have been associated with various health hazards. Sample items include: 'Do you get headaches from VDT use?' and 'Do your eyes become irritated and fatigued from VDT use?' The second scale identifies the percentage of employees who are truthful with their responses by categorizing certain responses as either faking good or faking bad.

The HFI takes about thirty minutes to complete. By administering the scale to all employees in a company two types of information can be analyzed. The personnel manager can obtain absolute values on the scales and compare the findings with norms that have been

developed from other companies. It is also possible to compare departments within a firm to determine which are the most stressful, and by analyzing items on the scale it may be possible to access the specific stressors. Of course, this latter type of information is much more difficult to ascertain as it may result from just a few items. Nevertheless, it is likely that the researcher has been provided some clues even from just a few items.

Although there are obvious advantages in the use of the HFI in an organizational environment, there is one particular overriding problem that may actually cause some confusion here. The issue that is problematic is the lack of a distinction between stressor variables, perceptions, and strain responses. For example, the organizational stress subscale examines the perceptions of stress in the organization, whereas job dissatisfaction is a strain indicator. Indeed, the job stress subscale also has items that sound more like outcomes than stimuli. As will be discussed later, it is clear that a burnout item, such as 'I feel burned out on my job', is one of the more common strain measures. As an overall measure of 'stress' in an organization (regardless of whether it is a stimulus or a response variable), the scale is quite sensitive. However, if the researcher wants to know which specific stimuli are having a negative reaction on workers, then it may be necessary to make distinctions among subscales, and often within subscales also.

Work Environment Scale (WES)

The Work Environment Scale (WES) was developed by Moos (1981). It was designed to assess the quality of worklife and stress levels in different parts of the organization. There are ten subscales consisting of ninety items in total. Test–retest reliabilities are quite good and norms are available from several thousand subjects. It is a relatively pure measure of stress stimuli. The ten subscales are the following – The definitions for the scales below are derived from Jones and Dubois (1987):

1 *Involvement:* the extent to which employees are concerned about and committed to their jobs.
2 *Peer cohesion:* the extent to which employees are friendly and supportive of one another.
3 *Supervisor support:* the extent to which management is supportive of employees and encourages employees to be supportive of one another.
4 *Autonomy:* the extent to which employees are encouraged to be self-sufficient and to make their own decisions.
5 *Task orientation:* the degree of emphasis on good planning, efficiency, and getting the job done.

6 *Work pressure:* the degree to which the pressure of work and time urgency dominate the job milieu.
7 *Clarity:* the extent to which employees know what to expect in their daily routine and how explicitly rules and policies are communicated.
8 *Control:* the extent to which management uses rules and pressures to keep employees under control.
9 *Innovation:* the degree of emphasis on variety and change.
10 *Physical comfort:* the extent to which the work environment contributes to a physical environment.

The Hostile Environment Inventory (HEI)

The HEI is a recent development and is concerned with stress as a function of racial and gender bias. As was discussed briefly under the heading 'Subjective stressors' on p. 35, the scale by Fisher *et al*. (1995) can be described as a good example of a 'pure' measure of the independent variable. The inventory consists of fifty-four items. Respondents are asked to 'indicate the likelihood of the following behaviors having occurred during the past year'. The behaviors depicted by the items could be described as hostile towards a particular race, religion, gender, national origin, or age group. From the individual items, the authors were able to extract nine scales (number of items, coefficient alpha reliabilities in parentheses): over the hill and out (5, .89), religious sensitivity (4, .72), made in the USA (3, .84), racism (14, .95), social cliquishness (3, .74), minority misbehavior (3, .74), woman as interloper (7, .92), woman as servant (8, .90), and woman as sex object (5, .84). Generally, the relatively high reliabilities of the scale attest to its psychometric soundness. If shown to predict strain response, the test may very well be able to identify which factor or factors are likely to impact negatively on the worker.

The Job Stress Survey

One of the newer scales in the field, the Spielberger Job Stress Survey (JSS) was developed to deal with several of the measurement issues raised by previous scales in the literature, including several of those mentioned above (Spielberger 1994; Spielberger and Reheiser 1994). According to Spielberger and Reheiser, the purpose of a stress scale should be, as much as possible, to assess the stimulus, antecedent, or predictor variable and not the dependent or outcome variable. Using the accepted definition in the field today (a convention that is more often violated than followed), the former is the stressor and the latter is the strain indicator. Besides the usual rating of responses to each item, the JSS has also incorporated another issue,

frequency of the stressor, which is similar to the conceptual distinction Spielberger (1972) made between state and trait anxiety. (A somewhat similar premise was used by Barone *et al*. (1988) in their Work Stress Inventory, another instrument with some very positive psychometric properties.)

The JSS contains thirty items or stressors (for example, 'excessive paper-work', 'working overtime'), which subjects are asked to rate on a nine-point scale. The subject is not asked to give an absolute rating but rather is required to compare each item to a standard stressor event, 'assignment of disagreeable duties'. In previous research, this last item was found to be close to the middle in a range of stress severity. In addition, subjects provide a frequency response to each item. They assign a score from 0 to 9 + days to each question. Two total scores are obtained: overall severity and frequency. Two factors, each consisting of ten items, were extracted by Spielberger (1994). For each of the subscales, job pressure and organizational support, a severity and frequency score are also obtained.

As the scale is purportedly a 'pure' measure of stress, it is particularly important to perform criterion or construct validity determinations. Turnage and Spielberger (1991) reported on one of these; in a study of stress levels for managerial, professional, and clerical personnel, the authors expected that the higher occupational levels would experience more stress. Overall, the results were consistent with expectations. Professionals had the highest intensity of job pressures. The managers reported experiencing job pressures more frequently than the professionals, who, in turn, reported more frequent job pressures than the clerical workers.

More studies are needed with this scale. Indeed, the distinctions I have made in my model, where I have tried to differentiate clearly between stressors and reactions to them, is consistent with the Spielberger approach. Nevertheless, there is still a problem even with this approach. The model requires both an objective and subjective evaluation of stress, as it is possible that there is either a direct effect or an indirect objective impact. Now, Spielberger does try to obtain as much information as possible about the stressor through the intensity and frequency indices; yet it is a subjective evaluation. What is required here is an objective assessment, or, at least, a scale completed by someone other than the participant in order to obtain a relatively unbiased estimate of the external stressor.

The Police Stress Survey and the Teacher Stress Survey

Two instruments that are consistent with the JSS approach are the Police Stress Survey (PSS) and the Teacher Stress Survey (TSS). As was noted earlier, these are popular occupations in the field of stress research. Each one of the scales contains items geared to measure specific stressors associated with the different jobs, a goal that Jackson and Schuler (1985) lauded as necessary in stress research. As described by Spielberger and Reheiser (1994), the PSS

contains sixty items that focus on potential stressors which law enforcement officers can expect in their jobs. As with the JSS, the PSS also gauges the perceived severity and frequency of occurrence of the items.

Murphy and Hurrell (1987) as well as Spielberger and Reheiser (1994) argued for an overlap in a core of items across different scales so as to enable comparisons among occupations. This type of design was used by Grier (1982) in the case of police officers and teachers. Of the sixty items on the PSS, thirty-nine of them also appear on the TSS; the only modification was substituting teacher and school for police and department. The remaining items were identified as particularly relevant for teachers (Grier 1982).

In summarizing the different scales, I find the approach of Spielberger and colleagues to be particularly useful and one of the hopes for continued advancement in the field. By encouraging the development of scales that differentiate between stress stimulus and strain response, a clearer picture of the links between the two types of variables can be obtained. Also their scale design allows for more insight into stressors for a particular field; in particular, such an approach allows for making more informed decisions about the stressors that may need to be dealt with inside a company. Let us take an example of a firm that supports various functions. Here, management can begin to make some informed decision about the stressors within the firm. There may be some common perceived stressors (such as pay inadequacy) across the entire company where intervention at the corporate level is required. Other stressors may be more local (like role stress) and require managers to be creative and find unique solutions for each set of circumstances. A scale that is able to identify common as well as unique stressors within the organization should prove particularly useful in research and practice.

The Teacher Stress Inventory (TSI)

Another stress scale for teachers, the TSI, developed by Fimian and Fasteneau (1990), really does not introduce anything new conceptually and has mixed the two types of items, stressors and strain reactions, in one scale. This is not to say there aren't teacher-related stressors that are unique and differ from other areas of work, but the TSI has little new in it conceptually. To its credit, the development sample consisted of more than 3,400 subjects and the authors have obtained clear and distinct factors. If used judiciously, the TSI can provide the researcher with data on both the independent and dependent variable. The user can make a decision whether to use one or both types of variables. The final version of the TSI consists of forty-nine items. The respondent is asked to react to each item on a scale from 1 ('not noticeable') to 5 ('noticeable'). A total of ten factors were extracted (number of items, coefficient alphas in

parentheses): professional investment (4, .75), behavioral manifestation (4, .82), time management (8, .83), discipline and motivation (6, .86), emotional manifestation (5, .87), work-related stressors (6, .80), gastronomical manifestation (3, .88), cardiovascular manifestation (3, .78), fatigue manifestation (5, .82), and professional distress (5, .82). It is quite obvious that some of the factors, especially the last four, refer more to strain reactions than to independent variables. Nevertheless, the work-related factor (such as 'little time to prepare', 'caseload/class too big', and 'too much administrative work') and time management (for example, 'have little time to relax', 'rush in my speech', and 'easily over commit myself') are stress variables that may help predict some of the other factors or dependent variables not included in the scale.

Barnett Job Experience Scale (BJES)

The Barnett Job Experience Scale (BJES) was derived from a list of sixty items assessing positive and negative job experiences (Barnett *et al*. 1993; Barnett and Brennan 1995). Using two judges, thirty-two of the items were assigned to seven subscales, where each one of the latter represented a relevant construct in the literature. With perfect agreement, the judges found that items fell into the following subscales: skill discretion ('challenging or stimulating work'), decision authority ('having the authority you need to get your job done'), schedule control ('being able to set your own schedule'), job demands ('having too much to do'), pay adequacy ('making good money compared to other people in the field'), job security ('lack of job security'), and relations with supervisor ('your supervisor's respect for your abilities'). The original scale consists of four-point Likert items (1 = 'not all' to 4 = 'extremely'), which indicate to what extent, if at all, each of the experiences described in the items were rewarding or of concern in their job.

It is interesting to note that each of the categories identified by Barnett *et al*. (1993) have been previously discussed in the book, sometimes under slightly different names. Some of the constructs are also part of theories that were described in detail and appear, in some form, as the basis for a large proportion of the literature in the field of (for instance, demands and control). It is for these reasons that I found these subscales particularly useful for researchers in the field who are interested in testing or applying one of the models.

The authors followed the judgmental development of the scales with a factor analysis, and five of the factors (skill discretion, schedule control, pay adequacy, job security, and relations with supervisor) emerged again (Barnett and Brennan 1995). Items from the remaining two factors, decision authority and job demands, overlapped to such an extent that the researchers could not distinguish between them. In the 1995 study, the authors decided to use the seven-

construct scale as part of the independent variable and determined that just skill discretion and job demands were significant coefficients in a structural equation model predicting psychological distress. Although the distress outcome measure covered a wide range of nonwork components, the two work-related constructs were able to explain 23 per cent of the outcome variance. Indeed, this compares favorably with many other stress studies and argues in favor of the BJES questionnaire. Of course, some of this overlap may be the result of the common method variance resulting from the exclusive use of self-report scales.

Occupational Stress Evaluation Grid

The Occupational Stress Evaluation Grid (OSEG) takes a completely different approach from all the other scales mentioned previously, as it tries to customize the stress instrument and make it both relevant and accepted by the specific organization that is the target for assessment. As presented by Singer *et al*. (1987), organizational stress is an intricate concept that needs a comprehensive perspective in order to best gauge its dimensions within a particular setting. Accordingly, definitions of the stressor that emanate either from management or from labor are liable to be biased and not represent or pinpoint the actual stimulus. Instead, a collaborative effort that brings the corporation and the union together is preferred. Singer *et al*. have devised a process that includes a 7×3 matrix where the rows represent seven stress levels (physical, biological, psychological, interpersonal, work setting, organizational, and sociocultural). The three columns refer to specific stressors at each level and two types of interventions relevant at each level, formal and informal ones.

The authors have an elaborate system for completing this matrix that involves a step-by-step program of meetings and consultation sessions with management and the unions. Briefly, the items to be used in a survey of workers' stress involve input from each work unit within the organization. This is quite important; in order to make the items as relevant as possible one must interview representatives of specific workers who will be asked to fill out the final instrument. For each of the seven categories, a subscale consisting of highly related items is formed. It is this subscale that will be used in stress surveys and may vary from organization to organization. I have used the term 'may' rather than 'will' because the investigators sometimes indicate that the use of a standardized instrument, particularly for the strain indicator, is appropriate. Work experiences are gathered from all sides in the organization, items are formulated (relevant for each of the stress levels), trial surveys are administered, and feedback to work-unit representatives is provided so as to verify the appropriateness of the items and to obtain their approval. Except for some word changes, the researchers at this

stage are able to write up their final version of the scale. A much more detailed presentation of the whole process is delineated in the article by Singer *et al*.

The entire process was tested in a hotel setting with approximately 200 employees who were performing various functions in a highly unionized environment. Although they encountered some obstacles with the union representatives, the researchers did make some good and useful contacts with them. However, management refused to cooperate with the project and to an extent hindered the administration of the final survey. This is not uncommon in organizational research, and I can attest to many studies where little or nothing was accomplished because of the difficulty or down-right failure to get the approval of one of the managers or executives in the personnel or human resources department.

According to Singer *et al*., this last issue is problematic as it violates one of the major tenets of scale development. Nevertheless, it was possible to conduct the survey in the hotel and some interesting findings were obtained. As the data were collected during a time of sensitive negotiations with management, the authors hypothesized that the most significant predictors of positive and negative emotions, specific subscales obtained from the test development with the workers, were the subscales 'satisfaction with management policies' and 'dissatisfaction with management practices'. The former variables served as the strain measures and the latter as the stressors.

An overall evaluation is quite difficult and it seems more appropriate to assess these components individually. First of all, the instrument has included many of the features that have been discussed previously in this book. Stressors have varied sources and not all of them are relevant in each case. Without carefully drawn differential hypotheses, it will be difficult if not impossible to arrive at meaningful conclusions concerning the stress–strain link. By being in constant touch with the workers and the unions in the hotel setting, Singer *et al*. were able to test specific hypotheses concerning the stressors that were present at the time of the study. This is also consistent with the concept of trying to 'customize' stressors before doing a survey. In addition, the authors explicitly list organizational and sociocultural factors separately from the individual ones. Although some of the terms used may vary, this is quite consistent with the model.

A criticism that can be lodged against the scale is the intermingling or mixing of stressors and strain measures. The authors are clearly aware of the distinction between the two types of variables, as attested by their hypotheses and analysis, but by including both types in one scale, several problems arise. Common method variance is one issue that is not clearly dealt with if the stress and strain are derived from the same self-report scale. Similarly, the types of strain covered here, psychological and physiological, do not include some of the more objective scales such as performance and withdrawal. It is for this reason that I reiterate the

need to separate the data-gathering for the stress measure from that for the strain measure. Each involves different processes, and combining them only tends to confuse the true links that may exist.

Some other scales

The literature is replete with more scales for measuring stress. Some were developed by the researcher for the specific study and have not been used again. Others suffer from extensive stress/strain confounding so that it is difficult to tease out one from the other. Nevertheless, it is worth identifying some of the more promising ones so as to allow future researchers better to identify the scale that best fits their needs. One of the scales with particularly positive features is the Quick-Scan Stress Test (QSST) (Radmacher and Sheridan 1995; Sheridan and Smith 1987), a twenty-seven-item checklist of stressors, based on the Karasek and Theorell (1990) model. In the development of the scale and a study for confirming its construct validity, the authors identified six factors: demand (for instance, 'having too much to do'), control (such as 'control of access to positions and rewards'), family conflicts (like 'experiencing a great deal of family friction'), lack of skill discretion and task identity (for example 'having to do jobs you cannot cope with'), lack of environmental control (like 'experiencing a high level of noise at work or at home'), and job strain outcomes (such as 'not having the opportunity to see friends socially'). As I have mentioned before in evaluating other instruments in the literature, the last of the subscales is actually a strain indicator. However, the QSST was quite successful in differentiating among occupations according to the Karasek and Theorell model.

Another scale that used the concept that it is critical to view stress as a multidimensional phenomenon is the Vitaliano *et al*. (1993) Dimensions of Stress Scale (DSS). The authors devised a twenty-four-item instrument that can be divided into six subscales: control (such as 'I believe my problem is controllable'), salience (for example, 'My problem is very important to me'), novelty (like 'I am quite familiar with these kinds of problems'), duration (for instance, 'I believe my problem is only temporary'), causality (as, 'My actions have contributed to my problem'), and predictability (like 'I know the course my problem will follow'). Using several different samples, the investigators found that, in general, the hypothesized factor structure was observed. Finally, the authors reported that construct validity was also adequate.

Self-report scales such as the DSS and the JSS are the types of measures that may very well help to establish the quality and magnitude of links between stress and strain in the future. Nevertheless, they are only part of the picture and, as presented in the last two chapters, clear

and objective measures of stress must also be identified and used in modeling the process. In the next chapter, some of the commonly used strain measures in the field will be discussed.

In summary, I have listed only a fraction of the scales that have been tested. Many stress instruments are short ones that are either designed for a specific purpose or follow a theoretical approach; for example, the demand–strain model has spawned several useful indices. I have tried to select scales that represent different measuring approaches rather than theoretical ones. For the latter, the interested reader can consult any study that is designed to examine a part of a theory or guides for helping in identifying specific stressors (Cooper *et al*. 1988). My preferences are for eclectic instruments, but there is no question that the theory-based ones have their place in stress–strain modeling.

6

PSYCHOLOGICAL AND PHYSIOLOGICAL REACTIONS

Psychological strain is part of life and it is difficult not to experience some form of it in the course of daily experiences. It can occur on the way to work (perhaps as frustration during a traffic jam on the main highway), at work (such as dissatisfaction with the lack of a promotion), at home (like depressive symptoms from the loss of a spouse), and even during leisure time (for example, anger at threatening clouds on the first day of vacation). In each of these cases, as well as many other similar reactions that can be easily conjured up by the reader, the individual is expressing some type of psychological or emotional reaction. The appearance of these responses does not preclude physiological or behavioral effects, which will be discussed later in the book, but it is likely that some type of psychological reaction will be present even if other types of strain effects are observed.

In a brief review of the literature, Barnett and Brennan (1995) found that the major variables that have been analyzed in stress–strain linkage models are job satisfaction, anxiety, depression, and scores on scales of specific and general psychological symptoms. One behavioral type variable, substance abuse, was listed. As we shall see, there are many other measures that the authors have not included, such as burnout, physiological symptoms, and behavior/performance measures. Indeed, Kahn and Byosiere (1991) identified forty-three different terms that could be considered as psychological strain reactions in the literature. Many of them actually overlap (for instance, tedium and boredom). The message is clear: although it may be hard to say which effects are real and which are not, stress definitely has an impact on the individual's psychological and emotional state.

Psychological reactions are similar to physiological ones in that they frequently represent immediate or intermediate outcomes rather ultimate ones. Researchers are often content with just measuring the psychological reaction. As a matter of fact, a large number of studies have focused on just one psychological strain measure, job satisfaction (Sullivan and Bhagat 1992). This state of affairs has several potential pitfalls. If the stressor in a particular study

was also determined with a self-report scale, then the problem of common method variance may distort findings, resulting in exaggerated correlations between the independent and dependent variable.

In other studies, it may be quite difficult to obtain any objective measure and, if the psychological response is available, then it may still provide useful information. Thus, if it is known that an attitudinal measure and a specific type of withdrawal behavior are related, then it may be worthwhile using the former in a stress study. Other things being equal (of course, that assumption is violated nearly as frequently as it is observed), a high stress– attitude correlation could be indicative of a possible withdrawal or performance decrement at some later time. Finally, one group of researchers (Shore *et al*. 1990) recommend attitudes rather than behaviors as the appropriate dependent variable because behavior (such as lateness) is often influenced by outside variables (like, a snow storm or a traffic accident) not in the worker's control, whereas intentions are exclusively in the complete control of the employee. Although there is some merit in this argument, I would still try to obtain, if at all possible, behavioral measures. In order for an organization to obtain a measurable gauge of the effects of stress, the latter measures are crucial. They will be discussed later in the book.

As we saw in our previous discussions of this question, this is frequently the only psychological variable that is actually appropriate. While this may be recognized as true, a study may provide a better clue to the stress–strain link, if the stressor is obtained from a source outside the individual whose strain response is being analyzed. Unfortunately, most of the psychological outcomes are measured by questioning the subject or worker exposed to stress (see Table 6.1). Furthermore, distortion of the actual effect of the stressor may occur if an immediate emotional indicator such as anxiety or anger is used in the study. For example, psychological responses such as nervousness preceding a first date, apprehension before

Table 6.1 Psychological strain outcomes and relevant instruments

Psychological strain	*Instruments*
1 Attitudes	
(a) Job satisfaction	JDI; MSQ
(b) Organizational commitment	Porter *et al*. scale
(c) Job involvement	Allen and Mayer scale
	Kanungo scale
2 Self-esteem	Rosenberg scale
3 Burnout	Maslach Burnout Inventory
4 General well-being	GHQ; SCL-90
5 Depression/other emotional symptoms	Zung scale, SCL-90

Psychological strain	*Instruments*
6 Social affiliation	Experimentally determined

a particularly difficult interview or before making an important decision, or the embarrassment at being rejected or insulted by a boyfriend (or girlfriend) or manager at work do not really describe the whole picture. As can be seen in some of the above-cited examples, the overall situation may be positive or the desirable consequences can occur at a later stage of the process. Overall, whether positive or negative consequences are eventually observed, psychological responses, as an intermediary stage in a stress–strain link formulation, is the rule rather than the exception in many, if not most, stress situations (Koslowsky *et al*. 1995).

ATTITUDES AS PSYCHOLOGICAL STRAIN

Besides the typical emotional and mental health consequences such as burnout and higher psychiatric morbidity, the concept of psychological strain, as discussed here, includes attitudinal indicators that have been used in the industrial/organizational psychological literature. Probably the two most popular ones are job satisfaction and organizational commitment. Although much of the research on the relationship between stress and attitudes focuses on the influence of the former on the latter, the causal link between them remains somewhat ambiguous (Curry *et al*. 1986). The direction assumed in this chapter is the usual one, but the discussion does not preclude a bidirectional process.

Some of the findings on the relationship between stress and strain are quite informative in helping us to understand the dynamics in predicting attitudes from stressors. It appears that attitudes may not respond as quickly or as directly to a stress intervention technique as compared to other types of emotional or psychological responses. In a study on changes caused by intervention, Cooper and Sadri (1991) found that after stress counseling workers showed decreases in anxiety, somatic anxiety, and depression, and increases in self-esteem but no change in job satisfaction and organizational commitment. This finding is consistent with the notion that specific types of strain that are directly related to the independent variable (such as anger directed at a manager's decision not to promote the employee) are more likely to change as a result of an actual change in the stressor or its appraisal by the worker. In contrast, job satisfaction and organizational commitment are much more general concepts and, although often influenced by stress, are also influenced by a host of other factors whose impact on attitudes can be expected to be much greater.

Job satisfaction

Both empirical and meta-analytic studies have reported that a negative relationship exists between stress and job satisfaction (Fisher and Gitelson 1983; Miles and Petty 1975). Others have been interested in the implications of this relationship for the organization (Kemery *et al*. 1985; Roznowski and Hanisch 1990). For example, do dissatisfied workers manifest more withdrawal behaviors (such as absence or turnover) than their satisfied counterparts? The empirical evidence seems to indicate that job satisfaction acts as a mediator between stress and withdrawal. This relationship is in addition to a potential direct effect of stress on withdrawal measures – for example, see Hendrix *et al*. (1985). Theoretically, there are few withdrawal models that do not include job satisfaction as an important element or link between individual difference variables and outcome (Hom and Griffeth 1995; Rhodes and Steers 1990; Steers and Rhodes 1978). In summarizing the various empirical and theoretical papers on the topic, Rosse and Noel (1996) suggested that the hypothesized negative relationship (between satisfaction and withdrawal) has generally been found. However, the association may be weaker than originally thought and by redirecting emphasis to satisfaction antecedents (for instance, such as stress), investigators may help to increase their prediction accuracy.

Conceptually, the link between various antecedents and job satisfaction can be understood as a cognitive process wherein the individual reports on judgments about the favorability of the work environment (Motowidlo 1996). As workers integrate their experiences at work, they begin to plan an appropriate reaction. A reaction such as job satisfaction is a function of how favorably the environment is evaluated. According to Motowidlo, favorability evaluations require judgments concerning 'how good or bad, how positive or negative, how likable and unlikable the work environment is' (p. 177). If stressors that make the worker feel uncomfortable are present, the environment can very well be evaluated as bad or negative and the worker will report low job satisfaction.

In order to make these judgments of favorability (or unfavorability), the worker retrieves events from memory. Accordingly, the type of stressors can have differential effects. Acute stressors which occurred sometime in the past (such as intermittent noise) may not produce as much dissatisfaction as a constant stressor (like work overload or monotony). Nevertheless, magnitude and intensity would be expected to influence the reactions to stress, regardless of the type of stressor acting on the individual.

Measures of job satisfaction

The scales commonly used for assessing satisfaction include the Job Descriptive Index (JDI) (Smith *et al*. 1969) or the Minnesota Satisfaction Questionnaire (MSQ) (Weiss *et al*. 1967)

and its shortened version (Arvey *et al*. 1989). I have had some success with the shortened version of the MSQ, which consists of twenty items, such as 'the evaluation for good work' and 'the work is secure and there is no concern about being laid off'. Respondents indicate next to each item the extent to which they are satisfied with the content of the item on a scale ranging from 1 ('very dissatisfied') to 5 ('very satisfied') and the sum of responses to the items forms the job satisfaction score. Internal, external, and overall satisfaction factors can be calculated. The researcher may choose one of them or use all three in a particular study. In a most interesting investigation that used the MSQ as the measure of satisfaction, findings showed that satisfaction may also have some heritable components (Arvey *et al*. 1989). If true, the place of satisfaction may also be in the beginning of the model, similar to personality, and not only as an outcome measure.

Probably the most popular measure of satisfaction is the JDI, which, according to Landy (1985), is easy for workers to use and understand, and has been shown to be empirically and psychometrically sound (Blau 1985; Hanisch and Hulin 1990). As this scale appears in so many studies in I/O psychology, it may be worthwhile to describe it in some detail. The version that usually appears in the literature contains items in five areas: work ('fascinating, complex'), supervision ('hard to please, stubborn'), pay ('fair, less than I deserve'), promotions ('promotion on ability'), and co-workers ('stimulating'). Using (Y)es, N(o), or ? as a response, subjects are asked to indicate whether each of the adjectives listed does or does not describe some aspect of their work.

The JDI scale has been analyzed with many personality, demographic, and behavioral characteristics over the years. Although it is generally used as a dependent variable in these studies, the cross-sectional research design that is often reported in the literature does not allow for more than a statement about the 'correlates' of job satisfaction. The introduction of techniques such as structural equation modeling accompanied by longitudinal designs has allowed investigators to draw causal inferences concerning the antecedents and consequences of job satisfaction (for example, Curry *et al*. 1986). Landy (1985) has argued that the fact that the JDI taps several areas makes it a very useful instrument. For stress researchers, it may provide information concerning stress –strain relationships in some areas and not in others.

Nevertheless, the JDI is a general measure of satisfaction and in some cases the stressors are quite specific. Recently, Carlopio (1996) suggested a new type of satisfaction measure, the so-called Physical Work Environment Satisfaction Questionnaire (PWESQ). Its items are considerably more focused and it tries to assess a person's satisfaction with several elements in the physical environment: design of the physical environment (lighting, air, and so on);

plant facilities (toilets, recreation areas, and so forth); work and system characteristics (work pace and information availability); equipment design (such as machines and materials); and health and safety (like training and hazard exposure). The scale consists of thirty-seven items and asks the respondent to what extent they are satisfied with that aspect of the job. In Carlopio's study, the author showed that the scale has construct validity, and in a structural equation analysis using the MSQ, JDI, and PWESQ, the latent (underlying) factor consisting of the last three scales was found to be a predictor of commitment which in turn predicted turnover intentions.

The new scale has many positive features that will help in complementing the JDI in future prediction models. Furthermore, as a measure in the present model, it has both stress and strain concepts interwoven within it. For example, the subject is asked about satisfaction with lighting in the company, a potential stressor. The degree of satisfaction is a strain measure and the lighting stimulus is a stressor. One way of using the scale efficiently would be to ask subjects about the presence (either as a yes/no item or how frequently it is a problem) of a specific physical environmental feature. This would then serve as a stressor stimulus for the satisfaction scale as originally formulated by Carlopio.

Organizational commitment

Organizational commitment usually involves some aspect of loyalty to the employer; often, the stressors here originate at levels other than the individual. For example, if an employer has decided to change some work conditions, such as introducing robots or other mechanical devices, the threatened employee may react negatively with a decrease in commitment. In general, the association between stress and organizational commitment is similar to that of stress and job satisfaction. As the stress becomes more intense or lasts longer, an individual's commitment to the organization would also start to decrease. As to the cause–effect relationship between organizational commitment and job satisfaction, research has not indicated a particular direction. It is likely that a reciprocal relationship exists with a change in one of the attitudes affecting the other one (James and Tetrick 1986). Thus, for an organizational stressor that may first affect commitment and where commitment continues to decrease, it is difficult to imagine a scenario where satisfaction will stay at the same level. Similarly, an individual stressor that elicits dissatisfaction with the job will eventually loosen the individual's ties to the organization.

Measuring organizational commitment

Probably the most popular description of the concept is characterized by three main factors: (1) a strong belief in and acceptance of the organization's goals and values; (2) a willingness to exert considerable effort on behalf of the organization; and (3) a definite desire to maintain organizational membership (OCS; Porter *et al*. 1974). The OCS consists of fifteen items such as 'I am proud to tell others that I work in his organization' and 'I think that my values and the organization's values are very similar'. For each item, respondents must indicate the degree to which it is true for themselves. Alternatives range from 1 ('very untrue') to 7 ('very true'). Internal consistency of the scale is relatively high, indicating that the items have high overlap even if they are assigned to different categories. An average score across all items is obtained for each subject. A shortened version with nine items is also available (Cook *et al*. 1981).

