

Minimizing Strain and Maximizing Learning: The Role of Job Demands, Job Control, and Proactive Personality

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Using a sample of 268 production employees, this study extended research on R. Karasek's (1979) demands–control model of stress in 2 ways. First, results show that R. Karasek's proposed interaction between demands and control when predicting strain occurred only for more proactive employees. This 3-way interaction helps reconcile previous inconsistent findings about the interaction between demands and control when predicting strain. Second, the study extends research by investigating the demands–control interaction and the moderating influence of proactive personality in relation to learning-oriented outcomes (perceived mastery, role breadth self-efficacy, and production ownership). There were no 3-way interactions among the variables when predicting these learning-oriented outcomes, but all were important predictors. These results show (a) that demands and control can influence learning as proposed in the dynamic version of the demands–control model and (b) that proactive personality plays an important moderating role.

Popular management practices and philosophies, such as the creation of a learning organization (Senge, 1990), employee empowerment (e.g., Conger & Kanungo, 1988), and high-involvement working (Lawler, 1992), all promote the development of self-managing, learning-oriented employees; the basic rationale being that organizations will gain a competitive advantage if they make better use of their human resources (e.g., Beer, Spector, Lawrence, Mills, & Walton, 1985).

However, at the same time as encouraging employee learning and development, the potential also exists for the new initiatives to increase employee stress. As Mohrman and Cohen (1995) described, a paradox of modern organizations is that “people have the opportunity for personal growth, skill development and connectedness to others, but they also confront a lack of security, ambiguity, competing demands, and unrelenting work pressures” (p. 377). Many

commentators have similarly observed that the drive for competitiveness can escalate levels of stress among employees. For example, some have argued that lean production (Womack, Jones, & Roos, 1990), described as “doing more with less,” increases the demands made of employees to intolerable levels, ultimately resulting in “mean” production (e.g., Delbridge, Turnbull, & Wilkinson, 1992).

Against this background, there is a need to learn more about how to simultaneously minimize the stress associated with excess job demands and maximize employee learning and development. One model that considers both of these outcomes is Karasek's (1979) demands–control model. Earlier formulations of the model focused on stress outcomes, the basic proposition being that psychological strain results from the combined effects of the demands of a work situation and the amount of control employees have to manage the demands. As Fox, Dwyer, and Ganster (1993) claimed, this model “has provided the underlying theoretical basis for most large scale studies of job stress conducted in the last ten years” (p. 290). Dynamic formulations of the model focus on how job demands and job control combine to promote employee learning and development (Karasek & Theorell, 1990).

Most significant, the model posits an interaction between job demands and job control. Thus, in jobs where the demands are high but control is low (referred to by Karasek as a *high strain job*), negative outcomes for strain and learning are predicted because the individual cannot respond optimally to the situation. However, if the demands of a job occur in parallel with high job control (referred to by Karasek as an *active job*), then incumbents are thought to

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be able to cope actively with the challenges, protecting them from strain and even leading to health improvements. Learning and mastery may also result. This proposed interaction is an important one within the context of an increasingly demanding modern workplace because it suggests that job demands can be increased with minimal threat to psychological health as long as job control is simultaneously enhanced. In other words, if the model is valid, initiatives such as lean manufacturing would not invariably be "mean," but their effects would depend on the accompanying work design strategy.

In this study, we investigated the demands-control model and the proposed interaction in relation to both strain and learning-oriented outcomes. In considering both types of outcomes, we extended the model to investigate potentially important attributes of individual employees. To be specific, our focus was on the potential moderating role of proactive personality. First, we investigated the moderating effect of this individual difference variable on the demands-control relationship when predicting strain. In part, our aim was to replicate findings from two recent studies that showed the importance of conceptually related individual difference variables when predicting strain outcomes. Second, we tested the demands-control model and the potential moderating role of proactive personality in relation to proactive and learning-oriented outcomes, including perceived mastery, role breadth self-efficacy, and production ownership. Few, if any, investigations have tested the learning-related predictions of the dynamic version of the demands-control model put forward by Karasek and Theorell (1990). Finally, we investigated the relationship between these learning-oriented outcomes (particularly perceived mastery) and job strain. We describe the rationale behind each of these three aims in greater detail.

Study Aims

Demands-Control Model and the Role of Proactive Personality When Predicting Strain

In support of the demands-control model, studies have consistently demonstrated that excess job demands can increase strain and strain-related outcomes (e.g., raised systolic and diastolic blood pressure) and that high decision latitude or high job control can serve to reduce these negative outcomes (see Karasek & Theorell, 1990, for a review). However, findings of studies investigating the proposed interaction between these two variables have been much less consistent (Ganster & Fusilier, 1989; Jones & Fletcher, 1996). Some studies have shown no evidence of an interaction (e.g., Carayon, 1993; Landsbergis, 1988), whereas others have shown the predicted interaction effect (e.g., Fox et al., 1993). Methodological explanations have been put forward to account for the discrepancies, relating

to, for example, the conceptualization and measurement of job demands and job control (Karasek, 1997; Wall, Jackson, Mullarkey, & Parker, 1996); the confounding effects of unmeasured third variables, such as socioeconomic status (Ganster, 1989); the use of a varying range of measures of strain; and the differences in power when using alternative methods to test the model (e.g., analysis of variance vs. moderated regression analysis).

A further potential explanation, and a more theoretical one, arises from the observation that people adapt in different ways to the environment and that these differences can influence the work stress process (Parkes, 1990, 1994; Siegrist, Peter, Junge, Cremer, & Seidel, 1990). Thus, individual difference variables might influence the nature of the demands-control relationship (Karasek, 1979; Xie, 1996). This suggestion is especially relevant when the mechanism by which job control is suggested to have its stress-reducing effects is considered. The assumption underlying the proposed interaction between job demands and job control is that incumbents in active jobs will take steps to manage the demands that occur, channeling their energy in a constructive way and thus minimizing strain. As Karasek (1997), stated, "Only average psychological strain is predicted for the 'active job' because much of the energy aroused by the job's many stressors ('challenges') are translated into direct action—effective problem solving—with little residual strain to cause disturbance" (p. 34.7). This premise is clearly founded on an assumption that incumbents will behave proactively when they have the autonomy to do so.

