

Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign

Robert A. Karasek, Jr.

A stress-management model of job strain is developed and tested with recent national survey data from Sweden and the United States. This model predicts that mental strain results from the interaction of job demands and job decision latitude. The model appears to clarify earlier contradictory findings based on separated effects of job demands and job decision latitude. The consistent finding is that it is the combination of low decision latitude and heavy job demands which is associated with mental strain. This same combination is also associated with job dissatisfaction. In addition, the analysis of dissatisfaction reveals a complex interaction of decision latitude and job demand effects that could be easily overlooked in conventional linear, unidimensional analyses. The major implication of this study is that redesigning work processes to allow increases in decision latitude for a broad range of workers could reduce mental strain, and do so without affecting the job demands that may plausibly be associated with organizational output levels. *

Well-known organizational case studies have indirectly referred to the important interactive effects of job demands and job decision latitude. Whyte's restaurant workers (1948) experienced the severest strain symptoms when they faced heavy customer demands which they were not able to control; Gouldner (1954) notes that personal and organizational tensions increase when close supervision is applied to miners under heavy work loads; and Crozier (1964) and Drabek and Hass (1969) discuss organizational strain which arises among groups of workers simultaneously facing heavy work loads and rigid rule structures or limited decision alternatives. Unfortunately, these case studies and their consistent findings have had little influence on survey analyses of mental strain among large groups of working individuals.

Instead, two survey research traditions have emerged to deal with the psychosocial effects of work environments. One tradition focuses on job decision latitude (decision authority or skill level), the other treats "stressors" on the job. Most of the vast literature on job satisfaction and mental strain focuses primarily on job decision latitude (for example, Kornhauser, 1965; even Hackman and Lawler, see p. 290), while the "life stress" tradition of epidemiological studies of mental health (for example, Holmes and Rahe, 1967; Dohrenwend and Dohrenwend, 1974) focuses on the illnesses induced by environmental stressors or job stressors alone (for example, Sundbom, 1971; Caplan et al., 1976; Theorell, 1976). Unfortunately, job decision latitude research rarely includes systematic discussion of job demands and the job demand literature rarely includes systematic discussion of decision latitude (Karasek, 1978a).

I suspect that many contradictory findings in the literature can be traced to incomplete models derived from these mutually exclusive research traditions. I suggest that a correct analysis must distinguish between two important elements of the work environment at the individual level: (1) the job demands placed on the worker and (2) the discretion permitted the worker in deciding how to meet these demands.

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Both of these characteristics of the work environment must be analyzed to avoid misinterpretation and/or inconsistencies. A typical paradox which arises from omitting one of them is alluded to by Quinn et al. (1971: 411): They found that both executives and assembly-line workers could have stressful jobs, but could not explain differences in their job satisfaction. It is probable that the obvious differences in the omitted variable of decision latitude for executives and workers account for the differences observed in their strain symptoms and satisfaction:

A major paradox of the study was that workers in higher status occupations were more satisfied than others with their jobs, were more mentally healthy, but at the same time experienced greater emotional tension concerning the events occurring on their jobs. Conversely, workers totally free of labor standards problems were not always among the most satisfied, since many of their jobs lacked the quality of self-developing challenge that appeared to be a major determinant of high job satisfaction.

Failure to distinguish between job stressors and job decision latitude is also reflected in the tendency to describe all structurally determined job characteristics as "job demands," regardless of their drastically different effects on psychological functioning. While the environmental determinacy of all of these characteristics supports the uniform terminology of demands, the lack of homogeneity of effects can lead to substantial misinterpretation, as in the case where decision authority is referred to as a "demand" (Blood and Hulin, 1967: 268). The implication is that job strain increases with all such "demands," but as we will see this is definitely not the case. Failure to distinguish between work load stressors and job decision latitude (skill level and decision authority) and their different effects could account for Ritti's inconsistent finding that "time pressure demands" are associated with strain symptoms, while "intellectual demands" are not. Kahn (1979) finds a similar difference in effects for "qualitative vs. quantitative job demands." Another version of this interpretive ambiguity occurs for a few conventional measures of job content, such as "responsibility," which mix aspects of both job demands and job decision latitude (Turner and Lawrence, 1965: 53).

A related problem is that the empirical association between job conditions and mental strain or dissatisfaction disappears in some well-known research findings, leading some authors (Hulin and Blood, 1968) to conclude that cultural values or individual differences overwhelm the effects of job condition on the individual. Two types of analytical errors could account for the lack of relationships. First, studies which fail to distinguish between demands and discretion and add the measures together would find relationships with strain symptoms cancelled out if, as we propose, the opportunity to use skill and make decisions reduces the undesirable effects of job demands. Second, failure to account for the possible nonlinear, nonadditive associations with mental strain that could occur from the interaction of two independent variables would produce different relationships for different subgroups, or insignificant relationships when findings are examined for linear trends (Turner and Lawrence, 1965; Hulin and Blood, 1968; Caplan et al., 1975; Andrews and Withey, 1976). A conclusive analysis thus requires ex-

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amining broad representative data which include all types of working situations.

Another type of difficulty occurs with current definitions of "overload" (or "underload") as a source of strain (McGrath, 1970; Harrison, 1978). Overload is usually defined as occurring when the environmental situation poses demands which exceed the individual's capabilities for meeting them. While this formulation correctly identifies the mediating role played by personal capabilities, it introduces the individual level of analysis prematurely. Attention should first be directed to other types of environmental variables which can moderate job stressors, such as decision latitude, and then to the moderating effects of individual capabilities or perceptions. Mixing both the environmental and the individual characteristics into a single measure, such as "overload," not only shifts attention away from environmental moderators but makes it difficult to derive unambiguous implications for either work environment or personnel policy.

THE JOB STRAIN MODEL

The model postulates that psychological strain results not from a single aspect of the work environment, but from the joint effects of the demands of a work situation and the range of decision-making freedom (discretion) available to the worker facing those demands. These two aspects of the job situation represent, respectively, the instigators of action (work load demands, conflicts or other stressors which place the individual in a motivated or energized state of "stress") and the constraints on the alternative resulting actions. The individual's job decision latitude is the constraint which modulates the release or transformation of "stress" (potential energy) into the energy of action. Thus, this is a stress-management model of strain which is environmentally based. If no action can be taken (Zeigarnik, 1927), or if the individual must forego other desires because of low decision latitude (Henry and Cassell, 1969: 179), the unreleased energy may manifest itself internally as mental strain.