Recently, a new perspective of commitment was suggested that divides the concept into the following three more general components: rational, normative, or continuance components of commitment (see, for example, Allen and Meyer 1990; Dunham *et al*. 1994). Although the first psychometric and validity evidence concerning the new scale is quite promising, it awaits some further testing before it can be recommended as the scale of choice, especially as the scale of Porter *et al*. has such a vast array of findings to back it up.

Other attitudinal measures

Besides job satisfaction and organizational commitment, investigators have suggested job involvement as an independent measure of worker attitudes (Brown 1996; Kanungo 1982). The ten-item Kanungo scale uses as a basis the fact that employees psychologically identify with the job and that they are concerned with the tasks they perform. As stress increases, it is expected that it will push workers to decrease their involvement with the present job.

In some ways, job involvement is similar to organizational commitment, as individuals high on both would be likely to behave in the same way. Although this relationship can be expected in many cases, the scales are tapping different attitudes. Organizational commitment, unlike job involvement, refers to one's relationship with the organization rather than the job. Thus, it is possible to be high on one type of attitude but low on the other. In our model, this would imply that individual type stressors (for example, pay inadequacy) might effect the person's involvement, whereas organizational level stressors (such as a proposed change in working conditions) would effect commitment. This link might continue and also manifest itself in different behaviors. A worker who is low in job involvement as a result of not getting an adequate pay increase may not be motivated to show up to work on time. Here, we might expect performance to decrease or lateness and absence to increase. In contrast, if

the stressor has its origin at the organizational level, then it is more likely that the lowered commitment might lead to turnover intentions or actual turnover.

Self-esteem as a dependent variable

Although personality is generally considered as a predictor, not a consequence variable, some recent findings have indicated that in certain cases, especially when we are not dealing with a stable, constant trait, it may follow intermediate measures of strain rather than precede it. Self-esteem is an example of a personality measure which can be expected to be influenced by outside factors. As one of the traits that have been investigated in several different contexts in general personality research as well as in I/O psychology (Gergen 1971; Tharenou 1979), self-esteem seems to undergo change over time (Rosenberg 1986). According to French and Caplan (1972), deterioration in self-esteem is a long-term outcome of stress.

The study by Kivimaki and Kalimo (1996) examined alternative models of the role of self-esteem in a stressful environment. The authors reported that the position of self-esteem in the model is hard to pinpoint. In some circumstances, French and Caplan's theory appears to be correct and self-esteem acts as a dependent variable. Using the ten-item Rosenberg (1965) self-esteem scale as either a causal or effect variable, the investigators reported that findings were consistent with the notion that 'chronic occupational stress is associated with increased psychic distress and lack of competence and a decreased level of global self-esteem' (p. 194). Unfortunately, Kivimaki and Kalimo used a cross-sectional design, which did not allow for testing a true causal hypothesis. In particular, as a dependent variable, self-esteem is assumed to be a changing, non-constant measure that is influenced by other indicators. Although a longitudinal design is appropriate in most stress research, it is essential when the measure is one that has both characteristics: stability and variability. In my opinion, it would require a carefully designed study with several measures taken over time to determine the exact impact of stress on self-esteem.

Burnout as a dependent variable

In all likelihood, the most popular and, perhaps, the most reasonable-sounding measure of the effects of stress is burnout. Both for the uninitiated and the initiated, it seems to be intertwined with stress and it is difficult sometimes to tell whether it is a stressor or a strain measure. The scales for measuring burnout emphasize service workers, and further work is needed to identify how burnout works in manufacturing. Perlman and Hartman (1982) have identified as many as forty-eight different definitions for burnout, including a feeling of exhaustion and

failure, estrangement from the job, and emotional exhaustion as a result of continuous demand. Often, it has been used as an indicator of behavioral variables such as absence, lateness, and intentions to leave. The perspective in such studies is that the two kinds of measures, emotional affect and behavior, are intertwined. In the presentation of the stress–strain model here, I assume that they are separate.

What are the causes of burnout? Some have argued that role conflict and ambiguity are potential antecedents (Leiter 1989). According to this formulation, it is a response to certain types of demands from the job that would make the worker more likely to find it difficult to continue the same type of work. Several scales for measuring burnout appear in the literature. One of these is the Pines *et al*. (1981) twenty-one-item scale. Using a five-point Likert format, responses range from 'never' to 'always'. This scale, unlike its more popular alternative described below, assumes that burnout is a one-dimensional concept. This one-dimensional feature of the Pines scale has been criticized as it does not allow for a more conceptually rich analysis of burnout as a strain variable (Schaufeli and Van Dierendonck 1995).

By far the most commonly used scale in the field, which has been used in many contexts besides pure stress surveys, is the Maslach Burnout Indicator (MBI) (Maslach 1981; Maslach and Jackson 1986). Because of its importance in stress studies, I will describe some of the scale's details in the following paragraphs.

The MBI was designed for human-service workers and consists of three dimensions: emotional exhaustion (nine items), depersonalization (five items), and personal accomplishment (eight items). Response alternatives range from 'never' (0) to 'every day' (6). In a study by Lee and Ashforth (1990), the authors found that the three-factor model of burnout is consistent with their data analysis. Furthermore, exhaustion and depersonalization were found to be highly associated and it was difficult to find the unique contribution of each. Consistent with the model presented here, the authors wanted to see if burnout had other associations, including a reduction in certain behavioral outcomes important for the organization. Exhaustion and depersonalization were more strongly associated with psychological and physiological strain than was the personal accomplishment dimension. On the other hand, personal accomplishment was more strongly related to perceptions of performance.

For many organizations, the importance of burnout is its potential to influence (objective) performance. Unfortunately, over the years there have been few well-designed investigations in this area. In their study of intensive-care nurses, Schaufeli *et al*. (1995) examined several aspects of the relationship between burnout and performance. The authors had argued that, following the lead of several other investigators, there is a need to identify the quality and quantity of the relationship between burn-out and job performance (Kahill 1988; Maslach and Schaufeli 1993). The Schaufeli *et al*. (1995) study found that burnout related differently to

each of the performance indicators in the study. Although the path coefficient in the structural equation model was not significant, burnout and subjective performance were found to be negatively related. Nurse burnout was found to be unrelated to effectiveness; that is, the number of patients dying in units with high nurse burnout was equal to those in units with low nurse burnout. The biggest surprise was the relationship between burnout and efficiency. In units where the nurses had a higher burnout, patients stayed in ICUs for shorter periods.

The last result was most striking and required some explanation by the authors. They argued that what may be going on is that in ICUs where the nurses have higher burnout rates they may be working faster, and if accompanied with higher-quality work, higher efficiency would be expected. Interestingly, the nurses in ICUs showed a high level of depersonalization and reduced levels of personal accomplishment but were not more emotionally exhausted than nurses from other units. Nevertheless, the negative mental state was not translated into a reduction in performance; on the contrary, efficiency seems to have been enhanced. The authors argued that the nurses' original burnout levels may be spread by a type of social affiliation where symptom contagion occurs as members feel that it is 'normal' to be burned out in such a stressful environment. This same process of social affiliation, argue Schaufeli *et al*., may be conducive to facilitating the communication and coordination needed for improving efficiency in the ICU. Thus, social affiliation is the 'carrier' for both higher burnout levels and higher efficiency rates.

Although this explanation seems somewhat far-fetched, it does raise an intriguing issue. Burnout seems to have many different effects, including positive, negative, and neutral ones. If so, can we identify which outcome can be expected in a specific situation of burnout? I would like to suggest that moderators should be included in future burnout research. For example, social affiliation, type of worker – most research has been in the service area; line workers must be studied, also – and organizational characteristics such as climate and physician–nurse relationship are all possible variables that may interact with the stressors present in the ICU. Finally, only a longitudinal design (neither the Lee and Ashforth study nor the Schaufeli *et al*. study used this technique) can really ascertain causal sequences, and this is required before one can draw any conclusions about the links between burnout and behavioral outcomes.

General well-being and emotional states

One of the more commonly used self-report scales in the field of stress is the twelve-item General Health Questionnaire (GHQ) (Goldberg 1978). Respondents are asked to indicate the extent to which they have experienced, over the past few weeks, somatic and affective symptoms relative to their usual level of health. The measure is appropriate for workers and

has been found to be significantly associated with several different types of stressors (Banks *et al*. 1980; Moyle 1995). For example, in the study by Moyle, the GHQ was found to be correlated to several different types of organizational stressors including perceived workload and fluctuations in workload. In a prediction model that included negative affectivity and work environment terms, Moyle showed that negative affectivity (NA) is a predictor of symptoms and interacts with environmental stressors such that high NA people are more vulnerable to the influence of environmental stressors.

Another popular measure of psychological and physical symptoms is the Symptom Check List (SCL-90) (Derogatis *et al*. 1976). It uses a self-report format and has been used in studies of post-traumatic stress disorders and psychiatric outpatients (Beaton *et al*. 1978). In particular, the subscale on depression and its global symptoms index have been used in organizational research as measures of strain (Beaton *et al*. 1978).

Finally, scales tapping various emotions or psychological states, some standardized ones but mostly custom-designed measures, are probably the most popular technique for assessing strain in stress research. Sometimes called 'measures of distress', these usually include but are not limited to psychological/emotional symptoms such as worry, nervousness, helplessness, disenchantment, and anxiety. In particular, depression is a very popular indicator in studies of work stress. For example, an instrument that has been used for measuring the latter is the Zung (1965; Zung *et al*. 1965) scale. The scale is a simple, eight-item index where higher scores indicate more depression, and has been shown to have a correlation of .70 with the D(epression) subscale of the MMPI. Another scale which has been shown to be highly reliable and was used for the same purpose is the twenty-item Center for Epidemiological Studies-Depression scale (CESD) (Radloff 1971). Some psychological symptoms scales are as small as three items (Patchen 1970) and even one item (Caspi *et al*. 1987; Frone *et al*. 1996).

Although the custom-designed scales are difficult to compare from study to study, they do allow the researcher to tap the relevant strain outcome in a particular investigation. These scales are often derived from existing instruments, and the investigator simply takes items that fit the situation. Similarly, a researcher sometimes will decide to take one or more factors from an existing measure and use them in their study. In the study of ethnic and gender differences in social constraints among New York City police officers, Morris (1996) derived several of her measures from existing scales and others were developed in close consultation with police department officials. Such a blending of items and scales allowed Morris to examine very specific hypotheses concerning the quality of the social interactions in her sample.

Social affiliation

An interesting series of studies were initiated by Schachter (1959), who examined, under experimental/laboratory conditions, reactions of subjects to stressors in the environment. Based on Festinger's (1954) social comparison theory Schachter argued that when faced with a possible uncomfortable setting or negative stimuli, an individual seeks others in a similar situation in order to compare feelings with others. Moreover, Schachter found that the people who are sought out are those who share the same stimuli, or, in our terms, are exposed to the same stressor. Interestingly, and consistent with the model, as the situation becomes more uncertain the individual is more likely to seek to affiliate. More recent work has indicated that anxiety reduction is a major goal for people who seek the company of others. For example, Wills (1991) reported that individuals who are threatened from outside sources or who actually face stress often turn to sympathetic people who are more likely to offer some form of social support.

Another approach to the social effects of stress assumes that an individual who is exposed to a potential stressor will want to obtain as much information as possible about the stressor and thus learn to cope in a more effective manner (Shaver and Klinnert 1982). When a person confronts a stressful situation, they seek individuals who know more than they do about the situation. In an experimental/field study that provided a comparison between social comparison and information seeking, Kulik and Mahler (1989) concluded that information seeking may be a more important motivator than social comparison. Patients who were to undergo some surgical procedure preferred, on the night before the operation, to spend time with someone who could provide information about the stressor rather than someone who was also about to undergo the operation and was, it would seem, in a similar danger. In summarizing the reasons why people affiliate when exposed to stressors, Buunk (1996) feels that many different reasons can be offered and each one may help explain a different situation. Moreover, it is possible that in a particular setting a person may want both social support and information so as to optimize their coping ability. Overall, the research evidence supports the positive and beneficial health aspects of affiliation for those who have experienced stress (Atkins *et al*. 1991).

As with other parts of the stress model, moderators also play a role here. For example, the *level* of strain felt may influence the need for affiliation. Molleman *et al*. (1986) reported that patients who are experiencing high anxiety levels are not interested in being with other people. They may very well want to be alone or just be with one or two very close friends. Also, the whole issue of social support as a coping device is relevant here. It is possible that sharing one's inner fears too much with others may have a backlash effect in that it allows the parties to become preoccupied with their mutual concerns (Hobfoll and London 1986).

Rumors, gossip, and other exaggerations may just heighten strain reactions rather than reduce them.

PHYSIOLOGICAL STRAIN RESPONSES

Research on the physical and physiological consequences of stress has increased at a rapid pace in the past decade (Corey and Wolf 1992; Evans and Carrere 1991; Fried 1988; Schwartz *et al*. 1996). Arguably, these consequences are the most direct, objective change that can be expected after an encounter with stressful stimuli. Although in many models physical and physiological symptoms are an ultimate outcome measure in the chain of stress–strain links, many present investigators categorize them as an intermediate effect which may have wider implications both for the individual and, in the cases of employees, for the organization as a whole (Fried 1988; Koslowsky *et al*. 1995).

Among the physiological effects suggested as relevant to stress are blood pressure indicators, gastrointestinal symptoms, and body fluids and chemical analysis. Within each of these categories, researchers have found positive associations between stressors and physiological response. However, the findings are not consistent and it is not unlikely that individuals will manifest different physiological responses to a given stressor. This latter phenomenon has produced somewhat confusing, if not conflicting, findings in the field. Fried (1988) argues that analyzing stimuli characteristics (such as chronic vs. acute stressors) and including self-report data as a support or additional indicator may help in reducing some of the ambiguity in the field.

In addition to the above outcomes, other types of indicators have also been lumped in with these stressors. For example, smoking, alcoholism, illness morbidity, and even mortality may be legitimate areas of research for the investigator of stress–physiological strain links (Landy 1992). In most cases of substance abuse, there are objective, measurable changes that do occur. Nevertheless, as the major issue with substance abuse involves the behavior rather than the internal effects, I have decided to consider smoking, alcohol, and drugs as behavioral reactions.

Although to the naked eye physiological indicators seem to be the best type of stress indicators, they are actually quite problematic. First of all, physiological changes in an individual can be expected without any specific stimuli present in the environment. Second, unreliability and instability of these measures within individuals is quite common and may fluctuate for many different reasons (it is not only the psychologist who must be concerned about reliability but also the physiologist). Third, the variability among individuals in their response to negative stimuli is as great as, if not greater than one would expect from

psychological or behavioral indicators. This may be a function of background and experiences of the individual; however, over the past years, genetics and heredity have become major sources for explaining observed physiological phenomena. This may help explain some of the following phenomena: why only 10 per cent of smokers get lung cancer and 10 per cent of lung cancer patients never smoked; and why many people who exercise get cardiovascular disease and others who never exercised do not get any type of CVD (Ivancevich and Matteson 1988; Porteus 1997).

In the following discussion of the various findings relating stressors and physiological responses, it will be important to define the context of the study so as to remove confounding factors. Besides the usual moderator/ mediator variables that will be discussed in a later chapter, issues such as the data collection design (cross-sectional vs. longitudinal), the social/ personality characteristics of respondents, and how the relevant variables were measured and determined are critical aspects of study findings. Of the many possible indicators here, Kahn and Byosiere (1991) found that only a few (for example, heart rate, blood pressure) actually had enough findings to indicate consistent trends and truly independent assessment. Nevertheless, this section will critically review the relevant literature and suggest measures that should be part of a well-designed stress study.

As the bulk of the physiological outcomes in the stress literature in the field can be divided into three categories of strain – cardiovascular, biochemical, and physical – I will use this taxonomy to present a brief summary of findings that have been reported in each of these areas.

Cardiovascular disease

When discussing the effects of stress on cardiovascular disease, it is important to distinguish among the different measures. Blood pressure seems to be the most ubiquitous one in the field and its negative manifestation is often referred to as 'hypertension' or 'elevated blood pressure'. As already mentioned, a host of demographic/biographic/genetic factors may be involved and a good study of the stress–blood pressure link must control for these variables. For example, women, at least till menopause, have a lower blood pressure than men, Afro-Americans have a higher level than non-Afro-Americans, and family history (or genetics) may explain as much as 50 per cent of the variability in blood pressure (Burt *et al*. 1995; Oparil 1995; Tambs *et al*. 1993). Schwartz *et al*. (1996) drive home an important point when they argue that the researcher must be careful not to neutralize too much of these so-called confounding variables in studying the impact of stress, especially if a non-experimental design is used. As the external stressors and perceived stress may overlap with these

confounding variables, it may be hard to study the impact of the former on strain responses after the latter have been completely removed statistically (as is often done in a moderated regression analysis). Thus, in order to eliminate the possibility of a spurious correlation, the investigator will have removed some of the causal elements inherent in the stressor.

With these precautions in mind, let us see what relationships have been found. First, it appears that the defense (flight or fight) reaction may be responsible for some cases of elevated blood pressure. Here, a person who confronts danger, perceived threat, or even just uncertainty may have to react, leading to an autonomic system arousal. Although this phenomenon has been associated with adrenaline production, a few studies have indicated that threat may also produce hypertension. For example, in a study of prisoners, those who lived in dormitory facilities had higher systolic blood pressure than those who lived in single-occupancy cells (D'Atri and Ostfeld 1975). The implication was that the threat or danger (as a result of the greater density and crowded sensation experienced by the former as compared to the latter group) produced higher arousal levels, which affected the prisoners' blood pressure levels.

Some evidence in favor of the Karasek demand–control theory and its explanation of strain reactions to stress was provided by Schnall *et al*. (1992) in a study of the blood pressure levels of working men with different types of jobs. If we divide jobs into two types of demands (high/low) and two types of job decision latitude (high/low) – individuals with high demands and low control had the highest blood pressure of all groups. In presenting their results, the authors deal with a complicated issue in the field which is particularly troublesome when studying physiological measures. How can we tell whether the observed strain is the result of acute stress or chronic stress? Phrased somewhat differently, is the subject responding to some very specific stressor at the moment the measure (for instance, blood pressure) was taken, or is it an underlying response that is symptomatic and characteristic of the individual? For example, what would happen in the Schnall study if the worker went to work in another setting and the demand X control combination changed, would his or her blood pressure also change? In my opinion, it is this type of study that is needed in the field. Here, the usual recommendation of longitudinal research is not enough, but subjects whose circumstances have changed over time are the ones whose measures are the most sensitive for discriminating between normal fluctuations and true effects.

Heart rate

Besides trying to determine longer-lasting effects of stress, it is also possible to examine the short-term heart rate. In a study of workload among air traffic controllers, heart-rate data were

collected using a portable ECG amplifier (Tattersall and Farmer 1995). For each subject in the study, heart rate was measured for the whole shift and during the preshift and post-shift testing periods. Also, the data were categorized as being either high- and low-workload periods. For air traffic controllers, the former is descriptive of the summer season and the latter the spring or autumn season. Two types of strain effects were examined: mean heart rate and variability. In general, the relationship between stress and physiological response did not show a clear trend; although the post-shift mean was the lowest, as expected, the highest heart rate occurred during the work breaks, an unexpected result. When mean and variability values were compared between the high and low workload groups, no significant differences were observed. The authors argued that heart-rate data are so individualistic that group analysis does not necessarily provide the best approach for examining the data; some form of analysis that does not aggregate data is recommended. It is not clear what Tattersall and Farmer intended by their recommendation.

In another study of the impact of stress on physiological functioning, Silverman and Smith (1995) examined how electronic monitoring would affect two types of responses: urine levels of cortisol and heart rate. The stressor in the study was the subjects' awareness that they were being monitored or observed during a mail-sorting task. Two independent variables – source of monitoring (human and computer) and level (constant and none) – were studied. The authors argued that heart rate should be highest for subjects in the constant, computer-monitoring situation as this group is hypothesized to be the most aroused. Again, although some of the results were in the predicted direction, overall there were no significant results.

I have already mentioned some of my interest in the field of commuting stress. Over the years, several studies in the field have used cardiovascular symptoms as a strain measure. For example, Simonson *et al*. (1968) reported that heart rate may increase even if the subject drives short distances. Changes in heart rate of up to 40 per cent, blood pressure increases of approximately 10 per cent, and some abnormal EEG patterns have been observed during and after driving. Interestingly, some of these driving effects are found primarily in urban driving and do not seem to be particularly affected by speed of driving (of up to 85 mph).

Using various parameters of the driving experience such as time, distance, and speed (distance/time), Novaco *et al*. (1979) found that various combinations of the commuting experience were associated with heart rate. Multiple regression analysis showed that heart rate, after controlling for covariates of age, cigarettes, and medication, was not related to any of the three objective commuting parameters. When blood pressure readings were used as the dependent variables, distance and speed but not time were significant predictors after controlling for the covariates. Also, the authors obtained a puzzling significant finding which they couldn't explain. When the measures of time and distance were taken together, referred to as 'commuting impedance' by the authors, and the moderator locus of control (internals vs.

externals) was included, increasing impedance levels (that is, a more difficult commute) was related to a decrease in heart rate.

Although cardiovascular measures seem to be legitimate and appropriate strain indicators, there seem to be too much fluctuation, individual differences, and other methodological artifacts to say that stress is a direct cause of changes in heart rate. Nevertheless, it is a possible consequence of stress and is a very promising field where research findings must be considered within a larger framework that includes demographic, genetic, and psychological reactions, and other potential individual difference variables.

Biochemical measures

The association between stress and biochemical responses is quite complex. Several investigators have long suspected that the human physiological system is very sensitive to such psycho-social stimuli (Frankenhaueser 1975; Lundberg 1984). One popular approach views the appearance of these agents as the body's response to arousal caused by some form of negative stimulus which may also serve as a link between the stressor and other types of somatic and medical problems (Steptoe 1991). Moreover, it seems that this arousal requires some type of cognition before any change in biochemical levels are observed (Rose 1987). Many of these intervening variables associated with stress include control, novelty, anticipation, unpredictability, and change in the stimulus. Although some researchers argue that the influence is direct, it is now well accepted that perceptual, subjective processes are at work wherein the brain translates negative stimuli to emotional effects, which is often, but not necessarily, followed by physiological, biochemical changes.

Many of the features described in the model were well illustrated in a study of the physiological response of bus drivers to traffic congestion (Evans and Carrere 1991). As their investigation included many of the concepts and specific variables mentioned throughout the book, I will describe it in some detail. Evans and Carrere gathered three types of data: (1) traffic congestion from an objective source – archival records on traffic volume and street carrying capacity; (2) a measure of job control which was obtained from a self-report questionnaire; and (3) a baseline sample of urine, and all urine excretions during the day were obtained so as to measure the impact of stress on two catecholamines, adrenaline and noradrenaline. Using regression analysis techniques to test the mediating properties of job control, the authors showed that traffic-related strain is the result of diminished self-control in the analysis of noroadrenaline as a dependent variable. Although the second analysis which used adrenaline as the dependent variable was not significant, findings showed that job control did serve as a partial mediator, reducing the strain variance explained by traffic

congestion. The design of the study was quite good, especially for one conducted in the field and not in the laboratory; nevertheless, it still suffered from several shortcomings. As it did not use a true longitudinal paradigm, causal direction – that is, a definitive statement about the objective stressor leading to perceived control leading to physiological response – was not possible. It is very possible that the catecholamine response reduces the feeling of control or that one of many other variables was responsible for the physiological response. Nevertheless, the significant and relatively high correlations, ranging from the low .30s to the mid .50s, observed here did support the notion that objective and subjective measures of stress are associated with catecholamine secretions. (From my research experience, these values are quite good for a study of the stress-strain link, especially if the variables include non self-report measures.)

Frankenhaueser and many other investigators in the stress field argued that increased levels of catecholamines after exposure to stressful stimuli reflect emotional reactions to outside stimuli. Nevertheless, the causal–effect reaction may be in the opposite direction; that is, physiological sensations may also serve as the precursor or antecedent to psychological, emotional consequences such as anger, frustration, and mood change. Thus, Frankenhaueser and Jarpe (1963) showed that subjective responses to infusions of epinephrine (a known heart-rate and blood pressure stimulant) was partially explained by the physiological reaction experienced by the person. Indeed, findings such as crowding on the train which seem to be associated with elevation in catecholamines (especially adrenaline) and with various measures of discomfort and other strain reactions (Lundberg 1976; Singer *et al*. 1978) may also have another interpretation. Does a finding of this kind preclude the possibility of a reverse effect; namely, as an individual's catecholamines increase, does that individual become more sensitive to their surroundings, perhaps as a result of sharpened sense of awareness? Very possibly, and if this can occur, the researcher must be aware of this possibility and either control for it or recognize, as Evans and Carrere did in their study, that proof for a specific cause–effect direction is, at best, conjectural. It is for this reason that the model used here depicts the causal direction among the strain variables as multidirectional, with any of the strains as potential causes (or effects) of the other ones. In conclusion, given the scarcity of research in this area and the complexity of the phenomenon – Fried *et al*. (1984) had found only forty-seven studies in organizational settings that used physiological measures – I can only suggest that while the negative effects of organizational stress are viewed by all researchers as a major issue in the field, the implications of biochemical change have not yet been fully understood. More carefully designed research with long-term follow-ups is needed before the process can be accurately delineated.

Physical measures

Although it is true that much of the research on the physiological effects of stress have focused on biochemical and cardiovascular changes, there are two other types of physical measures that have appeared in the literature: first, general physical, objective symptoms; and second, musculoskeletal disorders. The general physical symptoms that I would like to discuss briefly are non-emotional disorders that include psychosomatic complaints of various types. The latter would include items such as eating and diet behavior, colds, infections, and psychosomatic or gastrointestinal problems. Although researchers have recognized the need to separate traditional psychological/emotional responses from physical ones, studies often lump the two types of outcomes together. For example, in their study of occupational stress in emergency rooms, Hammer *et al*. (1985) identified three scales for measuring strain in a hospital setting: job satisfaction, psychosomatic complaints, and frustration/exhaustion. The last two scales should represent parallel but distinctive concepts. Instead, psychosomatic complaints include terms such as 'nervous', 'tension', and 'tired'. Each of these words could appear as part of the exhaustion/frustration scale. In one form or another, this problem repeats itself quite often in the literature.

An additional issue that causes some confusion here is that the measure of physical symptoms is often obtained from the worker in the same way that information on psychological/emotional functioning is obtained. For the researcher, the measures turn out to be relatively subjective and it is difficult to distinguish between the two types of measures. A person who says they have a cold is really providing a self-report or a personal evaluation of their situation. A good example of the overlap both in assessment and conceptually between the two types of strain measures is the Occupational Stress Questionnaire (OSQ) (Elo *et al*. 1992). The questionnaire consists of items that gauge both the stressor (monotony, variety of job duties) and strain (psychological, physical). The psychological scale consists of items relating to worry, depression, anxiety, and so on. The physical items relate to ailments such as dizziness, headache, chest pain, and stomach pain. One feature of the scale which has some properties of an objective indicator is the fact that subjects are required to respond to the *frequency* of the strain symptom (1 = very seldom) to 5 (very often) rather than to its presence or absence. Nevertheless, the scale is traditional self-report and cannot be compared, at least on the objectivity component, to data obtained from some source outside the worker themselves (observation, colleagues at the job, company or personnel records).

One suggestion for obtaining a degree of confirmation for the self-report response is to use company records as a check or standard. For example, a report of many physical symptoms can be compared to the number of days absent. Although the absenteeism indicators cannot

actually provide information on whether the physical symptoms were present or not, they can tell us whether they were sufficiently severe to prevent the worker from arriving at work. Of course, absence as a result of sick days are usable only if they are teased out from other types of voluntary measures of absence available in company files.

One of the more objective types of physical symptoms which, in many cases, is quite observable and measurable are the muskuloskeletal disorders. A person may suffer low back pain, may have difficulty sitting, or just moving limbs freely from exposure to negative stimuli. In a recent study, Bongers *et al*. (1993) found that lack of autonomy and variety at work were associated with back pain and shoulder problems. Lundberg (1996) also points out that there seems to be a gender effect here, with women showing greater musculoskeletal problems than men. It is unlikely that this is a function of the differences in physical strength between men and women, especially since studies show that these strain effects are not related to any clear physical attributes (see, for example, Jonsson *et al*. 1988). Instead, the gender interaction with stressors is probably reflective of the job characteristics of each group. According to Lundberg, women are more likely to be employed in occupations that are monotonous and repetitive. Such occupations do not allow the worker to relax and unwind; instead, psychological strain and tension are produced, making the person vulnerable to all types of physical ailments. In the chapter on stressors, these activities were identified as potential negative stimuli.

Probably the most chronic physical ailment experienced by Westerners is low back pain. Epidemiological surveys show that more than 60 per cent of the population may suffer from this problem during their lifetime (Kelsey *et al*. 1990). Interestingly, and most important from a stress researcher's perspective, causative lesions are usually not found. This would support the notion that psycho-social factors, especially stressors, may be very prominent antecedents of low back pain. This seems to be true from several perspectives. First of all, if a specific stressor causes a tension buildup or frustration, it may very well predispose an individual to a problem such as low back pain. Second, it is also likely that a person who has a job that is stressful or not satisfying may be more willing to report such pains than a person who is highly satisfied with the job.

Some form of psychological and physiological symptoms seem to be the fate of modern people. With stress a part of most jobs, it seems that these responses may be difficult to avoid. In the next chapter, I will present some of the behavioral consequences of stress and see how they may be related to the types of responses studied here.

7

BEHAVIORAL CONSEQUENCES OF STRESS

Generally considered as one of the ultimate outcomes of, or at least a likely reaction to, other strain outcomes, the variables discussed in this chapter may have broad implications for the individual and the organization. Although they are usually measured at the individual level, it is relatively easy to accumulate behavioral values at the group, department, and organizational levels. Unlike the equivalent measures for emotional and physiological strain, overall totals or means can be interpreted easily by the organization. Behavioral outcomes are, in most cases, objectively determined, and the arithmetic calculations on them are meaningful. To illustrate the point, let us take an example from one of the most popular measures in this category, absences. A department usually keeps track of the absence record of each of its employees. Besides trying to understand how various antecedents such as stress relate to the individual's attendance record, there is quite a bit of useful information at the aggregate level, too. Is the departmental rate increasing over time? What can the organization do to effect a change in some of the intra- and inter-departmental variables so as to reduce the undesired behavior? In particular, can we identify the role of stress in an overall model that includes behaviors as ultimate outcomes?