However, not all employees approach their environment in a proactive manner. In a recent article, Bateman and Crant (1993) identified proactive behavior as a personal disposition, or a relatively stable behavioral tendency. This concept of proactive personality was shown to be distinct from other personality concepts (such as need for achievement and locus of control), to be able to differentiate among individuals, and to be significantly associated with an array of criterion variables (such as transformational leadership). They described the concept in the following way:

The prototypic *proactive personality*, as we conceive it, is one who is relatively unconstrained by situational forces, and who effects environmental change. . . . Proactive people scan for opportunities, show initiative, take action, and persevere until they reach closure by bringing about change. . . . People who are not proactive exhibit the opposite patterns—they fail to identify, let alone seize, opportunities to change things. . . . They passively adapt to, and even endure, their circumstances. (p. 105)

We proposed that the demands-control interaction would apply primarily to proactive employees. We expected these individuals would take advantage of autonomy afforded them to manage job demands and thereby limit the threat of demands to their psychological health. Passive job incumbents, however, were expected to be less likely to act to

reduce job demands; rather, they would endure demands—a process that would incur strain. In essence, we predicted a three-way interaction between proactive personality, job control, and job demands when predicting strain. This hypothesis could be phrased as follows: In all cases except one, job demands will cause strain. The exception is the case where employees have both the opportunity to reduce the job demands (i.e., high job control) and the inclination to do so (i.e., a proactive personality). Neither of these conditions (high job control or proactive personality) will be sufficient on its own. Phrasing the hypothesis in these terms had parallels with Peters and O'Connor's (1980) proposal that the impact of personal variables (e.g., motivation and personality) on performance is constrained by situational variables in the workplace, such as the degree of job control. In a similar manner, the prediction was consistent with the view that the impact of personality is less in so-called strong situations, such as where job control is low, than it is in so-called weak situations, such as where job control is high (Mischel, 1977). If people have little discretion over their tasks, then regardless of whether they are passive or proactive, there is little opportunity to act on and reduce the job demands that occur.

Two recent articles provided strong support for the view that processes in the demands–control model are moderated by proactive personality (Xie's [1996] investigation of the moderating effect of an individual's perceived "ability–job fit" also had similar findings). First, Schaubroeck and Merritt (1997) found that self-efficacy moderated the demands–control relationship when predicting blood pressure. For people high in self-efficacy, they found the results matched those predicted by the demands–control model. However, for those low in self-efficacy, high job control combined with high job demands was associated with negative health consequences, a result opposite to that predicted by the model. A second study found that active coping moderated the demands–control interaction when predicting burnout among 367 nurses (de Rijk, LeBlanc, Schaufeli, & de Jonge, 1998). Similar to Schaubroeck and Merritt's findings, the predicted interaction effect between job demands and job control was found for those high on active coping, whereas high job control tended to increase the burnout attributable to job demands for those low in active coping.

Although neither self-efficacy nor active coping is considered a stable dispositional variable in the same way as proactive personality, there is overlap between the concepts. Self-efficacy is concerned with a person's belief that he or she has the capability to act on situational demands (Wood & Bandura, 1989). Active coping is defined as the "attempt to come to grips with problems at work by cognitively analyzing the situation and/or by concrete action in order to solve or overcome the problem" (de Rijk et al., 1998, p. 5). One would imagine that proactive people are highly likely to engage in active coping strategies and to have high

self-efficacy. For example, Bateman and Crant (1993) proposed that proactive people will use problem-focused strategies for coping with stressful demands (i.e., active coping) rather than emotion-focused strategies. There is therefore sufficient overlap in the concepts to consider that the current study was in part a replication of the two investigations cited above.

In summary, our first aim was to investigate whether proactive personality moderates the relationship between job demands and job control when predicting strain. We predicted that there would be a three-way interaction between the predictor variables. To be more specific, we proposed that, for proactive employees, there would be an interaction between job demands and job control: High job demands would not be associated with strain when job control was high, but high demands would be associated with strain when job control was low. For passive employees, we proposed that there would be a main effect of job demands such that high demands would be associated with strain regardless of the level of job control.

To reduce the likelihood of a Type II error (to which tests of interactions are susceptible), we used a measure of job demands that does not incorporate affective elements. As argued by Wall et al. (1996), including an affective element within the independent variable (such as by assessing the extent to which people feel under pressure) builds in spurious main effects if the dependent variable is also an affective evaluation, such as strain. In a similar manner, the measure of job control used here focused only on that feature and did not include aspects such as the opportunity to learn new things. Many tests of the demands–control model have used measures of job control that are confounded with other such concepts (Wall et al., 1996). It was also important to test the hypothesis in a context where there was sufficient variation in each of the three independent variables (Johns, 1991), particularly for those situational variables that were more likely to be restricted. We thus identified a context where levels of both job control and job demands varied widely across the sample.

Demands–Control Model, Proactive Personality, and Learning-Oriented Outcomes

Our second aim was to consider the demands–control model and the potential moderating role of proactive personality in relation to proactive and learning-oriented outcomes. This approach derives from Karasek and Theorell's (1990) dynamic formulation of the demands–control model. On the basis of an interactionist perspective regarding the links between environment and personality, these authors hypothesized two spirals of learning and behavior that result from the combination of job demands and job control. The first, a positive behavioral dynamic, was argued to act as follows:

An active job and its successful learning opportunities lead to an increased feeling of mastery and confidence. This feeling in turn helps the person to cope with the inevitable strain-inducing situations of the job. The result is reduced residual strain and thus increased capacity to accept still more learning and positive personality change, *ad infinitum*. (Karasek & Theorell, 1990, p. 103)

The second, a negative behavioral spiral, is suggested to result from a so-called high-strain job in which the combination of high job demands but low job control leads to "a diminished feeling of mastery over situations . . . [which] in turn restricts the capacity to cope with job strain and leads to still higher residual strain levels, *ad infinitum*" (Karasek & Theorell, 1990, p. 103). The proposal, therefore, was that particular combinations of job demands and job control not only affect strain, but also affect learning.

At the time, Karasek and Theorell (1990) acknowledged that the dynamic model was largely untested. This situation seems to be unchanged. As these authors highlighted more recently (Theorell & Karasek, 1996), researchers to date have neglected to investigate proactive and learning-oriented outcomes of demand-control combinations. Likewise, de Rijk et al. (1998) advocated studying motivational outcomes of the demands-control model, particularly in relation to the potential moderating effect of individual difference variables. Considering a wider range of outcomes, beyond strain and strain-related variables, would be consistent with the perspective that mental health should not just be considered as an absence of stress symptoms but should also be viewed in terms of positive mental health indicators (Warr, 1987, 1994). Warr (1994) argued that "we should reject a 'passive contentment' view of mental health (p. 86)" and that we should consider more active indicators of mental health, such as competence, mastery, aspiration, and desire for autonomy.

To explore adequately these aspects of the dynamic demands-control model, proactive and learning-oriented outcome variables are needed. Concepts such as job satisfaction are inappropriate because they can be quite passive (such as the state of resigned satisfaction; Bruggeman, Groskurth, & Ulich, 1975). We used three relevant outcome variables: perceived mastery, role breadth self-efficacy, and production ownership.

Perceived mastery is a particularly salient concept in Karasek and Theorell's (1990) dynamic extensions to the model, as shown by the quotes cited above. A sense of mastery is effectively opposite to the state of learned helplessness (Seligman, 1975) and refers to an employee's belief that he or she can control or act on job demands that occur. For example, if a shortage of materials occurs, then employees feel they can approach their suppliers and ask for a delivery of materials. The demand still exists, therefore, but it is seen as controllable. Karasek and Theorell (1990) argued that such an increased sense of mastery is most

likely to occur when there is sufficient challenge in the job and this challenge is matched by a high level of control. This theory implies an interaction between job demands and job control. Consistent with the arguments developed in relation to job strain, we proposed that proactive personality might moderate the demands-control relationship. That is, because proactive employees are likely to make use of the high control afforded to them, those in active jobs would be the most likely to develop a sense of mastery. We therefore proposed a three-way interaction between job demands, job control, and proactive personality when predicting self-reported mastery.