A note on definitions is in order. Hereafter we will not use the term "stress" (referring to an internal state of the individual) because our research does not measure it directly. Instead, three related terms should be defined: The first term is an independent variable that measures stress sources (stressors), such as work load demands, present in the work environment. These are called "job demands." The second measures decision latitude and is called "job control" or "discretion." The third is a derived composite measure that is called "job strain." Job strain occurs when job demands are high and job decision latitude is low (see Figure 1). I predict that this composite independent measure, job strain, is related to the dependent variable, symptoms of mental strain.

In practical terms, the task-level dimensions of the model may be relevant to important issues at the organizational level: output level and authority structure. Job demands (especially work load demands) probably express the overall output level of the firm, and job decision latitude is probably closely related to the firm's authority structure and technology, although further research would be required to

establish the nature of those linkages. Thus, an important potential implication of the model is that the mental strain consequences of high organizational output levels may be contingent on the flexibility and equity of the organizational decision structure.

Figure 1 summarizes the types of jobs that might result from different combinations of job demands and job decision latitude. The labeled diagonals actually represent two interactions: situations where job demands and job decision latitude diverge ("A"), and situations where they are *matched* ("B"). The first situation, when demands are relatively greater than decision latitude, is of primary importance in predicting mental strain. Although the exact mathematical form of the interaction can probably not be distinguished clearly with the present data, the present theory best fits the pattern of a "relative excess" interaction (Southwood, 1978): Strain equals the excess of demands over decision latitude.

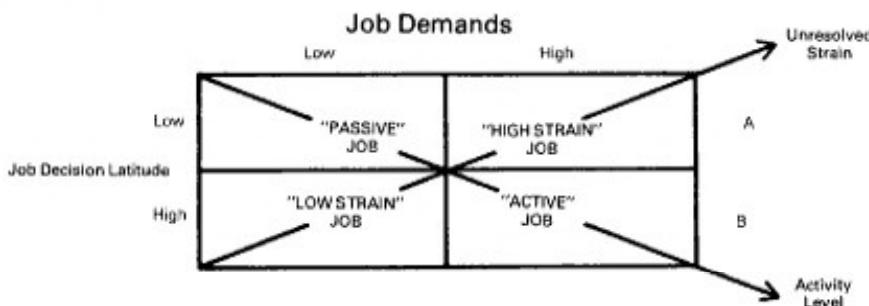


Figure 1. Job strain model.

The model contains two predictions. First, following Diagonal A, strain increases as job demands increase (Friedman, Rosenman, and Carroll, 1958; Quinn et al., 1971), relative to decreasing job decision latitude (Frankenhaeuser and Rissler, 1970; Glass and Singer, 1972; Beehr, 1976; Frankenhaeuser and Gardell, 1976; Langer and Rodin, 1976). Second, incremental additions to competency are predicted to occur when the challenges of the situation are matched by the individual's skill or control in dealing with a challenge. When job demands and job decision latitude are simultaneously high (Csikszentmihalyi, 1975), we define the job as "active" and hypothesize that it leads to development of new behavior patterns both on and off the job (Diagonal B toward lower right). The model predicts that jobs at the opposite extreme (defined as "passive job") induce a decline in overall activity and a reduction in general problem-solving activity (Suomi and Harlow, 1972; see also the "learned helplessness" literature: Maier and Seligman, 1976).

The utility of the overall model is based on the separation of job demands and job decision latitude. Ideally, these two aspects of the job should be highly correlated: "Authority is commensurate with responsibility." In fact, there is considerable empirical evidence that the correlation is low, which implies that there are substantial groups of workers with discrepant demands and decision latitude. A varimax factor analysis of an approximately equal number of job demand and job decision latitude measures from the U.S. Quality of Employment Survey Data 1972 (Table 1) confirms empirically

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the dichotomy of job demands and job decision latitude. Composite indicators additively constructed from responses to the questions in Table 1 are correlated at .11, and Swedish data show similarly low correlations ($r=.25$ in the data base used here; $r=.02$ to $.14$ in a large Swedish white-collar union data base, Karasek, 1978b).

THE DATA

The data used to test the stress-management model come from recent national surveys in the United States and Sweden. The Swedish survey (Johansson, 1971a) is a random sample of the full adult population (approximately 1: 1,000) aged 15 to 75, with a response rate of 92 percent for 1968 and a response rate of 85 percent for 1968 and 1974. The U.S. survey, the University of Michigan Quality of Employment Survey for 1972, is based on a national stratified sample of housing units with a response rate of 76 percent. The Swedish data contain both expert and self-reported evaluations for some job content characteristics and are also longitudinal: The same workers were interviewed in 1968 and in 1974. The U.S. data are not longitudinal but are richer in detailed job descriptions. Both data sets represent attempts to sample randomly the full national working population. This analysis is based on male workers only; other research has indicated that the relationship between work and mental status for women is often complicated by the additional demand of housework (Karasek, 1976). The analysis of the Swedish data only includes employed workers (82 percent of the male work force). I also limit the analysis to job content at the level of the individual and do not address the undeniably important effects of work group and organizational level processes, except as they affect individual jobs.

JOB DECISION LATITUDE: INDIVIDUAL CONTROL AT THE WORK PLACE

Job decision latitude is defined as the working individual's

Table 1

Factor Analysis of Job Content Dimensions, U.S. Quality of Employment Survey, 1972 (Employed Males, Ages 20-65; N=950)

Varimax factor loadings	Factor I Job Decision Latitude	Factor II Job Demands
High skill level	(.59)	.21
Learn new things	(.55)	.27
Nonrepetitious	.27	.01
Creative	(.71)	.07
Allows freedom	(.42)	.19
Make one's decisions	(.77)	.01
Participate in decisions	(.73)	.08
Have say on the job	(.74)	.03
Work fast	.05	(.44)
Work very hard	.20	(.55)
Lots of work	.23	(.40)
Not enough time	.32	(.46)
Excessive work	.04	(.51)
No time to finish	.07	(.58)
Conflicting demands	.13	.35

Loadings greater than .40 in parentheses.

potential control over his tasks and his conduct during the working day. Two measures, "decision authority" and "intellectual discretion," were selected for this study because of their similarity to other measures in the literature ("discretion and qualification scale," Gardell, 1971; "intellectual discretion," Kohn and Schooler, 1973) and their importance in job and organizational design strategies. These measures are also similar to the two central components of the Hackman and Oldham (1975) and Turner-and-Lawrence-derived (1965) Motivating Potential Score: autonomy in task organization decisions and variety in skill use (these appear to account for the bulk of the variance on the M.P.S. score: scale-item correlations .80 and .62 respectively.)

