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The Double Meaning of Control: Three-Way Interactions Between Internal Resources, Job Control, and Stressors at Work

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The Job Demand-Control model postulates that job control attenuates the effects of job demands on health and well-being. Support for this interactive effect is rather weak. Conceivably, it holds only when there is a match between job control and individual characteristics that relate to exercising control options, such as locus of control, or self-efficacy. This three-way interaction was tested in a sample of 96 service employees, with affective strain and musculoskeletal pain as dependent variables. As hypothesized, job control attenuated the effects of stressors only for people with an internal locus of control. For people with an external locus of control, job control actually predicted poorer well-being and health as stressors increased. For self-efficacy, the corresponding three-way interaction was significant with regard to affective strain.

Keywords: job control, locus of control, self-efficacy, job demand-control model, resources

Control is seen as important for psychological well-being across many domains of psychology. Theorists have claimed that having control is an important motive guiding human behaviors (Heckhausen & Schulz, 1995) and a lack of perceived control is central in the development of depression (e.g., Seligman, 1975). In the domain of job stress, one of the most influential approaches that underscores the importance of control is the Job Demand-Control model (Karasek, 1979). The central tenet of the model is that job control can weaken (buffer) the negative effects of demands on strain. Allowing for job control should help employees to cope with the demands at work and thus ameliorate their health.

Recent reviews on the Job Demand-Control (JDC) model have concluded that there is good evidence for the main effects of job control but only modest support for its moderating influence (e.g., de Lange, Taris, Kompier, Houtman, & Bongers, 2003). A number of explanations have been offered to explain the inconsistent findings. Some, like Terry and Jimmieson (1999), refer to measurement issues, most notably the overly broad measure of "decision latitude" by Karasek (1979). Further, it has been argued that the demand-control interaction holds only for particular outcomes (e.g., Dwyer & Ganster, 1991), or specific occupational groups (e.g., de Jonge, Dollard, Dormann, Le Blanc, & Houtman, 2000). Finally, the postulated interaction may hold only in the presence of other types of external resources (e.g., social support, see Johnson & Hall, 1988) or dispositional characteristics (e.g., de Rijk, Le Blanc, Schaufeli, & de Jonge, 1998; Ippolito, Adler, Thomas, Litz, & Holzl, 2005; Parker & Sprigg, 1999; Parkes, 1991; Rodriguez, Bravo, Peiro, & Schaufeli, 2001; Schaubroeck, Jones, & Xie, 2001; Schaubroeck & Merritt, 1997; Totterdell, Wood, & Wall, 2006). This last point is the focus of the present article.

Two of the dispositional characteristics that have been studied frequently in the context of the JDC model are locus of control and self-efficacy (e.g., Schaubroeck et al., 2001; Rodriguez et al., 1999). Although people with a tendency toward an internal locus of control (referred to as "internals" below) believe that most outcomes are the result of their own actions, people who tend towards an external locus of control ("externals") believe that external sources (chance, other persons) determine their outcomes (Rotter, 1966). Self-efficacy refers to the belief that one is able to mobilize the skills that are necessary to attain a given goal (Bandura, 1997). Regarding the relationship between locus of control and self-efficacy, they both are part of a chain of convictions

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regarding one's possibility to cope: An internal locus of control indicates that things can be influenced in principle, whereas self-efficacy indicates that one is able to exert this influence in an effective way. These two convictions are not the same, but they do overlap (cf. Ng, Sorensen, & Eby, 2006). Both represent control beliefs, and we will use this term from now on to characterize both.

Both dispositions can be conceptualized at varying degrees of specificity. A global disposition that is important for one's functioning in general represents one end of the continuum. Narrow beliefs that refer to specific life domains (such as work) or to specific competencies (such as computer skills) represent the other end. Locus of control originally was conceptualized in global terms (Rotter, 1966), but there are more specific scales, referring, for instance, to work locus of control (Spector, 1988). A recent meta-analysis (Ng et al., 2006) included both general and work-related locus of control, and did not find substantially different associations with other variables. Self-efficacy, by contrast, originally was conceived in rather specific terms (Bandura, 1997). Even work-related self-efficacy (e.g., Schaubroeck & Merritt, 1997) is already more global than advocated by Bandura. Nevertheless, some authors (e.g., Krampen, 1991) have developed global (general) self-efficacy scales, which have been used in work-related research (e.g., Van Yperen & Snijders, 2000). In our view, both approaches have their pros and cons. In specific terms, these constructs are likely to show especially strong associations for the domain to which they are tailored. As broad dispositions, they reflect general tendencies of interpreting the world. Accordingly, it can be expected that they are important for a broad array of domains. Using a broad approach, therefore, enhances comparability of findings across domains. In this research, we have opted for the broad approach.