Finding such an interaction would support Karasek and Theorell's proposal that high-demands, high-control jobs (i.e., active jobs) promote a sense of mastery that in turn inhibits strain. In other words, if there was a three-way interaction that paralleled the interaction hypothesized for predicting strain, this would add weight to the idea that employees in high-demands, high-control jobs do not experience high strain because they develop a stronger sense of mastery. Thus, by examining perceived mastery as an outcome of the demands-control model as well as by investigating its association with job strain (discussed below), we were able to investigate whether this mechanism is a plausible one.

We also investigated the demands-control model in relation to two further outcome variables: role breadth self-efficacy and production ownership. The first of these refers to employees' confidence that they can carry out a wide range of integrative, proactive, and interpersonal activities that extend beyond traditional technical tasks (such as talking to suppliers and meeting with customers; Parker, 1998). This variable is conceptualized as a domain of self-efficacy that is particularly pertinent to employees in today's flexible integrated organizations. Production ownership is a related concept and assesses the breadth and proactivity of an employee's role orientation (Parker, Wall, & Jackson, 1997). A narrow "that's not my job" role orientation is indicated by an employee with low ownership, that is, by one who does not feel a sense of concern for production problems that extend beyond a narrowly defined role. An employee who feels shared responsibility for a wide range of strategic and long-term production issues, such as customer dissatisfaction, has a more flexible and proactive role orientation. Although these learning-related outcomes were not explicitly considered by Karasek and Theorell, we expected that they would be associated with job demands and job control in a similar way to perceived mastery. We therefore predicted that proactive employees in high-demands, high-control jobs would be the most likely to possess a sense of self-efficacy that they can carry out a range of integrative, proactive, and interpersonal tasks and would also be the most likely to exhibit a sense of high production ownership.

Our focus on self-reported mastery, role breadth self-efficacy, and production ownership rather than more stable disposition variables (such as proactive personality) was quite deliberate. Although the dynamic formulation of the demands-control model predicts personality change, Karasek and Theorell (1990) proposed that such change only occurs over very long periods. Because the context of our study was one in which employees in the situation of high job control were likely to have experienced this aspect for only a relatively short period (i.e., since the introduction of team working), we focused on outcome variables that are more intermediary and therefore likely to reveal the effects of recent learning. Although we did not examine change here (because the study drew on cross-sectional data), it remained important to use concepts that have been shown to change in response to the environment. Research has shown that enhanced job control can promote the development of broader and more proactive role orientations (Parker et al., 1997) as well as the development of higher role breadth self-efficacy (Parker, 1998).

In summary, we proposed that there would be a three-way interaction between job demands, job control, and proactive personality when predicting perceived mastery, role breadth self-efficacy, and production ownership. We expected a significant interaction between job demands and job control for proactive employees but not for passive employees. For proactive employees, we expected that high job demands and high job control would interact when predicting perceived mastery, role breadth self-efficacy, and production ownership. For passive employees, we expected only main effects of these variables.

Association Between Learning-Oriented Outcomes and Strain

In addition to exploring perceived mastery as an outcome of demands-control relationships, we also investigated the link between this variable and job strain. Karasek and Theorell (1990) proposed two ways that feelings of mastery and strain might be linked. First, drawing on the concept of learned helplessness (Seligman, 1975), they argued that accumulated strain—such as that arising from a high-demands, low-control job (a high-strain job)—inhibits a person's ability to learn and develop a sense of mastery. Second, they suggested that the cumulative result of learning from a high-demands, high-control job is "to increase skills and feelings of mastery, which in turn are associated with a reduced perception of stress" (Karasek & Theorell, 1990, p. 101). We therefore hypothesized that feelings of mastery would be negatively associated with strain.

We also explored the relationships of role breadth self-efficacy and production ownership with strain, although we did not necessarily expect negative associations. These measures can be seen as positive indicators of mental health,

but this does not mean they should go hand in hand with reduced job strain. As Warr (1994) noted,

Separate components of mental health are not always positively intercorrelated. For example, proactive, risk-taking people may be considered healthy in terms of competence, aspiration and autonomy; but their difficult interactions with the environment may also make them anxious for a considerable proportion of time. (p. 86)

Method

Organizational Background

Participants were production employees in a wire manufacturing company based in the United Kingdom ($N = 268$). About 18 months before the survey, the company introduced a team-working initiative within production. The initiative had mixed success. In some areas, team working had resulted in substantially higher levels of shopfloor job control (e.g., operators themselves decided the scheduling of their machines). In other areas, the work design remained as it always had been and operators had little control over the timing or methods of their work. The context thus provided sufficient variation in job control to test the hypotheses. There were also variations in job demands caused by the different technologies and processes required to make different products (e.g., plain wire, galvanized wire, welded mesh products).

Procedure and Sample

Questionnaires were administered by researchers in group sessions during worktime. Confidentiality was emphasized, and the purpose of the study was explained as evaluating the company's team working initiative. The response rate was over 70%.

The age of participants ranged from 18 to 60 years, with an average age of 40.26 years ($SD = 10.18$). Organizational tenure ranged from less than 1 year to 38 years, and the average tenure was 16.65 years ($SD = 8.72$). All participants were male production-level operators (some of the operators were designated as team leaders); there were no supervisors or managers included in the sample.

Measures

Biographical information. Each respondent indicated his age (in years), tenure in the company (in years), gender, and whether he was a team leader or a team member.

Proactive personality. We assessed proactive personality by using four of the highest loading items in Bateman and Crant's (1993) scale designed to assess personal disposition toward proactive behavior (defined as the relatively stable tendency to effect environmental change). The items were as follows: "No matter what the odds, if I believe in something I will make it happen"; "I love being a champion for my ideas, even against others' opposition"; "If I believe in an idea, no obstacle will prevent me from making it happen"; and "I am excellent at identifying opportunities." Participants rated these items on a 5-point scale ranging from 1 (*not true at all*) to 5 (*very true*). Cronbach's alpha was .85.

Job demands. We assessed job demands by asking respondents how often they experienced each of eight production prob-

lems, such as wire breaks or tangles, shortages of materials or supplies, and unplanned scheduling changes. Each of the demands was identified as a commonly occurring problem by the managers and union representatives who were involved in designing the survey. Participants used a 5-point scale ranging from 1 (*rarely or never*) to 5 (*constantly*). Cronbach's alpha was .83.