BEHAVIOR AS AN ULTIMATE OUTCOME

Although it is possible, in some cases, for stress to act directly on ultimate outcomes, it is more likely that its effects will be on other, more intermediate, strain measures first. The integrative model recently presented by Hom and Griffeth (1995) showed stress as influencing turnover indirectly by acting through job satisfaction. In the following discussion, unless otherwise stated, the assumption will be that the influence of stress on the dependent variable is in concert with another variable either as a joint predictor (that is, as a moderator) or influencing the outcome measure through other variables.

In order to see what behavioral effects can be expected from one (or more) stressors, let us take a hypothetical situation from a relatively common situation in modern organizations. Assume that management has decided to downsize and eliminate a certain percentage of the employees in the company. Employees who have heard about the stressor now face a period of ambiguity or uncertainty. The next chapter discusses the role of ambiguity in the model, but, suffice it to say that an individual now experiences stress, and some reaction is likely. The worker exposed to the stressful situation does an appraisal of the chances that it will affect them. If the appraisal leads to a conclusion that it may very well affect them or even if they are just left in an uncertain state, emotional reactions such as worry, tension, or irritability may ensue. Physiological responses, including biochemical changes or hypertension, are also possible in such a situation. In addition to these more immediate responses, some workers may experience more chronic physical/physiological reactions (lack of sleep, loss of appetite). Further stress (such as an increase in the frequency or intensity of rumors concerning potential layoffs), or even the fallout from the original stressor, can then result in behavioral changes. The worker's performance decreases as it becomes harder to concentrate on work. Lateness or absence behavior may indicate that the worker is now looking for a new job, or, perhaps, just trying to avoid the negative atmosphere at work.

Thus, an objective stressor (decision to downsize) in combination with the subjective stimulus (perceived or imagined layoff) can have quite negative effects on the remaining employees, canceling, to some extent, the cost savings associated with downsizing. Finally, it is possible that the increase in negative behaviors and the decrease in performance will, in turn, have an impact on some of the affective behaviors, such as job satisfaction. The dual, reciprocal effects or nonrecursive links are a reasonable chain of events which can be expected in a process model. In the present chapter, I will discuss some of the more important behavioral variables that have been identified as potential consequences of stress.

Whose behavior is affected by stress?

I have already discussed the fact that stress can affect the individual worker. However, others in the organization may also be affected even if they were not exposed to stress. These effects can be seen directly when a late or absent employee simply does not perform the required job during the time period assigned to them. Indirect effects on other employees can be seen when an individual under some level of stress may find it difficult to concentrate and work effectively in an organizational setting that requires team performance. Here the stressor affects not only those exposed to the stimulus but also others who must work together with the affected employee.

The organization's economic costs as a consequence of stressors on individual employees may be seen as an indirect organizational outcome. However, when many workers are simultaneously exposed to a stressor such as is commonly found during the period after a firm announces downsizing and layoffs become part of the routine, the impact on the firm's performance can be quite substantial. Medical compensation, recruiting, and retraining individuals who must replace those who have left the organization, as well as lost sales due to lower employee output, can be traced to stressors now operating in the environment. Although it is recognized that such organizational consequences can also be a function of the psychological and physiological reactions to stress, it is behavioral/performance strain that is more easily measured and its impact more clearly linked to organizational economic expenses and costs.

Traditionally, the behavioral indicators associated with the world of work include productivity and performance, as well as measures of withdrawal, including lateness, absence, and turnover. However, in the case of home stressors, other types of measures may very well be appropriate. For example, today it is not uncommon for mothers or fathers to experience the pressures, and sometimes conflicting interests, associated with career and family. The behavioral consequences of such stressors may range from fewer interactions with the children (or even decisions to postpone having a family) to violence, substance abuse, and divorce. Some of these will also be presented below.

A review of various behavioral consequences of stress as reported in the literature will be presented. Discussion will also include the fallout for the organization (where appropriate) and consequences for significant others such as fellow workers, colleagues, spouses, and partners (where the data are available). In this conclusion, among the overt reactions to downsizing that have been documented recently in the literature are an increase in suicides and traffic accidents among employees whose companies had decided to consolidate and reduce their payroll (Anthony *et al*. 1993: 528–9).

STRESS AND WITHDRAWAL

For years, I/O psychologists have tried to determine whether or not the various modes of withdrawal can be placed under one rubric. Traditionally, lateness, absence, and turnover are the usual measures that have been examined in this area. After exposure to stress, such measures may be considered as a way for an individual to express neglect and disrespect towards work. It also has a negative 'psychological' message to others; that is, an individual not exposed to the negative stimulus may react to the behavior of others. For example, in a situation where employees are tardy, morale and work motivation within the total

organization are likely to deteriorate (Cascio 1987; Jamal 1984). Thus, co-workers who see one of their colleagues constantly arriving late, particularly if sanctions are not clearly defined or apparent, may start to think along the same lines and change their own behavior. Similarly, if there is an atmosphere of absenteeism or people leaving the job for other places of work, then the idea may take hold and influence others to do the same.

Recently, researchers have altered the traditional measure of withdrawal to include new types of behavior. For example, Hepburn and Barling (1996) expanded the concept of lateness, or the first stage in the withdrawal process, to include missed hours which occur in the middle of the day. Thus, an employee who spends more time at lunch than is allotted by the company or even spends too much time on the phone before returning to the usual tasks is, according to the authors, 'partially absent', a concept that sounds as if it is somewhere between lateness and absence. The Hepburn and Barling study used a work–family conflict stressor, employees who must do errands for their elderly parents, to illustrate the source of the negative stimulus. Although full absences may also ensue as the parents need more attention, it does not seem likely that turnover and going to work somewhere else would be a method for solving the problem.

Some theoretical perspectives

The relationship between stress and behavior is quite complex, and several theories have been postulated in the literature. One is that objective stress always impacts on perception first and then perception, in turn, has an impact on behavior or performance. Here a mediator is seen as a required intermediate stage. A somewhat different approach is suggested by Siegrist (1996). In his article on the effort–reward interaction as being responsible for the experience of stress, Siegrist argues that low reward and high negative affect may result in mood change, lowered motivation, and the desire to stay away from work. In such a conceptualization, a mediator variable is not necessary.

More specifically, what mechanism would explain the choice of withdrawal behavior? Why do some choose lateness, and others absence or turnover? If exposed to a specific stressor which behavior is more likely to occur? The answer to this question draws us into one of the most controversial issues in the area. The debate over the existence of a withdrawal progression hypothesis dates back to some of the original work by Herzberg *et al*. (1957). They described a framework that views lateness, absence, and turnover as a series of successive withdrawal behaviors. In such a scenario, lateness is perceived as a first-stage response, followed at some later time with absences, and in the last stage, turnover or

voluntary withdrawal is tried. The underlying assumption is that lateness is a less severe reaction to stimuli, absence a moderate one, and turnover an extreme one.

Not all researchers share this opinion on the relationship among the so-called withdrawal measures. Some have argued that a progression approach does not explain most situations. Accordingly, workers may try all three behaviors in the sequence suggested but it is not a requirement or even a common phenomenon. Indeed, they argue that overall there is no relationship between the variables (Rosse 1988), or, that two of them (lateness and absence) are possibly negatively related (Nicholson and Goodge 1976). A negative relationship would indicate that individuals who use lateness as a response to stress would not be likely to use absence, and vice versa. Both of the latter two approaches assume that different processes with different antecedents are present. Nevertheless, the weight of the empirical evidence indicates that, at least, a moderate positive relationship among the variables do exist (Clegg 1983; Hanisch and Hulin 1990; 1991; Koslowsky *et al*. 1997). If we do assume that this is true, it still does not tell us why we might expect some workers to go on to the so-called higher levels of withdrawal and why some do not. What process is involved?

I would like to suggest two related stress processes that may help explain a withdrawal progression approach. If we assume that the three behaviors are all methods of avoidance, then they may act as coping techniques (Chapter 8 provides a more detailed discussion of coping). An individual exposed to stress (for example, a supervisor or colleagues who are difficult to work with as they make unreasonable demands) may decide to avoid the workplace for a part of the day. As the stressors continue, the worker may find it easier or less stressful to be absent all day. At some point the magnitude of the stressor becomes overbearing, and the only way to remove it is to leave the present job and go to work somewhere else. This process is consistent with Rosse and Noel's (1996) suggestion that a psychic overload resulting from stressful situations may lead to withdrawal behavior as a 'safety valve'.

This view of withdrawal as a coping device is also suggested in Rosse and Hulin's (1985) concept of adaptive behavior. According to their perspective, an employee who feels that the behavior they have chosen does not reduce negative affect will try another 'adaptive strategy'. When successful adaptation occurs, the individual is said to be engaged in an adjustment mechanism that fits their needs, a concept that we have labeled as coping. Applying Rosse and Hulin to our formulation here, one would expect that, after achieving an adequate adjustment level, the progression to a more severe form of withdrawal would stop.

However, not everyone uses withdrawal as a coping device. Here, as in many other links in the model, moderators may determine which type of individual is more likely to use withdrawal as a coping device. For example, Parkes (1984) showed that workers low in self-

confidence may be more likely to use a passive behavior such as absence. According to this perspective, absence or turnover does not really allow the researcher to confront the stressor; rather, they are avoidance techniques that do not necessarily solve a worker's problems. As a matter of fact, one may expect that a worker who has left one company because of stress may be more likely to leave their next job for the same reason.

As appraisal is an essential feature in linking stressors to workers' actions such as coping (Tattersall and Farmer 1995), identifying the cognitive process in withdrawal behavior may help provide a possible explanation for its temporal, sequential features. Feelings of inequity are an affective, cognitive process, that has been used to explain behavior in social research. According to Adams (1965), an individual who feels that their ratio of outcomes to effort is unfair as compared to a significant colleague's ratio will behave in such a way as to remove the imbalance and restore equity. These feelings, which are influenced by an individual's appraisal (regardless whether they are correct or not) of the environment, are considered motivators as the worker can be expected to act as a result of the stimulus. An example of a stressor that may engender such feelings is inadequate pay, which was already discussed in a previous chapter. A worker may come to work late because they feel an injustice is being done to them. Then, for employees who now feel that by coming in late a balance between outcomes and input has been restored, there would be no reason to move on to more severe behaviors. The feelings of inequity are no longer motivating.

However, employees who feel that the injustice still exists even after arriving late – that is, they do not feel that balance has been restored – may continue with a more severe form of withdrawal: absence. Or, if that does not accomplish reduction in strain, then turnover may be the last resort. This approach does not necessarily indicate a causal link between lateness and absence; rather, both are being influenced by an outside factor such as feelings of inequity. It is not that lateness causes absences to occur. Accordingly, the worker chooses the behavior that least interferes with the organization's functioning but provides personal relief to the subjective impression of injustice. Also, lower levels are not necessarily abandoned and the worker may continue with lateness behavior even after starting absence. If it takes a progression approach or a combination approach, the worker will use any method of withdrawal behavior that restores balance. Incidentally, this notion is quite consistent with the most frequent finding in the literature; namely, a positive association among these behaviors. However, the lack of any positive proof concerning the progression hypothesis may simply reflect the fact that some workers do not move up on the severity scale and others use a combination of withdrawal behaviors.

I have tried to present a few explanations for the possible impact of stress on specific behaviors and also on the progression hypothesis. Regardless of the specific mechanism

involved, an empirical examination of the progression model requires testing the change measures over time on both the causal variables and the effect variables. This would involve the inclusion of stress measures, appraisal of inequity, and the withdrawal measures in a complete longitudinal design.

Lateness

Although several researchers have focused on employee lateness in the past few years (Blau 1994; Koslowsky *et al*. 1997), a computerized search on organizational stress and lateness behavior yielded no relevant studies for the present survey of research in the field. Although other potential antecedents or correlates such as satisfaction, commitment, personality, and demographics have been examined (Koslowsky *et al*. 1997), in general, lateness has been considered the orphan of withdrawal behavior. This is true for several reasons. Unlike absence or turnover, data are often not collected on lateness and, even when the organization has a policy of punctuality, its enforcement may be spotty. Thus, some workers are allowed to make up the time lost and it is not unusual for colleagues to 'check in' someone else. With absence or turnover, this is much more difficult to do.

One variable that may be associated with lateness is the commuting experience. Workers who have a longer commute (time or distance) would be expected to report more stress. Although a direct link has not yet been reported, a recent study by the author showed that the inclusion of perceived stress measures as mediators explained a moderate, yet significant, percentage of employee lateness variance (Koslowsky, unpublished manuscript). Other researchers have also argued that a possible consequence of a difficult commute is lateness behavior (Gaffuri and Costa 1986; Leigh and Lust 1988). As these last studies involved either examination of survey data or assumptions about the commuting experience, further analysis, using sophisticated, longitudinal studies, is needed before definitive conclusions can be drawn.

Absence

Similar to the other measures of withdrawal, absence is a method of avoidance for reducing or even eliminating stress. Workers who are performing monotonous tasks have been found to be absent more frequently (Ferguson 1973; Johansson *et al*. 1978). In the study of the effects of both objective and subjective monotony on strain reaction by Melamed *et al*. (1995), the authors found that, for women, objective monotony was related to absence whereas subjective monotony was related, for both men and women, to absence. As noted

previously, although such jobs are often not complex, they do require quite a bit of diligence. Absence is a way of not having to deal with the task on a particular day. Melamed and colleagues offered several explanations for the sex differences; it is possible that female workers are just more affected by objective negative work conditions than men. Another possible explanation is that women who had higher absence frequency than men use this method for stress coping more frequently than men.

Turnover

A series of studies in the field have used turnover intentions as an ultimate outcome measure. However, the inferences drawn from the studies have been inconsistent. Although several have found that stress had an effect on satisfaction and that satisfaction had an effect on turnover intentions (Hendrix *et al*. 1985; Kemery *et al*. 1987), Kemery *et al*. (1985) also showed a direct stress–turnover intentions link. The last study mentioned used a structural equations technique to test the various influences.

The argument for the indirect link is clear. Only those who are dissatisfied after exposure to a stressor will want to leave. The direct effect would imply that the stressor is so powerful that the way to avoid it is to leave the firm. Except for very extreme situations, this seems quite difficult to visualize. Studies that did find a relationship may be more likely to have been the result of common method variance between self-reported stress and strain measures.

Substance abuse

One of the behavioral responses that may have wide-ranging implications for the individual, organization, and the family is substance abuse, including alcohol, drugs, and smoking. Faley *et al*. (1988) estimated that $30 billion of lost productivity can be attributed to drug use, and $60 billion may be attributed to alcohol abuse. Although these variables have been considered by some as coping devices since they help ease the pain of stress (Violanti *et al*. 1985), it is usually an outcome variable in a stress process rather than a mediator or moderator (see, for instance, Beehr *et al*. 1995). Nevertheless, researchers have also found that the very nature of substance abuse – lack of concentration or physical illness – can lead to other organizational outcomes such as absenteeism and accidents (Bass *et al*. 1996; Bross *et al*. 1992). In many organizational intervention programs, the target is not the stressor or its links, as would be expected in a stress–strain model, but the behavior itself. Also, if drinking is in very moderate proportions then it is more likely to be viewed as a coping device, but if it gets beyond a certain limit, then it is, for our purposes, an outcome or strain. An individual does not have to be in a

treatment program to be labeled as an excessive drinker; if it can be shown that the behavior has its own consequences, then it is problematic on its own. Defining the limit or identifying someone's consumption as excessive may vary from individual to individual and therefore, in most studies, can only be measured in relative terms.

Beehr *et al*. (1995) used a self-report questionnaire to assess the drinking behavior of a group of 177 policemen, an occupation which is particularly prone to stress. The following three items measured on a seven-point 'never' to 'always' scale were used. (1) 'During the past six months, how often did you worry or feel guilty about your alcohol consumption?' (2) 'During the last six months did you ever drink more than planned?' and (3) 'During the past six months did you have periods where you could not remember what happened when you were drinking?' The mean value on the scale was 1.98 (SD = 11.33, coefficient alpha = .83). Using a wording modification, Beehr also examined the strain reactions of the spouses. They were asked whether they worried about their alcohol consumption, whether they drank more than planned, and whether there was a loss of memory when drinking. The mean for spouses reactions, 1.34 (SD = .74, coefficient alpha = .90), was less than for the men. One might conjecture that compared to the wives, the working husbands were more exposed to the stressors, which would tend to raise their mean value on alcohol consumption. As the questions were somewhat differently phrased for each member within a pair, it is hard to know for sure. Conclusions from the survey of policemen's drinking habits are that alcohol consumption is a mild problem, although the job is a relatively stressful one.

Work–family conflict is another variable that may serve as a predictor of alcohol consumption. In an interview study by Frone *et al*. (1996), subjects' alcohol use was examined as a function of work–family conflict. The authors used three measures to tap heavy alcohol use: (1) a single item that asked subjects how many times during the past year had they consumed five or more drinks (ranging from 0 = 'never' to 8 = '5 or more'); (2) a single item that asked subjects how many times they had drunk enough to get drunk or high during the past year (ranging from 0 = 'never' to 8 = '5 or more'); and (3) subjects had to answer the number of times they had experienced each of a list of ten alcohol-dependence symptoms (for instance, the number of times during the past year that subjects had drunk as much as a fifth of liquor in a day). An overall measure of alcohol use was determined by averaging the standardized scores of each of the measures. Moderated regression analysis showed that, after controlling for a series of covariates (mostly demographic variables), work–family conflict was a significant predictor of heavy alcohol use.

Of course, alcohol consumption has also been found to be associated with stressors outside the work setting. Many of the acute stressors mentioned in the first chapter, such as a major life event, the loss of a spouse, moving, and so on are all potential stimuli that may bring about

alcoholism. As a specific illustration, post-traumatic stress disorder reactions (PTSD), one of the ailments frequently found among individuals who have experienced some type of 'shocking experience', such as with soldiers on the battlefield, are linked to many anti-social behaviors including drinking. In an interview study by Bremner *et al*. (1996), the authors found that alcohol consumption began when the symptoms of PTSD first manifested themselves. Usually, symptoms were first noticed sometime after exposure to the stressful situation, during the combat experience, and were found to increase in the first few years after the war.

Smoking

At present, I do not want to enter the debate on whether smoking represents substance abuse or not. There is little question today about the addictive and potentially harmful physical effects of smoking; nevertheless, in most circles, smoking is still considered as more socially acceptable than alcohol or drugs, particularly hard drugs. As with other types of substances, smoking has been shown to be a reaction to some type of stress. Recently, Todd *et al*. (1996) examined the relationship among several types of role stressors (occupational, marital, and parental), as well as the conflict between roles, on smoking behavior. Findings were consistent with the hypothesis that role stressors and the conflicts among them affect smoking behavior. Interestingly, socialization and norms that deter substance abuse were not particularly important in buffering the stress–smoking relationship.

Performance

From a theoretical perspective, it is possible to resort to equity theory again to explain the relationship between stressors and performance. Investigators have argued that stress creates an imbalance which, in turn, can be viewed as a motivating force for the employee to act in such a way as to try to achieve perceived equity at work (Walster *et al*. 1978). Although there are several possible reactions to these feelings, one of the most basic responses that a worker can make is to decrease performance, which would have the effect of modifying the amount of input in the equation (Greenberg 1989; Tosi *et al*. 1994). In this way equity would be restored. The performance decrement could be expressed by decreasing effort or productivity, including refusing to work overtime, letting obvious mistakes go through, or simply not bothering to do what is required in order to produce the best product possible.

Empirically, there have been a relatively large number of studies that included performance as the outcome or strain effect. Using middle managers and blue-collar workers, Jamal (1984) found that as stress increased, performance decreased. Both Rabinowitz and Stumpf (1987) and Potter and Fiedler (1981) indicated that the source of stress may be important in determining whether performance is affected. For example, in the latter study, coast guard officers reported lower performance levels, when the stress involved their relationship with the supervisor. Job stress, however, was not shown to affect performance.

Positive stress effects on performance

Although the assumption till now has been that stress and performance are negatively related, the dysfunctional perspective, there is an alternative approach that cannot be entirely dismissed (Sullivan and Bhagat 1992). Some researchers have discussed the motivating, enervating, and challengeproducing aspects of stress as a positive feature (Beehr 1985; Jamal 1985). For example, an inverted U relationship is one such possibility. Here, low stress is said not to arouse a worker adequately and too much stress can be debilitating, but a moderate amount can be just what 'the worker needs' to perform well.

Sullivan and Bhagat (1992) alluded to another possible distinction between the positive and negative effects of stress on performance. The relationship may be positive if the individual is exposed to the stress for a short period of time; perhaps this is what occurs at the beginning of a project or in a new job. The performance may be enhanced for a short period of time; however, if the stress continues and becomes long term, then the worker may experience burnout and possibly a reduced level of performance. There may be moderators at play here, too. A high selfmonitor may more readily accept the short-term stress that the worker encounters in a new job. Other possible moderators may involve the worker's approach to the job. For example, a high level of need for achievement may turn a possible stressor into a stimulator. Baker *et al.* (1966) examined the performance of army officers after exposure to stress. Positive and negative performance enhancement was found to be a function of task involvement. Again, such conjectures require longitudinal studies where the short-term effects of stress can be compared with the long-term ones.

In general, this view sounds quite reasonable and may very well account for some of the mixed findings in the field. Empirical studies on the stress–strain links shows that a true linear relationship cannot be expected, as moderators and mediators come into play at different stress levels. Although the issue of a complex relationship can be posited for any strain measure, it has usually been associated with performance because it is the one that seems most

easily understood by the researcher as falling into a certain framework. For example, it attains a certain plateau in response to a moderate stressor. If the stressor is already having an influence on a worker, it is difficult to imagine circumstances where the relationship will turn around without an intervening variable coming into play. According to inverted U theorists, performance may be blocked if too much stress exists or is perceived and cancels its positive effects.

Moreover, results in any specific investigation are dependent on the stress level examined (Beehr 1985). As the U relationship may very well be idiosyncratic with stress having differential effects, a comprehensive study would require testing the strain reactions to various stress levels across people and within people. This may explain why this relationship has been found more frequently in laboratory settings than in the field. Only with the former is it possible for an investigator to examine a variety of between- and within-stress levels in a reasonable period of time.

A summary

The scenario presented at the beginning of our discussion on performance and behavior seemed quite reasonable and several studies did support the stress–behavior linkage. Nevertheless, the relationships reported in most studies were weak, and it was difficult to say that stress had a major direct impact on organizational behavior. In a related area of research, dating back as far as 1955, Brayfield and Crockett pointed out that the correlation between a psychological state, satisfaction, and a behavior such as performance is quite low. Indeed, the review of the stress–performance literature is quite consistent with this conclusion (Sullivan and Bhagat 1992). What is wrong? Why shouldn't we be able to report a relationship between two variables that from a theoretical perspective seem to have a high overlap?

Schneider (1996) offers one solution to this problem. Much of the theory in the field is derived from theorizing about organizational differences, whereas the analysis has been done at the individual level. Translated to our case, it would mean that organizations under stress are expected to perform more poorly than organizations experiencing little stress. However, the method of analysis usually involves examining stress levels of individuals and comparing the response to performance. Studies that would compare the same variables at the organizational level would have a better chance of obtaining a significant relationship. This is exactly what happened in the study by Ostroff (1992), when measures were calculated at the organizational level and partial support for this thesis was obtained. Although not directly a part of the model presented in the book, it would seem that effects –

at least, the behavioral ones – require the use of the organization as the unit of analysis. This is consistent with the emphasis I have placed on the need to consider stressors beyond the individual. Similarly, at the other end, the individual may also not be the correct focus. It may well turn out to be that a large part of organizational outcome variance can be explained by changing the unit of analysis.

8

MEDIATORS AND MODERATORS

Until now the book has emphasized the independent and dependent variables in a stress–strain model. Before one can understand the links, direct or indirect, in such a formulation, it is necessary to examine the role of potential mediators and moderators. Such variables can help explain why findings across studies are often inconsistent. The detection of indirect effects between causal and effect variables is a function of the mediator variables included in a study. Similarly, a study that has included a particular level or category of the moderator may yield different relationships than the equivalent study using another category. Indeed, the purpose of techniques such as meta-analysis is to permit overall conclusions to be drawn concerning the homogeneity of relationships within a specific level or category of the moderator.

THE DISTINCTION BETWEEN MEDIATORS AND MODERATORS

Mediators, according to Baron and Kenny (1986), either explain the relationship between the independent and dependent variable or they reduce the relationship between the two. One can compare a specific stressor– strain pair before and after the inclusion of the mediator to see if the relationship has changed. Mediators are, generally, variables that correlate with the predictor (independent) variable and are considered as links between these variables and the dependent variables. They reduce the variance explained by the independent variable. In a completely mediated process, the variance explained by the predictor is reduced to 0. In the next chapter, I will explain the multiple regression technique for determining the existence of a mediator.

Another way of visualizing such an effect is the typical finding in structural equation modeling. Here, the researcher tries to show that a mediator positioned between two other variables is said to be present and significant (for example, subjective perception mediating

between environmental noise and annoyance). Accordingly, the link between the predictor variable and outcome goes through the mediator, and its impact is considered indirect. In many cases, a direct link is also observed and represented visually by an arrow linking predictor and outcome. If a direct link does not exist, we can conclude that the only impact is indirect and that there is no variance left for the predictor to explain after the mediator has been entered into the equation.

Evans (1997) has also distinguished between various types of mediational processes, some of which may very well interfere with or even prevent the researcher from verifying their hypotheses: reverse causality, reciprocal causation, feedback, and spuriousness. Reverse causality refers to the fact that in many cases the outcome may indeed be the cause of the mediator rather than the other way around. Reciprocal causation occurs when the mediator and outcome are each the cause of the other. In a structural equations approach, bidirectional arrows would be required.

A moderator acts quite differently. Such variables are said to be independent of the predictor. Again, the best way to visualize the case of a moderator is in the context of regression equations. The moderator is the variable that is added to the equation after the independent variable was entered. A third variable, the product of the independent variable by the potential (that is, hypothesized) moderator is then examined. If this last measure explains a significant proportion of the variance not yet explained by the previous variables, then we assume that there is a moderating effect. Not surprisingly, much of the research in the field of organizational behavior, including stress, is focused on identifying moderating effects. In particular, such a technique is useful for helping to explain conflicting findings. Thus, a failure by a researcher to replicate findings from an reanalysis of a set of independent and dependent variables may very well indicate that there is a moderator at play.

Figures 8.1 and 8.2 illustrate the links typically found in mediating and moderating processes. It should be noted that, in each case, a direct influence of stressor on strain measure is still possible. If a mediator exists, the stress–strain link is weakened or eliminated. If a moderator exists, the stressor–strain link can exist independently of either the moderator–strain link or the interaction–strain link.

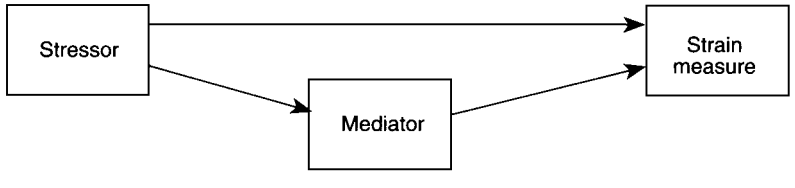

Figure 8.1 An example of a mediator

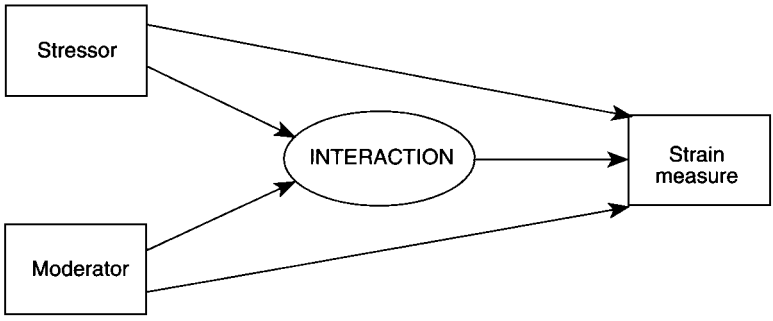

Figure 8.2 An example of a moderator

One other aspect of the relationship between these variables should be pointed out. Although there is some controversy over the exact role (mediating or moderating) of certain variables in stress research (such as job control, as discussed on p. 125), within a specific context a variable can only serve one role. This is true since a moderator must be uncorrelated with the independent variable whereas a mediator is by its very nature correlated with the independent variable. Across studies, it may very well serve different roles and even within a study various aspects of a specific concept may play different roles. Thus, actual control may be considered as a moderator, but a second variable, perceived control, may be a mediator within one research design.

In order to emphasize the last point, I would like to provide an example from a recent study of a stress model. Kivimaki and Kalimo (1996) examined three major variables in their study: perceived stress, self-esteem, and strain symptoms. This study arrived at many important conclusions but, nevertheless, the use of these variables in the study was unique to the authors. For example, self-esteem was studied as an outcome measure; in the present book, I will take the perspective that personality is a moderator. The authors considered strain as a mediator. This is true when there are other strain measures that appear later (as will be discussed below); however, in the Kivimaki and Kalimo study, the symptoms variable was the only 'official' strain measure. In their measure of stressors, a measure of monotony was combined with a job control subscale. This is consistent with one of the major theories in the field. However, it would not be unreasonable for a researcher in another study to use the former as the stressor and the latter as the mediator, especially if the latter were measured with a self-report scale. The authors were right in what they did but it is not the only way to use the variables.

I believe that one of the reasons that it seems we are often just spinning our wheels and not making any significant advances in the field is the lack of agreement on the definitions of the terms. Replications of studies where the terms were all used identically and the same analysis

was applied are needed. The problem is most acute when it comes to distinguishing between mediators and moderators. In particular, the statistical analysis, which is determined by the role each variable plays in the model, will be affected, and it is clear that inferences concerning significance, meaningfulness, and role can be influenced by the analysis chosen. In addition to listing some of the mediators and moderators in the stress process, I will try to present a framework for categorizing the different types of variables. It is not the only perspective possible but, based on the theoretical and empirical literature, it is a reasonable taxonomy.