Mismatches Between Job Control and Control Beliefs

Research is largely consistent in finding that an internal locus of control and high self-efficacy are associated with better psychological adjustment and better physical health (Bandura, 1997; Spector et al., 2002). In addition to these direct effects on health, people with an internal locus of control as well as those with high self-efficacy beliefs should profit indirectly through the effective use of control opportunities in the environment. Because they believe that reinforcements are a result of personal effort or that they are able to achieve a goal by their own means, they tend to cope in a more problem-focused way (e.g., Ng et al., 2006). By contrast, people with an external locus of control are more likely to believe that things cannot be changed, and people low in self-efficacy are not convinced that they possess the necessary skills to alter the situation. Thus, externals and people low in self-efficacy should be less prone to cope in a problem-focused way. They do not possess the personal resources needed to make effective use of the external resources available (Semmer, 2003). Put differently, if the (job) environment offers control opportunities, and if one's personal beliefs are conducive to using control opportunities, there is a fit between person and environment, as the person will perceive his or her own efforts to control the environment as promising. Job control in combination with internal locus of control, or high self-efficacy, therefore represents a good example of fit in the sense of P-E-Fit theory (e.g., Edwards, 1996). These situations would be characterized by a high "supply value" fit in terms of P-E-Fit theory: The individual prefers (job) control, and the environment supplies it. Similarly, a good fit for an individual with low control beliefs is represented by an environment that does not offer high job control.

A misfit will also be represented by two conditions. The first is an individual with high control beliefs who is confronted with low job control. This individual tends to believe in exercising control but is constrained to do so. This condition is therefore likely to be stressful. The second misfit concerns an individual with low control beliefs who is confronted with high job control. Such an individual will be less strongly convinced that exercising control is promising, and therefore is less likely to use control options.

Note that the second misfit (high job control, low control beliefs) need not be stressful. The individual might simply ignore the control options, confining him- or herself to one strategy that he or she usually employs when confronted with the situation at hand. In terms of P-E-Fit theory, the situation is one of excess supply that does neither good nor harm (Edwards, 1996). It is also conceivable, however, that this type of misfit does become stressful. Job control implies the possibility to make decisions. It seems plausible theoretically that this possibility is perceived as a requirement to make decisions. Control then turns from a supply to a demand, and individuals with low control beliefs are likely to perceive themselves as not sufficiently able to meet this demand—the situation becomes an "ability-demand" type of

misfit. This seems especially likely when the individual expects that making decisions will not only yield no advantage but rather implies a possible threat. Thus, being able to decide which equipment to buy may be risky for people who lack confidence in their ability to judge the advantages of the various options. Under these circumstances, one may prefer that someone else makes the decision, especially when one expects to be blamed for a poor outcome (Burger, 1989).

From this perspective, the "high-strain" condition that the JDC model specifies becomes a special case that applies only to people high in control beliefs. Statistically speaking, this implies a three-way interaction. In addition, indeed, there is some support for such an interaction, although it is far from equivocal.

Locus of Control and the Stressor-Control Interaction

Some experimental studies have found an attenuating effect of (perceived) control in stressful situations for internals only (e.g., Bollini, Walker, Hamman, & Kessler, 2004; de Good, 1975). Results from field studies are less supportive, however. Daniels and Guppy (1994) found that, under the condition of high job demands and high autonomy, well-being was highest among internals. In two studies by Parkes (1991), however, job autonomy acted as a buffer against high demands only for employees with an external locus of control. Further, Rodríguez et al. (2001) report that employees with an internal locus of control and strong social support showed more job dissatisfaction under conditions of high, as compared to low, job control. In sum, there is some evidence suggesting that control is a buffer against stressors only for internals. The number of studies is small, however, and the evidence is inconsistent with regard to field studies.