Job control. The degree of job control was assessed using the measure developed especially for production environments by Jackson, Wall, Martin, and Davids (1993; see also Wall, Jackson, & Mullarkey, 1995). Items were combined from two highly correlated subscales: Timing Control (which assesses the extent to which an individual has the opportunity to determine the scheduling of his or her work) and Method Control (which assesses the extent to which an individual has choices in how to carry out work tasks). Each item asks employees to indicate the extent to which they have control over various aspects of their job on a 5-point scale ranging from 1 (*not at all*) to 5 (*a great deal*). Cronbach's alpha for the 9-item measure was .85. As a validity check in the current sample, employees who were designated as team leaders were shown to have significantly higher levels of job control than those production employees who were not in this category ($p < .001$).

Job strain. We assessed job strain using a measure derived from Warr's (1990) scale of anxiety-contentment (see also Sevastos, Smith, & Cordery, 1992). Participants were asked to rate how much of the time, in the past month, their job had made them feel tense, anxious, worried, contented, relaxed, calm, and comfortable (the last four items are reverse scored). Ratings were on a 5-point scale ranging from 1 (*never*) to 5 (*all of the time*). Cronbach's alpha was .78.

Perceived mastery. We assessed respondents' sense of mastery by asking them to indicate, for each of the eight job demands they experienced (wire tangles, shortages, and so forth; see *Job demands* section), the extent that they felt they could resolve the problem. The response scale ranged from 1 (*not at all—it is out of my hands*) to 5 (*a great deal—I can sort it out*). Cronbach's alpha for the scale was .80.

Role breadth self-efficacy. We assessed role breadth self-efficacy by using the seven highest-loading items from Parker's (1998) measure. Employees were asked how confident they would feel carrying out a range of proactive, interpersonal, and integrative tasks, such as visiting people from other departments to suggest doing things differently and designing new procedures for

the work group. The response scale ranged from 1 (*not at all confident*) to 5 (*very confident*). Cronbach's alpha was .93.

Production ownership. We assessed participants' production ownership using Parker, Wall, and Jackson's (1997) measure, which was designed to assess the proactivity and breadth of a production employee's role orientation. Employees were asked to indicate the extent to which various production problems (e.g., customer dissatisfaction, high costs in their work area) would be of personal concern to them. They rated these items on a 5-point scale ranging from 1 (*to no extent—of no concern to me*) to 5 (*very large extent—most certainly of concern to me*). We included two additional items to incorporate aspects for which management wished to see employees develop a sense of ownership. The problems concerned increasing levels of absence for the group and above-average levels of scrap in the work area. A higher score on the total scale indicates higher production ownership and therefore a broader and more flexible role orientation. Cronbach's alpha was .90.

Results

Table 1 shows the intercorrelations between the variables and their means and standard deviations. Results are described for each of the aims in turn.

Demands-Control Model and the Role of Proactive Personality When Predicting Strain

Table 1 shows that there were significant correlations between each of the predictor variables and job strain. Both job control and proactive personality were negatively associated with job strain ($r = -.12, p < .05$; $r = -.13, p < .05$, respectively), whereas job demands was positively associated with job strain ($r = .36, p < .001$). These results were consistent with the previous literature that has shown that low job control and high job demands are associated with poorer mental health. In addition, our results added to the literature in that they suggested that more proactive people are less likely to report strain.

Also, there was a significant positive correlation between job control and proactive personality ($r = .22, p < .001$).

Table 1
Intercorrelations Between Major Variables and Their Means and Standard Deviations

Variable	M	SD	1	2	3	4	5	6	7	8
1. Age	40.26	10.18	—							
2. Tenure	16.65	8.72	.70***	—						
3. Job control	3.66	0.86	.09	.09	—					
4. Job demands	2.87	0.87	-.07	-.06	-.01	—				
5. Proactive personality	2.45	0.94	.06	.10	.22***	-.04	—			
6. Job strain	2.93	0.72	-.06	-.09	-.12*	.36***	-.13*	—		
7. Perceived mastery	2.06	0.78	-.02	.01	.22***	-.26***	.21***	-.24***	—	
8. Role breadth self-efficacy	2.66	1.09	-.04	-.00	.23***	.08	.49***	-.10	.26***	—
9. Production ownership	3.34	0.83	.00	.02	.19***	.08	.28***	-.04	.30***	.42***

Note. $n = 268$, except for perceived mastery, where $n = 256$.

* $p < .05$. *** $p < .001$.

One interpretation of this correlation was that autonomy promotes the development of greater proactivity. However, as we discuss later, this interpretation was not the most likely explanation for the current sample because those employees with high job control were likely to have had these jobs for a relatively short period of time. Perhaps more likely was that more proactive employees self-selected themselves into more autonomous roles, or that they created more autonomy for themselves within their existing jobs, such as by voluntarily taking on some supervisory duties.

The hypothesis concerning the three-way interaction predicting job strain was tested using the recommended hierarchical moderated multiple regression procedure (Arnold & Evans, 1979; Evans, 1991). Although age and company tenure were not significantly correlated with the main variables, we held constant any small influences these variables might have had on the results by entering age into the first step of the regression equation (in order to avoid problems attributable to multicollinearity, only age was used as a covariate because it was highly correlated with tenure). The next step was the entry of the main effect variables (job demands, job control, proactive personality), followed by the two-way interaction terms (i.e., cross-products of each of the predictor variables), and finally the three-way interaction term (the product of all three predictor variables). The incremental variance explained in the final step represented an estimate of the size of the three-way interaction when predicting job strain. All predictor variables were centered (i.e., subtracted from their mean), as recommended by Aiken and West (1991). We used a one-tailed test to assess the significance of the three-way interaction term because the direction of the hypothesis was specified a priori.

The hierarchical moderated multiple regression procedure is recognized as a very conservative test (Busemeyer &

Jones, 1983), and predictor variables must be reliable if researchers are to have a reasonable chance of discovering moderator effects (Dunlap & Kemery, 1988). It is therefore important to note that the reliabilities of predictor variables were all high (above .80).

Table 2 shows the results of the regression analysis. The entry of the main effect variables in Step 2 contributed a significant amount of incremental variance to the prediction of job strain ($\Delta R^2 = .15, p < .001$). Job demands had a significant beta weight in the final regression equation ($\beta = .37, p < .001$), as did job control ($\beta = -.11, p < .05$). Proactive personality almost had a significant beta weight in the final regression equation ($\beta = -.10, p < .10$). The entry of the two-way interaction terms did not add a significant amount of incremental variance to the prediction of job strain, although the Job Demand \times Proactive Personality interaction had a significant beta weight ($\beta = -.11, p < .05$). Most important, as predicted, the three-way interaction between job demands, job control, and proactive personality made a significant incremental contribution to the regression equation after the entry of previous steps ($\Delta R^2 = .02, p < .01$), and the beta weight for this term was significant in the final equation ($\beta = -.12, p < .01$).

Having established the presence of a three-way interaction effect, we investigated whether the specific pattern of results was consistent with that predicted using the method recommended by Aiken and West (1991) and Jaccard, Turrisi, and Wan (1990). We plotted the three-way interaction by inserting high (one *SD* above the mean) and low (one *SD* below the mean) values for the three predictor variables into the regression equation and then drawing the two-way interaction between job demands and job control for proactive employees and passive employees (see Figure 1).