MEDIATORS IN A STRESS MODEL

Probably the most commonly used mediator in the stress literature is some form of cognitive or perceptual process. A clear example of this can be seen in a model suggested by Spaccarelli (1994), who examined subjects' cognitive appraisals as a mediator in explaining the mental health effects of child sexual abuse. Abuse, the stressor or independent variable in the study, was conceptualized as a series of events in the subjects' past that had the effect of increasing negative reactions if mediated by cognitive processes. Interestingly, the mediator usually includes an active or conscious awareness on the part of the individual; nevertheless, research in some areas of personality and clinical psychology indicate that potential stressors such as sexual abuse may have an impact even if the mediator is at a subconscious level.

Although the definition for a mediator in its statistical sense is quite clear and anyone applying structural equations or regression analysis is bound to use it correctly, practical research is another matter. Often the authors in the psychology literature have confused the terms and called a variable a mediator when it actually was being applied as a moderator. For example, in a well-designed experiment to test the mediating effects of exercise levels, Hobson and Rejeski (1993) examined the role that different doses of acute aerobic exercise have on psycho-physiological responses to mental stress. Following exercise periods that varied from 10 to 40 minutes, subjects' systolic blood pressure, diastolic blood pressure, and mean arterial pressure were evaluated. Findings were not clear, but the authors concluded that a demanding level of exercise was associated with lowered diastolic blood pressure and arterial blood pressure. Although exercise level was called a mediator, from the analysis it actually appears that it was serving as a moderator.

Another example of moderator variables that were incorrectly used as mediators are the personality indicators that many investigators have referred to as nuisance variables which allegedly interfere or confound results. In some contexts, especially when the nuisance

variable is learned or developed as a by-product of working for a firm, then the variable may indeed be a mediator. However, if it represents a style of behavior that is not specific to an organization, then it is a moderator. For example, Elliott *et al*. (1994), using a phenomenological format for a research design, hypothesized that trait-negative affectivity and trait-positive affectivity would mediate between stressor and strain. The former was found to be mediator, albeit only partially, whereas the latter variable had no mediating properties.

In the next few sections, examples of different types of mediators that have been studied in the stress process will be presented. I have tried to choose recent examples from the literature that illustrate each mediator type and attempted to identify findings that have implications for model development.

Perceptual and cognitive mediators

Many researchers have tried to test the exact role of subjective measures in a stress–strain process. In a recent study by Melamed *et al*. (1995), the relationship between objective and subjective work autonomy and various outcome measures was examined in a large study of blue-collar workers. Using moderated regression analysis, the authors compared the fit of their data to three alternative models: (1) subjective autonomy does not mediate between objective and stressors and outcome; (2) subjective autonomy mediates the entire relationship between the independent and dependent variable; and (3) subjective autonomy acts as a partial mediator, with the objective variable directly explaining some of the outcome variance. Three outcome measures were predicted: job dissatisfaction, psychological distress, and sickness absence. The findings showed that individual's perception of their job was moderately related to the objective measure and this perception partially mediated between the objective measure and outcomes. The perceptual variable explained only a portion of the total variance accounted for by the stressor; the former variable, therefore, played a dual role. First, it was, according to Melamed *et al*., an explanation of the stress–strain link; that is, the common elements of the independent variable and the mediator were (partial) substitutes for each other. Second, the fact that the mediator and stressor did not correspond perfectly indicated that each one also explained unique variance of the strain variable. In contrast, a moderator is not assumed to play both roles; though it may be directly related to the strain measure (this is definitely not a requirement and is often not the case), it is only its interaction term that indicates that moderating effects are present.

How well did the two stressor variables predict the strain measures? Was there any differential prediction or were they predicted with equal accuracy? The authors considered this to be one of the important issues in their study. An analysis showed that job dissatisfaction and psychological distress were associated mainly with perceived monotony, and sickness absence was associated with both objective and subjective autonomy equally. The inferences from these findings are clear. Researchers need to look at both types of predictors; objective measures are usually not the best predictors of subjective strain and, in the analysis reported by Melamed *et al.,* each type of stressor was a significant predictor of strain.

An interesting cognitive type of mediator was recently suggested in an investigation of predictors of physiological activity (Lash *et al.* 1995). The authors examined the role of a stressor's gender relevance as a mediator of sex differences in cardiovascular reactivity (CVR). The hypothesis was that women would show greater CVR to women's relevant stressors and men would show greater CVR to men's related stressors. Only partial support for the hypothesis was obtained. Although these predictions for systolic blood pressure reactivity was confirmed, the findings for heart-rate reactivity was not as predicted. Moreover, women showed greater diastolic reactivity were the men did to the feminine-relevant test, but the men did not show greater diastolic reactivity than the women did to the masculine test.

Short-term vs. long-term strains

Perhaps the most common form of mediator in longitudinal models or hypothesized causal frameworks is short-term or intermediate strain measures. This refers to the concept that stressors act directly on some and indirectly on other outcome measures. Very few stressors can be expected to lead directly to ultimate outcomes such as turnover or cardiovascular disease. Instead, a more common scenario is the formation of intermediate outcomes acting as mediator variables. According to this perspective, a mediating variable between a stressor and strain response can also be considered a stressor for the later strain response. In trying to do a metaanalysis of mediators, it is crucial for the investigator to determine the exact use of the variable in each study. Whereas ambiguity is a stressor in some studies, it may very well be labeled a mediator in other contexts. The latter would be particularly true if the study had or implied the existence of a stressor before the mediator.

Several investigators in different contexts have used the distinction between intermediate and long-term strain as an integral part of their formulation. For example, Koslowsky *et al.* (1995) presented an illustration of the difference between these strains in their process model

of commuting stress. Negative attitudes, for example, were outcomes of commuting stress, but these attitudes were predictors of certain types of withdrawal behavior. Their formulation can be applied to many other work contexts. Thus, a fireman may have different reactions to the stressors confronted; some of the responses may be temporally related so that later stages are perceived as a function of earlier ones. In a dangerous job such as theirs, many potential stressors could be identified. Even after returning to the station after fighting a major fire, physiological measures such as adrenaline, heartbeat and pulse rate are all likely to be high. Given that fighting any fire is quite stressful – a very reasonable assumption – each time they return to the station house, one could expect three stages of reactions or outcomes occurring in a temporal sequence: (1) physiological symptoms; (2) attitudes and affective reactions such as burnout; and (3) behavioral outcomes such as performance (for example, having to go out to a second fire may be quite difficult to deal with and a decrease in reaction time might be expected), withdrawal (such as refusing to continue working in such a situation, lateness, absences, and so on), and health and safety actions (for instance, carelessness if required to go out a second time).

Such a sequence of events has many implications. First, from a theoretical viewpoint, it appears that by removing one of the earlier links, there is no reason to expect employees to manifest any of the later strain stages. Management may find it easier to cut the link between physiological and attitudinal outcomes than the one between attitudinal and behavioral outcomes. If the fire department has identified high blood pressure as a strain measure among its employees after fighting a difficult fire, it may want to make available some form of relaxation or meditation to reduce physiological activity and prevent negative attitudes from forming. Second, acceptance of such a model within an organization implies that differential coping techniques must be used at different stages. The stage of the outcome chain at which the employee is found will determine which intervention method is most appropriate. Blanket or uniform interventions may not be appropriate if workers are found at different points in the process.

In the paper by Israel *et al*. (1996), a similar framework is suggested, albeit in much greater detail. According to their model of the stress process, a sequence of strain responses are hypothesized with the first stage of strain including short-term physiological (elevated blood pressure), psychological (tenseness), and behavioral (alcohol use) responses, and the second stage containing the same categories but with the chronic equivalent of each strain response. Thus, for the physiological response, cardiovascular problems are posited, for the psychological problems, anxiety disorder, and for the behavioral category, alcoholism.

Another example of strain as an intermediate response was shown in a recent study which examined the French and Caplan (1972) model of self-esteem as an ultimate product of stress.

Kiviamaki and Kalimo (1996) used regression techniques to test the argument that strain serves as the immediate response to stress and as the predictor of self-esteem. I have already discussed the self-esteem measure as a response variable rather than as an independent variable or a moderator. Here, I want to emphasize the role of intermediate strain in the French and Caplan model. The fact that an individual is subjected to stressors, many of which cannot be controlled, may induce a lack of competence in the worker. Over time, the lack of confidence in a specific area may extend to a more general perception, resulting in a lowered self-esteem for the worker. This conjecture is quite interesting and may help explain much more than a personality measure ever could. Unfortunately, the cross-sectional study reported by Kivimaki and Kalimo (1996) did not allow for an adequate causal test of the impact of the short-term strains on other, more permanent outcomes.

Organizational mediators

Just as the stressor side of the equation has organizational mediators in addition to individual ones, individual and organizational mediators can also be identified on the strain side. In a very interesting study by Michela *et al*. (1995), the authors suggested a three-stage framework for describing the stress process. In it, they assumed that the organizational climate is a result of organizational membership and is, in turn, the antecedent for various types of strain responses. Organization membership refers to the entity to which the worker belongs. This could be the company or branch office, the department, or the team/work group. Although many other factors are posited as possible influences on the mediator and the strain variable, as well as the link between them, the authors presented a hierarchical nested model where the impact of the industry on individuals is mediated by group and organizational mediators.

The basic methodological argument made by the authors was that the individual's reactions are a function of a mean climate from the level above which is in turn a function of the level above that. What constitutes climate? For example, are rewards fair? Are the interactions and relationships among workers within an entity positive and encouraging, or negative and disappointing? The authors used a self-report scale to measure the climate variable because, they argued, climate, by its very nature, must be a cognitive and perceptual concept rather than a purely objective one.

As I will discuss in the methodological section, it is often beneficial to measure a subjective variable by using worker responses. The potential problem of common method variance arises when the same respondent is asked to give their impressions of more than one variable such as the stressor (perhaps a stimulus in the work or in the general environment) or

the mediator (such as climate) and then strain (like symptoms). With this limitation in mind, the author extracted the following three factors from the self-report: achievement ('In our unit, we set very high standards for performance'), empowerment ('I often have the opportunity to influence the goals or actions of my unit'), and affiliation ('People I work with take a personal interest in me'). In reporting their results for each of the variables as a mediator of the stress–strain relationship, the authors stated that empowerment findings were 'solidly' consistent with their expectations and the other two dimensions were 'promising'.

The authors resorted to the P–E model as their theoretical basis. According to this approach, organizational climate should be an important factor because it assesses whether the work environment provides the experiences the employee wants or needs. A central part of the theory is the argument that stress exists when the wants or needs of the person and the environment do not fit. Thus, a worker in a low empowerment environment may feel strain because they need or want to have more say in the organization than the organization is willing to give over.

Coping as a mediator

The issue of coping and intervention is one of the most crucial ones in a stress-strain model. The distinction between the two concepts is often lost in the literature. For the present purposes, 'coping strategies' is the more general term for dealing with stressors, whereas 'intervention' refers to one of the techniques that is commonly applied. 'Intervention' also has the connotation of some outside force or stimulus, and 'coping' may include internal mechanisms, also.

What is coping and what are its components? In their conceptual and empirical study of the concept, Dewe and Guest (1990) used the Folkman (1984) definition as their basis for analyzing coping. According to Folkman, coping is a cognitive or behavioral technique for reducing or tolerating the internal and external demands that are part of any stressor. One of the problems with this definition is the need to get information directly from the worker or individual exposed to the stressor, who alone can report on any cognitive coping that may be occurring. Folkman and Lazarus (1980) also provided the field with the most popular view of how coping is accomplished. It is, according to them, either problem-focused or emotion-focused. The former refers to tackling the source of stress, perhaps by trying to eliminate it or meeting it head on. The latter refers to confronting the negative outcomes or strain responses by accepting the existence of the stressor but limiting its impact. Many other variations of the coping construct have been suggested, but the Folkman and Lazarus framework has been the basis for a large number of the studies in the field.

Using a clearly defined five-stage process, Dewe and Guest (1990) developed a taxonomy for coping techniques. As their methodology has wide-ranging applications for uncovering many of the components in a stress process, I will review their research strategy. First, using open-ended questions, a list of coping techniques are identified. Second, a checklist based on the items identified in the first phase is devised. Third, the checklist is administered along with critical incident questions. Fourth, content analysis and factor analysis are used to identify the underlying components. The fifth and final phase involves administering the questionnaire to various populations to determine whether the components generalize across populations.

In total, sixty-three coping strategies identified from the first and second stages produced six factors or, as the authors called them, components: (1) rational task-oriented behaviors which include steps taken by the worker to deal directly with the stressor, responses which might facilitate direct action, and actions designed to avoid any further repercussions; (2) emotional release, which includes an expression of feelings (such as anger or irritability); (3) use of human resources, which includes involvement of the family – the help of other people is used here to a larger extent than any of the other components; (4) recovery and preparation, which involves dealing with the problem only when the worker is ready for it; (5) postponing action refers to the worker trying to distract themselves or avoiding the stressor; (6) passive attempts to tolerate and live with the stressor refers to the worker doing nothing except trying to rationalize the existence of the stressor. Using the Folkman and Lazarus taxonomy, the six factors were identified as either problem-focused or emotion-focused. Except for rational task-oriented behavior, the first component, all factors were either mixed or emotion-focused.

Is coping a mediator or moderator?

In examining the literature, it is my impression that the term ‘intervention’ has been associated more with a mediating role and ‘coping’ has more of a neutral connotation, indicating both moderating and mediating functions. I will try to elaborate on this last point. Experts in stress management seem to be split on whether coping is a moderator or mediator in the stress–strain link. From my perspective, it isn’t an either/or proposition. Rather, there are times when coping indeed interacts with the stressor to explain additional variance and there are situations where the stressor must ‘pass through’ the coping mechanism. The more reasonable empirical, if not theoretical, inference from intervention techniques is that they represent a mediating function. Thus, an individual who copes adequately should experience little or no impact or strain effect. Anyone who is taught or trained to avoid, confront, understand, or suppress the stressor has in a sense performed a mediating process. Even the

term ‘stress management’ has the connotation of reacting to the stressor rather than interacting with it (that is, in the statistical sense). Except for the last one, all the Dewe and Guest components are good illustrations of some type of active coping that tries to break the stress–strain link.

An example of the use of intervention as a mediator was discussed by Israel *et al*. (1996) in their analysis of the impact of a poor safety environment on the physical and psychological health of hospital workers. In their comprehensive intervention model, the intervention technique was positioned between the stressor and the strain responses. Their approach involved several phases of data collection, hazard surveillance, effectiveness review, and the establishment of a task force. All of these were part of a mediating process that would allow the hospital to deal effectively with the objective safety characteristics and legitimate concerns of employees. Moreover, similar to the general stress–strain model presented in Chapter 2, the authors used a multilevel intervention scheme as part of their approach. Thus, a new disposal system for needles and environmental modifications for safety enhancement were organizational level interventions, managers providing the right protective equipment for workers was an organizational, departmental, and individual level intervention, and, finally, video-based training techniques were individual level intervention techniques.

There was a side issue discussed by Israel *et al*. which has some implications for the present discussion. The authors pointed out that the simple application of an intervention program in an organization may cause its own strain reactions. It is important that management be aware of the ‘psycho-social tensions likely to accompany an intervention of this complexity and magnitude’ (p. 273). In their hospital setting, they found that a training course on managing change was not enough and the strain response still came through. As a matter of fact, one of the potential byproducts of the intervention program was an interaction (that is, a moderating effect) between the psycho-social tension and the physical stressors. Management needs to be aware of this possibility when designing any change program, as it could easily have as much of a negative effect as the original problem and put into question the viability of the intervention program. This impact of the intervention process on new strain responses that were not present before implementation is consistent with a mediating role. As was shown in several cases above, the mediator can be both an explanation or substitute for the stressor’s impact on strain and an additional source of stress in the process.

Defining successful coping

How do we define effective coping? When is a person considered as either immune to or inoculated against stress? It is very hard to imagine the concept of a ‘strain-resistant’ worker.

Indeed, perceptions of low levels of work strain are deceiving. An individual may seem healthy at work but not at home or vice versa. Furthermore, it is not clear to many in the field of clinical psychology that to be strain-suppressed is actually healthy. Models by researchers such as Maddi and Kobasa (1984) and Antonofsky (1987) have tried to identify the factors that are part of a healthy individual in that they have learned to manage stress, perhaps confront it, and turn it into a positive motivator rather than allowing its effects have a negative influence on work or home activities. Terms such as 'hardiness', with its three factors – commitment, challenge, and control – have been used to describe the healthy individual in an organizational setting. Although not explicitly linked, the hardiness factors can be viewed as the result of the successful use of one or more coping components as described by researchers such as Dewe and Guest or Folkman and Lazarus.

Social support as a coping technique

Social support is one of the major coping methods in the workplace today. Research findings have indicated that this technique is effective for reducing stress effects. Several review studies (Cohen and Willis 1985; Latack and Havlovic 1992) have concluded that there is a great deal of benefit to social support. In a sense, the technique is somewhat unique in that coping is dependent on others rather than on the individual's own resources. What does social support do for the worker? It allows the worker to discuss the stress with another person and get new ideas about its meaning and its severity, and perhaps advice on how to cope within the organizational setting. Psychologically, it is clear that talking about problems has many benefits over suppression. In most settings, the listener or the one providing the social support is not a work-related colleague or supervisor but someone who is not perceived as a threat – generally, a spouse or trusted friend outside the company.

Beehr *et al*. (1995) argued that important people in one's life (perhaps the term 'significant others' is the right term today) can promote or constrain the effects of stress on the individual. I have previously indicated some of the stressors that emanate from the role conflicts between home and office. On the other side of the coin, the home may provide a level of social support that is critical for the individual's healthy overall functioning. Beehr *et al*. argue that the employee and spouse should be viewed more as a team rather than two individuals, each with their unique stressors and their personal reactions to these stressors. Indeed, their analysis of the responses of policemen and their spouses to questionnaires containing items on stress, strain, and coping techniques showed that the structure of coping activities of spouses was very similar to that of police officers. Although their data were not conclusive, it may be possible to infer from the multiple regression analyses which they conducted that coping may

be a process involving an 'intact family system'. Just as the worker is not the only one affected when strain is present, they are not the only ones who must learn to cope. For the researcher and the manager, an intervention program may need to include spouses (or significant others) if it is to have any long-term impact.

Beehr *et al*. also uncovered an interesting relationship that has both practical and methodological implications. The authors found that, within a family environment, divorce was a potential outcome of work and nonwork stressors and that the responses of the employee and spouse to the possibility of divorce were highly correlated. This contrasts with the conclusions that several authors have drawn from the item on marital status (for example, married vs. not married) that appears in many questionnaires. Such an item does not appear to be a good indicator of social support and coping in a stressful situation. A worker who is married but is thinking of divorce is, in all likelihood, not getting much social support from home. A questionnaire needs to gauge the viability of the relationship between worker and spouse before drawing conclusions concerning social support in a stress setting.

In summarizing the use of social support within the organization, several critical points must be made. For some types of individuals, this coping technique may be the best way to face or ward off the stressors emanating from the organization. Little research is available on what type of individual will choose social support rather than one of the other Dewe and Guest factors. Such information may be useful in specific circumstances; for example, an organization may be interested in identifying who is likely to perform well if assigned to an overseas position far from home.

Although Jaffe (1996) suggests that social support (similar to the third Dewe and Guest factor) be included as an additional 'hardiness' factor as it has been shown to have an impact on the stress–strain model, it does not convey the same active working-through process that the three existing factors connote. I agree that social support is an important coping technique and has shown much promise in stress research. However, the individual who meets stressors at work and is able to function well and not suffer strain reactions if they are committed or challenged or in control of the situation is qualitatively different from the one who copes with the help of social support. In the former, the job or work turns into a more positive experience, whereas in the latter the job may still lead to discomfort but it is manageable.

The implications of coping for the organization

From an organizational perspective, a healthy workforce would be expected to be a better, more effective organization. Maddi and Kobasa (1984) argue that it is possible to develop hardiness in employees so that individuals learn to cope with stressors and lead more healthy

lives in the workplace and at home, all to the benefit of the firm. Findings seem to support this notion. In reviewing some of the literature in the field, Jaffe concluded that 'healthy companies' – not only from a stress perspective – showed higher morale and greater effectiveness. If this inference is correct, it would seem most logical and reasonable for companies to foster, encourage, and teach healthier methods of coping with stressors.

Recently, Schneider (1996) has discussed the difficulty of instituting an organizational change such as stress management at one level and expecting it to have an impact at higher levels. Without the proper synchronization and coordination, the probability is quite high that the intervention will not go anywhere beyond change in some individual behaviors. The failure to have an impact at higher levels even when the intervention at the lower level is effective has been called 'the productivity paradox' (Attwell 1994). Schneider argues that in order for an intervention to be meaningful for the organization a number of actions are necessary. These actions must be 'congruent in their goals, strategies, actions, and measures to the intended effects of the original intervention' (p. 562). The implication of this conclusion for organizations is wide ranging. Organizational performance is not determined by a simple sum of the individual levels of performance. Instead, Schneider argues that inhibitors or facilitators act as moderators between the intervention and the performance. These include, but are not limited to, communication, technological, and financial factors which will determine whether a particular change at the lowest level will be translated into a meaningful overall change. A change can be expected to make an impact at a higher level if the moderators have been aligned so as to be supportive. More importantly, the individuals in the organization have to be of one mind. If some members do not believe in the change process or have not integrated the goals of the change, then they can ruin it for the whole system. It is not that workers have to be homogeneous – see Herriot and Pemberton (1995) for a discussion of this issue – but their commitment to a goal, whether it is removal of a stressor or changing the product line, must be the common, overlapping element in the organization.

Let us take an example that illustrates the situation quite explicitly. If management introduces participation decision-making (PDM) to help employees work out some of their stress-related problems, it will not have any major impact if the message has not been broadcast and integrated at all levels, not only at the employee level. The fact that workers are being trained in applying PDM does not necessarily indicate that this style of management fits into the goals and strategies of the organization. If only one element is out of sync (such as a manager on the production line who wants to keep the old system of decision-making), then it will likely interfere with the attainment of desired goals for the entire organization. Schneider states emphatically that all parts of an organization must be made up of people who have the attributes and the motivation to behave in a specific fashion so as to make the

organization function in an integrated and harmonious way. Stressors will not go away because a few people have been taught some new ideas. They will remain as long as the organization has not become a unified system whose parts are all geared up to 'fighting' the negative stimuli.

Job control as a mediator

There is probably no specific variable or even concept in stress that has as much written about it as job control. I have already discussed the role of job control as an independent variable in predicting strain. Although it appears implicitly in many stress models, it is most prominent in the formulation of Karasek's job strain model. On the one hand, it sounds like a moderator in that the interaction of demands and control influence the strain response. On the other hand, it also has some of the characteristics usually assigned to the stressor or independent variable; demands and control can come as a 'package' stressor or by itself. A good example of this usage is the study by Carayon (1995) where a chronic stressor is defined in terms of the degree of job control exercised; the more time the individual does not have control, the greater the strain symptoms experienced. Nevertheless, in the model here, it is possible to view job control as a mediator that really helps direct or explain the relationship between stressor and strain. In a well-designed study of the effects of traffic congestion on physiological functioning, Evans and Carrere (1991) showed that perceived control does indeed act as a mediator. (In the section on physiological effects of strain, their study was cited as a classic one, both theoretically and methodologically.)

Before discussing several specific aspects of control, I would like to offer a general distinction that may help clarify some of the existing confusion in this area. Control acting as a moderator would indicate that the variable represents a general disposition of the individual; when designated as a mediator, control is acting as an intermediate stage; that is, an individual is responding to the effects of a 'strong' stressor by experiencing a lack of control (actual or perceived). In turn, the loss of control has various kinds of implications regarding strain for the worker. As a mediator, control is a function of a specific situation whereas as a moderator it is a more stable, less flexible characteristic.

Real and perceived control

Although most applications of control in the literature are perceptual, actual control can be seen in the case of retirement where the decision to leave a job or firm is sometimes in the control of the worker. I have already discussed retirement as a potential stressor, but it may be

possible to explain the consequences by type of decision. For example, in the study by Herzog *et al*. (1991) choice or control was found to be a significant intervening variable in the retirement process. The authors showed that those who had stopped work and said they had little choice about the decision (perhaps as a result of early retirement in a downsizing situation) reported more strain reactions than those who retired voluntarily.

The beneficial effects from perceived control are expected to be similar to those obtained from real control. The fact that perceived control is an adequate coping mechanism implies that high levels of perceived control modify or even reduce the negative impact of impedance on strain. Murphy also argued that it is probably less stressful never to have had control over a situation than to have had it and lost it (1988: 324). For many organizational intervention procedures, this is a cardinal proposition. When increased worker control is introduced, it should not be for a temporary period. Rather, the organization that has decided to make changes for the purposes of greater worker control must make a longterm commitment and give the worker either real control or perceived control. Knowledge that control will remain in the hands of the worker is essential. In practice, perceived control may be enough, as it allows the person to assume that the stressful stimulus can be turned off or, at least, reduced.

In the stress literature, several concepts have been linked, and one has sometimes been used to explain the other. Control can be viewed as a means for the individual to cope or remove ambiguity. This implies that one is a mirror image of the other. In addition, the literature also includes such words as 'uncertainty' and 'unpredictability'. Before proceeding with a discussion of coping techniques, I think it would be worthwhile in trying to present some of the theoretical and empirical research that has been done with these concepts and see if they can help us in understanding control as a coping technique.

Control and ambiguity

One of the major issues in identifying the links that connect the various stages in stress–strain models is explaining the impact of control, actual or perceived (Jackson 1989). For some researchers, control is the lynchpin which connects stressors to strain or outcome measures. Individuals who feel that they are in control of their environment are likely to experience less impact from stressors. For many years, researchers have known of the importance of control in determining the level of psychological and physiological health experienced by workers (for example, Frankenhaueser 1989). In particular, according to the Karasek strain model, the concepts of uncertainty and control are critical elements in determining whether strain will result, and, if it does, at what levels (Landsbergis and Vivona-Vaughan 1995).

The construct validity of job ambiguity was recently examined by Breaugh and Colihan (1994). The authors started with one of the common and, sometimes, circular definitions of ambiguity: namely, an employee's perceptions about the uncertainty associated with a job. The authors suggested two explanations for the detrimental effect of ambiguity. One assumes that role ambiguity is inherently negative and stressful (Kahn *et al*. 1964). If this is so, then there could indeed be a personality component involved (personality will be defined below as one type of moderator), since people have, more or less, a need or drive to reduce the uncertainty (King and King 1990). A second definition for ambiguity refers to the fact that it may interfere with an individual reaching his or her goals (ibid. 1990). Because of ambiguity, the individual is prevented from doing the job correctly. This definition fits our concept of ambiguity as a mediator. If an individual is confronted with a potential stressor – for example, finishing a job by a certain time – one of the reasons it may have negative consequences is because it has ambiguous features associated with it.

What exactly are these ambiguous features? In a scale developed by Breaugh and Colihan (1994), three factors were identified: (1) work method ambiguity, (2) scheduling ambiguity, and (3) performance criteria ambiguity. The first factor refers to the uncertainty with regards to the methods and procedures that should be used to do a particular job. Another way of saying this is that a clear determination of the process involved is needed for a worker doing a specific job (Sawyer 1992). The second factor refers to uncertainty about the standards that will be used to determine whether a job was performed satisfactorily or not. Finally, the last factor refers to the uncertainty associated with the scheduling, timing, or sequencing of work activities. For example, a worker needs to know priorities and how best to allocate time so as to meet the demands of the organization. McGrath and Kelley (1986) have labeled temporal role ambiguity as a situation where information is lacking as to when to do the specific parts of a job. Stressors in this situation can lead to negative consequences as the worker tries to resolve the ambiguity.

Although control can be seen as part of the stressor and even as a moderator in some circumstances (Evans and Cohen 1987; Schaeffer *et al*. 1988), yet if an individual uses control as a means to deal with the uncertainty in the environment, it is a coping device or mediator. For example, applying the definition cited above, a worker who is not sure what to do to get a raise can be under a great deal of stress. If the issue is clarified, there is a feeling of greater control of the situation in that now they know what is expected of them in order to get the salary increase. If this is sufficiently motivating, the worker can modify or direct behavior so as to achieve the goal.

Another approach to the coping aspect here was provided by Lazarus and Folkman (1984), who argued that uncertainty does not allow the individual to anticipate the stressor. Thus,

when an uncomfortable situation is predictable, an individual is given the opportunity to prepare, and either mitigate or ward off the potential negative effects. On the other hand, removing the uncertainty gives a warning, so to speak, to the individual that they can relax and, perhaps, recoup some of the resources that may be required for coping when the stressor is about to begin again. Such respites, which are essentially cognitive in nature, are quite helpful both for acute stressors and chronic ones. This may help partially to explain some of the fluctuations and variability in physiological measures (see the section on physiological measures). Data from another area, women's menstrual cycles, support this general line of thinking. Chernovetz *et al*. (1979) found that women who were able to predict their menstrual cycle suffered less discomfort than those who couldn't, even if the former had more actual distress.

O'Driscoll and Beehr (1994) offered a definition consistent with the present perspective of uncertainty. The authors suggested that one possible mediator in a stress process may be the effort-to-performance uncertainty or the performance-to-outcome uncertainty. As depicted in our model, such mediators act either in the first stage or the second stage of the stress–strain link. In the first stage, a worker may have difficulty understanding what performance can be expected from a given effort or, phrased somewhat differently, a worker may not know if a certain effort will lead to the expected performance. Assuming that a strain response has occurred in the first stage, further negative consequences could be avoided completely or at least mitigated if the worker is clear how performance is translated into outcome. In their study of the effects of stress, the authors found that role stressors contributed separately and through uncertainty (which acted as a mediator) to three measures of strain: job satisfaction, an indicator of psychological strain, and turnover intentions.

This reduction in uncertainty is part of the control mechanism even if the latter is just perceived as such. In many studies, a self-report, so-called subjective, questionnaire measures the perception that the worker has of control in the situation. The recent study by Thomas and Ganster (1995: 13) supported this contention. They found that perception of control served as a mediator between supportive organizational policies in response to work–family conflict and strain measures consisting of physiological responses and job satisfaction.