In analyses of surveys with large samples, "decision authority" and "intellectual discretion" are correlated ($r=.48$ in the U.S. data; see also high correlations between similar measures in Hackman and Lawler, 1971: 282; and Jenkins et al., 1975: 175). Thus, highly skilled work that allows little decision authority appears to be a relatively rare combination in practice (although Frankenhaeuser and Gardell, 1976, describe such a job for lumber graders). Therefore, in analyzing the U.S. data, we additively combined four measures of decision authority and four measures of intellectual discretion into an aggregate scale (Cronbach, $\alpha=.82$, see Appendix A). In future research it would be desirable to distinguish between the effects of several different aspects of decision latitude (i.e. with respect to skill, task organization, time pacing, organizational policy influence, control over potential uncertainties, decision resources). However, our aggregate decision latitude scale appears to closely approximate a "core" of generally correlated measurements of this type. This scale is divided at approximately the quartile points for use in Tables 2 and 3.

The Swedish intellectual discretion indicator was constructed from a measure of the skill level required for the worker's job¹ and his evaluation of the work as repetitious (lacking in variety). We reason that repetitious work, even if it once required skill, loses its capacity for intellectual challenge after constant rehearsal. Indeed, the vast majority (79 percent) of repetitious job responses were from workers specifying that no formal training beyond elementary education was required for their job (see also Gardell, 1971; Kohn and Schooler, 1973). Thus a repetitive, low-skill level job is the lowest step on the intellectual discretion measure. The other steps are, respectively: elementary skill level job (not repetitive); job requiring at least one year additional training; job requiring at least three years additional training.

It is certainly possible that a worker's personality affects his perception of decision latitude. Fortunately, the Swedish data provide both self- and expert assessments of "intellectual discretion" to assess the magnitude of this difference. Occupational evaluators at the Swedish Central Statistical Bureau use a six-level rating scheme to measure the "education demanded, assigned, or expected of a particular occupation" (Carlsson et al., 1974: 387). The Swedish self reported intellectual discretion measure correlates highly with these expert ratings ($r=.69$ (1968); $r=.64$ (1974), which corroborates other findings (Kohn and Schooler,

1

This question changed slightly between the 1968 and the 1974 surveys. In 1968 the question was, "What is the typical education level of a person in your type of position?"; in 1974, "What is the level of education required by your job?" Years of training are often used to estimate skill level. This measure must be distinguished, of course, from the respondent's actual education, and there is evidence that respondents made this distinction (Karasek, 1976: 115).

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1973, $r=.78$; Hackman and Lawler, 1971, $r=.87$ [average for autonomy and variety]; Gardell, 1971) and suggests that self-assessments are a reasonably accurate measure of job decision latitude.

JOB DEMANDS

The goal in constructing the scale of job demands is to measure the psychological stressors involved in accomplishing the work load, stressors related to unexpected tasks, and stressors of job-related personal conflict. There is no attempt in this article to measure the impact of physical job stressors, which may affect the individual by other mechanisms than those discussed here (and possibly lead to further physiological strain, particularly for blue-collar workers, Sundbom, 1971). Stressors such as fear of unemployment or occupational career problems might also contribute to these measures, but Buck (1972) finds that the demands related to accomplishing the task are the most commonly cited source of job pressure when a wide variety of potential sources are reviewed.

There is much less research assessing the congruence of self- and objective ratings for job demands than there is for job decision latitude. A self-report of a "demanding" job on the indicator probably will also express an element of subjective perception of stress (Lazarus, 1966). However, this subjective aspect could lead to underestimating the job content and mental strain associations: The social desirability of certain responses would probably reduce reports of depression.

Questions about job demands in the U.S. data clearly measure the pressure of output on the job: "Does your job require you to work very fast, hard, or to accomplish large amounts of work? Are you short of time?" (see Appendix A). Seven items forming an acceptable scale (Cronbach's $\alpha=.64$) were added together to construct a final index of psychological job demands. One confirmation of the construct validity of the scale is that it can be used to discriminate occupations one would normally consider to be psychologically demanding using the U.S. Quality of Employment Survey and the 1970 Census Occupational Codes (Karasek, 1978a: 11). This scale is divided at approximately the quartile points for use in Tables 2 and 3.

The Swedish psychological job demands indicator is a Guttman scale of responses to questions about whether the job is hectic and psychologically demanding (coefficient of reproducibility = .94, coefficient of scalability = .78; Karasek, 1976). Although task pressures are probably the primary source of the job demands measured here, the indicator is broad in coverage and cannot distinguish specific job demands. The content validity of the indicator is confirmed by the fact that it correlates with known job stressors such as piece rate work, lack of rest breaks, and anticipation of job loss. The indicator does not correlate highly with stressors from other spheres of life such as family problems or small-child care.

MENTAL STRAIN INDICATORS

The Swedish survey contains questions inspired by the American Health Survey of mental and physical well being.

A set of indicators was drawn from both the U.S. and Swedish surveys roughly measuring mental strain symptoms. These items are similar to questions in the Gurin, Veroff, and Feld (1960) Mental Status Index and the Langner (1962) 22-item scale. Several findings have confirmed the usefulness of self-reports of mental health impairment (for a discussion of this literature, see Langner and Michael, 1963; Schwartz, Meyers, and Astrachan, 1973; Seiler, 1973). The scales were originally constructed to screen mental patients; however, Seiler (1973) concludes that the scales are best interpreted as measures of psychological strain.

The complete group of mental and physical illness symptoms² available in both the U.S. and Swedish data is factor analyzed to avoid the possibility (suggested by Seiler, 1973) that our indicators also identify physical or psychosomatic ailments. We isolated two factors corresponding to two aspects of mental strain: exhaustion and depression. The exhaustion indicator is based on responses of tiredness in the morning and complete exhaustion in the evening. The depression indicator is constructed from responses of nervousness, anxiety, sleeping problems, worry, and depression (see Appendix A).

FINDINGS

Table 2 presents the findings from the test of the job strain model in two formats. In the upper portion, the percentage of workers with "severe" levels of depression or exhaustion is displayed as the vertical axis of a three-dimensional diagram. Psychological job demands and job decision latitude are the other two axes, as presented in Figure 1. In these diagrams, the dependent variable has been dichotomized (0,1). The percentages shown represent the probability that the worker with each specific combination of job demands and job decision latitude has experienced relatively severe exhaustion or depression ("often" have such a problem in the U.S. data).

Inspecting Table 2, we find that the symptom variations conform to the predictions of the job strain model for both countries. First, it is primarily workers with jobs simultaneously low in job decision latitude³ and high in job demands who report exhaustion after work, trouble awakening in the morning, depression, nervousness, anxiety, and insomnia or disturbed sleep. Second, the relation between job content and mental strain is similar for both Swedish and U.S. workers, using self-reported data.