Figure 1 shows that, as predicted, job demands was strongly associated with job strain for passive employees

Table 2

Summary of Results for Hierarchical Regression Analysis Testing the Interaction of Proactive Personality, Job Demands, and Job Control When Predicting Job Strain (N = 268)

Step and variables entered	1	2	3	4
1. Age	-.06	-.01	-.01	-.02
2. Job control		-.10†	-.10†	-.11*
Job demands		.36***	.35***	.37***
Proactive personality		-.09	-.10	-.10†
3. Job Demands \times Proactive Personality			-.12*	-.11*
Job Control \times Proactive Personality			.01	.00
Job Control \times Demands			.00	-.01
4. Job Control \times Job Demands \times Proactive Personality				-.12**
R^2	.00	.15***	.16***	.18***
ΔR^2		.15***	.01	.02**

Note. The displayed coefficients in the four columns are standardized beta weights at each step. One-tailed tests were used to assess the statistical significance of the beta weight for the three-way interaction and the change in R^2 for this step.

† $p < .10$, two-tailed. * $p < .05$, two-tailed. ** $p < .01$, two-tailed. *** $p < .001$, two-tailed.

with both high and low job control. Job demands was also positively associated with job strain for proactive employees with low job control, but there was a much attenuated association, almost negligible, between job demands and job strain for proactive employees with high job control. In other words, there was an interaction between demands and control for proactive employees, as hypothesized.

We repeated the above three-way plot using a more extreme group of proactivity (i.e., two *SDs* above the mean). We did this because the mean level of proactivity in the sample was quite low, which meant that the proactive group (one *SD* above the mean) had an average score just over 3, representing the response category *moderately true* on the scale measuring proactivity. To explore the influence of having even higher proactivity, we created a so-called very

proactive group (two *SDs* above the mean), which had an average proactivity score above 4 (somewhere between the scale response categories *quite true* and *very true*). The results for this more extreme group matched those obtained using the proactive group for the situation of low job control, but they differed slightly for the situation of high job control (see Figure 1). For very proactive employees with high job control, higher demands were associated with lower strain. This result suggested that having more, rather than less, job demands might be better for very proactive employees in high-control jobs. In other words, a job that has high opportunity for autonomy, yet which lacks opportunity for challenge, could incur stress for those individuals with a very strong propensity to act on the environment.

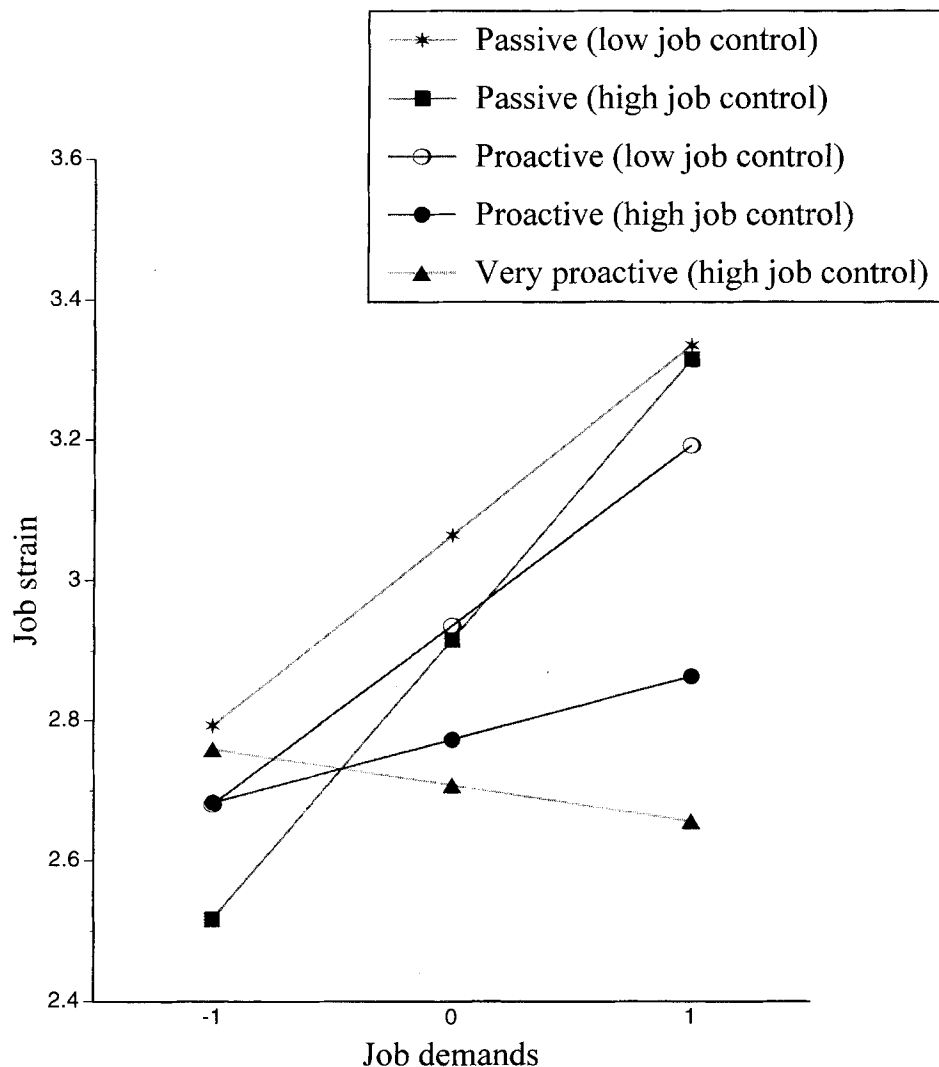


Figure 1. Three-way interaction between job control, job demands, and proactive personality when predicting job strain: Fitted regression equations ± 1 *SD* from the mean, (except for the "very proactive" equation, which is $+2$ *SDs* from the mean).

Demands–Control Model, Proactive Personality, and Learning-Oriented Outcomes

The second aim of the study was to investigate the demands–control model in terms of active learning-oriented outcomes (perceived mastery, role breadth self-efficacy, and production ownership). We hypothesized that there would be a three-way interaction between job demands, job control, and proactive personality that would mirror that obtained for strain.

We used the same regression procedure as that described for job strain to test the relationships between the predictor variables and the learning-oriented outcome variables. Table 3 shows the results for each of the outcome variables (note that variations in sample size reflect different amounts of missing data for each of the outcomes). There were no significant three-way interactions among the predictor variables for any of the learning-oriented outcomes (the three-way term accounted for less than 0.05% of the variance in all the analyses), thus failing to provide support for our hypotheses. We therefore present the results without showing this final step of the analysis.

Regarding the findings for perceived mastery, there were no significant two-way interactions; however, each of the predictor variables had a significant main effect. Thus, perceived mastery was positively associated with proactive personality ($\beta = .15, p < .05$) and job control ($\beta = .19, p < .01$) but was negatively related to job demands ($\beta = -.28, p < .001$). Proactive employees were therefore likely to have greater perceived mastery than passive employees as were employees who had high job control as compared with those who had low job control. In addition, those employees in low-demand jobs had greater perceived mastery than those in high-demand jobs. The finding that there was no significant three-way interaction among job demands, job

control, and proactive personality meant that the development of perceived mastery did not fully explain the observed three-way interaction among these variables when predicting job strain. We return to this point in the Discussion section.