Control and time management

An example of an intervention technique in a stress-strain model is time management. (Many of the ideas in this section come from Koslowsky, in press.) Groth-Marnat and Schumacher

(1995) list time management along with techniques such as relaxation training, biofeedback, and cognitive restructuring for promoting physical and psychological health, particularly at work-sites. Unlike time urgency, which is discussed on p. 138, this technique is considered as a learned activity and not a personality or innate trait. Time management is a specific coping strategy allowing the individual to control by either reducing or eliminating several of the timerelated components of the stressor that are affecting the individual. By structuring one's activities so that time is under the worker's control, thus permitting more efficient scheduling, prioritizing, and time allocation, the worker is, according to Breaugh and Colihan, removing some of the ambiguity in the job.

Koeske *et al*. (1993) argued that both the behavioral and cognitive components are employed in such coping mechanisms. This implies that those who are attempting to control time actively need to plan their strategy and tactics very carefully. In this formulation, time management can be seen as a conscious attempt by the individual to reduce ambiguity so that the stimuli are under their control. Consistent with the Breaugh and Colihan 1994 findings, the technique here includes prioritizing so that need and wants are first identified, then ranked in importance. Resources and time are then allocated according to these preferences (Hall and Hursch 1982; Macan 1996; Macan *et al*. 1990). Several controlled studies have shown that time management can be taught and that it is amenable to intensive training programs. For example, King *et al*. (1986) found that subjects who had been taught how to manage their time were better able to cope with stressors. These subjects learned not only how to 'face' the stressors but also to get involved with other less threatening activities.

In her analysis of the components of time management, Macan (1994) showed that the largest impact of time management was on perceived control of time. Again consistent with our expectations, those who had learned to manage their time more efficiently experienced greater subjective impressions of control. To illustrate this point, the author reported that students who perceived greater control of their time reported performance and psychological benefits. This was manifested both behaviorally by an increase in academic performance and physiologically by a decrease in somatic symptoms. The importance of time management was also emphasized in a study of job stress among occupational therapists. Sweeney *et al*. (1993) examined coping strategies employed by the thirty subjects in the study. Besides the stressors that were beyond their control (such as organizational politics), therapists suggested that focusing on time-management techniques, including the appropriate use of planning and rescheduling of tasks, when needed, would help in managing strain levels.

The link between time management and control

One issue on the relationship between time management and control remains unanswered. What comes first, perceived control or time management? Macan (1994) concluded from her studies that an individual who works efficiently has the ability to control or the perception of control, rather than the other way around. This last inference would be consistent with the general argument made here. If perceived control of time is viewed as a method of coping with stressful stimuli, then it would seem reasonable to assume that an individual who wants to reduce these effects must change either cognitively or behaviorally. A worker experiencing stress may have a feeling of low level of control which, in turn, produces a higher level of strain response. Time management may be seen as 'interfering' with the stressor–control link. As time management becomes more integrated within the individual – that is, it is used to deal with the various facets of the job – the worker is able to reduce the strain outcomes.

It is also important to recognize that the link that is broken does not have to be between the specific stressor and the feelings of perceived control. Thus, a worker who is threatened by a stressor such as a demand to improve productivity or to stay late in order to finish a project may feel overwhelmed, not because of that specific stressor, but because of all the other aspects of the job and home responsibilities that need to be maintained. The advantage of time management is that it can allow the worker to deal simultaneously with all the various stimuli. As they begin to work more efficiently, all parts of the job are affected, not only the immediate stressor that caused the feeling of loss of control. On the other hand, a worker who always feels that time-related stimuli are causing strain is probably a time-urgent individual. The influence of this moderator will be discussed below.

Measuring time management

Macan (1994) presented a model that shows a relationship between timemanagement behaviors, perceived control of time, and stress outcomes. Although time management training was not shown to influence timemanagement behaviors, the latter were significantly linked, by path coefficients, to perceived control of time and, in turn, to negative consequences. A time-management scale was constructed with thirty-three items that were grouped into three factors: goal-setting/prioritizing, mechanics of time management, and preference for organization. The path model linking the variables showed that the largest coefficient was the one between the last factor and perceived control of time.

If taught by the organization, time management must be integrated by the employees before it is likely to have any impact. Macan (1996) examined effects of a time-management

(TM) training program on several outcome and strain measures, including TM behaviors, control over time, job-induced and somatic tensions, and job satisfaction. Although exposed to a TM training program, subjects' TM behaviors had not changed when examined four months after beginning training. Using a self-report questionnaire, Macan found that strain effects were not reduced in the group that had been trained. The subjects also had not changed. It is not sufficient merely to just attend classes or see some videos on how to be more efficient. Time management should help in reducing the impact of stress on strain, but it requires a cognitive acceptance and then an actual change in behavior, not just a passive approval of concepts such as efficiency and time management.

Unpredictability and uncertainty

Before leaving the issue of job control and coping, I would like to present a framework for understanding the links between two related concepts, unpredictability and uncertainty. Sometimes mistakenly used by investigators as a gauge of the level of control, the first term describes an environmental situation and the second refers to the cognitive state in which a person finds themselves after confronting unpredictability in the environment. Uncertainty is similar to ambiguity, as discussed on p. 126, but it will be used here as the response to unpredictability because the two terms are often used together or one is sometimes mistaken for the other. Using this dichotomy and the general model framework postulated in the book, it is possible to view unpredictability as antecedent to uncertainty, which, in turn, is a component of control. A model which links the two concepts and helps provide some insight into the relationship between stressors and mediators in the more general situation will be delineated.

It is possible to think of two types of variables, situational variables and personal variables, in addition to the stressor itself, as components of the first stage in a stress process. Thus, unpredictability is a situational variable that moderates or interacts with other first-stage variables such as noise or work overload and personality. In the second stage, uncertainty is what the individual experiences as they react to the various components of the first stage. According to Sauter *et al*. (1989), uncertainty is a *cognitive*, *individual* process that triggers actions such as processing and organizing the available data. A worker who needs predictability and is in a situation that is inherently unpredictable may experience accentuated or magnified perceived stress. The latter variable will be the mediator between firststage variables and more serious strain consequences. Of course, each of the stressors may also influence the strain measure directly. However, I predict that in most cases the first-stage variables will go through perceived stress.

Time and unpredictability

Often an individual may not be able to change the environment directly to their satisfaction. Aversive events may occur at times which are random, or, at least, are perceived that way. Knowledge of their occurrence, or even their predictability, may be enough to change the negative effects of stress. An example of this phenomenon comes from the field of commuting stress where research paradigms and models describing linkages among predictors and outcomes have recently proliferated (Koslowsky *et al*. 1995; Novaco *et al*. 1990, 1991). Here is a situation where the environment (for example, traffic congestion, noise or crowding) is not under the control of the commuter, who is a victim rather than an actor in such cases. Nevertheless, there may be a stress-reducing device available here too. Given the lack of real control over the situation or the lack of choices (such as routes or modes of transportation during the rush hour) available to most commuters, individuals may still experience a sense or perception of control if they can predict the duration of the (aversive) experience.

When control of the environment is, for all intents and purposes, not available to workers, they may opt for another choice, namely, predictability (Seligman and Miller 1979). Thus, knowledge of when an event, good or bad, will occur or for how long it will last can be as effective as actual control in enhancing its positive effects. In addition, human subjects in laboratory studies threatened by electric shock preferred predicting its onset rather than receiving it unexpectedly (Averill 1973). This preference was moderated by personality in one study (Miller 1987), and the amount of attention paid to the predictor in another study (Burger 1989).

This aspect of predictability (or lack of it) has ramifications in many actual stressful situations and can be used to the benefit of the individual. Thus, providing information about the expected length of time that one will be exposed to a stressor can potentially reduce expected strain. Even after exposure to the stressor and the onset of some negative reaction, diminution of its severity or magnitude can be achieved by removing some of the uncertainty. According to this approach, coping mechanisms can be initiated before or after the onset of negative consequences.

Similar to predictability, other researchers have invoked the term ‘uncertainty’ to describe the effect of different environmental stressors on organizational consequences. In an atmosphere where the organizational climate fosters uncertainty, perhaps due to a lack of information, strain reactions are a likely outcome (Carayon 1995). McGrath (1976) has referred to the ‘uncertainty of outcomes’ felt by workers as partly responsible for negative physiological and behavioral consequences. Carayon wrote that ‘experienced (what we call perceived) stress does not result from a misfit between the perceived demand and the

perceived ability to cope with it but rather from the uncertainty of meeting the demand' (p. 29).

Jackson (1989) has argued that much of the stress observed in organizational settings is to a large extent a function of uncertainty. In their article on the relationship between managing stress and uncertainty, Schuler and Jackson (1986) cite environmental stressors as one of the main origins of uncertainty. Sharit and Salevendy (1982) reported that the number of factors that may be seen as occupational stressors is limitless. They felt that the underlying factor in many types of occupational situations is uncertainty. As the work most of us perform becomes more complex, uncertainty associated with the job becomes more prominent and with a concomitant increase in potential negative impact. Landy (1992: 125) feels that many of these other types of stressors can involve inadequate knowledge about an event. Accordingly, it is possible to extend the concept of uncertainty to uncertainty in time also. The more that is known about the duration of the stressor – that is, the more one is made aware of its likely end – the less likely it is produce a perception of stress, even if the objective measures are still present. In the commuting situation, the impact of the usual stressful characteristics (namely, long distance and excessive time) may be lessened if the commuter knows when the journey to work is expected to begin and when it will end.

Some other mediators

Physiological functioning as a mediator

In an interesting study by Barton (1994), strain effects (job dissatisfaction, health, fatigue, anxiety, and so on) of night-shift versus rotating-shift nurses (that is, working one or more consecutive nights before switching to some other work schedule) were compared. The author expected that the first group might have an advantage over the second group because the former could maximize adaptation and minimize disruption by increasing the number of night shifts worked. Also, as had been shown previously (Czeisler *et al*. 1982), a possible mediator here is the individual's circadian rhythm. Humans engaged in shift work may feel somewhat desynchronized in that when they want to sleep they have to work and when they should be up, they want to sleep. The fact that the circadian rhythm is being disrupted has been shown to lead to various negative consequences.

Barton's study was designed to examine differences on a series of outcome and descriptive variables and did not really look at the potential mediating properties of circadian rhythm. Nevertheless, by collecting data on activity disruption, flexibility of sleeping, and languidity (the reverse of alertness), it was possible to infer that a stress–strain link might well be mediated by circadian rhythm. Subjects' mean values on these last two indicators, part of the

Circadian Type Inventory (Folkard *et al*. 1979), were consistent with this hypothesis. Thus, permanent night nurses exhibited a greater alertness at night than in the day and greater flexibility in their sleeping pattern.

Religion, meditation, and cognitive restructuring

One of the coping techniques that has been suggested as a potentially effective mediator is the whole issue of religion, religious practice, and belief. According to the definition presented previously, religion is a good example of a coping rather than an intervention strategy, as it is not something the organization can impose on the individual. Rather, religion is available to any employee who believes in some force, being, or concept outside of themselves. It can provide solace and comfort to an individual who is exposed to stressors and it can put into some type of perspective the strains and negative consequences that an individual must suffer. Also, I am considering it as a mediator because it is something that is available to a worker when needed. Thus, a worker may or may not be 'religious' in his or her daily life activities. However, when confronted with stressors, it is a resource that can be invoked by the worker to break or reduce the stress–strain link.

Empirical findings with work-related stressors have not been very promising. Folkman *et al*. (1986) showed that religiosity and strains are not associated, and Beehr *et al*. (1995) found that religiosity did not serve as a coping device for policemen exposed to stress. However, in the last study it did provide a possible indirect benefit. Spouses of policemen who were religious were better able to cope with their husbands' strains. More research is needed in this area, especially as recent discussions in the popular and scientific literature have indicated that religion may play a role in many aspects of health (*USA Today* 1997).

Meditation

Research on meditation indicates that it can lower respiration rate, increase oxygen intake, reduce blood pressure, decrease tension and initiate a state of calm, and create a sense of well-being. While there are many meditation techniques, most seem to work equally well. Meditation is particularly effective at coping with stress and inducing relaxation. The relevant techniques can be learned relatively quickly and do not require special equipment.

Findings in the literature support the proposition that meditation is an effective coping technique. For example, using a pre-test-post-test design, McCain *et al*. (1996) reported that several relaxation techniques, including meditation, were able to improve the emotional well-being and quality of life for forty-five men with HIV disease. Few well-controlled

studies with meditation have been reported in an organizational setting; nevertheless, it would appear that if it can help in allowing an individual to relax, then it should be beneficial for many workers.

Cognitive restructuring

A cognitive psychologist may argue that between a stimulus and response there is a thought process which takes place. For example, waking up to a rainy morning might elicit distinctly different responses from different people. A farmer might breathe a sigh of relief when he thinks of rain watering his parched fields. A college student might react with irritation at the thought of a canceled outdoor picnic with a girlfriend. The same stimulus evokes different responses because of the thoughts that intervene during the process. Albert Ellis's rational emotive therapy posited that many of our negative feelings are caused by irrational thought processes (Ellis 1978). In any stressful organizational situation it should be possible to identify the elements that are stressful and see if one can be taught to take a different perspective about the activities involved. Thus, an assembly-line job with its repetition is boring, perhaps because the person may be imagining themselves doing the same thing over and over again. Is it possible to think through such a job and arrive at a different set of thoughts? Can this be taught to the worker? The answer, Ellis would argue, is 'yes'.

Let us take an example from another field, such as accounting, where time pressures are expected to increase dramatically as April 15 (the deadline for filing tax returns in the United States) approaches. The accountant is well aware of the time pressure and is constantly being driven by the notion that 'I must finish all the returns by a certain date and, even, hour'. Monetary penalties, lost customers, and negative feedback are often the costs associated with tardiness. While there is a measure of control available, it is somewhat limited. It is true that the accountant can decide how many tax returns to take on, how early in the season to start work on them, and so forth, yet events and stimuli which are beyond one's control often occur. A computer may stop working, a piece of information from a client does not arrive on time, or a bad cold can retard the pace of work. These delays sometimes appear as interminable. It is at this juncture that one's thoughts assume a great deal of importance.

The onset of one or more stressors can cause the accountant to become frustrated, angry, or irritable; by taking a more rational and positive view of the situation, they may accept the situation and cope through changing their cognitive style and developing a more rational and positive thinking approach, such as, 'Yes, I will finish the job on time, and if not, I know that I gave it my best'. It isn't easy; the inner dialogue that takes place between stimulus and response can occur so quickly that it may be hard to isolate and identify. Slowing down that

process and becoming aware of intervening thoughts is crucial to changing attitudes and affective reactions.

The accountant may try to put the stressors in their proper perspective. New thoughts can be substituted for confronting each of the stressors; it isn't necessary for the individual to focus only on the negative aspects of the stimulus; solutions can be part of the cognitive framework.

Similar in many ways to meditation, Meichenbaum's (1983) idea that self-speech can help in managing our behavior is much the same as someone else speaking to us and providing helpful comments. First, the person is made aware of how much negative self-talk often occurs. The person is encouraged to conduct self-talk which inspires confidence, a positive attitude, and anticipation of success. In a sense, it is like having an inspiring coach on board who believes in you and your capacity to cope. In the example above, the accountant may try to analyze to themselves why each potential stressor is having an effect. If the solutions to potential stressors are thought through and the end result is seen as a realistic goal, there is no reason to expect that the effects of the negative stimuli will be greater than the effects from the new positive attitude.

MODERATORS

In the following pages, I will try to identify some of the more popular moderators in the literature. As with other variables in the stress–strain model that have been discussed till now, variables may play several roles, including independent variable, moderator, mediator, and even an outcome measure. Whereas it is clear that a variable such as gender is nearly always a moderator, others are really a function of the author's or researcher's intention.

In a specific model, a moderator may both be a direct cause of strain and, in combination with another stressor, add to the variance explained by the stressor. Usually, the theoretical contribution is not the main effect of the moderator but its interaction effect which allows better prediction and sometimes an explanation for a stressor's influence that would not be available from the stressor by itself. Indeed, for many investigators, the search and identification of moderators is *the* goal of their research. There is another feature of a moderator that contrasts it with nearly all other variables in a stress model. The moderator is never a resultant variable. That is, it always has an arrow leading away from it rather than towards it. Although stressors usually behave in the same way, it is possible for certain job stressors (such as inadequate pay) to be a result of certain types of outcome variables (like poor performance). Of course, mediators and strain outcomes (for instance, short-term ones) are expected to be causal and effect variables in a process model.

Measures and source of stress

A commonly used moderator in social research is different versions, measures or categories of the independent variable. This approach assumes that both the quality and degree of the relationship between stress and strain is a function of the stress measure employed in the study or the source. Studies that examined several types of stressors can help shed some light on potential differences in stress–strain links. For example, measures such as person-role, intra-sender, inter-sender, and overload were found to be differentially related to various measures of performance (Rabinowitz and Stumpf 1987). Similarly, source of stress can be important. One may assume that a stressor whose origin is one's peers may have different effects from a stressor whose origin is one's parents. Barnes *et al*. (1983) found that the former positively influenced academic performance whereas the latter had a negative influence on it.

This categorical breakdown can also be applied by the meta-analytic researcher. Meta-analysis refers to gathering a series of studies in a particular area – namely, samples that used the same independent and dependent variable to examine a relationship. A series of corrections (basically for sampling error, measurement error, and attenuation) yield a value which can be said to be a better estimate of the independent–dependent variable association than the value obtained from any one specific study. A critical part of the analysis involves examining variability of the associations and trying to reduce this variability by identifying relevant moderators. If one sees that the variability has decreased within a particular category of the moderator, then it would seem essential to include the moderator in describing a relationship. In the field of stress research, such analyses would help in determining which measures or sources of stress are related to strain and how these associations differ. The reason this type of analysis is important in stress research is that few investigations have used more than one type of stressor. However, by collecting the findings across many studies, associations that are a function of source of stress can be determined. Finally, the meta-analysis may also be used on the strain part of the relationship. Although researchers commonly examine various strain measures within a particular study, a meta-analysis can be used to infer the category of stressor that affects each of the various strain measures (see Rabinowitz and Stumpf 1987).

Personality

In recent years, the role of personality research has undergone some major changes. First, the issue of trait stability is no longer taken as a given (Basic Behavioral Science Task Force 1996). In many circumstances it appears possible and, apparently, advisable to try to change one's destructive traits so as to function better. An example cited by the task force indicated

that Type A personality patients showed a reduction of more than 50 per cent in subsequent heart attacks after undergoing counseling and intervention programs. However, the problem is more complicated than that. Not all aspects of personality can be modified, and the parts that can be do not necessarily affect strain responses.

When one thinks of personality, it is usually in terms of underlying traits. The recent success of being able to categorize people into one of the 'Big Five' traits has created an agreement and consensus (relatively speaking, of course) in a field that was previously split into many camps, each with its own different scales and definitions (Costa and McCrae 1992). The personality traits that have been identified include the following: extroversion, agreeableness, conscientiousness, emotional stability, and intellect.

However, the task force also identified a personality process which includes the concepts people use for 'interpreting their experiences and their enduring expectancies about what they can and cannot do effectively' (Basic Behavioral Science Task Force 1996: 24). An example of this type of factor is will power used for regulating one's own behavior so as to achieve worthwhile long-term goals. Will power is a good example of a variable that may interact with any sort of independent variable. Although I am not aware of any research in this area, one can hypothesize two different situations. For individuals with little will power, the stressor effects should be stronger than for individuals who have a strong will power. Especially in an organizational framework, a worker may consciously decide to 'accept' certain stressors and suppress any negative reactions (for example, lowered performance) to them. If other goals such as a promotion or a pay raise are considered worth striving for, certain personality types may be able to eliminate or mitigate the influence of a stress–strain link.

Time urgency

I have already discussed the importance of time as part of a mediating process that influences perception of control. An individual who feels an unusual need or pressure to respond to time beyond the normal obligation may be described as 'time urgent.' When time urgency does manifest itself in a work setting, strains of different types often result (Landy *et al*. 1991; Schriber and Gutek 1987). The time variable need not be associated with a specific job or activity, it may occur every time demands are made or simply describe a trait and style of behavior that is independent of outside demands. Thus, its impact on strain can manifest itself in two ways: first, job demands or environmental stressors often require an individual to consider the element of time, even when this is not the natural tendency of the employee; and second, an individual's response to this demand can be a function of a stable personality

pattern, so that a time-urgent reaction occurs even if the outside demands do not require it. In the present model, both types of reaction would be included, though it is possible that in some cases the first type of situation describes a mediator, which can be unlearned so that responses to demands would be more reasonable.

Similar to the state–trait distinctions used by Spielberger *et al*. (1979), time urgency has both permanent and temporary components associated with it. Thus, some people may feel the pressure of time on all occasions while others choose when to be aware of it and when not. For some, all activities, including work, recreation, family time, or just relaxing, are done by consulting a watch. They are always on time for meetings, or celebrations such as a wedding or going-away parties, or at the airplane terminal at the beginning of a vacation. Others for whom time urgency is at a lower level or who are able to pick and choose what to attend to, may, nevertheless, be forced into seeking time information. For example, an organization that sets rewards, actual or real, as well as performance evaluations on the basis of arrival time at work, to meetings or general punctuality may have no alternative but to conform. In this case, time urgency is no longer a trait but, rather, a condition imposed on the individual by external stimuli, and acts, as described above, as a mediator.

According to several researchers, time urgency, a major subcomponent of the Type A personality pattern, is a correlate of various psychological and physical ailments (Price 1982; Wright *et al*. 1992). Within an organization, where time-related variables are often critical, time-urgent individuals may have difficulties in functioning, especially if the work environment tends to interfere. Job-related stress may be a function of how the organization responds to an individual who arrives on time. Indeed, reactions to a late arrival are part of the normative expectations operating within that environment. In the study by Schriber and Gutek (1987), the time variable was considered as part of the *culture* of an organization. Furthermore, Schriber and Gutek felt that satisfaction, organizational withdrawal, and productivity may all be related to the match between an individual's use of time and the organization's expectations.

Measuring time urgency

Based on analyses from a combination of self-report measures, Landy *et al*. (1991) identified a multifaceted construct that includes the following factors: competitiveness, eating behavior, general hurry, task-related hurry, and speech pattern. In a more recent study, Conte *et al*. (1995) found a five-dimensional model to fit their data: time awareness, scheduling, listmaking, eating behavior, and deadline control. Although the relative merits of the scales

still need to be tested empirically, it appears that at least several inferences from the findings seem reasonable. Time urgency is a multifaceted variable characterized by dispositions that are either associated with or may lead to specific behaviors.

Furthermore, taking some of the suggestions of Conte *et al*. one step further, there may be some merit in examining the interactions between external events, such as stressors, and specific components or factors of the time-urgency concept. What would be the implications of the model if the interactions were significant? The resulting model would include several moderators each interacting with the stressor(s). Perhaps just as important, it would provide a better understanding of where and how to apply an intervention. Thus, if meeting deadlines rather than making lists is the compulsive part of the personality, it may be possible to put the deadline into its proper perspective and show the individual how best to deal with it, such as getting help when needed. If the time-urgency problem is focused on making lists, then it may be necessary to show the worker how to prepare them more efficiently, perhaps by using a calculator/organizer or a computer.

Both Landy *et al*. and Conte *et al*. found time awareness to be one of the underlying dimensions of time urgency. Unlike the other dimensions of time urgency, time awareness can also be considered as the cognitive component of time urgency and belongs more to the mediator category than to the moderator. There are people who are naturally more aware, and this could be considered a part of the personality construct. However, when it is referred to as part of perception, then it is a variable that is influenced by other variables such as stressors. For example, a 'time-aware' worker who has a high workload which must be completed at the end of a period of time is likely to notice and experience, and, perhaps, feel uncomfortable as the hour passes and gets closer to the deadline. Such a situation can be quite stressful and its appraisal can indeed lead to tension and even physiological changes, such as a decreased flow of lymphocytes. For example, Meijman *et al*. (1995) showed that such a situation, which is described by higher perceived workload and a decreased feeling of control, was related to a lower level of this immune indicator.

Locus of control

Unlike the control variable which describes an actual or perceived relationship between person and environment, locus of control is a *personality* measure which reveals whether an individual believes that what happens to them is primarily determined by external or internal factors. According to the formulation presented here, it is expected that those with a greater sense of internal control believe that they can change the environment and should suffer less

strain effect. They will seek out methods, techniques, or just a different approach to deal with the stressors that they confront. Unlike the externals, this group feels that the stress–strain link will be broken if and when they act. The effectiveness of locus of control in studies of the stress–strain process has a somewhat checkered past with inconsistent findings (Gulian *et al*. 1989; Keenan and McBain 1979; Montag and Comrey 1987; Novaco *et al*. 1979). Montag and Comrey (1987) found that externality was associated with a greater number of traffic accidents. Novaco *et al*. (1979) examined locus of control as a potential moderator of the relationship between commuting stressors and outcomes. Their findings were somewhat ambiguous. Although significant interactions in the hypothesized direction were obtained in predicting some dependent measures (such as task performance), for other outcomes measures (like mood indices) significant findings for locus of control were opposite to those expected; that is, externals showed less strain measures. Given the critical stressor and mediating roles of control in a stress model, I think that locus of control does have a place in the stress–strain model. Nevertheless, at present, it seems that the measures available have not successfully distinguished between the two types and it may take a new approach to classify subjects.

Intolerance of ambiguity

Frone (1990) examined the notion that intolerance of ambiguity (IOA) or need for clarity moderates the stress–strain relationship. Although this moderating role would be expected to be highest with ambiguity as a stressor (or, as I have pointed out, a mediator in a process comprising several stages), studies have shown that IOA may also serve as a moderator when other stressors, such as conflict or overload, are present. Using Budner's (1962) definition of the concept – namely, that individuals high on IOA 'perceive ambiguous situations as sources of threat' – Frone found that the stress–strain link is stronger among the former type of workers. When faced with an ambiguous situation, a high IOA worker appraises stressful situations (not necessarily ambiguous ones) as more threatening than do low IOA workers.

Self-monitors

Another personality characteristic that may serve as a moderator is selfmonitoring. According to Snyder (1987), a person high on this trait adapts their behaviors to the changing conditions. Thus, when confronted with a stressor, the worker can readily adjust behavior or learn to change their actions so as to reduce its negative effects. As reported by Baron (1995), a high self-monitor has another interesting trait that allows them to survive where others

might not. They know how to give the impression of coping well; they are better able to hide their true feelings and thus seem comfortable in situations where others might express their discomfort, or, at least, transmit non-verbal cues that indicate discomfort. A person low on self-monitoring would find it harder to adapt as they prefer to be consistent, rigid, and consequently less able to respond to stressful situations. In a study of managers, analysis of questionnaire data showed that in conflict situations, the high self-monitor, as compared to the low self-monitor, reported fewer conflicts and a greater willingness to compromise and cooperate in order to resolve conflicts (Baron 1989).

Personality research in the future

Researchers in I/O psychology have not been particularly successful with personality measures as predictors (Dorn and Matthews 1992; O'Brien and DeLongis 1996). When personality is compared with some other types of indicators, it has been found wanting. In a more general study of predicting various outcomes from personality, Mount *et al*. (1994), using the big five personality factors, reported that predictions from two personality dimensions, conscientiousness and extroversion, yielded correlations in the .20s which were inferior or, at best, equal to those obtained from observer evaluations.

Nevertheless, other researchers have had some modicum of success in applying the 'Big Five' theory in predicting some strain outcomes. In one study, conscientiousness was found to be related to a measure of anxiety (Bernardin 1977). More recently, persistence as a personality trait was found to be a moderator of the stressor–strain link. Using job demands as a stressor and several different strain variables of managers and nonmanagers, Hochwater *et al*. (1993) reported that persistence moderated the relationship for some of the stress–strain links.

These findings seem to raise quite a bit of confusion (perhaps 'ambiguity' would be the correct term) for the stress researcher. In several cases, personality did serve as an important moderator. However, inferences are difficult to make as the additional prediction afforded by personality is not consistent. What should be done to identify the best course of action in such a situation? I see the goals in this area as twofold. First, in order to be of any help in the model, the appropriate personality measure is needed in each case. The greater the correspondence between the personality trait and the strain measure, the better the prediction. However, beyond that, what I feel holds the most promise is the attempt to focus only on the role of personality as a moderator and not as an independent variable. The variable by itself may indeed not predict strain (and, except, for some isolated cases, there is no reason to expect

anything else) but in conjunction with other stress stimuli could very well explain additional variance.

Let us take an example from the area of lateness. In discussing some of the potential correlates of lateness, Blau argued that punctuality appears to be an underlying personality construct that may affect lateness behavior (see also Richard and Slane 1990). It is associated with a specific behavior and is a consistent and stable trait that may, but does not have to, apply to both work and nonwork situations. Similar to the concept of time urgency, 'punctuality' is the more appropriate term to describe an individual who does what is required to make sure of arriving on time. It is here that punctuality can be observed as interacting with one or more stressors to predict strain. A punctual individual in an organization where time demands are high will suffer strain if an obstacle to an early arrival time appears. A delayed commuter train, an unexpected errand for the family or flat tires can all trigger a list of strain reactions.

Besides the importance of finding the appropriate moderator, there is another aspect to personality–stress research that may be quite productive. Generally, researchers examine only one or two types of stressors in combination with personality. Before making a determination whether personality is a significant moderator or not, it may be useful to include several different types of stressors, including individual, organizational, and extraorganizational factors in the model. By testing various stressors, it is possible that an interaction with personality may be uncovered, even one not thought of previously. For example, whereas researchers tend to use variables at the same level so that personality would be coupled with some individual stressor, it is likely that an organizational variable such as climate or structure will show a significant stressor–personality interaction.

A person X situation (that is, a type of stressor) interaction has been shown to be a significant and valid predictor in different settings and, I believe, is the direction that should be pursued. Regardless of whether there is a personality main effect or not, the inclusion of the 'right' measure in a prediction equation can be expected to help explain more variance than the main effects by themselves (Epstein and O'Brien 1985; Mischel 1977).

Attitudinal variables as moderators

Till now, attitudes have been seen as outcome or strain variables; that is, the effect of strain. However, it is possible to analyze attitude as a moderator, also. For example, Begley and Czajka (1993) analyzed commitment to the organization as a grouping variable that divides individuals into those who cope with stress and those who do not. Their findings showed that commitment acted as a moderator variable, with low-commitment individuals showing a

negative association between stressors and strain outcomes. High-commitment individuals showed no association between stress and strain. They argued that employees committed to the organization were able to buffer or resist the effects of stressors by providing stability and feelings of belonging. In such a model, other variables still affect the outcome directly but the moderator explained additional outcome variance.