Regression-based summary estimates of the job content and mental strain association are presented in Table 2, part B. The strength of the regression associations is presented in terms of "standardized risk ratios," a statistic commonly used in epidemiological studies of illness where the dependent variables are dichotomous⁴ (Rosenman et al., 1976; Morris and Rolph, 1978). The intuitive meaning of the ratio is the change in the odds of having the illness for each standard deviation change in the independent variable (a Standardized Risk Ratio of 1.42 implies a top-to-bottom decile difference in illness risk of 4:1). Translating the odds

2

Symptoms selected for the factor analysis had to be common to both U.S. and Swedish symptom lists; be relatively high in frequency ($\geq 4\%$) to allow factor analysis; be validated by a Swedish reinterview performed by doctors (Johansson, 1971b; Karasek, 1978a), which showed them to be either accurate or conservative estimates of symptom frequency.

3

Use of separate scales for "intellectual discretion" and "decision authority" (see Appendix A) yield associations with the symptom measures which do not differ significantly from each other (Karasek, 1978a; Table 3).

4

The regression coefficients presented in Table 2, part A are necessarily small because of the markedly non-normal symptom distributions, whether used as dichotomous variables or complete scales.

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back into symptom percentages, depression in the United States ranged from 43 to 17 percent, decile-to-decile, while in Sweden it ranged from 30 to 11 percent. In the United States, exhaustion varied from 34 to 11 percent from the top to bottom deciles; in Sweden, it varied from 49 to 20 percent. Although the meaning of the symptom levels differs somewhat in the two national questionnaires, the general range of variation, and its association with job demands and job decision latitude, is remarkably similar when the two national samples are compared.

The three-dimensional diagrams based on the dichotomized dependent variables give an easily interpretable picture of the relationship between job content and mental strain, including interactions. It is also desirable to assess the interaction effects by statistical procedures, but this is difficult to do. The model proposes a specific mathematical form for the relationship, a "relative excess" interaction (Southwood, 1978), where job strain increases with the relative excess of demands over decision latitude. (This formulation is analogous to other theories of relative deprivation and conflict.) While this formulation clearly qualifies as a joint relationship or interaction according to Southwood's definition (1978: 1155), in many cases it is impossible to distinguish it empirically from a linear, additive relationship. A regression analysis to compare different mathematical interaction forms can be performed, but this really presumes a more precise theory and data than we have. Our theory is not yet sufficiently precise to warrant excluding related mathematical forms⁵—such as a model based on the absolute value of difference. (Underestimation of interaction significance is also a problem; see Althauser, 1971.) On the other hand, the alternative statistical procedure used to test for the significance of interactions, analysis of variance, is too insensitive; it fails to give credit for deviations from linearity which display a particular pattern based on an ordinal level of the dependent variable.

In spite of these shortcomings, results of two such tests are presented in Table 2, parts A and C. The first test is a regression analysis with the interaction term added to the regression along with decision latitude and demands; the second is an analysis of variance adapted for a (0,1) dependent variable (Bishop, Fienberg, and Holland, 1975). The interaction term for the regression analysis is an "absolute difference model," with a constant term chosen to give greater emphasis to problems of too many job demands and less emphasis to the problem of too much decision latitude (see Appendix B).

Table 2 shows that there is only moderate evidence for an interaction effect, understood as a departure from a linear, additive model. However, both the demands and the decision latitude regression terms are significant and of the appropriate sign to confirm an interactive "relative excess" model, which is the simplest statement of our theory. In addition, there is evidence of a nonlinear interaction for depression among Swedish workers (clearer evidence of interaction is available in Table 3).

Judgments about job characteristics by both workers and experts are possible only with the Swedish data base. The

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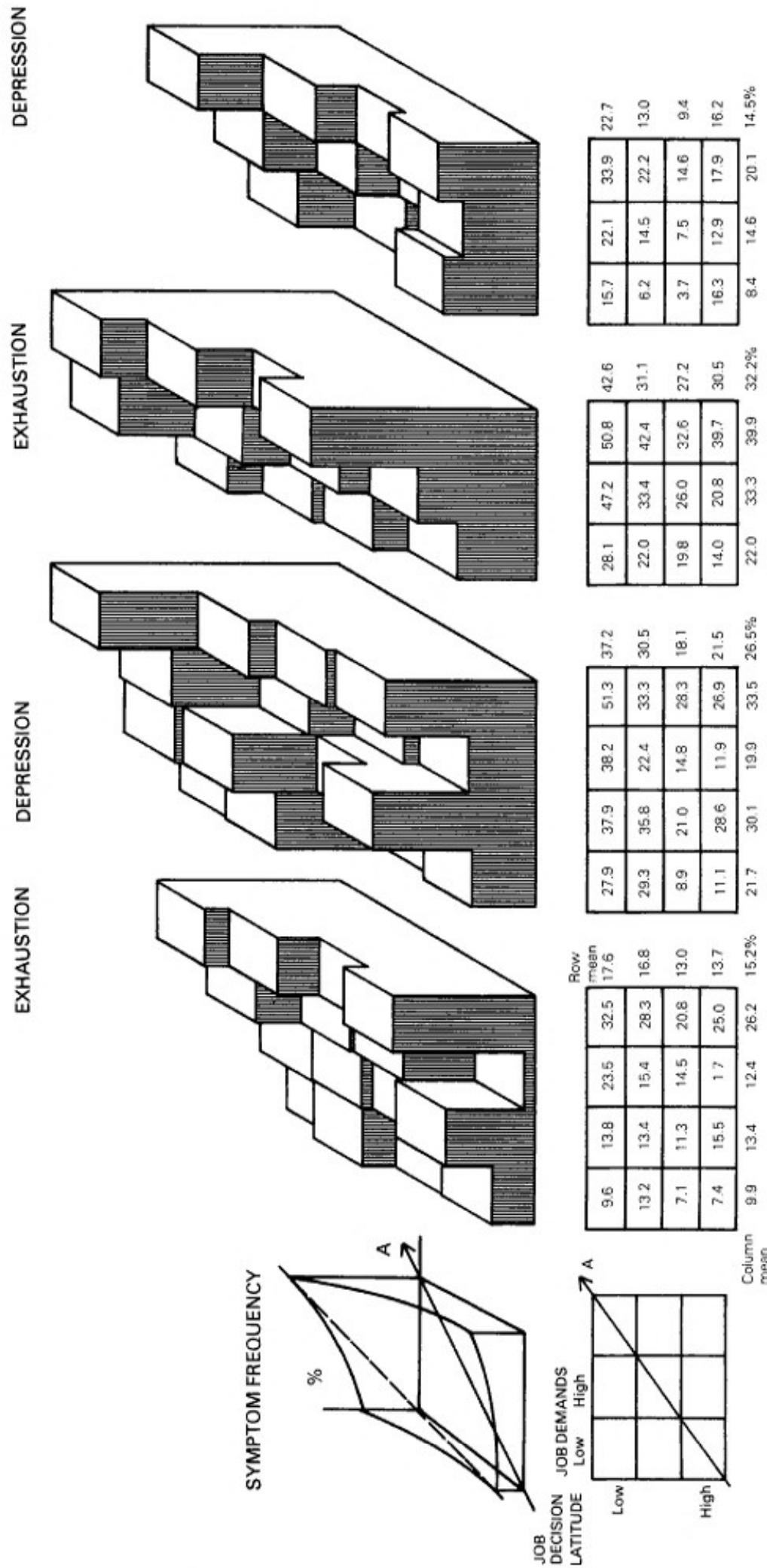
Although one common interaction form, a multiplicative interaction centered at the mean of the independent variables, is not acceptable because it predicts a downturn in strain at low demands and low decision latitude.