Self-Efficacy and the Stressor-Control Interaction

Four studies have tested the three-way interaction among demands, job control, and self-efficacy. As for locus of control, however, there are discrepancies in these findings. Schaubroeck and colleagues demonstrated that job control is beneficial under conditions of high demands only for employees with high job related self-efficacy, the dependent variables being blood pressure (Schaubroeck & Merritt, 1997) and chronic symptoms of upper respiratory infections (Schaubroeck et al., 2001). Similarly, in a longitudinal study by Jimmieson (2000), high job control buffered the effect of role conflict on depersonalization only among individuals with high job self-efficacy. For three other dependent variables—psychological well-being, job satisfaction, and somatic health—however, job control buffered the effects of role conflict regardless of the level of self-efficacy. Salanova, Peiró, and Schaufeli (2002) compared the effects of generalized self-efficacy with task-specific (computer) self-efficacy. They found a three-way interaction with both self-efficacy measures but the pattern of results was in line with predictions only for task specific self-efficacy.

In summary, evidence is strongest for self-efficacy that specifically relates to the job, or to specific tasks. Specific measures yielded the predicted interaction in four studies, although in one of them (Jimmieson, 2000) only for one of four dependent variables. Despite this positive trend for job or task specific self-efficacy, the number of studies clearly is too low to permit firm conclusions. Further studies are needed on all levels of specificity (general, job, and task).

The Present Study

Goals and Hypotheses

As shown, research suggests that job control can have positive as well as negative effects on well-being. The crucial point may be whether employees' control beliefs match the control opportunities offered by the (job) environment. Given the inconsistent results from field studies concerning locus of control, and the paucity of research on general self-efficacy, our goal was to add empirical evidence with regard to these two variables in the context of the Job-Demand-Control model.

In addition, we wanted to include two types of dependent variables. To ensure compatibility with existing research, we decided to employ a variable that has been used frequently in research on occupational stress, including investigations of the three-way interaction that we focus on (Daniels & Guppy, 1994). This variable is negative affective well-being, or affective strain, which is a prominent outcome in stress research because it is inherently linked to the experience of stressful situations (Lazarus, 1999). In addition, we wanted to add an outcome variable that is of special importance but has not been investigated in the present context: musculoskeletal pain. Musculoskeletal pain has often been found to be associated with psychosocial work characteristics, including job

demands and control (for a review see Hurrell, 2001). Recent models assume that the tension created by the stress experience manifests itself also in muscular tension, particularly by keeping low threshold motor units active even in the absence of physical load. The main pathway is seen in the activation of the sympathetic adrenal medullary system, particularly norepinephrine, which heightens muscle activity by increasing the sensitivity of the muscular synapses (Lundberg et al., 2002). To the extent that stress causes muscular tension, variables that may attenuate the stress experience, such as job control, should also attenuate muscular tension.

These processes make musculoskeletal pain a promising candidate with regard to possible effects of job demands and control. Furthermore, a recent study (Byrns, Agnew, & Curbow, 2002) suggested that attributing back pain to external influences is associated with more pain, which suggests a relationship with locus of control. Finally, musculoskeletal pain is a leading factor for morbidity and sickness absence, as well as for workers' compensation costs (Elfering, 2006), and so evidence concerning specific associations with work-related and person-related variables is of special interest.

Based on the considerations above, we expect a three-way interaction between stressors, job control, and control beliefs. The interaction postulated by the JDC model (i.e., that job control buffers the negative effects of stressors on strain) should hold only for people with high control beliefs. Specifically, this leads to the following hypotheses:

Hypothesis 1: Musculoskeletal Pain

Job stressors will be less strongly associated with musculoskeletal pain under conditions of high, as compared to low job, control, but only among participants with high internal locus of control (Hypothesis 1a) and high self-efficacy (Hypothesis 1b).

Hypothesis 2: Affective Strain

Job stressors will be less strongly associated with affective strain under conditions of high, as compared to low, job control, but only among participants with high internal locus of control (Hypothesis 2a) and high self-efficacy (Hypothesis 2b).