For role breadth self-efficacy, there was a significant main effect of job control ($\beta = .11, p < .05$) and proactive personality ($\beta = .46, p < .001$), and there was a marginally significant main effect of job demands ($\beta = .09, p < .10$). There was also a significant two-way interaction between job control and proactive personality ($\beta = .12, p < .05$). Using the procedure recommended by Jaccard et al. (1990), we plotted this relationship (see Figure 2). This plot shows that, although higher job control was associated with greater role breadth self-efficacy for proactive employees, there was almost no relationship between these variables for passive employees. The results therefore suggested that job control is only associated with greater role breadth self-efficacy for those individuals who are likely to make use of that control, that is, employees who interact proactively with the environment.

The third outcome variable we investigated was production ownership. After the entry of the background variables, the main effects contributed 10% of additional variance to the prediction of ownership ($p < .001$). There was a main effect of job control ($\beta = .14, p < .05$), a finding that was consistent with previous research showing that job control promotes the development of higher ownership (Parker et al., 1997). There was also a significant main effect of proactive personality ($\beta = .25, p < .001$) and a marginally significant main effect of job demands ($\beta = .10, p < .10$). In addition, there was a significant interaction between the latter two variables ($\beta = .12, p < .05$). As shown in Figure 3, higher job demands were associated with greater production ownership for proactive employ-

Table 3

Summary of Results for Hierarchical Regression Analysis Testing the Relationships of Proactive Personality, Job Demands, and Job Control When Predicting Learning-Oriented Outcomes

Step and variables entered	Perceived mastery (<i>n</i> = 257)			Role breadth self-efficacy (<i>n</i> = 268)			Production ownership (<i>n</i> = 264)		
	1	2	3	1	2	3	1	2	3
1. Age	-.03	-.07	-.08	-.04	-.07	-.09†	.00	-.02	-.02
2. Job control		.19**	.19**		.12*	.11*		.14*	.14*
Job demands		-.27***	-.28***		.09†	.09†		.09	.10†
Proactive personality		.16**	.15*		.47***	.46***		.25***	.25***
3. Job Demands × Proactive Personality			-.09			.05			.12*
Job Control × Proactive Personality			.03			.12*			.03
Job Control × Job Demands			-.02			-.07			-.00
<i>R</i> ²	.00	.14***	.15***	.01	.27***	.29***	.00	.10***	.12***
ΔR^2		.14***	.01		.26***	.02†		.10***	.02

Note. The displayed coefficients are standardized beta weights at each step.

† $p < .10$, two-tailed. * $p < .05$, two-tailed. ** $p < .01$, two-tailed. *** $p < .001$, two-tailed.

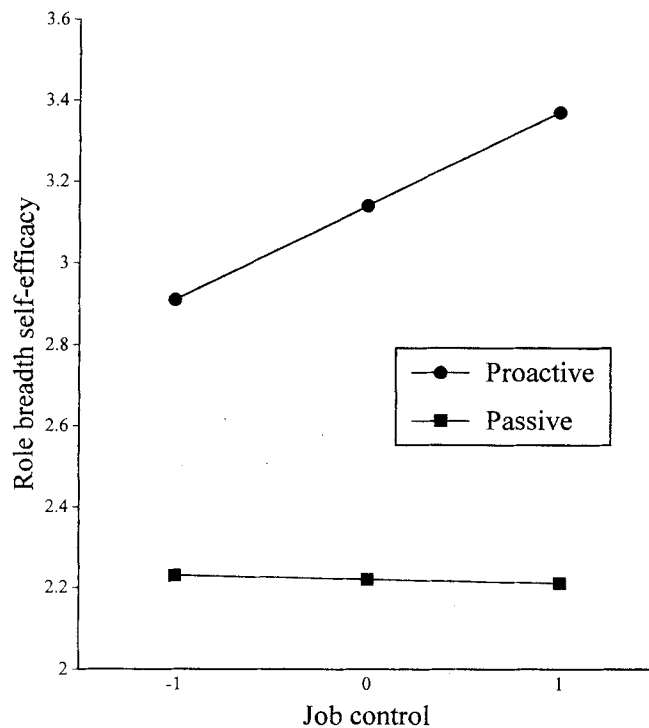


Figure 2. Two-way interaction between proactive personality and job control when predicting role breadth self-efficacy: Fitted regression equations ± 1 SD from the mean.

ees, but there was a negligible association between these variables for passive employees.

Overall, the results supported the view that job control, job demands, and proactive personality may be important facilitators of proactive and learning-oriented outcomes. However, these variables combined together and interacted in different ways to the observed three-way interaction when predicting job strain (see the summary of results in Table 4). Low job demands, high job control, and high proactivity added together to predict mastery; an interaction between proactive personality and job control combined with high job demands to predict role breadth self-efficacy; and an interaction between job demands and proactive personality combined with high job control to predict production ownership.

Associations Between Learning-Oriented Outcomes and Job Strain

The third part of our study concerned the relationship between strain and learning-oriented outcomes. We hypothesized that perceived mastery would be negatively linked to job strain. We also investigated the relationship between job strain and role breadth self-efficacy and production ownership, although we did not make any hypotheses in relation to these associations.

As shown in Table 1, perceived mastery had a significant negative association with job strain ($r = -.24, p < .001$), as expected. Neither role breadth self-efficacy nor production ownership was significantly associated with job strain. Results therefore showed that employees who feel more mastery over their work environment experience less job strain.

Discussion

Against the backdrop of an increasingly demanding workplace, we set out to extend and develop inquiry into the demands-control model of strain. Although the demands-control model is one of the most popular models underpinning stress research in the last few decades, tests of the proposed interaction effect have not yielded consistent results. Moreover, there has been a failure to consider the model in relation to the more dynamic and learning-oriented outcomes proposed in later formulations of the model.

Summary and Implications

In the first part of the article, we provided a potential explanation for the inconsistent conclusions to date regarding interaction effects. We proposed that Karasek's (1979) demands-control interaction would only apply to more proactive employees who are likely to take advantage of high job control to manage more effectively the demands they face. Our results supported this premise. For employees categorized as passive, there was no demands-control interaction: Job demands were strongly associated with strain, regardless of the degree of job control. In contrast, for proactive employees, higher job demands were strongly associated with strain when control was low, but demands had a much attenuated, almost negligible, association with strain when job control was high. For even more proactive employees (i.e., those with proactivity scores greater than two SDs from the mean), job demands were associated with lower strain, suggesting that these employees prefer at least some job demands. This latter finding is consistent with the idea that "a truly healthy situation is one that contains challenges for the individual" (Karasek & Theorell, 1990, p. 94).