Table 2

Test of the Job Strain Model with Symptoms of Exhaustion and Depression

U.S. Quality of Employment Survey,
Employed Males, Aged 20-65 ($N=911$) ^a

Swedish Level of Living Survey,
Employed Males, Aged 18-66 ($N=1,896$) ^b



	β Coefficient	β Coefficient	β Coefficient
A. Regression estimates c			
1. Decision latitude	-.065***	-.150***	-.117***
2. Demands	.150***	.118***	.143***
Regressions estimates c (w/interaction term)			
1. Decision latitude	-.004	-.109***	-.110***
2. Demands	.077*	.075*	.060***
3. Abs. diff. interaction term e	.111**	.066	.137***
B. Regression estimates (logit=0, 1 symp.) d			
1. Decision latitude	S.R.R. -.141***	S.R.R. -.130***	S.R.R. -.129*
2. Demands	-1.14 1.57***	1.20*	1.45***
C. Analysis of variance (log-linear-0, 1 symp.)			
1. Decision latitude	***	***	***
2. Demands	***	***	***
3. Interaction	***	***	***

* $p \leq .05$
** $p \leq .01$
*** $p \leq .001$

b Swedish cell sizes, row by row:

89,163, 65
287,449,144
81,146,144
43,101,184
27,71,60,68

a U.S. cell sizes, row by row:

73,58,34,40
76,67,52,46
56,80,55,48

c Using the full symptom scale without dichotomization

d Standardized Risk Ratio. This is the change in the odds of having the symptom for each standard deviation of the independent variable. This value can be determined by logistic regression, in which the dependent variable is the "logit" of the probability of the predicted event ($\log(p/(1-p))$), and the independent variables are in the form used in conventional linear regression (Morris and Rolph, 1978).

e See Appendix B for interaction term formulation.

findings based on the objective ratings of job discretion are approximately the same as those based on the workers' own reports (Karasek, 1978a; see also Gardell, 1971). Thus, objective data suggest that the findings are not artifacts of the "perception" of control (Geer, Davison, and Gatchel, 1970) or due to self-reporting "bias." The hypothesis that the findings represented only biased reports by "strain-filled" workers about their jobs is also contradicted by the similarity of the findings for two countries (similarly industrialized), in spite of potential differences due to language and culture.

ALTERNATIVE STRAIN INDICATORS: ABSENTEEISM, PILL CONSUMPTION, AND JOB DISSATISFACTION

If the job strain model has general validity, it should predict a broad range of mental strain findings. The test below uses several alternative dependent variables. I examined the more "subjective" job satisfaction indicators, which have been shown to depend primarily on intrinsic job qualities (Kalleberg, 1976). Here the model clearly reveals interactive effects which may have clouded earlier linear, or unidimensional analyses. A second set of alternative dependent variables offers more "objective" evidence that the work environment takes its toll on job-related behavior; the job strain model predicts both pill consumption and sick-day absences.

Swedish survey measures of behavior patterns allow us to test for "objective" evidence of job strain. Table 3 displays data on tranquilizer and sleeping pill consumption in 1968, and on the number of sick days taken in the previous year. Findings for both the expert's rating and the self-reported measure of job decision latitude reveal that jobs with low decision latitude and high demand are as strongly associated with pill consumption and sick days as they are with reports of mental strain.

The long tradition of equivocal findings with variously defined job satisfaction indicators has given job satisfaction research an equally equivocal reputation. Although the ambiguity inherent in the job satisfaction indicators is difficult to avoid, the analysis in Table 3 is based on two often-utilized scales: one ten-item scale measuring job-related depression ("feel blue when thinking of job," I.S.R. scale, see Appendix A) and another five-item scale measuring attachment to the job ("Would you recommend it to a friend? Are you planning to change jobs?" Kalleberg, 1977). The three-dimensional diagrams are again utilized to show the joint effects of job decision latitude and job demands on a combined indicator of severe dissatisfaction (dissatisfaction on at least two measures on either scale).

It is evident from the diagrams in Table 3 that the overall relationships are quite complex and the interaction terms in the regression equation are highly significant (p always $\leq .001$). Nevertheless, the results are consistent with the job strain model. The job dissatisfaction indicator displays a strong increase (workers in the top job strain decile have six times the dissatisfaction of workers in the bottom job strain decile) in the same manner as the indicators of Table 2. A small secondary peak at low job strain is also observable for

the dissatisfaction indicator. A small percentage of jobs may be too comfortable. While not directly predicted by our model, this finding of an unbalanced U-shaped relationship is consistent with Selye's (1956) paradigm of stress adaptation: Neither too much nor too little strain is good for the organism. We would add that too much strain is clearly worse than too little (Naatanen, 1973).

The other obvious feature of the dissatisfaction distributions is the secondary peak for "passive" jobs. This phenomenon is consistent with the second prediction activity level change, made by the model. Although the mental strain symptoms showed no marked relation to "passive" work, the model proposed a separate mechanism to govern the development of "active" and "passive" behavior patterns on the job. I hypothesize that "passive" job content is also associated with job dissatisfaction. This conclusion is bolstered by the strongly significant $F \geq 7.9$ coefficient for an interaction term which combines both job strain and activity level effects (see Appendix B)⁶. Although a full discussion of this mechanism is beyond the scope of this article, recent research has bolstered the finding that behavior patterns in general are affected by the "active" or "passive" quality of the job (Karasek, 1976; Elden, 1977; Karasek, 1979; see also Langer and Rodin, 1976). Thus, "active" or "passive" job content could quite plausibly be a component of job-related feelings of satisfaction.