Note that, with regard to people with low control beliefs, our hypotheses are compatible both with an association between stressors and dependent variables that is not moderated by job control, and an association between stressors and dependent variables that is stronger under conditions of high job control. As stated above, both these mechanisms seem plausible.

Method

Sample

The analyses are based on a cross-sectional field study of 96 employees (64% males) from three departments of a large Swiss logistic enterprise. The study was presented at general meetings of the departments. Because work could not be stopped, there were several meetings, so that everyone had a chance to attend. Attending one of the meetings was mandatory. Participation in our study was voluntary, and the response rate was approximately 65%. Participants completed the survey in the following week during working time. The sample includes blue-collar workers (e.g., people transporting goods) as well as white-collar workers (e.g., secretaries, accountants). Seventeen percent of the participants worked at night at least occasionally. Preliminary analyses showed that there was no systematic association between the study variables and the different departments. However, employees with night work reported more musculoskeletal pain, which will be discussed in the section on control variables. The age of the participants ranged from 19 to 61 years, with an average of 38.15 years (SD = 10.56). Seventeen percent had completed primary education (9 years), 79.2% had completed secondary education (mostly in terms of an apprenticeship), and 3.1% had college or university degrees. Controlling for educational background did not change the results we obtained. Organizational tenure ranged from 1.5 years to 41 years; the average tenure was 17.73 years (SD = 11.00). Most of the participants (86.5%) were employed full-time; none of the part-time workers was employed at less than 50% (i.e., at least about 21 working hours per week).

Measures

Job stressors. In previous research, demands have been conceptualized differently. Some authors used a measure of workload to capture demands. However, Karasek (1979) conceptualized job demands more broadly, including "work load demands, conflicts or other stressors" (p. 287), and many other

studies adapted this broader concept (e.g., Schaubroeck & Merritt, 1997). In the present study, we follow this tradition of a broader definition. A short self-report version of the Instrument for Stress Oriented Task Analysis (ISTA; Semmer, Zapf, & Dunckel, 1995) was used. It assesses five task stressors with four items each: time pressure (e.g., inability to take breaks as usually because of high workload), concentration demands (e.g., to what extent the work requires mental effort), performance constraints (e.g., having to work with inadequate devices or obsolete information; this scale was originally called "problems in work organization"; Semmer et al., 1995), uncertainty (e.g., unclear instructions or decisions based on insufficient information), and work interruptions by supervisors, colleagues, or clients. All items had a 5-point Likert format, reflecting either intensity or frequency, depending on what was more appropriate for a specific item. As frequently was done in previous research (e.g., Elfering et al., 2005; Frese, 1985), we combined the five stressor scales into a single index in the analyses to enhance clarity of the presentation, and to avoid the danger of obtaining statistically significant effects by chance because of a large number of statistical tests. Such an index of stressors represents a heterogeneous concept, consisting of scales that are correlated yet do not represent a homogeneous construct. For such an index, the composite score reliability proposed by Nunnally and Bernstein (1994) is the appropriate reliability estimate. Its value was $r_{YY} = .86$.

Job control. Given the problem of confounding control with skill utilization (Terry & Jimmieson, 1999), we used a more focused measure of control (ISTA; Semmer et al., 1995). Similar to the measure of Totterdell et al. (2006), it captures aspects of method control (three items, e.g., to what extent one can independently plan and organize one's own work) and time control (three items, e.g., the amount of influence on work pace and schedule). The response format ranged from 1 (very little/not at all) to 5 (very much). Internal consistency for the scale was $\alpha = .89$.

Locus of control. Generalized locus of control was measured with a brief version of Levenson's (1974) scale, developed by Sapp and Harrod (1993). Respondents were asked to indicate the extent to which they agree with nine statements relating to agents of control (self, luck/chance, or powerful others) on a 7-point scale. An example for self as the agent of control is: 'My life is determined by my own actions.' Items were combined to yield a single score, with high scores indicating an internal locus of control ($\alpha = .84$).

Self-efficacy. Generalized self-efficacy was assessed using a shortened scale by Krampen (1991). It consisted of four items (e.g., 'Even in difficult situations I always have an idea what to do') on a 6-point scale, with high scores indicating high self-efficacy ($\alpha = .80$).