The finding that proactive personality moderates the demands-control interaction when predicting strain largely replicates those findings from other recent studies investigating concepts related to proactive personality. Thus, the interaction between job demands and job control obtained for proactive employees mirrors that observed for high self-efficacy employees in Schaubroeck and Merritt's (1997) study of systolic blood pressure. The interaction pattern is also similar to, albeit more pronounced than, that obtained by de Rijk et al. (1998) in their high active coping condition when predicting burnout. In general, the findings of this study are consistent with the premise that job de-

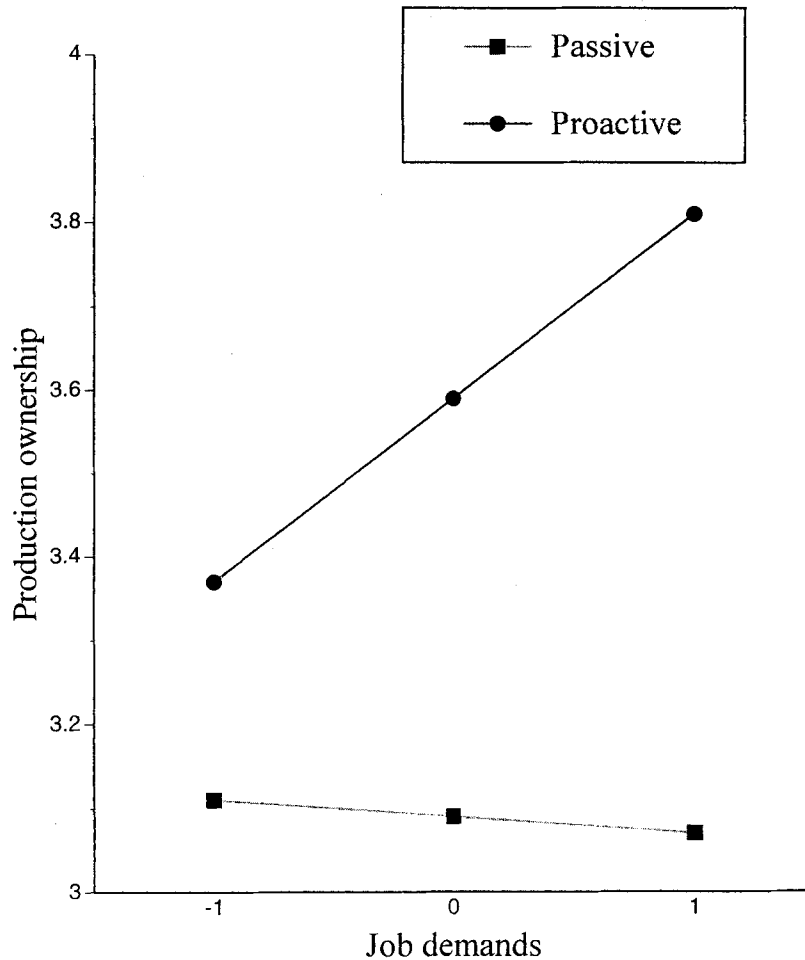


Figure 3. Two-way interaction between proactive personality and job demands when predicting production ownership: Fitted regression equations ± 1 SD from the mean.

mands will cause strain unless employees have both the opportunity (i.e., job control) and the propensity (i.e., a proactive personality) to act on them.

The moderating influence of proactive personality was shown further in the second part of the article, where we examined the demands-control model in relation to non-strain outcomes as suggested by Karasek and Theorell's (1990) dynamic extension to the model. Results showed that there was no three-way interaction among job demands, job control, and proactive personality when predicting mastery, role breadth self-efficacy, and production ownership. However, all three variables were important predictors of these learning-oriented outcomes, either alone or in some combination (see Table 4). To help interpret these findings, we present the results separately for proactive employees (Figure 4) and for passive employees (Figure 5) using the heuristic device developed by Karasek (1979) to describe the model (i.e., a matrix of four job types created by the combination of job demands and job control). Extrapolating

from the results of the regression analyses, we show each job quadrant with an indication of the likely level of each outcome variable. For example, proactive employees in jobs with low demands but high control will tend to have high perceived mastery because of the positive association between mastery and each of proactive personality, high job control, and low job demands; likewise, proactive employees with high job demands and high job control will tend to have high production ownership because this outcome was associated with high job control and, for proactive employees, was associated with high job demands.

Using this method of presentation, we can see that Karasek and Theorell's (1990) linking of demand and control with learning-oriented outcomes is reasonably appropriate for proactive employees. These authors proposed that the best jobs for promoting development are those with high demands and high control (i.e., so-called active jobs) because these provide environmental challenges and opportunities for successful learning. Examining Figure 4 for pro-

Table 4
Summary of Statistically Significant Results From Regression Analyses

Outcome	Main effects	Interactions	Interpretation
Strain	Job control (-) Job demands (+) Proactive personality (-)	Three-way	Control moderates stressful effects of demands for proactives; demands associated with strain for passives, regardless of amount of control
Perceived mastery	Job control (+) Job demands (-) Proactive personality (+)	None	Perceived mastery associated with high control, low demands, and a more proactive personality
Role breadth self-efficacy	Job control (+) Job demands ^a (+) Proactive personality (+)	Two-way (proactive personality with control)	Control positively associated with RBSE for proactives but not for passives; demands positively associated with RBSE
Production ownership	Job control (+) Job demands ^a (+) Proactive personality (+)	Two-way (proactive personality with demands)	Demands positively associated with ownership for proactives but not for passives; control positively associated with ownership

Note. This table shows the highest-order interactions only. A plus sign (+) indicates a positive association; a minus sign (-) indicates a negative association. RBSE = Role breadth self-efficacy.

^a These relationships were almost statistically significant ($p < .10$).

active employees, the high-demands, high-control job category is associated with positive learning outcomes (i.e., moderate mastery, high role breadth self-efficacy, and high production ownership), and these outcomes are consistently more positive than those indicated for the job categories of (a) low demands, low control and (b) high demands, low control. The one anomaly is that the low-demands, high-control job category is associated with higher perceived

mastery than is the case for the high-demands high-control job. However, it cannot be assumed that all outcomes are equally indicative of learning and development, and one could argue that high ownership for a wide range of production problems and high self-efficacy (as obtained for the high-demands, high-control jobs) are more indicative of learning and development than having a sense of total mastery over job demands.

Findings for the demands-control model in relation to learning are therefore reasonably consistent with Karasek and Theorell's (1990) predictions for proactive employees. However, the same conclusion cannot be reached for more passive individuals (see Figure 5). Although both the low-control jobs (i.e., high-demands, low-control jobs and low-demands, low-control jobs) are associated with poor learning-related outcomes as would be expected, so too is the high-demands, high-control job referred to by Karasek as active. The classification of active is therefore quite inappropriate in this case. Indeed, the results suggest that, for passive employees, the best set of learning outcomes, as well as good outcomes for job strain, will arise from the situation of low job demands and high job control.