TESTING THE MODEL WITH LONGITUDINAL DATA

The Swedish data contain responses to the same job content and mental strain questions in 1974 as in 1968, allowing a test of the model with longitudinal data. The job strain model predicts that workers with jobs that have become more demanding and allow less decision latitude will show more mental strain symptoms at the end of the change period than at the beginning. Such a test permits evaluating the major alternative explanation for the findings in the previous section: the characteristics of the individual such as education, genetic inheritance, family experience, or certain personality traits fixed in youth (Zaleznik, Ondrack, and Silver, 1970) predispose the individual to mental strain and choosing an undesirable job. Changes in symptom frequency that are observed in the panel data should be attributable to changing environmental circumstances, while the effects of fixed individual background characteristics should remain constant.

Change data are subject to a broader variety of error than cross-sectional data are (which has led some authors to generally discourage using it, see Cronback and Furby, 1970). Nevertheless, in spite of potentially large random errors, a fairly clear positive association between changes in job strain and changes in mental strain symptoms from 1968 to 1974 is visible for the full sample in Figure 2. For the sample of the full Swedish work force, problems such as exhaustion and depression increase with age, but for workers with declining job strain, these problems decline. It is as though positive changes in the work environment reversed these effects of "aging" (see also Palmore, 1969).

One method of controlling for individual differences in sus-

6

It should be noted that both analysis of variance and a multiplicative form for the interaction term do not yield significant coefficients for what appear to be strong interactions when either visual inspection or other interaction forms are utilized. The implication is that many studies testing for interaction effects using only the commonly employed multiplicative term or analysis of variance may erroneously conclude that "interactions are non-significant," when other forms for the interaction could yield significant results as occurs in Table 3 for the satisfaction variables (Southwood, 1978).

Table 3

Test of the Job Strain Model with Reports of Dissatisfaction, Pill Consumption, and Sick Days

U.S. Quality of Employment Survey, 1972,
Male Workers, Aged 20-65 ($N=911$)^a

Swedish Level of Living Survey, 1968,
Employed Males, Aged 18-66 ($N=1,896$)^b

JOB DISSATISFACTION

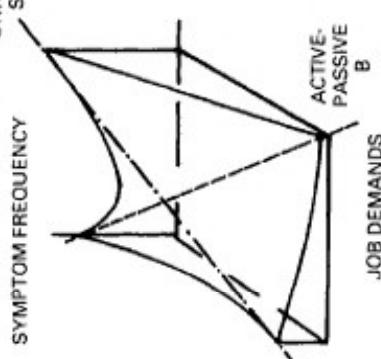
SICK DAYS
(5 or more days per year)

UNRESOLVED STRAIN A

PILL CONSUMPTION
(Tranquilizers and
Sleeping Pills)

LIFE DISSATISFACTION

SICK DAYS
(5 or more days per year)



JOB DECISION LATITUDE	High π_A		Low π_A		Row mean
	Low	High	Low	High	
High	24.1	16.5	21.6	27.5	22.0%
Column mean	24.1	16.5	21.6	27.5	22.0%
Low	40.9	26.3	42.9	55.3	39.8
Row mean	40.9	26.3	42.9	55.3	39.8

JOB DEMANDS	High π_B		Low π_B		Row mean
	Low	High	Low	High	
High	18.5	10.9	14.3	13.8	13.7
Column mean	18.5	10.9	14.3	13.8	13.7
Low	9.4	11.3	23.5	23.9	16.2
Row mean	9.4	11.3	23.5	23.9	16.2

	β Coefficient	β Coefficient	β Coefficient
A. Regression estimate c			
1. Decision latitude	-.296*** .080***	-.201*** .044	-.057*** .104***
2. Demands			.004
Regression estimate c (w/ interaction term)			
1. Decision latitude	-.221*** .001	-.130*** -.030	-.014 .071** .055
2. Demands			.015 .017
3. Abs. diff. interaction term e	.120***	.113***	
Regression estimate c (w/interaction term)			
1. Decision latitude	-.131** .094***	-.053*** .056***	
2. Demands			-.172***
3. Combined effects inter. term e	-.191***		
B. Regression estimates (logit-0, 1 symp.) d			
1. Original scales			S.R.R.
1. Decision latitude	-.176*** 1.21*	-.204*** 1.16	-.144*** 1.01
2. Demands			
2. Transformed Scales (see p. 288)			S.R.R.
1. Strain (= Dem.-Dec.)	1.63***	1.93***	-.125*** 1.54***
2. Activity level (= Dem. + Dec.)	-1.35**	-1.53**	
C. Analysis of variance (log-linear-0, 1 symp.)			
1. Decision latitude	***	***	
2. Demands			
3. Interaction	***	***	

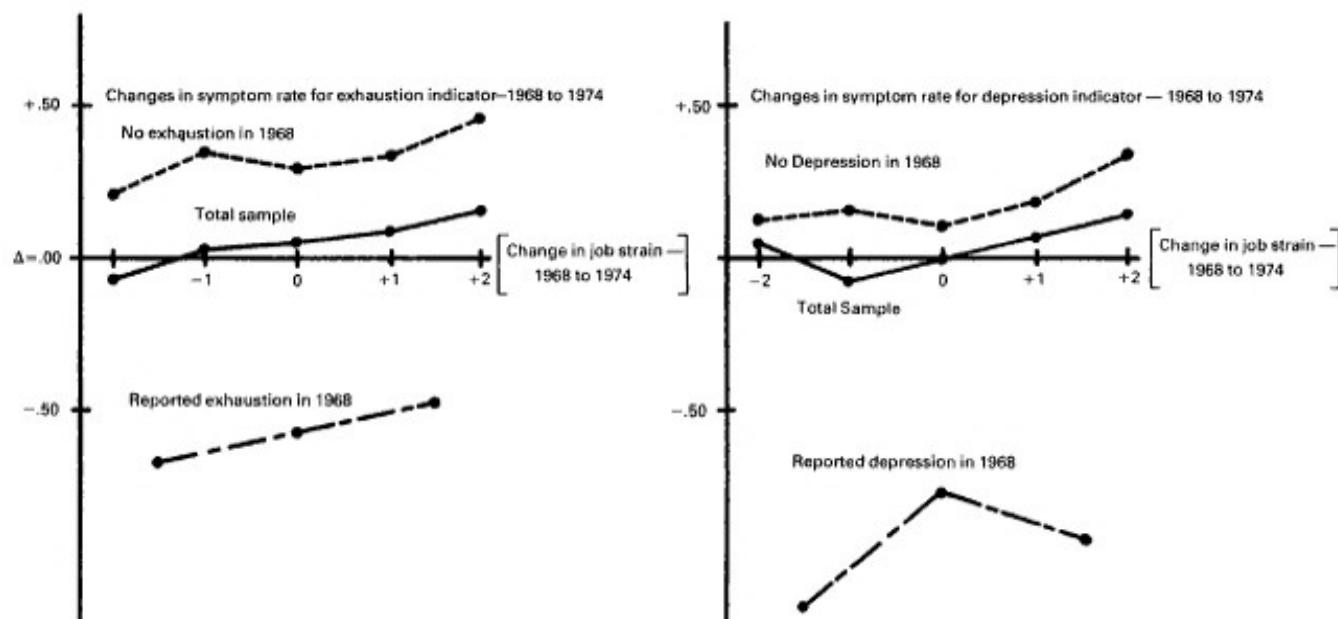
* $p \leq .05$
** $p \leq .01$
*** $p \leq .001$