Gender

Many, if not most, studies of stress have included gender as part of their variable for consideration. In their seminal article on gender and stress, Jick and Mitz (1985) argued that gender is not only a predictor of stress but is also a moderator. Gender was associated with more strain reactions for women as they reported more symptoms including depression and discomfort. Nevertheless, I would tend to doubt that there is something genetic that makes women more likely to behave in such a way. Rather, I think that women, as a result of socialization/culturalization, are more susceptible to certain types of stressors.

What are some of the processes that make women vulnerable to the effects of stressors in an organizational setting? It is difficult to say and considerably more difficult to examine scientifically. Some suggestions have been offered. Novaco *et al*. (1991) alluded to the fact that since women, as compared to men, may have more errands to perform (such as shopping, or driving the children to school) on their way to work, greater strain symptoms associated with the commute would be expected. As their explanation was offered only after seeing the findings, this particular hypothesis has not yet been proven in a study. For example, one interesting question that needs to be explored is the strain level among commuting men and women who perform an equal amount of errands on the way to work.

Besides the burden of the socialization process which dates from childhood, an adult working woman also confronts a working environment different from a man's. In the last few decades there has been a revolution in women's work–family role that may have an effect on some of the stress– strain links. Quantitatively and qualitatively the stressors impacting on women are different from those impacting on men. In support of this thesis, Lundberg (1996) argues that although the participation of women in activities outside the home has increased considerably, women's responsibility for both the home and family remains basically the same. Negative strains have been found both at home and at work, often as a consequence of this dual role. Though spillover effects are likely and social support may be less from a wife who works and does not have the time for 'tender loving care', the stressors women confront in the job and at home have very specific sources. As an example of this situation, a woman

may be frustrated by the fact that she has to give up a professional career because of conflicting demands.

Spielberger and Reheiser (1994) tested their Job Stress Survey on a group of 922 females and 859 males. Their scale provides total scores on perceived severity and frequency to a list of thirty stressors. Overall, there was little gender difference on these two subscales. However, several individual items were found to differ between men and women, but not always in a constant fashion. As an example, the perceived severity of the item 'working overtime' did not differ between men and women, however, the men saw this item as occurring much more frequently than women. On a frequency ranking, men ranked this item as third in frequency of occurrence and women ranked this as fifteenth.

In studies where gender differences were not part of the study hypothesis, it was, nevertheless, used as a moderator in *post hoc* analysis to see if the observed relationships were the same for men and women. For example, Cox (1985) found that women appraised monotonous tasks as less boring than did men. In a second study, Cox *et al*. (1984) found that women doing repetitive work had greater strain reactions than men. From these results, Melamed *et al*. (1995) hypothesized that women would react differently from men to various indicators of repetitive work and underload. Indeed, that is exactly what they found with the observed relationships between independent and dependent variable differing by gender for a behavioral variable, absence, and less so for the psychological measures of strain.

In trying to develop a framework for the moderating effect of gender on strain responses, Matuszek *et al*. (1995) identified several types of stressors that have a different effect on men from that on women. These include an individual variable (overload), an organizational variable (labeled by the authors as 'politics', which in our model is a component of organizational climate), and an extra-organizational variable (socioeconomic status). The moderating effects of gender manifest themselves not only in their interaction with the stressors but also in the coping methods used. According to Matuszek *et al*., women are less likely to use problem-focused strategies (pp. 119–20) and more comfortable with applying their social networks to mitigate the effects of stress. Finally, the authors concluded that women are vulnerable to more strain reactions than men and cope less effectively with stressors.

What is the lesson of the moderating effect of gender on the organization? Can an organization either use this information to assign functions or try to minimize strains to which each gender is exposed? I think that an organization that takes an active role and tries to take into consideration special needs is more likely to have a healthy workforce. Lundberg suggests that it may be necessary for organizations to reallocate work functions between the sexes so as to allow the women to work more efficiently and still feel that

family life has not been compromised. Let us take an example. Relocation, a stressor discussed in a previous chapter, has stress implications for men and women alike. Some of these, such as finding a new home, selling the old one, and moving expenses, are clearly obligations of any modern organization and should be provided for men and women alike. However, in areas which are somewhat more ambiguous such as the needs of a single mother who has been relocated, the organization may be insensitive or just simply unaware of specific needs. Finding an appropriate school or a daycare center for a mother who is unfamiliar with her new surroundings can go a long way in reducing work–family conflicts. Till organizations take into consideration women's specific needs in a realistic way without patronizing or demeaning the women's role, it appears that it will remain a major moderator in the stress process.

Organizational moderators

I have already discussed the possibility of stressors and mediators at the organizational level, but it is also possible to conceive of several variables beyond the individual as possible moderators. In their comprehensive review and analysis of organizational effects on satisfaction and performance, Sullivan and Bhagat (1992) identified three categories of moderators: individual, group, and organizational. A careful analysis of their moderators shows that they are using the term quite loosely and include variables that have been placed here as mediators. For example, they consider control (perceived and actual) as an individual moderator and social support as a group moderator. Each of these were classified in the present model as mediators. For them, any variable that interferes with or influences the stress–strain link is a moderator. In their evaluation of the field, they have found that it is difficult to talk of a stress–strain link without considering the moderators at all levels of analysis.

What is a typical moderator at this level? I would refer to the variables in this category as organizational types rather than organizational values or culture, which are more closely associated with stressors or mediators. The 'type' measure would include categories such as industrial vs. service organization, civil service vs. profit-making, or high tech vs. low-tech, and so on.

Strain differences as a function of organizational type really represent both an individual and an organizational moderator. For example, the reason an individual may choose to take a civil service, government position rather than a job in a highly competitive profit-making organization may be related to the stress levels expected from each type of job rather than the content or substance of the job. The former organization offers the worker security and fixed hours which provide a certain level of comfort. The latter organization may offer challenge,

the thrill of winning and sometimes losing in the marketplace. This distinction is also relevant at the departmental level. Thus, within a company some types of jobs require more initiative, more intensity than others. A stressor (for example, completing a project within a given time) may not be taken as seriously by an employee in a situation where the penalties are not usually meted out or where the worker gets a promotion (or doesn't) based on longevity rather than merit. In these cases, the organizational type is said to interact with the stressor to accentuate or reduce strain effects. In the methodology chapter (Chapter 10), I will discuss some of the issues associated with the effects of more than one moderator.

In a recent treatise by Zuboff (1988), an analysis of the organizational environment as it appears to the modern worker was presented. This new environment has relevance for both stressors and moderators; for direct and indirect effects. Zuboff argued that the modern workplace introduces disadvantages with new hazards and potential stressors, as well as advantages with wide-ranging possibilities. Jaffe (1996) identified new variables in the 'knowledge work environment' that have implications for the health of the individual and the organization as a whole. In the communication and technological world that we face every day, it is not possible to be intellectually passive or to remain at the same skill level interminably. Although the emphasis has changed from manufacturing to service and, in many ways, working conditions are much improved, there are situations where an interaction between stressor and environment will produce a particularly high level of strain. Thus, a stressor such as an organizational demand to become proficient with a new computer program or technology might interact with the type of organizational environment (Attwell 1994). If a modern, highly competitive organization is involved and workers need to be up to date with all the available ideas and techniques in the field, then a worker may experience an uncomfortable stress level as they attempt to 'keep up'. The stress could lead to a variety of strains as possible consequences, including job dissatisfaction, anxiety, and absences. In contrast, in a more relaxed environment (such as a job in a non-profit organization), the same demand would be seen as a management suggestion to keep up to date. If the worker opts to postpone or ignore the advice, then it remains just that – advice, and not a demand to perform or face the consequences.

IMPLICATIONS

We have listed some of the more important mediators and moderators that have appeared in the literature. In addition, some of the theoretical and methodological issues have been discussed. Yet, there is still one other issue that needs to be understood; namely, how does the organization or management treat the information gleaned about each type of variable? Let us take the case of intolerance of ambiguity (IOA) to illustrate the application of the

distinction between the type of variables in an organizational setting. In his discussion of IOA, Frone (1990) points out that data on individuals could help the organization decide who could be placed in ambiguous job situations. Thus, for a high IOA, jobs that are clearly defined would be best for the worker and the organization. Indeed, it may be useful to include IOA information in the selection process. They may feel it can be used to assign candidates to the appropriate position within a firm. Research in this area is necessary to see if such a system would indeed make a difference in strain measures such as behavior and performance.

By considering a variable as a mediator, rather than a moderator, a different set of organizational implications are present. Here, it may be possible to make a change; that is, influence the reaction to the stressor even after the employee has already joined the company. If a variable such as ambiguity (the converse of lack of control) is the result of a situation in the company or specific job conditions, then, as mentioned before, it may be possible to retrain, teach, or have the worker change their behavior using one of the coping or stress management techniques already mentioned. Frone cites an interesting approach for reducing ambiguity. Participative decision-making (PDM) is a way of getting the worker involved so that they are informed about the substance of the stressors and the best ways of combating its negative effects. Thus, if management wants a situation that will not lead to long-range effects detrimental to the firm, PDM can be viewed as a possible intervention to remove such situational ambiguity. Moderators are more permanent, and, although the information that a particular stressor is moderated by gender or personality can be used in placement or classification, it is not readily amenable to modification. It is this distinction that has guided my writing of this chapter: mediators can be modified and moderators cannot.

9

MODELING THE STRESS–STRAIN PROCESS

REGRESSION TECHNIQUES

Although the basic findings resulting from a traditional analysis of variance (ANOVA) can be shown to be equivalent to those obtained from multiple regression, the purpose of each statistical procedure is different. The former is usually appropriate for experimental design where cause– effect inferences are in order. Thus, an investigator who has manipulated one or more independent variables, randomly assigned subjects and handled other methodologically relevant issues properly can conclude that the change in the value of the dependent variable can be attributed to a change in the value or the level of the independent variable(s).

When the variables are not obtained from a true experiment but rather from a quasi-experimental design (lacking true control or experimenter manipulation) or even a cross-sectional study where the independent and dependent variables were collected simultaneously, analysis of variance statistics are not suitable. One of the commonly used procedures is multiple regression analysis (MR), which allows for the examination of the relationship between one or more independent variables, their interactions, and the dependent variable. Although causal effects may actually exist, the study design permits inferences only as regards relationships.

When stress research is conducted in the laboratory under controlled conditions, it is possible to examine the effects of a manipulated or planned change in the independent variable on the dependent variable. However, the bulk of the research in organizational psychology involves field analysis where variables are observed and not manipulated. The form of the analysis involves correlational data, which endows the whole field with certain features. Although many rich statistical techniques are available for analyzing such data, the limitation as regards cause–effect statements implies that the researcher and practitioner must proceed cautiously before drawing inferences regarding the explanation of observed

phenomena. Best-fitting models which indicate directions or temporal relationships among a set of variables can provide the researcher with nothing more than findings supportive of or consistent with certain theories. This does not mean that models cannot be proposed and tested. Indeed, regression analysis allows for developing models which can be cross-validated, used as prediction equations, and accepted as an adequate description of the relationships among variables. In some cases, especially if the researcher wants a greater understanding of the processes involved, an association observed in a regression model may then be manipulated or tested in the laboratory.

Nevertheless, as is the case with most models in the stress literature, it is difficult to make definitive statements concerning the comprehensiveness of the obtained equation. Practical decisions are often elusive. For example, what is the expected decrement in performance for a particular noise level? If more control over noise is provided to the worker, what will this do to their satisfaction level? Precise theoretical statements concerning how noise and/or control work are limited by the variables included in the study. It is always possible for a so-called 'third variable' that was not included in the study to exist. Also, a particular problem in field stress research is the makeup of the sample. I have already shown that specific occupations have built-in stressors frequently requiring instruments that are samplespecific. A researcher's findings may be limited to the sample studied and not be representative of other occupations.

A brief review of some of the techniques often associated with multiple regression analysis and particularly relevant for stress research – hypotheses testing with regression models, testing for moderators, and testing for mediators – will be discussed briefly below. The ideas presented below are gleaned from Cohen and Cohen (1983), Tabachnick and Fidell (1989), and Kerlinger and Pedhazur (1973).

Some background for applying MR

It is important to point out specific aspects of MR that can be crucial for understanding both the technique and inferences that can be drawn from it. As can be seen from much of the discussion in this book, one of the main goals of the stress researcher is to measure the contribution that a particular variable or group of variables makes towards explaining some reaction or outcome. In terms of regression statistics, the former are the predictors, and the index of prediction accuracy is determined by examining explained variance. In theory, as we add more variables, more of the variance in the outcome should be explained. However, in practice, this rarely happens. The fact is that only in rare cases do more than a few variables – two or three in most cases – make any contribution. To understand why this happens, we must examine the nature of multiple regression. If we view the outcome variable as made up of several non-overlapping pieces, then each new predictor should be aimed at trying to overlap

or explain one of these pieces. If we have identified some true correlates, then the first ones that are entered into the equation can be expected to overlap with outcome. However, as we add more variables, the unique contribution of a new predictor in explaining outcome variance decreases as it probably overlaps with variables that have already been entered into the equation.

This problem is compounded by another phenomenon, the relatively low correlation that any one specific stressor has with any specific measure of strain. According to calculations made by Zapf *et al.* (1996), even if a long list of variables in a regression equation were found to be significant (this is possible if we have enough subjects in the study), one would expect the contribution of any specific source of stress to be quite low. This issue will be discussed further in the chapter on methodological issues.

Testing hypotheses, including the significance of moderators

First of all, MR equations center on the variance-explained measure, R^2. We can define this terms as:

$$R^2 = SS_{reg}/SS_y$$

The denominator represents the sum of the squares in the outcome measure and the numerator refers to the sum of squares that are explained by the independent variables as predictors.

Second, the basic formula for testing the significance of a specific equation is based on ideas derived from analysis of variance (ANOVA). The correct formula is

$$F = (R^2/k)/(1 - R^2)/(N - k - 1)$$

The numerator contains the term for variance explained (in ANOVA terms, mean squared between) and in the denominator, the unexplained variance (in ANOVA terms, mean squared within). The letter k represents the number of independent variables in the prediction. In hypothesis testing, the crucial measure is the additional variance explained by a new predictor. The correct formula here is:

$$F = (R^2_{wi} - R^2_{w0})/M)/(1 - R^2_{wi})/(N - k - 1)$$

The major difference in the formula is that the numerator now contains the difference in variance explained between the equations with (wi) and without (wo) the new predictor(s). The term M refers to the number of variable(s) entered in the present set. The new variable can be a simple independent variable (main effect) or the interaction term; that is, the product of two independent variables. If the addition of the interaction term adds significant variance, then we can say that a moderator effect exists – one of the independent variables can be viewed as serving as the moderator of the other.

It is possible to examine several different types of moderating effects. We can say that the interaction is ordinal (for two or more values of one independent variable, the difference in effect between the values of the second independent variable is not constant) or disordinal (an X plot occurs in the model; where the effect of a particular variable at some values is exactly opposite to that obtained at other values). If the interaction is not significant we can say that the model is linear.

Mediating hypotheses can be examined through a three-stage process where, in the first step, the independent variable is regressed on the dependent variable and the variance explained (R^2) is noted. In the second stage, the hypothesized mediator is also regressed on the dependent variable and again R^2 is noted. Finally, in the third stage, the independent variable is regressed on the dependent variable after the potential mediator has been forced into the equation. If the R^2 at the third stage has been reduced to 0 or even just significantly less than it was after the first stage, then the findings indicate that a mediator exists. A very clear example of this was reported by Evans and Carrere (1991).

Research suggestions when using MR

Although MR can be used for testing whether several variables are related to a dependent variable, it says nothing about the temporal sequence. In an hierarchical analysis, a common technique for examining hypotheses, the variables can be entered in a specific order as set down by the researcher and dictated by the theory, but it does not indicate the direction of the links among variables. For this reason, the preferred method for trying to reach the proper inferences concerning linkages and directionality is structural equations modeling, which is discussed below.

Often a researcher is interested in comparing predictions afforded from two separate regression analyses. For example, two environmental stress scales may be compared on their ability to predict a specific outcome measure. A test of significance is available for comparing two variables (or sets) of predictors and determining which variable (or set) does the better job in predicting a specific outcome (see Tabachnick and Fidell 1989). As the formulae are somewhat involved, suffice it to say that the critical issue is determining the correlation between predicted scores from the first predictor with those of the second one.

An interesting possibility with MR is the ability to analyze residuals. Residuals here refer to the discrepancy between predicted and observed dependent variables. In a sense, the residual is the other side of the coin from variance explained. However, an enterprising researcher may try to understand why prediction was poor in certain cases. Is there a pattern? For example, in a stress study, it may be that for every even-numbered person in a list over-

prediction occurred, and for every odd-numbered person, under-prediction was observed. Perhaps the even-numbered subjects responded to the questions in an order opposite to those of the oddnumbered ones. In one case, it created artificially high scores and, in the second case, it lowered the scores. I must admit that after having tried this technique many times, I have not been rewarded with any revealing trends in the data.

Finally, non-linear trends can also be tested. Thus, it is possible to examine the quadratic or higher-level relationship between variables. In a study by Wood and Hokanson (1965), the authors found that physiological activation which causes an increase in heart rate is beneficial for performance only up to a certain level. Afterwards, performance begins to decline. Such a trend of performance scores is considered to be a quadratic distribution (Kerlinger and Pedhazur 1973).

Path analysis and structural equation models

As it is hard to isolate the link or set of linkages that is responsible for a specific response, statements concerning the nature of the theoretical model as well as the critical nodes or junctures in the process are often difficult to prove. A partial solution that has become quite popular over the past few years is the formulation and testing of structural equation models (SEM). After the hypotheses in a specific study have been formed and the data have been collected, linkages may be examined in two ways: in accordance with *a priori* expectations and following *post hoc* clues supporting unexpected linkages. With the proper cautions, as discussed below, the latter can be used to identify linkages that were not hypothesized originally. The mathematical and statistical formulae underlying the technique are beyond the scope of the present work. The reader looking for a more detailed theoretical foundation can consult several recent works (Bollen 1989; Cuttance 1987; Loehlin 1992). For a simplified presentation of the fundamental equations at a level that can be understood by readers with a moderate amount of technical background, the chapter by Ullman (1996: 709–812) in the Tabachnick and Fidell book is highly recommended. Much of the discussion below, unless indicated otherwise, is derived from Ullman's chapter.

Rationale for path analysis

A subcategory of structural equations, path analysis allows the researcher to use multiple regression techniques along with information on either temporal order or the theoretical formulation associated with a specific set of observed measures (also referred to as manifest

variables) to determine the significance of the proposed linkages. For example, in a typical stress investigation, a certain demographic, such as educational level, may be posited as preceding the strain measure. Also, a measure of subjective stress can be suggested as leading to the strain response. Now, in the usual regression analysis, we can get the joint effect by examining the R^2 associated with the dependent variable. It is also possible with the use of analysis of covariance or hierarchical regression analysis to obtain the impact of subjective stress on strain after accounting (or controlling) for education. With path analysis, the emphasis is different, as the technique allows the researcher to measure the indirect and direct effects on a dependent variable. The dependent variable need not be the ultimate one and intermediate outcomes may have direct and indirect effects associated with them also.

Path analysis, as well as SEM, is often used to test for the presence of mediators. A mediator is a variable that is posited as explaining the link between two other variables. Thus, in Figure 9.1, noise acts as a direct cause, as well as an indirect one, of reduced performance levels – see Fox (1980) for a detailed discussion of direct, indirect, and total effects. Without the path analysis, the investigator would not see how the set of variables are acting on the dependent measure. For example, by just examining noise alone, the researcher does not see how this environmental stressor impacts on the mediator, the indirect effect on the dependent variable. Similarly, by using self-report only to assess the mediator without obtaining information on the 'objective' characteristics of the noise stimulus, part of the explanation for reduction in performance may be lost.

A few more words about causation may be appropriate here. Ullman (1996) writes that causality is not a statistical issue but rather one of design. If the variables were collected in a temporal sequence and the relationship among them fitted into some theoretical understanding, then an assumption of causality is proper. The investigator must view path analysis, as well as SEM, as an alternative for testing hypotheses derived from non-causal as well as causal phenomena. Even when an experiment is carried out, these statistical methods may very well be preferred over some of the alternatives mentioned above. When several outcome variables, occurring over time, are assumed to be related to each other and the proper

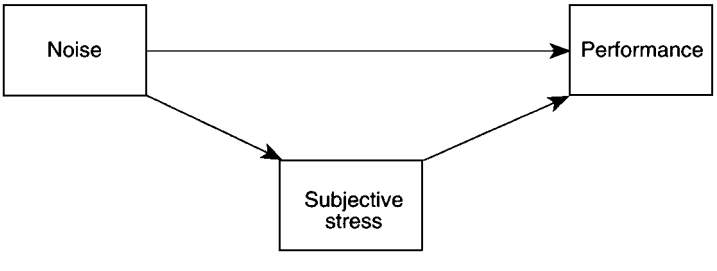

Figure 9.1 Direct and indirect effects of stressor

experimental manipulation is applied, path analysis and SEM allow the investigator to test whether the temporal hypothesis is indeed a true reflection of the empirical data. As with ANOVA, correct inferences concerning causality are a function of the degree to which the experimenter was successful in randomizing subjects and controlling for extraneous variables. On the other hand, a set of data collected at the same time, a socalled cross-sectional study, analyzed with path analysis cannot lead to a definitive conclusion concerning cause and effect; although it may be indicative it is not conclusive. Here, the path analysis and SEM allow the researcher to say that the hypotheses 'fit' the observed linkages and are consistent with a possible temporal sequence among variables.

An interesting aspect of this discussion is illustrated in Figures 9.2 and 9.3, which include demographics (number of children) as an independent variable. It is quite apparent that demographics precede the other three variables in the study. However, as the investigator did not manipulate the measure, it is hard to say what the 'true' causal process is; perhaps outside factors are involved. Let us take a university setting as an example. Strain may exist as a simple reaction to an environment where rules, requirements, and deadlines are found. Thus, it is possible that a sample of subjects who have spent time in a similar formal setting (for instance, the military), may also react negatively and show strain the way the original group did. On the other hand, if we were to look at a work environment with few formal trappings, the individual may experience fewer strain reactions and the links shown in the figures may not even show up.

There is another aspect about the two figures that is characteristic of both path analysis and structural equations; namely, the ability to compare models for adequacy of fit. Indeed, as we shall see (pp. 173–76), the testing of models and comparisons among them form the crux of the SEM methodology. Thus, in Figure 9.2, the effect of number of children is not mediated, whereas in Figure 9.3 a mediator has been included. Which provides the better fit? Is there an indirect effect that is necessary for explaining variance associated with the dependent

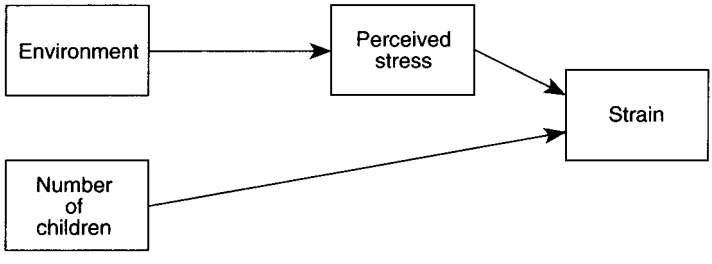

Figure 9.2 Direct effects of number of children on strain

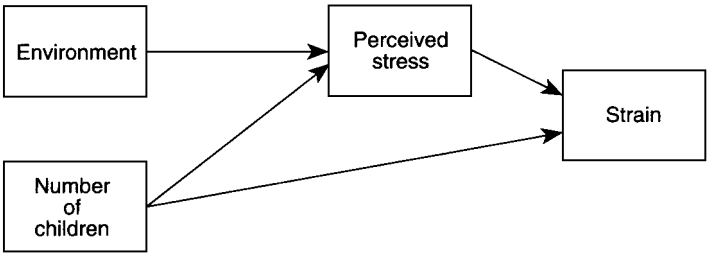

Figure 9.3 Direct and indirect effects of number of children on strain

variable? Moreover, it is possible that only the indirect effect is relevant. This would imply that number of children does not affect strain directly, and the arrow leading from this variable to strain should be eliminated in Figure 9.3. This type of relationship will be illustrated below.

STRUCTURAL EQUATION MODELING

Besides the usual advantages of path analysis, structural equations or the analysis of covariance structure allows for the inclusion of latent factors as the potentially relevant causal variables. Thus, it may not always be clear which specific observed measures are causally related, especially if they intercorrelate to the outcome measure, but it is possible with the structural equation technique to show that the underlying factor with the common elements from all the relevant measures is actually responsible. Let us illustrate with an example from the study of the effects of role conflict, ambiguity, and organizational culture on experienced stress (referred to in the present book as strain response) as reported by Van der Velde and Class (1995). Three factors derived from the twelve-item culture scale were aggregated (to make it similar to the organizational culture which was measured at the unit level) and all observed measures were used in the regression analysis. The authors reported that role conflict and ambiguity mediated between several of the organizational culture factors and strain. The authors did not use path analysis to test their main hypothesis – namely, to determine whether the impact of organizational culture is both direct and indirect (acting through role conflict and ambiguity) – nor to examine the influence of underlying factors on strain. Such a judicious use of SEM may have provided more accurate information on the relative impact of the indirect and direct effects. When applying structural equations, there are many advantages for considering the items as relating to an underlying factor, which is

more stable than the individual items, and which should be considered as the independent or dependent variable in the stress–strain model.

The following discussion in the chapter is divided into three sections: (1) some general features of SEM; (2) a brief explanation of some of the data input and output specific to SEM; and (3) a worked-out example. By first presenting some of the general and specific elements involved in the analysis, the reader will be able to see if the technique it is at all appropriate for their own research problem and how to proceed in collecting the proper data, a crucial enterprise by itself. The actual problem analyzed here should be easy to follow after understanding the first two sections. A brief explanation highlighting some of the important inferences from the output with relevant applications will suffice. In addition, when appropriate, specific methodological issues associated with SEM will be discussed. The next chapter also presents some of the general problems involved in model building.

General characteristics of SEM

Overall, the main question can be viewed as an attempt to determine the degree of fit between observed associations and expected ones. Ullman (1996) says that SEM is a confirmatory process that allows the researcher to combine factor analysis with regression analysis. Unlike many other statistical procedures, the investigator here must have a theory in mind before starting the analysis; indeed, the theory should guide the datacollection process also. This should not prevent the researcher from trying to refine the model during and after the analysis. Of course, this must be followed with reconfirmation and a repeated analysis of the newly discovered relationships. Although SEM must be used with caution (Cudeck 1989; James *et al.* 1982), the relatively new approach to the analysis of a set of correlations has been a boon to field researchers. In the worst case scenario, the pattern of correlations can be used for disproving a specific directional hypothesis between variables or, if the findings warrant it, a certain set of linkages provide support but not proof for a specific hypothesis. In the best case, it yields a true cause–effect system that provides information concerning amount of variance explained by a factor, reliability of indicators, and estimates of parameters such as regression coefficients, direct effects, and indirect effects.

Research designs with some or all of the following characteristics would indicate that SEM is warranted: (1) correlational (or covariance) data that include more than one measure from a specific domain; (2) an attempt by the investigator to show causal relationships among measures of a study; or (3) an effort to obtain support for the existence of a particular set of linkages. Although other techniques for similar types of data have been offered in the past, structural equation modeling is the method that seems to be preferred in the literature today.

In a major critique of cross-lagged correlations, a potential alternative to SEM that was quite popular more than a decade ago, Rogosa (1980) showed that the former method is not really an adequate or accurate gauge and is not recommended. In particular, the inability to account for measurement error, a major feature of SEM, is a major disadvantage of cross-lagged techniques.

Till recently, the two most popular computer programs for carrying out structural equations were EQS (Bentler 1985) and LISREL (Joreskog and Sorbom 1984). Many of the original programs in the area were quite complicated and prevented potential users from applying the new technology. The incorporation of routines for handling SEM within popular statistical packages such as SAS and SPSS has made the technique considerably more user friendly. However, the recent introduction of graphics packages with a simple interface to other statistical programs has considerably simplified the application of structural equations. In particular, AMOS 3.6 (Arbuckle 1997) provides a very straightforward set of text instructions and procedures for drawing the hypothesized models. In addition to the stand-alone package, AMOS also comes bundled up with a customized version that is distributed by SPSS (1997). The user can enter AMOS directly from the stand-alone program or through one of the SPSS statistical options. In the latter case, a simple instruction (similar to other commands such as Regression or Manova) brings up a new screen containing all the tools required to execute the AMOS program.

As AMOS is a graphics-oriented program, it can be mastered, even by novices, in a relatively short period of time. The drawing commands will produce, with just a few clicks of the mouse, a latent factor oval with all its observed variables and appropriate error terms. In addition, AMOS will print output that includes, at the discretion of the user, maximum likelihood estimates, chi-square, unstandardized or standardized parameter estimates, as well as, a series of other fit estimates. The author of the program has tried to include a wide range of the acceptable measures and methods of presentation, in text or in graphics form. Overall, the package is quite impressive and should contribute to greater use of the technique and to a better understanding of the findings. All the analyses reported here used the AMOS package.

Special features of SEM

In actuality, there are two components (or models) associated with SEM: (1) a measurement model, and (2) a structural model. The first refers to the observed or manifest variables and the underlying constructs they are purportedly measuring. This technique used by itself is sometimes referred to as confirmatory factor analysis. It differs from traditional factor analysis in that the investigator must identify the links between measures (or items) before

beginning the analysis. From my experience, it is quite a bit more difficult to obtain meaningful findings (namely, a good fit between theory and data) using confirmatory analysis. The usual problems of redundant items, measurement error, and unexpected links affect the match between theory and empirical findings. In contrast, with factor analysis, given a data set with at least moderate correlations, it is nearly guaranteed that some sort of significant factor pattern will be uncovered. It is likely that SEM findings, when meaningful patterns are indeed obtained, will be more easily reproduced and, thus, the technique is said to provide a more robust output than traditional factor analysis. As a final word about the relationship between the two techniques, an investigator involved in a new research area may want to start by examining a factor analysis whose observed pattern may help them refine hypotheses, and then, at a later stage, after more data have been collected, SEM would be applied.