Integrating the results for strain and learning-oriented outcomes together, this study shows the importance of proactive personality as a moderator of the demands-control model. From a practical perspective, a key implication to draw out is that the success of increased job control as both stress-prevention and learning-enhancing strategies will depend on the proactivity of employees. Work redesign interventions that enhance job control (such as empowerment and self-managing work teams) will provide proactive employees with the autonomy to manage more effectively

	Low job demands	High job demands
High job control	<p>low-demands high-control job (referred to as a <i>low strain</i> job)</p> <hr/> <p>low job strain high perceived mastery moderate to high RBSE moderate production ownership</p>	<p>high-demands high-control job (referred to as an <i>active</i> job)</p> <hr/> <p>low to moderate job strain moderate perceived mastery high RBSE high production ownership</p>
Low job control	<p>low-demands low-control job (referred to as a <i>passive</i> job)</p> <hr/> <p>low job strain moderate perceived mastery low to moderate RBSE low to moderate production ownership</p>	<p>high-demands low-control job (referred to as a <i>high strain</i> job)</p> <hr/> <p>high job strain low perceived mastery moderate RBSE moderate production ownership</p>

Figure 4. Results for proactive employees presented in terms of Karasek's (1979) demands-control matrix (Karasek's job classifications are shown in parentheses). RBSE = role breadth self-efficacy.

		Low job demands	High job demands
High job control	Low job demands	low-demands high-control job (referred to as a <i>low strain job</i>) <hr/> low job strain moderate perceived mastery low RBSE low to moderate production ownership	high-demands high-control job (referred to as an <i>active job</i>) <hr/> high job strain low perceived mastery low RBSE low to moderate production ownership
	High job demands		
Low job control	Low job demands	low-demands low-control job (referred to as a <i>passive job</i>) <hr/> low job strain low perceived mastery low RBSE low production ownership	high-demands low-control job (referred to as a <i>high strain job</i>) <hr/> high job strain very low perceived mastery low to moderate RBSE low production ownership
	High job demands		

Figure 5. Results for passive employees presented in terms of Karasek's (1979) demands-control matrix (Karasek's job classifications are shown in parentheses). RBSE = role breadth self-efficacy.

stressful demands that can occur and will promote the development of production ownership and other learning outcomes. However, for more passive individuals, who are less inclined to effect environmental change, enhancing job control is likely to have little value as a stress-reducing intervention as long as job demands are high. The results also suggest that enhancing job control will promote learning in the form of mastery for passive employees when job demands are low. A key recommendation, therefore, is that interventions for more passive individuals should revolve around the management of job demands.

In this respect, one option would be to use proactive personality as a selection criterion for very demanding jobs, ensuring that passive employees are not exposed to situations that are likely to overwhelm them. Another option is to introduce interventions to remove or reduce job demands, such as initiatives like total productive maintenance that aim to eliminate machine breakdowns. Another strategy would be to support and train passive employees so they can deal more effectively with common job demands, effectively coaching them to behave in ways that might come naturally to their more proactive colleagues. Over the longer term, such a strategy could facilitate an active problem-solving style and even greater proactivity among passive employees, thereby increasing the extent to which these individuals can cope with demands. Coaching employees to take up the opportunities offered by more autonomous jobs is likely to be especially critical for those who have been in highly simplified jobs for many years and who are likely to have become more passive as a result.

So far we have discussed strain and learning-oriented outcomes as if they were independent. However, Karasek and Theorell (1990) argued that these outcomes are linked because accumulated strain inhibits the development of mastery and the development of a sense of mastery reduces perceptions of stress. In the third part of the study, consistent with this premise, we showed that perceived mastery was associated with lower job strain. Nevertheless, as shown by the particular pattern of results, the development of a sense of mastery does not appear to be the only mechanism underpinning the lowering of strain. There must therefore be additional reasons why proactive employees in high-demands, high-control jobs have lower levels of strain. One possibility is that excess energy aroused by demands is channeled into problem solving, with the result that "there is little residual strain to cause disturbance" (Karasek, 1979, p. 36). In other words, regardless of whether employees develop a sense of mastery, the act of dealing with the job demands results in a redirection of energy that would otherwise cause job strain. More investigation is clearly needed to better understand whether these or other mechanisms operate.

Limitations and Further Research

One limitation of this study concerns the use of self-report measures to assess job demands and job control. Although we used reliable measures that were not conceptually confounded, the fact that both the independent and dependent measures were assessed by self-report means that there are potential problems of common method variance. However, as described in the Method section, we demonstrated that the measure of job control differentiated between two groups with distinct levels of autonomy (team leaders and other production-level employees). Moreover, for the findings showing interactions, the threats of common method variance are reduced because the effect of a self-report bias or common method variance would be to inflate the main effects and to reduce the likelihood of detecting an interaction (Wall et al., 1996). Of course, the potential still exists that common method variance has influenced the findings, especially the main effects, and replication using more objective measures of job demands and job control remains important.

Perhaps a more significant limitation of the study is its cross-sectional design. A longitudinal study where predictor variables are related to job strain and learning-oriented outcomes at a later point in time would be ideal. Such a strategy is particularly important for investigating the hypothesized dynamic and reciprocal influences between the work environment and learning. For example, our results suggest that, at least for proactive employees, high-demands, high-control jobs promote learning, yet the reverse causal explanation is plausible. Thus, those with a

strong sense of mastery, self-efficacy, and ownership could have self-selected into more autonomous and demanding jobs or could have adapted their roles to ensure they have greater job control. There is no way of teasing out the relative contribution of these effects from a cross-sectional study. Longitudinal studies with multiple survey points are needed.

Another consideration is that the study was conducted in an organization that had recently introduced team working, and we know little about how this context might influence the demands-control model or the moderating role of proactive personality in the longer term. For example, the type of the demands could alter as team working progresses, with more group coordination or boundary-management demands occurring rather than purely technical ones as focused on here. Moreover, because of task interdependencies within a team, the management of demands is likely to be a social process, requiring team cohesion and cooperation. How these different sorts of demands and their interdependencies relate to job control and proactive personality needs further inquiry and will probably require a distinction between individual-level and team-level job control.

Finally, in the current study we focused on particular learning-related outcomes (such as developing a sense of mastery) and considered the more stable dispositional variable of proactive personality as a moderator. In reality, proactive personality is likely to be an outcome as well. As we have suggested, in the longer term, and with appropriate coaching and support, one could predict that passive employees whose jobs are redesigned to have greater autonomy will become more proactive. This finding would be consistent with evidence from Frese, Kring, Soose, and Zempel (1996), who reported that job control and complexity promoted the greater use of personal initiative in an East German sample of employees. The fact that job control was positively associated with proactive personality in the current study is consistent with this view. We would expect that, because many of the employees currently in high-control jobs are likely to have been in this situation only for a quite short period (i.e., since the instigation of team working), this relationship between job control and proactive personality will become stronger over time. If employees' proactivity does increase as a result of greater job control, we would predict from the results of the current study (a) that their mental health will improve accordingly as they more actively manage the demands they face and (b) that they will develop a stronger sense of mastery, higher role breadth self-efficacy, and a more proactive role orientation.

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