a U.S. cell sizes, row by row:
73,58,34,40
76,67,52,46
56,80,55,48
27,71,60,68

b Swedish cell sizes, row by row:
89,163, 65
287,449,144
81,146,144
43,101,184

c Using the full symptom scale without dichotomization
d Standardized Risk Ratio. This is the change in the odds of having the symptom for each standard deviation of the independent variable. This value can be determined by logistic regression, in which the dependent variable is the "logit" of the probability of the predicted event ($\log(p/(1-p))$), and the independent variables are in the form used in conventional linear regression (Morris and Rolph, 1978).

e See Appendix B for interaction term formulation.



**Figure 2. Changes in symptom frequency by changes in job strain, 1968 and 1974
(Swedish employed males, aged 18-66; N=1,926).**

ceptibility (and also avoiding potentially "distorted" symptom reports of depressed or exhausted respondents) is to divide the sample into two groups, with and without mental strain symptoms in 1968, and to examine both populations for changes in symptoms between 1968 and 1974. The dashed lines reveal that both groups developed symptoms that are associated with changes in job strain.

Testing all personality characteristics in order to discount them as alternative explanations would be an endless task. However, characteristics of the job selection process itself substantially limit the number of alternatives to be investigated; the individual trait must clearly relate to the individual's possibility of changing jobs. First, it is not easy to change jobs (Breer and Locke, 1965), and many job content changes are not the result of the worker's free choice but of factors such as automation, data processing, or reorganization. Second, the major determinant of job mobility has been shown to be the worker's education, along with the worker's father's education (Blau and Duncan, 1967; Tuma, 1976). Controlling for these factors does not substantially diminish the associations between job content and mental strain shown in Table 2. Although these associations are generally clearer for individuals whose fathers have elementary education (80 percent of our sample) they also remain positive, if irregular, for the individuals whose fathers had more education. Regardless of background, job changes are positively associated with symptom changes.

It is not the goal of this research to suggest that individual differences are not important. Indeed, some significant variations do occur when we control for individual background factors such as education, father's education, age, income, social class, and urban or rural location. However, the final associations rarely drop below two-thirds of the value observed here for the males in the sample (see Karasek, 1976; Karasek, 1978: Table 6). We also feel that appropriate measures of personality should be recognized as joint determinants of the job design process, as Hackman and Oldham

(1975) suggest. However, the scope of the job content associations foreshadows one difficulty in controlling the effects of "objective" work environment for personality measures: Care must be taken not to select a personality measure which could itself be determined by job conditions.⁷

DISCUSSION

It was suggested that two major paradoxes in job strain research might result from failure to consider the joint interactive effects of job demands and job decision latitude. First, misinterpretation of the true source of job strain could occur when the contribution of either job decision latitude or job demands is overlooked, or when these job characteristics, which operate differently, are mixed indiscriminately. Second, "disappearance" could occur when the counteracting effects of job demands and job decision latitude cancel each other out. "Disappearance" could also result when generally applicable nonlinear or interactive findings vanish in small subpopulations when the relationships are summarized linearly. This problem is especially important in job satisfaction studies in light of the complex relationships found in Table 3.

Ritti (1971) found a "paradox" in a test of job demand indicators: an increase in one measure of job demands, time pressure, was associated with diminished satisfaction (misutilization); while an increase in another measure, intellectual demands, was associated with increased satisfaction. A further surprise was that the greatest satisfaction was associated with heavy time demands plus heavy intellectual demands.

The first finding is consistent with our model if, as we suggest, intellectual responsibility is treated as a measure of decision latitude and time pressure as a measure of job demands related to work load. Ritti's second finding is also consistent with the activity level mechanism of our model and our finding in Table 3: The highest satisfaction occurs with "active jobs," where both the challenge of high job demands and the opportunity for significant use of judgment and discretion are available.

Turner and Lawrence's (1965) findings illustrate a possible paradox of disappearance. Although some of their findings display a positive or a curvilinear relationship between job satisfaction and job decision latitude (measured as "responsibility," but recall its problems, p. 286) they conclude that no clear relationship exists. The findings presented in this article show that nonlinearities per se do not prevent a conclusion in support of a plausible model. Another Turner-and-Lawrence finding — a positive association between job decision latitude and job satisfaction existed only in rural areas — is contradicted by my tests controlling for urban or rural location with national population samples (Karasek, 1978a; Table 6). I find that the associations are at least as strong in urban areas. Turner and Lawrence's findings were based on 11 plants; the urban factories possibly represented an unusual subpopulation with restricted variance (located on the inflection point in the job strain curve).

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Such a potential problem arises for Hackman and Oldham's measures of "need strength," which is similar in its formulation to their independent variables, and could plausibly be the result of job socialization (see the "passivity" discussion above, also Kohn and Schooler, 1973; Gardell, 1976) or cognitive dissonance processes. To control for such a measure risks eliminating some of the variances that are to be explained.

Blood and Hulin (1967) and Hulin (1971:166) fail to discriminate between job demands and job decision latitude. They contend that an absence of an increase in job satisfaction as job "level" (job decision latitude) increases is evidence of alienation from middle class values. However, their interpretation of alienation from the work ethic (Hulin and Blood, 1968: 49) and, in part, their criteria for identifying alienated workers, are based on increased satisfaction when job demands are reduced (Blood and Hulin, 1967: 268). Our model shows that for the vast majority of workers, lower work load demands are associated with increased satisfaction. The "work ethic" has always had its limitations. The failure to distinguish between job demands and job decision latitude, and failure to consider their counteracting results, may be responsible for the "paradox of disappearance" in the Hulin and Blood findings.