In the measurement model, SEM programs provide estimates of the overall fit, the loadings of the latent (or underlying) factors on the manifest or observed variables as well as residual variance (error terms) associated with each measured variable; they constitute the major part of the output and is the information provided by the researcher when reporting the results in a confirmatory analysis. The manifest variables can be scales, self-reports, or objective measures; frequently they are single-item indices that may be found in a scale on burnout or noise measurement. When more than one observed variable for a construct is available, latent factors, which represent a common element among several items, can be extracted. Then these latter variables become either the causal or effect variables in the model and yield more meaningful links than single scales do. One of the salient features of structural equations is that the use of common variance factors provides a 'more thorough test of the underlying . . . [latent factor]' (Schaubroeck *et al*. 1992: 325).

Measurement models can be used to estimate the reliability of each of the observed items. Actually, in an overall SEM analysis, which also includes a structural model, the same estimates can be obtained. Using a program such as AMOS and inputting the correlation or covariance data yields a separate indicator of reliability for each measure. The reliability values that are obtained will be a function of the assumptions made in the model. For example, if the researcher had argued that two measures of a certain construct have equal variances (in SEM terminology, had placed certain constraints on the parameters), then the reliability values would be different than if no constraints had been placed on the observed measures. An important lesson here is that the model, as it is hypothesized by the researcher, will affect the quality of the inferences drawn by the researcher. This implies that reliabilities obtained in this way from a data set must be qualified and the reader made aware of the assumptions concerning variances, covariance, and length of each of the observed scales. It would also be

worthwhile consulting a standard work or discussion on mental testing for information on how the reliability is affected by various assumptions (Rock *et al*. 1977).

It is interesting to note that, unlike the usual case of factor analysis, SEM is often applied to a set of independent measures or constructs that already exist. Thus, it is possible to posit a concept such as organizational withdrawal with its associated measures – social loafing, lateness, absence, and withdrawal – and try to determine whether an underlying concept actually exists. As was mentioned in a previous chapter, not all researchers feel that the concepts represent a similar reaction to the organization, and trying to find the common elements may not be useful, or even correct. SEM is a tool for examining this controversial issue. Besides telling us whether a fit exists, SEM provides us with weightings or information concerning the importance of each measure in defining the overall concept. In a model that uses stressors as predictors of behavior, it may very well provide a good fit prediction with the latent factor of withdrawal but not with any of the individual outcomes.

The second component, the structural relationship, refers to the links or causal relationships that exist among (underlying) factors, factors and observed measures, and, less frequently, among measures. Two types of variables are said to exist here: exogenous and endogenous ones. The former refers to variables that are never the outcome of other variables, rather, they are always the potential predictors. In SEM terms, they only send out arrows, never receive them. On the other hand, endogenous variables are variables that are the result of other variables. They have, at least, one arrowhead pointing at them. Endogenous variables can also be the cause of other variables. This type of situation is very common, especially in temporal models. Thus, burnout may be the result of perceived stress, but burnout itself may be the cause of poor performance or all types of withdrawal behavior.

The structural part of SEM begins to resemble multiple regression and, indeed, regression coefficients for each path are the parameters that link the variables. Also, similar to regression analysis, a residual term or variance associated with an outcome measure not explained by other predictors is also part of the model. Referred to simply as ‘error’, it is an essential part of any SEM model. Unlike the usual regression procedure, an estimate for error must be included here, as SEM modeling requires consideration of all variables which affect an outcome.

Although not a requirement, a full comprehensive model would normally include both components. Although it is possible, in any specific study, to focus on either component, in analyzing the links between stress variables and various intermediate and ultimate outcomes, both the measurement and structural components have a role. According to Anderson and Gerbing (1988), failure to test a measurement model first and by itself may result in a failure to identify the cause for poor fit. A very good illustration of this technique can be seen in the article by Schaubroeck *et al*. (1992), who used the comprehensive model to prove that a

nuisance factor overlaps with emotional strain measures. Interestingly, the inferences derived from the analysis of each component were not identical and such complementary, if not contradictory, findings are not surprising.

Interpreting an SEM analysis

A cardinal rule to remember when using the procedure is that all models being proposed for evaluation should, at the first stage, be based on theory and not data exploration. If the latter is tried, then cross-validation with another sample must be performed before definitive inferences can be drawn (Byrne 1989). One of the problems here is that programs such as AMOS and LISREL make data exploration relatively easy and most inviting. As a matter of fact, many SEM programs automatically search for 'better-fitting' models.

The input consists of two types of measures: exogenous variables that are external to the model and not dependent on or influenced by any of the other variables; and endogenous variables that are affected by other exogenous or endogenous variables. In a typical stress situation, stressors (such as role conflict), personality, and demographics are all exogenous, and strain measures of attitudes or ultimate organizational behavior are endogenous. All the programs basically proceed by providing maximum likelihood estimates of the free parameters (that is, individual links unconstrained by the assumptions of the model) and then evaluate their fit with the empirical data. In addition, the researcher is provided with overall indices of fit for each model.

Indices of overall fit

As with several other statistical techniques, such as logistic regression and multiway frequency analysis, the χ^2 statistic is used for assessing fit. The degree of freedom associated with the χ^2 is the number of distinct sample moments (which is equal to the sum of the number of variances and covariances) minus the parameters to be estimated. As with the other statistical tests that use χ^2, a nonsignificant result indicates that the model and the observed data do not differ. Nevertheless, this index has many problems, especially as relates to the number of subjects in the study. For a large sample size, the null hypothesis is likely to be rejected even if the discrepancy between expectation and observed data is small. Similarly, it has been shown that for small sample sizes the use of χ^2 leads to inaccurate probability levels. For these reasons, many other fit indices have been proposed. Below, I discuss some of the more popular ones in the literature.

Bentler and Bonnett (1980) suggested the normed fit index (NFI), which compares the hypothesized model to a completely independent model where no links are posited. The formula for the NFI is:

$$(\chi^2_{\text{independent}} - \chi^2_{\text{model}})/\chi^2_{\text{independent}}$$

This comparison to a null model has some intuitive sense as it allows the researcher to state how much better the hypothesized model is than a situation where the researcher assumes that no relationships actually exist. Furthermore, the NFI can be calculated for each other alternative model suggested by the researcher. Especially when a particular area is controversial and several different sets of linkages have been suggested, the NFI provides an efficient method for comparing model fits. Often, an output presented in a journal article may list a series of models, each based on some type of theoretical consideration, which have been tested and compared to the null model. Using the terminology of James *et al*. (1982), the series of models tested should be 'nested' under each other. James *et al*. discussed the need for a development of sequences of nested models prior to actually conducting the analysis, in order that 'theory trimming' or exploration of the data be avoided.

The NFI, as well as the other fit indices used with SEM, are unlike most statistical tests used in scientific research. Usually, a probability level of .05 (or, in some cases, .01) is an accepted value of significance, and a decision concerning rejection (or not) of the null hypotheses is pretty clear cut. Here, there are usually guidelines or rules-of-thumb that are, to a large extent, arbitrary. Nevertheless, over the past few years, they have come into such habitual usage that it would seem hard today to publish an article that has not followed the accepted convention. For example, the NFI is considered as indicating a good fit if the value is above .90. A few of the other fit indices and their decision rules include the following.

First, two further chi-square related indices are the difference and the ratio tests. The first refers to the fact that in nested models, a difference between two chi-square values is itself distributed as chi-square with degrees of freedom equal to the difference in degrees of freedom between the two models. The chi-square difference measure is particularly useful when the investigator is interested in improving model fit by adding (or estimating) an additional link or links. Here, a significant result is clearly what would be needed; that is, a significant difference indicates that the addition of another link improves fit. However, two difficulties or cautions must be emphasized. First, for small samples, bias may be present. Also, the investigator must proceed with caution. Mere testing of additional links without any theoretical basis can lead to capitalization of chance findings. A related test which considers each suggested model independently compares the observed χ^2 to its degrees of freedom.

Again, because it is based on the χ^2 statistic, it may be influenced by sample size and is, therefore, somewhat biased. A value less than 2 is considered a good fit.

Second, goodness of fit index (GFI): this is the first of two indices that examine proportion of variance in the sample covariance matrix accounted for by the estimated population covariance matrix (Ullman 1996: 750). A value greater than .90 is considered essential so as to be able to say a good fit exists.

Third, adjusted goodness of fit (AGFI): this is also a measure of proportion of variance explained but it adjusts for the number of parameters in the model. Again, a value above .90 is considered a good fit. Because of the adjustment, the AGFI is always less than the GFI.

Fourth, normed fit index (NFI): this index is a very popular one in the literature and compares the researcher's proposed model to some baseline model. Usually, the independent model, which assumes that variables are uncorrelated, is used for comparison purposes. This model allows an investigator to draw inferences concerning how much improvement was obtained by proposing specific linkages. The maximum value is 1, which represents a perfect fit.

Fifth, parsimony adjustment to the NFI (PNFI): this index is one of two commonly used measures that adjust for parsimony. Parsimony refers to the fact that it is always better to posit a model with fewer linkages, especially if it explains a large proportion of the variance/covariance in a model. The so-called 'saturated' model, which explains all possible associations, is the exact other extreme of an independent model. It is, according to Arbuckle (1997: 551), the most general model for fitting observed data points and is, basically, vacuous in that it can be made to fit any set of data. The goal in science, in general, and in SEM, in particular, is to try to explain as much as possible with as few estimated parameters as possible. With this explication as background, the PNFI is equal to NFI (df/df_b), where df = degrees of freedom associated with the model being evaluated and df_b = degrees of freedom associated with the baseline or null model. The closer the value is to 1, the better the fit. From my experience, it is rare that the calculated value of the PNFI is very close to 1.

Sixth, root mean square residual (RMSR): this is an index based on residuals and is somewhat similar to the equivalent statistic used in multiple regression analysis. RMSR refers to the difference between the sample variances and covariances and the estimated population variances and covariances (these values are derived from the model). Here, a small value represents a good fit and a value of 0 indicates that the hypothesized model and the data are identical.

As the reader may have noticed, there are quite a few fit statistics available in SEM. And I have only listed a small fraction of what exists in the literature! Especially when compared

to multiple regression analysis, the plethora of indices may leave the reader somewhat bewildered. More than anything else, I feel that this is simply characteristic of a new technique in social science that is both popular and controversial. Each suggested index is said to be an improvement over the previous one. Where does that leave the user? What does the user do after completing an actual analysis? If the indices show a consistent trend (a good fit or a bad one), the investigator can report any one of the relevant measures mentioned above. However, if there are inconsistent results, what should be done? The temptation, perhaps, is to use the index consistent with the theory and ignore the others. This may be fine when the researcher's needs are only internal; however, when publishing results, it may be wise to report all the data as this provides others with an understanding of the issues that are still not clear. Ullman (1996) recommends that an inconsistent result should be reexamined. Testing the theory again on another sample, perhaps with some modification of the suggested links, could do the trick. In any case, the inconsistencies are not unusual, especially if some of the indices tend to support the model very weakly and the others are just barely beyond the cutoff point.

Further details and formulae for each index can be found in the articles/ books by Bentler and Bonnett (1980), Byrne (1989), James *et al*. (1982), Bentler and Dudgeau (1996), Ullman (1996), and Arbuckle (1997). For those considering confirmatory factor analysis, the Byrne book is particularly useful. The Bentler and Dudgeau review article does an excellent summary of some of the very practical concerns in SEM.

Parameter indices

Besides the overall fit indices, additional statistical output concerning individual parameters is also available. The most common method for obtaining parameter estimates in SEM is through maximum likelihood estimates (Ullman 1996). Ullman feels that if assumptions concerning normality and independence are reasonable, then maximum likelihood is a relatively good choice. Indeed, this is the default procedure in AMOS.

In discussing this aspect of SEM, one sees how terminology has seemingly taken over the field. Various statistical packages use different Greek letters to represent different approaches For example, in the LISREL package, the matrix of coefficients between dependent variables (latent factors predicting other latent factors) is called beta, the one between dependent and independent variables is called gamma, and the covariances among independent variables is the phi matrix. (I well remember the first time I had to confront these letter and names. They were difficult to remember as none of them, except the beta, was readily connected to other

commonly used terms in statistics.) One of the outstanding features of AMOS is the extensive use of verbal descriptions for each matrix rather than symbols or letters. A typical output for the standardized regression weights is labeled exactly this way. Furthermore, the use of graphics both in the input part of the program and in the output has nearly eliminated the jargon associated with many of the earlier versions of SEM. For an old-time user of LISREL, it is quite impressive when the output is made so clearly available and accessible both in text form and on the figure depicting the linkages.

The major parameters that are estimated by programs such as AMOS include the variance, covariance, error, loadings, regression coefficients, and multiple regression. For the researcher testing a temporal or sequential link among variables, the coefficients which describe the links between latent factors is most important. Similar to regression analysis, it is possible to obtain standardized and unstandardized regression coefficients. Because of the problem of identification (described below), the former are preferred as they are not related to the value the researcher uses to fix the path coefficient between the unobserved error term and the observed variable. The variances, covariances, and loadings are the statistics usually available from the measurement part of the model, and the weights and multiple regression are for the structural part. Besides the estimates for each parameter, AMOS provides the standard error and critical ratio. A value of 2 or more for the critical ratio is considered as significant.

Some relevant terms in SEM

Identification: I have already alluded to this concept in discussing parameter estimates. As one of the more confusing issues in SEM, the problem of nonidentifiability has to be dealt with any time the researcher has to estimate models containing unobserved variables. For the novice (and, sometimes, even, for the more advanced user) in SEM, 'the model is not identified' is probably the most common error message. Simply stated, the problem arises from the fact that there must be a unique solution for each parameter. If there is more than one possible estimate available, then we have a case of nonidentifiability. This issue is easily visualized by considering a typical SEM model. After determining the number of data points (that is, the number of variances and covariances) in a model, this value is compared to the total number of parameters (regression weights, variances, and covariances) to be estimated. If the former is greater than the latter, then there is no problem of identification. If these two values are equal, the parameters will produce a perfect fit (the so-called saturated model), and the issue becomes a trivial one. In the case where the parameters to be estimated are greater than the data points, the researcher must reduce the number of parameters to be estimated.

In the overall recursive (see below) SEM model, whether it is the measurement or the structural part, the investigator can confront the problem of nonidentifiability by either assigning an arbitrary value to one of the parameters (often a value of 1) or fixing it in some other way (such as by saying that two parameters are equal to each other). Programs like AMOS provide standardized and unstandardized output for the regression weights. Arbuckle (1997) argued that the arbitrary assignment makes the nonstandardized output not easily interpretable as it is a function of the assignments made by the investigator. Both the overall fit measures for the model, the standardized coefficients, and correlations (instead of the variance/ covariance matrix) are not affected. For an investigator who has a theoretical basis for deciding what values to assign to the regression weights or how to set the relationship among the parameters, either standardized or unstandardized coefficients are meaningful and usable.

Recursive/nonrecursive models: If one can draw an arrow or a series of arrows emanating from a variable that will lead back to the original variable, the resulting model is called nonrecursive. In contrast, recursive models lead away from a variable and do not loop back, either directly or indirectly, to that variable. In the former case, at least one feedback loop among the endogenous variables is said to exist. In the latter case, no variable in the model has an effect on itself.

Figure 9.4 shows a nonrecursive model between perceived stress and lack of control in a typical stress–strain situation. Here, the double arrows between the two endogenous variables indicate that a loop exists never necessitating a return to the exogenous variables. Some of the issues relevant to these models, such as stability indices for determining whether one can expect the regression weights to converge to a stable set of values and determining identification criteria for these models, are beyond the scope of this book (see Ullman 1996; Bentler and Freeman 1983). Suffice it to say that hypotheses containing such a set of linkages are indeed manageable with SEM, and may help in understanding relationships that traditional procedures such as analysis of variance or regression models cannot readily cope with.

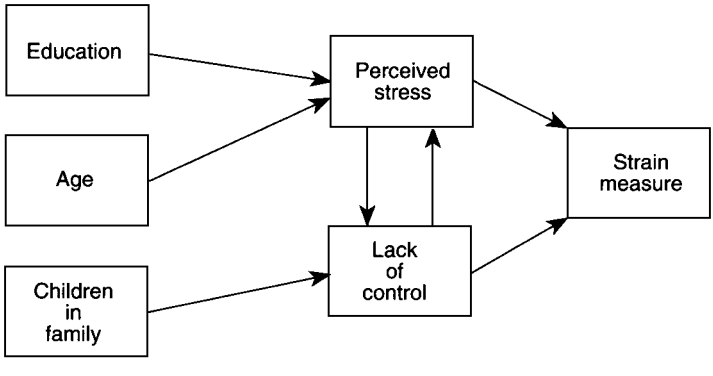

Figure 9.4 A nonrecursive model

Modification index: One of the interesting features in the output of SEM programs is the ability to improve the model *after* an analysis has been completed. What this means is that the researcher may wind up with a model that is considerably better than the one that was hypothesized at the beginning. Ullman (1996) feels that there are two reasons why an investigator may want to change the original model: (1) the study was exploratory and the main purpose for conducting it was to find the best fitting model; and (2) the theory that was tested did not fit well and now it is possible to increase fit by changing or, very frequently, adding some new links. Arbuckle (1997) writes that the most natural way to modify a model would be to relax some of the assumptions. Thus, in a nested analysis, if two error terms were originally thought to be uncorrelated, one can posit an association and see how this improves the fit between model and data. One word of caution here. As such a procedure involves adding a new parameter that must be estimated by the program, an identified model may become unidentified. If this is the case, the investigator may decide to change one of the existing links to see if the overall model is now providing a better fit. One of the problems with this suggestion is that a comparison is no longer possible as the new model is no longer nested under the old – see James *et al*. (1982) for a discusson of this issue.

The test for model improvement can be accomplished by examining the change in chi-square between the original and new model. After the new chi-square is subtracted from the old one, the difference is examined using a chi-square table (the degrees of freedom are equal to the change between the old and new degrees of freedom). Nearly every additional link is expected to increase fit so it does not necessarily tell us much about the underlying process. Therefore, several suggestions should be considered before deciding that a new model has been found. First, is the new chisquare significant? If yes, then proceed. What has happened to the parameters in the model? Was there a substantial change or not? Arbuckle provides an example where the value 4 is used as a minimum change in chi-square but does not discuss what should be the minimum change in parameter estimates.

In all cases, I would be hesitant to report a model based on some modification index that was applied in only one particular case. Instead, whether exploratory work or theoretical confirmation is involved, it would need replication or cross-validation. An identical sample or another similar one would be the appropriate procedure here. Although it will not be illustrated here, SEM packages such as AMOS are particularly useful for comparing fit and parameter estimates across groups. It would seem to me the least a researcher should be required to do before reporting on an SEM analysis based on modification indices. Stability across samples would also be a correct step in moving from exploratory to confirmatory types of analyses.

Some words of caution

Some methodological rules of thumb when applying the SEM in practice would be in order. As structural equations include multiple regression analysis as an integral part of its technique, the ratio of sample size to estimated parameter of about 10:1 would be appropriate here too (see, for example, Nunnally 1978). Interestingly, the ratio uses parameters rather than variables, as the former is the more relevant value in SEM. Several simulation studies have shown that coefficients become stable if at least 100 subjects are used (Cuttance 1987).

Although researchers are prone to hint (often in a roundabout manner) that the lack of a significant finding (namely, good fit between hypothesized model and data) from an SEM analysis is indicative of a causal sequence among variables, this is actually an incorrect inference unless the usual experimental manipulation and randomization have been followed scrupulously. There is nothing wrong with an exploratory study for developing ideas and crystallizing hypotheses. In particular, if the findings were obtained from cross-sectional data, it is incorrect to draw cause–effect inferences, which are, at best, only supportive or consistent with study objectives (Glass *et al*. 1993). Glass *et al*. (p. 153) state that findings from a structural equation analysis of questionnaire data (where independent and dependent variables are all 'embedded' in one scale), a classical example of a cross-sectional design, does not permit 'explicit causal inference' statements but does permit inferences concerning support (or lack of support) for study hypotheses. Nevertheless, it is my opinion that the situation in social science has improved over the years and that statements stating that the 'data are supportive or consistent with a specific model' are quite common today in the literature and more extreme statements concerning causal statements from such data are becoming less common.

Even if the researcher has done a good job in controlling the extraneous variables, there is always the danger that results are sample-specific, for any number of reasons. As we are generally not interested in very localized results, cross-validation should be a part of every SEM analysis. It is noteworthy that only in social research is the need to replicate stated so frequently and so often violated. In medical or other life science research this goes without saying. Would the Federal Drug Administration in Washington recommend the use of any drug without first doing laboratory studies, field studies, many times each? In social research, fewer rewards (such as likelihood of publication or prestige associated with a introducing a new theory) are obtainable after a replication study and so there is a dearth of such investigations.

Another common problem with structural equation methodology is the reliance on one method of data collection, such as self-report scores, for much of the observed data in an

investigation. As the input in SEM consists of correlations (or covariances), a researcher may delude themselves that, by using solely a self-report format, meaningful inferences concerning linkages would be possible. Although this is obviously not a necessary condition for SEM, researchers focus only on the input into the program and not the research design. When a researcher uses only one method for data collection (such as measures of stress, strain, personality and so on, all coming from employee responses), results may be biased or distorted. These are problems shared with most current research in work attitudes (for example, Jex *et al*. 1992). A way to avoid such a situation in stress research may be to try to obtain the data available from other individuals or other sources. For example, another possible respondent who may have information concerning the stressors in the organization is the supervisor, or, if it is an organization that uses group decisions, other team members should be able to respond to items concerning the existence of outside negative stimuli. Also, at the other end of the model, strain measures such as behavior and performance can be obtained from personnel records and files. The bias in self-report versus more objective measures of the same behavior has already been documented in some areas. For example, Johns (1994) found that self-report absences are underreported as compared to data from personnel files.

Assumptions of the model

As with most statistical procedures, assumptions concerning the critical variables are necessary before beginning the analysis. As a complete structural equations model consists of exogenous and endogenous variables, the discussion focuses on each of these types of variables. Much of the following review of assumptions is based on Billings and Wroten's (1978) critical article on path analysis and the non-technical presentation of the use of structural equations in personality research by Judd *et al*. (1986).

Perhaps the key issue in the evaluation of SEM models is identifying the 'quality' of the fit. However, the power considerations involved were often not considered. As we saw above, many fit indices are available for determining the 'right' or best model. In most statistical applications, we are interested in rejecting the null hypothesis, and this, of course, has the usual Type I and Type II errors associated with it. With SEM analyses, we want to accept the null hypothesis, and from our usual hypothesis testing perspective, it is nearly impossible to conclude that a specific model is the correct one. Besides its sensitivity to sample size, a good 'fitting' model based only on the findings from the chi-square test may be deceptive because the parameter estimates are likely to be trivial or, sometimes, even nonsensical. This problem

of parameter estimation also exists when trying to fit a complex model. The more links that are hypothesized, the more parameters need to be estimated, and the greater the chances that the model will not be identified. Moreover, as we mentioned previously, a large sample size will nearly guarantee that the null hypothesis is rejected even if it does provide a relatively good fit to the data. Some of the indices discussed above are designed to reduce our dependence on sample size.

Another bothersome issue in interpreting SEM findings concerns the nature of the scores. As with many other types of multivariate situations, multivariate normality and independence assumptions are basic assumptions, especially as concerns the dependent variables. Except when utilizing non-parametric techniques, this is a common requirement for the measures in a statistical analysis. When individual outcome measures are not normally distributed, the major inferences concerning strength of the parameters, sequence, and direction of the variables may be compromised. Of particular concern are dichotomous, endogenous indicators such as turnover (whether someone left or not after a period of time). The use of maximum likelihood estimates for the parameters appears to be a good choice, as it is less sensitive than some other methods to violations of normality and will provide adequate estimates of relevant parameters.

As for predictor variables, the restrictions can be relaxed somewhat. Arbuckle (1997) argues that, for some cases, the distribution of the exogenous fixed variable (which is known beforehand or measured without error) may take any shape, provided that the remaining variables are normally distributed, the variance/covariance matrix is the same for every pattern of the fixed variable, and the expected values of the random variables depend linearly on the values of the fixed variables. For example, AMOS would have no problems handling ANOVA or ANCOVA designs where the treatment variable may be divided into two categories (such as a treatment group and a control group).

As the number of subjects increases to 500 or more, all limitations (both for exogenous and endogenous variables) become less significant. In some cases, transformations of the variables (for example, square root or log of the raw data values) will reduce skewness. When a series of dichotomous variables are used as indicators, they can be summed first so as to produce an indicator with a much higher likelihood of meeting the distribution requirements for SEM. Departures from normality of such scores can be expected to be much smaller than with the individual items. Several articles have dealt with this particular problem and, for many ‘problematic’ type variables, it is advisable to make some form of transformation before conducting an SEM analysis (see, for instance, Bentler and Dijkstra 1984; Browne 1984; Ullman 1996).

The need to assume uncorrelated, independent residuals or error terms is also vital for achieving correct estimates for loadings associated with the parameters. Uncorrelated residuals is the default option in most SEM programs, and permits the researcher to assume that other unmeasured variables were not responsible for observed relationships. If there are other variables that should have been measured and can account for the unexplained variance in two or more variables within a model and weren't included, then the researcher cannot argue that the model is a complete or accurate one.

As for missing data, the rule of thumb does not differ much from that applying to other statistical analyses. The use of variables with missing data may produce a bias in the findings and, where possible (easier said than done in most of the studies I have been involved with), should be avoided. Moreover, some of the structural equations packages (such as AMOS) which can handle analyses with missing data do not provide all the usual output when this occurs. Also, a matrix containing only complete data would be the best of all alternatives. (Incidentally, it is not recommended that researchers use pairwise deletion of variables so as to obtain a matrix of correlations containing different number of subjects for each pair of variables. According to Hayduk (1987), this technique leads to biased estimates for some of the fit indices and parameters.)

The set of assumptions related to regression analysis in general is applicable to the typical structural equation models also. First, the relationship among variables is assumed to be linear, additivity of the effects of causal variables are assumed (that is, no interaction effects exist), and the variables are expected to have properties of interval scales. Nevertheless, violations of each of these rules can be dealt with through alternative procedures. Billings and Wroten (1978) suggest the use of categorical predictor variables or exponential terms in the model to solve the first problem. An interaction term consisting of the product of the two factors can be calculated and used as a causal variable (however, the proper analysis for the interaction term is moderated regression analysis, as discussed previously in the chapter). Again, Billings and Wroten argue that wellconstructed measures employing a reasonable number of values and consisting of several items will enable the researcher to do the analysis even if the interval scale assumption is not met.

Testing a stress–strain model with structural equations

In order to understand the role structural equations play in modeling the stress process, I would like to present an analysis that takes us through a worked-out example with an opportunity to compare the results from two potential models. The example comes from the field of commuting stress, and illustrates quite clearly some of the pitfalls that may result and how it may be possible to overcome them.

First, it might be worthwhile to review some of the stress-relevant issues that have already been discussed. Researchers today agree that the stress– strain relationship is often mediated by perceptual and cognitive processes. Nevertheless, it is possible that the stressor also works directly on the outcome variable. Structural equations modeling is ideally suited for testing whether the second possibility is true, and, if it is, how much this additional link contributes to improving model fit. The present technique is also useful for examining another issue in commuting stress. How are the concepts of time and distance related to each other? Are they common stressors or are they independent ones? In order to appreciate the SEM technique, I would like to digress for a few paragraphs, provide some background on the whole topic of commuting stress, and see how SEM can answer several questions that have till now only been controversial without any real solution. SEM may be an approach for answering several of these questions.

Some background on the commuting experience

The field of commuting research is characterized by a lack of consensus on how best to define the stressor. A short history of the literature may be appropriate – for a more detailed discussion of the field, please refer to Koslowsky *et al*. (1995). As time and distance appear to be the most obvious measures of the commuting experience, some combination of the two has been suggested as the best way to conceptualize the stressor. Indeed, Martin (1971) cited data to support the practical equivalence of the two terms (time and distance) in many cases. Also, Novaco *et al*. (1979) reported a correlation of .93 between the two measures. These were the independent variables used in most of the early reports on the effects of commuting.

At first glance, it would appear that average speed is an ideal measure of impedance. If it takes longer to get to work (or to return home), more impedance is implied. However, this simple measure is confounded with so many other extraneous factors as nearly to obscure its meaning completely. For example, a commuter driving at 35 mph is not necessarily experiencing more impedance than another driver driving at an average speed of 50 mph. The former may be using only local streets and going at the maximum permissible speed and actually experiencing no 'obstacles' along the way, whereas the latter may be driving on a superhighway (on a German autobahn, this driver is probably only crawling) and experiencing many 'obstacles' along the way. Interestingly, Novaco *et al*. (1990) found that 'average speed increases as an artifact of commuting distance' (p. 234) – a further indication that speed is not a function of obstacles but of various other extraneous variables.

As research in the field increased, researchers – for example, Novaco *et al*. (1979); Novaco *et al*. (1991) – tried to calculate some combination of time and distance so as to better

represent the independent variable or stressor. In an insightful attempt to make some sense of the field, Novaco *et al*. (1979) popularized the concept of *commuting impedance*. As defined by the authors, impedance was seen as a behavioral restraint on movement or goal attainment (Novaco *et al*. 1991). Essentially, impedance consists of anything that frustrates the intention to arrive at a particular destination – for example, distance, slow speed, or traffic congestion. Novaco *et al*. (1979) observed that commuting can be a significant stressor when measured in terms of the degree of commute impedance. One of the problems with the measure was that it was sample-specific. Thus, a new calculation of the categories (high, medium, and low levels of impedance were hypothesized in their studies) would be required in each sample where time and distance distributions varied. Results have not been consistent nor, particularly, practical. As impedance did indeed relate to some outcomes and not to others, it was not clear if the investigators had indeed uncovered a useful, new concept. Also, their analysis linking commuting impedance to outcomes was carried out by a series of multiple regression equations. Although such procedures are useful for identifying specific relationships, it does not provide the investigator or the reader with an overall framework. A method of combining the findings could be provided by SEM.

Mediator and moderator variables in the commuting experience

Novaco and colleagues also dealt with the issue of subjective commuting experience. While objective impedance was clearly a factor here, the perception of the commuting experience also needs to be taken into account. Indeed, it may be more important to consider the commuter's reaction to the trip between home and work than some objective indicator. For example, while an hour's train ride may involve more time and distance than a 35-minute commute by car, for some people the train ride may be perceived as less stressful because they would not have to buck traffic or fight to find a parking space. For others, time alone in a car might be perceived as less stressful than riding in a train (or, especially, a commuter subway with other people). Thus, the measure that may be required is some type of qualitative indicator rather than a quantitative one.

In summary, SEM seems especially appropriate here as it would allow us to accomplish the following in one analysis: (1) define a possible latent factor from time and distance data; (2) examine the direct and indirect effects of predictors; (3) assess the mediating role of perception; and (4) combine strain data, in this case organizational withdrawal behavioral, so as to obtain a more general prediction model.

The present analysis

In a study of commuting stress that one of my students conducted in order to fulfill his thesis for the MA degree, data concerning demographics and perceptual and behavioral data were collected for each individual. The demographic data consisted of the distance between home and work (KLM) and three different time measures: time to get to work on a good day when there were no particular commuting problems (TimeG), time on a bad day (TimeB), and the difference between the two (TimeD). As the TimeD measure is actually an objective piece of information, it can be viewed as a stressor that gauges environmental uncertainty. The perceptual data consisted of four questions (stress2, stress3, stress4, and stress5) asking the subject to react to the commuting experience. (Originally, the scale consisted of six items, two of which were dropped because their correlation with other items produced some inconsistencies and difficulties in interpreting the graphs.) In addition, the following behavioral data were collected: (1) the number of days the commuter missed from work because of illness ('absences'), and (2) the number of hours the commuter missed from work (an hour is equal to 1/8 of a workday) during the months of January and February 1993 ('lateness'). After obtaining management's and workers' permission, as well as a promise of anonymity, the MA student culled the organization's personnel files (without knowing the subject's name) and identified the relevant behavioral information. Finally, the model also included an organizational measure, whether the person was on a flextime schedule or not. Although the data analyzed here were originally used for two other purposes – first, testing hypotheses concerning the withdrawal progression model, and second, describing the relevant personal variables in the commuting process (Krausz *et al*., in press) – they will be used here for illustrating the use of structural equations for testing models in a sequential fashion.

The data in Tables 9.1 and 9.2 were collected from 142 employees of a service organization in the central part of Israel. A quick perusal of the correlation matrix

Table 9.1 Means and Standard Deviations of variables in stress–strain model

Variable	*Mean*	*Standard deviation*
Stress2	2.90	1.78
Stress3	3.27	1.97
Stress4	2.68	1.87
Stress5	2.59	1.83
TimeD	23.14	17.08
KLM	15.54	14.18
Flextime	1.55	0.50
Lateness	2.43	2.75
Absence	0.55	1.16

Note: TimeD refers to the difference in time between a bad day and a good day.

Table 9.2 Intercorrelation matrix for stress–strain model

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1 Stress2	–	62	65	69	29	32	12	18	30
2 Stress3		–	65	63	41	26	13	13	23
3 Stress4			–	57	30	17	15	12	28
4 Stress5				–	39	35	05	20	21
5 TimeD					–	48	12	05	06
6 KLM						–	01	00	16
7 Flextime							–	10	09
8 Lateness								–	16
9 Absence									–

supports the notion that the stress variables appear to come from one domain. Similarly, the time and distance variables showed a correlation of .48 – relatively high, but expected. In reporting the findings, what is most critical for us now is Figure 9.5, which shows a proposed commuting stress–strain model. As can be seen from the links that have been drawn, objective stress, perceived stress, and withdrawal are all unobserved, latent factors which are associated with different measures. Flextime is a potential organizational measure that was tested as a potential moderator at two points: as a link to perceived

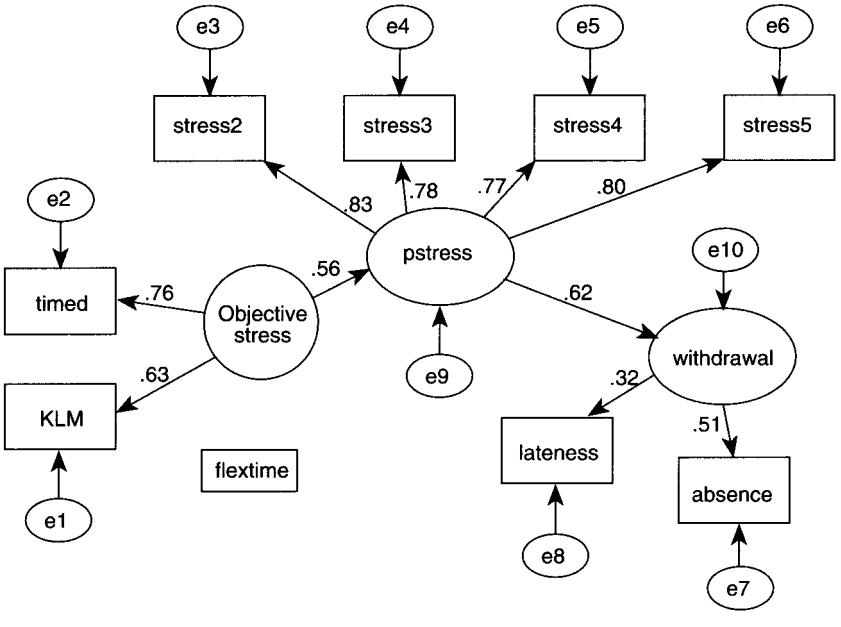

Figure 9.5 Structural equation model with standardized coefficients

stress and as a link to withdrawal. Furthermore, the following structural or causal links have been included: objective stress-perceived stress, objective stress-withdrawal, and perceived stress-withdrawal. The values on the arrows for the measurement model can be viewed as loadings and for the structural model as regression coefficients. T-tests on these values showed that all were significant except for the link between objective stress and withdrawal. In order to avoid possible problems associated with identifiability, all the reported values in the figure use standardized regression weights.

Finally, Table 9.3, which summarizes fit measures, indicates that, as compared to the independence model, Model A (which does not include the objective stress–withdrawal link) and Model B (which includes the objective stress-withdrawal link) are considerable improvements. This is evident from every one of the indices used. As Models A and B do not really differ much on the fit indices and the objective stress–withdrawal link was not significant, I would tend to conclude that the first model is the better one. The rule of parsimony would also support this conclusion; since the two models provide about the same degree of fit, then the less complicated one should be used. Flextime was examined as a potential moderator at several points in the model (linked to the latent factor perceived stress as well as linked to the latent factor withdrawal) and was not found to improve the fit.

Table 9.3 Measures of fit for stress–strain model

Model	*Chi square*	*df*	*p*	*Chi square/ df*	*NFI*	*GFI*	*AGFI*	*RMSR*
A	35.27	26	.106	1.36	.911	.947	.908	.05
B	34.67	25	.094	1.39	.913	.948	.907	.05
Independence model	397.12	36	.000	11.03		.531	.414	.27

10

GENERAL METHODOLOGICAL ISSUES

This chapter describes several issues that are particularly relevant for understanding the links in a stress–strain process and for testing an overall model. A careful consideration of these problems will have both theoretical and practical benefits; as it will allow the researcher to improve the accuracy of predictions and, perhaps, provide for more effective interventions.

IDENTIFYING THE STUDY VARIABLES

One of the features of stress research that has impeded progress in the field is the rather large number of antecedents and correlates available for examination. The variables that have been studied over the years have depended as much on the researcher's background as on the substance and content of issues under investigation. For some researchers, especially those with less of a theoretical bent, the choice of variables in a particular study is a function of practical rather than conceptual concerns. Because of the vast number of variables and constructs that exist in the area, it is likely that inferences from any specific set of data will be biased. I will try to expand on this last point by presenting several illustrations of problematic research paradigms.

Typical examples of inaccurate design in the stress field include the lack of a subjective or perceptual indicator and the inclusion of two versions of the same measure as both the stressor and strain indicator. The former issue involves an analysis with just the objective stimulus, such as noise or pollution, representing the independent variable or stressor, without considering the cognitive component as described in the model presented in the book. As has been stated many times before, the researcher should only expect, at best, a small direct impact from the objective stimulus on the response variable. Even in the few cases where this

may happen, such as when a loud, piercing sound hinders concentration, the indirect effect would probably still be the more important one.

Stress research also lends itself to the problem of a lack of clearly defined variables, which may result in role confusion between the stimulus and response. It is not uncommon for a researcher to see the stressor and the strain indicator, or in a more clinical setting 'poor health,' as both the cause and effect variable. If this occurs within a study, then it is simply a matter of the researcher having determined a correlation between a variable and itself yielding essentially a meaningless finding. How does this occur? A researcher may be interested in determining the effects of organizational structure as a stressor within an organization. Among the measures used for the stressor is the quality of the interaction between supervisor and subordinate. At the same time or even at some later stage, the researcher assesses strain by examining employee satisfaction with the supervisor–subordinate relationship. The findings here would not be very illuminating. A reader who encounters a significant relationship in such a study may be misled into generalizations concerning the underlying construct (for example, structure and satisfaction). This is more likely to occur if the two variables have different and distinct names (such as 'structure' and 'job satisfaction').

One final word of caution is appropriate, and may serve as a useful clue that the findings are actually trivial. From my experience in the field, any independent–dependent variable correlation above .40 is quite rare. Indeed, any correlation, even a low one, can be the result of the use of redundant variables, and measurement error may have attenuated the level of the association. Nevertheless, as stress–strain correlations within a particular study, uncorrected for measurement error, are not expected to exceed .40, I would recommend this value as a threshold for indicating that further scrutiny of the variables is required. Similarly, Zapf *et al*. (1996) have argued that a value as low as .30 and definitely when it reaches .50 can be attributed to common method variance, and such high correlations were especially frequent when self-report data were used for both the stressor and strain variables.

A parallel problem can also occur if one wants to evaluate the stress– strain relationship by looking at a series of studies in the field. Rather than performing an empirical study, the investigator may do a descriptive review or a meta-analysis, perhaps by including one or more moderators. A non-systematic approach, which simply lists the different findings without integrating them, does not add much to the field and is, for most purposes, not really worthwhile. The researcher must first equate in some way the stress and strain measures across studies. Even sophisticated techniques such as meta-analysis that allow researchers to infer the magnitude of relationships between two variables by combining a series of studies require first a knowledge of the exact nature of each type of variable before the technique is applied.

A related issue that is not easily dealt with in a meta-analytic context is the problem of variable roles across studies. How does one combine perceptual stress from one study where it was considered as the dependent variable with another study where it was used as the independent variable? Assuming a correlate such as age in each study and a researcher who is interested in obtaining some overall measure of age-perceptual stress association, is it legitimate to combine the findings when the variables served different purposes in each study? The obvious problem occurs when the researcher manipulated the perceptual stress in one setting (perhaps, in a laboratory setting) and in the other setting it was measured as a function of the objective stressor.

Some of the problems related to variable role confusion are particularly acute when both measures are self-report – unfortunately, a common problem in stress research. The general issue of such subjective measures is discussed in further detail below.

The limited number of variables studied

One of the major issues that has plagued all of industrial/organizational research but that appears particularly relevant in the stress field is the limited number of variables that can be studied at any one time. This problem exists for the stressor, strain, and moderator variables as well. For example, a researcher who examines the impact of a specific independent variable on a specific dependent variable may conclude that a significant link exists. However, what does this tell us about another independent variable or another dependent variable? Can we conclude that stress and strain are invariably associated? Obviously not. Conversely, the lack of a specific relationship does not indicate that stress and strain are not associated. Indeed, it is possible that just changing the statistical analysis (perhaps through variable transformation) will yield a significant result that the first analysis did not reveal.

Wall *et al*. (1996) discussed this issue as a problem in stress research in general, and their study in particular. The percentage of variance of the strain measure explained is usually a fraction of the total as 'only a small number of operationalizations of the relevant constructs' (p. 163) is feasible in any individual study. In their research, only cognitive and mental demands were examined and others, such as those derived from physical work or effort, were not included.

I don't think that we will ever be able to solve this problem completely. A researcher who is aware of the need to include many different types of variables (stressors, strains, moderators, and mediators) as well as of the importance to measure them in different ways is still limited by time and resources. Only a fraction of what is available will actually ever get included. However, a well-designed study that has included as much as possible in terms of

variables and instruments is more likely to contribute to the field. Also, by recognizing this specific limitation, the investigator will make the extra effort to use more sophisticated designs and be more cautious in their inferences from a specific data set.

Laboratory vs. field research

Drawing the correct conclusions from research requires, first of all, the correct protocol. Two basic protocols can be identified: laboratory and field research. In the first one, the investigator is trying to minimize the effects of outside or extraneous factors. As will be shown later, such control, which is accompanied by some degree of artificiality, has a role in the industrial/organizational psychologist's repertoire. Studies in the field can take several forms. A *field experiment* involves the researcher exercising some control, albeit limited, in manipulating the levels of the independent variable. As described by Seashore (1964), a field experiment involves measuring some identifiable change in the situation, a method for measuring the change, and the testing of a hypothesis comparing 'experimental' and 'control' groups. Although there is some limited control over these two groups, it is not complete.

In the typical *field study*, the researcher enters the picture after some event has occurred or, if they are lucky, follow participants from the beginning through the end but do not interfere with the independent variable. It has the features of '*ex post facto*' research in that observations of relationships are reported, and manipulation is, for all intents and purposes, not present (Tosi *et al*. 1994).

Although work stress is by definition a phenomenon found in the field, investigators have tried to test various aspects of the cause–effect process in a *laboratory setting* (Averill 1973; Burger 1989; Miller 1987). The findings from studies conducted in such artificial settings are assailable, mainly, on the grounds that they lack external validity. Nevertheless, the benefits of laboratory research are clear. The simple fact that the researcher is able to isolate and examine the relevant variables in a specific hypothesis provides a starting-point for identifying the qualitative and quantitative nature of specific links and, more importantly, for developing more comprehensive theories at a later stage. The measures that are taken there are more accurate as some form of control is possible, and it is often possible, in a relatively short period of time, to do one or more follow-up studies.

A classical series of studies in this vein was reported by Schachter (1959) when he tried to explain strain reactions such as seeking affiliation and social contact during anxious moments. Each follow-up investigation was planned so as to test an hypothesis developed in a previous study. Rejection or acceptance of a hypothesis was quick, relatively speaking, of course, and involved little effort besides finding subjects willing to participate or willing to

undergo a specific treatment. This must be compared to the situation that exists in a field study. Setting up the study on someone else's turf, getting permission to test a group of employees or manipulate a variable such as stress, and the reluctance of management to provide objective data (such as absences, performance, and so on) are all obstacles that may cause interminable delays. From a practical perspective, it is possible to differentiate between the two types of studies by considering one important feature only: the degree of control exercised by the researcher. In the laboratory study, the researcher is in charge, whereas in the field study this is done by someone else (management, unions, environmental factors, and so forth).

In discussing the distinction between laboratory studies and field research, Rodin (1985) has argued that laboratory studies do indeed contribute to the advancement of science even in the social sciences. As theory development is a major advantage of laboratory studies, Rodin feels that the rush to produce socially relevant studies may hinder the understanding of process and linkages found among variables. The argument that the laboratory yields only a part of the picture and is, therefore, irrelevant is also refuted. Intervention, whether prevention or treatment, is often effective even when based on only partial knowledge. The fact that other variables are involved in a specific link is not always important. In any case, when a field is new or a researcher wants to examine quickly a relationship or a moderating effect, a laboratory study provides the type of information that allows for preliminary findings to be reported in a field.

The above argument is not a *carte blanche* for conducting research that is not well grounded in theory or that results from not clearly defining hypotheses before beginning a research program. Actually, the reverse is true. The theme of this book has indeed been to consider a wide range of variables each playing a different role, so as to test the stress–strain link in the most comprehensive fashion. To maximize the contribution from a research enterprise, it is recommended that both types of studies need to be conducted. First, preliminary work such as pre-testing or the common problem of choosing among several measures of a concept requires a more restricted setting where specific scales can be tested quickly and refined so as to yield the best possible measure for the field study. Also, this is the time to test some very specific hypotheses concerning stress–strain links. I am sure most researchers can remember quite well the frustration of finishing a field study only to find out that one of the scales used in the study was not psychometrically adequate.

Whether we are dealing with a brand new scale or applying an old scale to a new group (such as another culture, another type of organization – service rather than manufacturing), careful testing in a laboratory-type setting where it is clear what the subjects are responding to is an efficient way to conduct the first phase of research. However, the proof of a particular

formulation – that is, testing a set of linkages developed from the first part – requires going to the field and observing what happens.

CONFOUNDING VARIABLES

Several confounding or nuisance variables have been identified in the stress literature but few have had as much written about them as negative affectivity (NA). Although its exact impact on the stress–strain relationship is controversial, NA has been described as a measure of trait anxiety (Watson and Clark 1984) that interferes with, and often exaggerates, the observed associations in stress studies. An individual who is high in NA will have a negative temperament and respond consistently in this fashion regardless of the specific stimuli to which they are exposed (Burke *et al.* 1993). In particular, subjective indicators, such as self-report measures, are more likely to be influenced by NA. As conceptualized by Burke *et al.* (1993), the dependent variable is as liable to be compromised by such nuisance variables as is the independent variable.

Triviality trap

Kristensen (1996) and Frese and Zapf (1988) argue that determining perceived stress (stimulus) and well-being (response) with self-report measures may lead the researcher into a triviality trap. This implies that such associations do not indicate a causal or even meaningful relationship between the two variables; rather, it may simply show that workers who report specific symptoms are more likely to report exposure to stressors than those who do not. Kristensen adds that associations here only convey useful information when significance is not shown; otherwise findings are basically trivial and do not contribute to our understanding of the stress– strain process. This situation resembles the NA problem.

A related issue that may lead a researcher to the wrong conclusion is the assumption that subjective job stress or job strain, if measured several times (as in a longitudinal study), is free of bias. One of the problems here is that exposure is hard to control completely. A person may indeed be in a very 'hot' environment as far as temperature is concerned, which has the potential of producing true strain reactions. However, even if measures were obtained several different times on each individual, people exposed to this negative stimulus might still be responding to 'other stimuli.' For example, an individual who is in a state of 'poor' well-being or who has some type of sub-clinical disease is more likely to report the existence of negative stimuli or stressors than a healthy person. Data on exposure in a self-report may simply

represent greater sensitivity rather than actual impact. One way of dealing with this issue would be to include sensitivity (or, perhaps, a general measure of well-being by some outside source) as a moderator. This would allow us to examine the impact of stressors among people with high sensitivity and among those with low sensitivity.

Self-report vs. objective/behavioral data

Often investigators of attitudinal and behavioral concepts in organizational research will use self-report scales as a substitute measure, especially when the stimulus is difficult to gauge or obtain. These measures may be also be referred to as confounding as they may mask true relationships. In addition, underreporting may occur (Johns 1994). It is interesting to note that underreporting may exist at the same time that correlations are unaffected. Perhaps this is the reason that, till recently, researchers did not question self-report studies.

In an empirical study of the self-report issue, Crampton and Wagner (1994) showed that, in some cases, the exclusive use of such scales can inflate the obtained associations. The authors divided up the variables in I/O psychology into thirty-seven groupings, including job satisfaction, absenteeism, leader traits, and organizational culture. Between variables representing each of two categories, they calculated, when available, the self-report correlations and the multi-source correlations. They then compared findings to see if there was any inflation of correlations. Among their findings, the authors reported that the correlations between stress and turnover intentions, stress and personality, and stress and role characteristics were significantly higher for the self-report than for the multi-source equivalent correlation. Also, there was a higher correlation observed for the self-report than for the multi-source study in the following correlates: turnover intentions, personality, performance, role characteristics, job scope, and leader initiation.

The authors drew the following general conclusions from their results. Inflation of correlations does exist when using self-report values; however, in cases like stress, the observed self-report correlations were only moderately affected. Of course, the Crampton and Wagner study is, at best, only a guideline, because the groupings or clusters that were formed were by necessity quite large and it is hard to tell which specific aspect of stress is affected and which is not. The stress cluster included: job stress, objective workload, perceived workload, staff shortage, death stress. For our purposes, it would seem that if possible one should try to obtain an objective measure for a environmental or organizational stressor. However, if some subjective measure is used as a substitute, the distortion may not be as great as originally supposed by researchers in the past (see, for example, the general condemnation of self-reports in an editorial by Campbell 1982).

An applied example from the stress field would be appropriate here. If the researcher wanted to determine the influence of noise and density on various outcome measures such as turnover and satisfaction, the use of self-report scales would have different implications for each pair of correlations. Inflated results might be expected if turnover intentions rather than turnover is used as the correlate. For job satisfaction, the measure is by its very nature a subjective indicator and the Crampton and Wagner findings do not indicate a problem. My recommendation here would still be to try to get another opinion outside of the subject, but if this is not available, the data can be used and assumed to be close to the value from a multisource study.

How do we get a second opinion in stress research? Simply, by getting other people involved. An effective method for measuring the stressor would be to obtain a description of the stimulus from the subject, accompanied by the experimenter corroborating the data through outside objective measures. When noise is the potential stressor, decibel levels are a possible indicator of stress. Nevertheless, the subject's response is important. As we have pointed out, a cognitive/perceptual process mediates between stressor and strain. With noise as a stressor, a self-report scale would enable us to gauge the subject's degree of stimulus awareness. In some cases, this could serve as the perceptual mediator described in the model. At other times, it may be useful to ask whether the stimulus was indeed stressful, and how it was perceived in relationship to other stressors acting on the individual at a point in time. The latter question may be particularly important when no information on the respondent's general anxiety has been objectively examined. Without knowledge about the individual's general stress level, it would be difficult for management or an organization to determine whether hypothesized stressors were the actual independent variables in a specific study.

Another issue concerning the value of self-report measures, even when objective stress measures are available, is the researcher's need to identify which dimension of the stimulus is being attended to. Again, noise provides a good example. Let's say, an individual worker is constantly being exposed to the various physical characteristics associated with an intermittent loud sound. These features include the pitch, volume, sudden starts and stops. An investigator who simply compared productivity or efficiency for two groups, those exposed to the noise and those not exposed to it, would not really know which specific factors of the stimulus were involved and might, in some cases, recommend the wrong intervention for reducing strain reactions. A scale (or scales) that measured the factors that were attended to, as well as tried to ferret out what factors caused specific negative reactions, would be considerably more useful, both theoretically and practically.

Assuming that self-report is the only method for measuring the stressor or strain, what are some of the techniques for improving the scale? For example, an examination of the Job Content Questionnaire of Karasek (1985), a popular measure of job strain, uses opinions or

attitudes (such as 'strongly agree', 'agree', 'disagree', and so on), which, according to Kristensen, are not really the ideal way to measure strain as they are particularly sensitive to some of the biases mentioned above. A better type of item would ask the respondent about the frequency and duration of the stimuli in addition to its intensity. The advantage of the latter form is that it is closer to a behavioral indicator if the respondent is required to estimate or even guess the number of times a particular event occurred. Thus, words like 'often', 'seldom', may allow the researcher to gauge the stimulus better rather than simply offering an opinion item which can be answered with little real effort and is much more likely to reflect some personal inclinations.

Where does this leave us in the field of stress measurement? From my perspective, it is much better to include both an objective/behavioral indicator and a perceptual stress measure than either one alone. In analyzing a stressor it is better to calculate its physical dimensions first and then follow that up with an indicator of subjective stress. This last measure can be improved if it is made to 'look' like an objective measure. With all this said, I still feel that it would be wrong to try to neutralize all aspects of subjectivity, as the 'internal perception' of stress is likely to be more important, in many cases, than the 'external reality'.

Some statistical issues

There is a long list of statistical issues that may influence the findings in a stress study. As most are common to all areas of social research, I will only cite some of the more salient ones in the field. One of these is the problem of measurement error in the variables. When the stress and strain variables are not measured accurately either because of deficiencies in the instrument or as a result of circumstances beyond the control of the researcher, it is, of course, not surprising that the observed correlation is limited in magnitude. What are some of the implications of this state of affairs? In general, reported findings are not to be taken at face value; as measurement error may have attenuated any reported correlation, one can assume that the actual association is higher. Interestingly, the attenuation is expected not only in the main effects but also from the interaction term (Aiken and West 1991; Busemeyer and Jones 1983). In our model, the observed moderating effect is probably underestimated. Moreover, if the moderating effect is ordinal, then the variance explained is less than if the effect were disordinal (McClelland and Judd 1993). Wall *et al*. (1996) devote a considerable part of their discussion to this last problem and it is worthwhile emphasizing some of their inferences here, too. Their findings illustrate a typical ordinal interaction: subjects at higher levels of control show an elevation in strain reaction in response to job demands, whereas subjects at lower control levels do not show an elevation in strain. Now, if the researchers had only examined

the overall effect, it would have shown, more or less, the average strain score of the low-control X demand interaction (Group 1) and the high-control X demand interaction (Group 2). Not particularly impressive. However, by examining the two groups separately, a different picture emerges. For Group 1, nearly 11 per cent of the variance is explained, and for Group 2 only 1 per cent.

Although a disordinal interaction may also show some differences by group, they will tend to be less pronounced. For ordinal interactions, separating out the interactions has both theoretical and practical implications. It can help support a portion of a theory which an overall analysis might tend to reject in totality. However, it seems to me that in the practical realm such a finding may be particularly useful. A manager who is aware that one group of subjects is behaving differently from other groups and the former is associated with changes in the outcome measure may be able to make more informed decisions about worker demands. In the study by Wall *et al.*, management may want to limit the demands placed on workers who are able to exercise very little control over their work environment, whereas demands may be kept at a relatively high level in jobs where the workers have a high level of control.

The magnitude of the stress–strain relationship

The previous discussion also provides a partial answer to a question that has been examined by many researchers over the years (for example, Kasl 1987; Nelson and Sutton 1990; Zapf *et al*. 1996). Why do we usually observe such low correlations in stress–strain studies? As mentioned above, measurement error and overall analyses of the data instead of analysis by group are likely to lead to a distorted picture of the actual relationships in the data. However, Zapf *et al.* (1996) have made a very cogent argument concerning the chances of finding a high correlation (above .30) in a specific study. Assuming that fifteen types of independent stressors and moderators actually exist (the present book has reviewed quite a few of them) and each one explains about the same amount of the variance in the dependent variable, then we would expect none of them to explain more than 7 per cent of the variance. Explained variance of 7 per cent translates into approximately a correlation of about .26, which would be considered a respectable outcome in a stress–strain study. Although I concur with the direction of the argument and their general conclusions, the assumption that the so-called fifteen areas which they have identified as causal variables are independent of each other is, in my opinion, somewhat tenuous. Even if we assume that there only fifteen causal areas, the individual contributions towards explaining the strain measure are probably not independent. Thus, it is likely that some of the stressors are probably more salient than others. Taking this

into account, it is reasonable to suggest that the correlations may reach higher values. What is a reasonable and meaningful (non-overlapping and 'true') correlation for the most salient stressors is difficult to determine with high precision, but the value of .40 suggested above seems to be a limit that is consistent with and at the high end of the previous empirical research.

SUGGESTIONS FOR IMPROVING STRESS METHODOLOGY

The need for better methodology in stress research is quite clear. Throughout the book, I have referred to several ideas for improving research design in conjunction with specific topics. However, there are some general points that need to be considered, many of which have been delineated by other investigators (such as, Sullivan and Bhagat 1992). Moreover, from my own experience and attempts to study the phenomenon, there are many pitfalls that can be avoided with some better planning.

First, as was the goal here from the start, only a process model can uncover some, if not all, of the myriad relationships that exist and have any chance of explaining a major portion of strain variance. Studying isolated phenomena, or a few variables at a time, has its place in the field; for example, a researcher may want to see if a particular variable acts as a moderator of a relationship. A negative finding may not be proof but a positive finding is highly indicative of the variable's role. Such information in isolation does not provide the investigator with a very thorough understanding of the various potential links in a stress–strain process. However, as a first step, such an investigation may be quite appropriate.

On the other hand, a comprehensive, multivariate approach has many advantages. Besides giving the investigator a chance to test the various links that are being hypothesized, the simultaneous action of several stressors, moderators, and mediators can be observed. Sullivan and Bhagat believe that the lack of more than one moderator in many studies is the probable cause for many insignificant findings. Thus, the link between the stressor and strain may be accentuated when the personality moderator interacts with an organizational one. If we amplify an example discussed in the previous chapter on moderators, a highly competitive type of organization, coupled with an individual who is not particularly competitive, may find a stressor such as meeting a deadline very uncomfortable – affecting both affect and performance. On the other hand, a competitive individual who is working in a challenging job may find the interaction stimulating. Even if tension and a degree of discomfort is created, performance may still be enhanced. Indeed, for some, the stressor creates a challenge that is

positive and stimulating. A double, triple, or higher level of interaction may sound quite complicated, but it may be the only way to understand what is really going on in a stress model.

Another issue that is very important in stress research is the measurement procedure, particularly for the objective stressor. Although the latter can sometimes be reliably determined by asking the worker to estimate the level of the stimulus (for instance, driving time or distance), in other situations it cannot really be ascertained by just asking a few questions of the subject. For example, environmental stimuli exist without our really knowing what their level is. Does a worker (or, for that matter, a psychologist) know what decibels of noise or lumens of light are in a particular workplace? The psychologist may have some idea of noise level but would find it difficult to pinpoint it accurately. In such studies, accurate, precise measuring instruments are needed, especially if the inferences are going to go beyond the mediator or perception of the noise or light stimulus. The physical stimulus here, as with the commuting situation, may have a direct negative impact beyond the indirect effect.

The element of time of measurements must also be viewed as a critical feature in any study of the stress process. If the researcher's interest is to arrive at cause–effect inferences, then it is necessary to perform an analysis other than cross-sectional. The latter is particularly sensitive to reverse causation and, in the case of self-reports for both the independent and dependent variable, causal statements are basically meaningless. The fact that about 90 per cent of all stress–strain studies were cross-sectional (Zapf *et al*. 1996) can explain why inferences in the field are so ambiguous and why studies in the field have not advanced much over the years. On the other hand, an investigator must be careful, as the simple fact that the measurements were taken at two different times does not guarantee that a causal relationship exists. Merely measuring a variable at Time 2 does not indicate that it occurred after the variable that was measured at Time 1. Time of measurement must be accompanied with both the proper design and statistical procedures so as to increase the chances that true cause–effect will be found and reverse causation or third variable influence can be eliminated with high probability.

Zapf *et al.* (1996) suggest the use of structural equation models, as discussed earlier in this book, because it has four advantages as compared to other methods in finding causal links. It accounts for measurement error, latent variables can be simultaneously included, reciprocal relationships can be tested, and third variables may be introduced into the model so as to determine the possible spuriousness of the observed relationships. All of these characteristics make the use of structural equations advantageous to competing techniques such as hierarchical regression equations and crosslagged panels.

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