Hulin and Blood also find that rural workers display a strong job content/job satisfaction association, while urban blue-collar workers do not (corroborating Turner and Lawrence's results). Hulin and Blood further infer that the cause of this discrepancy is "urban alienation from middle class values," although they do not measure feelings of alienation directly. Recent studies controlling for attitudes and alienation (Shepard, 1970; White and Ruh, 1973) have found that these controls do not diminish content-job satisfaction findings. This finding, plus our finding that the association is as strong in urban areas as in rural areas, suggests that the Hulin and Blood conclusion is really the product of a special subpopulation⁸ and an inappropriate generalization of their findings. Hulin and Blood's policy implication that "job enrichment" strategies should not be recommended for low status, blue-collar urban workers is also not supported by secondary controls in our analysis (Karasek, 1978a; Table 6). Indeed, I conclude that this group is the one most affected by problems of strain and related feelings of dissatisfaction, and should be the focus of job redesign programs.

The last example of a contradiction that can be resolved refers to overall life satisfaction. Table 3 shows that life dissatisfaction is as strongly related to job characteristics as job dissatisfaction is. The relationship, predictable by the job strain model, is obviously nonlinear and has the characteristic interactions between the job demand and job-decision latitude variables ($p \leq 0.01$). This may explain the Andrews and Withey's "paradox of disappearance" (using a linear model and no interaction) — "job concerns show only a modest relationship . . . to satisfaction with life-as-a-whole" (1976: 129). The Andrews-and-Withey life-satisfaction measure is very similar to the one used here, and their analysis is based on a representative survey of the U.S. population ($N=1,927$).

CONCLUSIONS

The job strain model predicts significant variations in mental strain. This prediction was borne out by nationally representative data for two industrialized countries, for a variety of mental strain symptoms, for a range of job content definitions, and for both expert and self-reported data. The Swedish data further suggest a causal relationship between jobs and mental strain outside the job: the longitudinal varia-

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Sales and House (1974) also found that analyses based on working class sub-populations in the data used by Hulin and Blood (based on 20 eastern companies) were inconsistent with analogous findings using other data bases. Hulin and Blood may have compared some urban workers, (with low demand and high job decision latitude for whom additional decision freedom is not associated with satisfaction) to almost any other group of workers where increased decision freedom is associated with satisfaction (see Table 3).

tions in jobs and symptoms between 1968 and 1974 confirm the findings of the cross-sectional data. The findings also have some limitations: the impact of social relations at the group and organizational level is not considered; the specific impact of different types of decision latitude and job demands is not distinguished; the impact of individual differences in perception of job demands is not assessed; and many of the detailed processes inferred by the stress-management model can only be suggested with the present data. These topics require further research.

An important implication of the job decision associations is that most working individuals in countries with advanced economies, such as the United States and Sweden, find that the "requirement" of using intellectual skill or making decisions represents an opportunity to exercise judgment. This enhances the individual's feelings of efficacy and ability to cope with the environment; it is not a source of stress.⁹ Table 2 demonstrates that the opportunity for a worker to use his skills and to make decisions about his work activity is associated with reduced symptoms at every level of job demands. We do not find, therefore, support for the belief that individuals "overburdened" with decisions face the most strain (Janis and Mann, 1977)¹⁰ in an industrialized economy. Literature lamenting the stressful burden of executive decision making misses the mark (for a fuller discussion of this literature, see Zaleznik, Kets de Vries, and Howard, 1977). Constraints on decision making, not decision making per se, are the major problem, and this problem affects not only executives but workers in low status jobs with little freedom for decision. Indeed, if we search the U.S. data for the most common occupation codes with high levels of job demands and low levels of job decision latitude, we find assembly workers, garment stitchers, freight-and-material handlers, nurse's aides and orderlies, and telephone operators. The working individual with few opportunities to make job decisions in the face of output pressure is most subject to job strain (Kerckhoff and Back, 1968).

Furthermore, both the satisfaction measures and the depression indicators show some covariation with the "activity level" of the job. That is, more "active" jobs are associated with satisfaction and reduced depression, even though they are more demanding. "Passive" jobs (with low demands as well as low decision latitude) are dissatisfying. Thus, our findings should not be interpreted as showing that the adverse effects of low job decision latitude are limited to workers with highly demanding jobs or even that such jobs should be changed by decreasing job demands (although this would appear at least to alleviate symptoms of mental strain). Related research findings suggest that employees with low decision latitude and low job demands face the different problem of passivity and apathy (for further discussion, see Karasek, 1976; Langer and Rodin, 1976; Elden, 1977; Karasek, 1979).

Possibly the most important implication of this study is that it may be possible to improve job-related mental health without sacrificing productivity. It would appear that job strain can be ameliorated by increasing decision latitude, independently of changes in work load demands. If, as would be

⁹

This is the implication of the generally monotonic, negative slope for job decision latitude in Tables 2 and 3. However, it would be desirable to measure "person-environment" fit for skill level in a more detailed analysis to isolate low skills groups for which the above results may not hold. Nevertheless, use of rather aggregate controls for either age or education in the U.S. or Swedish findings does not alter job decision level slopes (Karasek, 1978a: Table 6).

¹⁰

Janis and Mann (1977) associate decision making with strain, but they emphasize the stressful situations (crises) which instigate the need for decisions — not the decision latitude available which modulates the effects of preexisting demands.

expected, work load is related to organizational output levels, these levels could be kept constant if mental health "externalities" were improved. Changes in the administrative structure would have to be made which improve the worker's ability to make significant decisions about his task structure, increase his influence on organizational decisions, and allow him discretion over the use of his existing and potential skills.

These job design suggestions contradict major principles of job design as proposed by Frederick Taylor. For a promised increase in economic compensation (by no means always realized), the worker allowed management to assume tight control of job-related decisions. While it was claimed that increased output would come from elimination of "wasted effort and unnecessary decisions" the overall workload probably increased in many cases. Not only have Taylor's policies probably led to mental strain that was overlooked when these theories were advocated, but in some circumstances demoralization associated with these jobs may even cancel the presumed productivity benefits. Policy decisions to centralize decision-making and job design expertise are often assumed to lead to the technological progress and production reliability that are needed for economic efficiency. However, unless these important economic linkages are reexamined in light of the effects of psychosocial mechanisms, many potentially more humane and productive forms of work organizations may continue to be overlooked.

The findings of a secondary peak in the job content and dissatisfaction associations could also have policy significance. There is evidence that at high levels of job decision latitude, symptoms level out or even begin to increase with increasing decision latitude. This leads to the conclusion that job redesign strategies attempting to reduce strain in already comfortable jobs may reach a point of "diminishing returns" and in fact create problems. Elimination of unnecessary constraints on decision making for managerial jobs may be a desirable strategy to reduce job strain in specific instances, but a broad increase in decision responsibility for this group may only increase their strain. However, for the lowest status jobs the reduction of strain associated with increases in decision latitude is substantial. While the problem of job strain affects employees at all levels in the organization, the solution must certainly focus attention on the most oppressive jobs.

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