Affective strain at work. Affective strain was measured with the 15 negative items of the Job-Related Affective Well-Being Scale (JAWS) by Van Katwyk, Fox, Spector, and Kelloway (2000). Participants had to indicate how their job made them feel, using different adjectives (e.g., anxious, frustrated). Response choice ranged from 1 (*never*) to 5 (*extremely often*); internal consistency was $\alpha = .88$.

Musculoskeletal pain. Musculoskeletal pain was assessed with two questions that are part of a measure of psychosomatic complaints by Mohr (2000). We asked for frequency of back and neck or shoulder pain during the preceding year (1 = *almost never/never*; 5 = *almost daily*; $\alpha = .71$). Previous results (Elfering, Grebner, Semmer, & Gerber, 2002) showed high correspondence of these items with standardized questions from the Nordic Questionnaire (Kuorinka et al., 1987), which is one of the most widely used instruments in this research domain.

Control variables. Previous work has shown that age is associated with more musculoskeletal pain and that women often report more musculoskeletal pain than men (Cassou, Derriennic, Monfort, Norton, & Touranchet, 2002). Therefore, we controlled for age and sex. Musculoskeletal pain is also related to night work (Elfering, Semmer et al., 2001). We therefore included night work as a control variable, with participants indicating if they had to work at night at least sometimes (0 = *no*; 1 = *yes*). Controlling for educational background did not change the results, so this variable was not included in the regression models.

There is a longstanding debate in the field of occupational stress research concerning the role of neuroticism. Whereas some researchers proposed that neuroticism (or "negative affectivity") is a nuisance factor that should be controlled for (e.g., Brief, Burke, George, Robinson, & Webster, 1988), others warned that this might partial out substantive variance (e.g., Spector, Zapf, Chen, & Frese, 2000). In the present paper, we partialed out the effects of neuroticism because of its strong association with negative affective well-being as well as with physical health-symptoms (e.g., Dollard & Winefield, 1998). Neuroticism was measured with a brief version (six

items) of the NEO-FFI by Schallberger and Venetz (1999). Internal consistency was $\alpha = .77$.

Results

Table 1 displays the means, standard deviations, and zero-order correlations of all the variables. We conducted hierarchical regression analyses to test the hypotheses, centering predictor variables around their grand mean to facilitate the interpretation of main effects in models containing interaction terms (see Aiken & West, 1991). The predictors were entered into the regression in the following five steps: (1) age, sex, neuroticism, and night work as control variables; (2) job stressors, job control, locus of control, and self-efficacy; (3) the interaction of job stressors and job control, which represents the interaction postulated by the JDC model; (4) the remaining two-way interactions, and finally, (5) the three-way interaction. Table 2 displays the results of the regression analyses. We concentrate on the three-way interactions, which are central to our study. These will be presented in the order that corresponds to the hypotheses.

Three-Way Interactions: Musculoskeletal Pain

Locus of control. With musculoskeletal pain as a dependent variable, the three-way interaction of job control, job stressors, and locus of control (Step 5) was significant, $\beta = -.34$, $p = .015$, explaining an additional 5% of the variance. The pattern is presented according to Aiken and West (1991) in Figure 1.

For a more specific test of our hypotheses, we conducted simple slope analyses as proposed by Aiken and West (1991). We also calculated slope difference tests following Dawson and Richter (2006). However, these results have to be interpreted with caution because slope difference tests have very low power unless the sample size is quite large (see Dawson & Richter, 2006).

For participants with an internal locus of control, job stressors were not related to musculoskeletal pain under conditions of high job control ($\beta = -.16$, $p = .328$), but marginally positively related to musculoskeletal pain under conditions of low job control ($\beta = .33$; $p = .070$). Further, these two slopes differed significantly from each other ($t = 2.09$, $p = .040$).

For individuals with an external locus of control, job stressors were related to musculoskeletal pain under conditions of high job control ($\beta = .86$, $p = .021$), but not under conditions of low job control ($\beta = .10$, $p = .641$). The difference between the slopes was marginally significant ($t = 1.66$, $p = .100$). Hence, job control acted as an additional stressor (see Figure 1). These results are in line with Hypothesis 1a.

Table 1
Descriptive Statistics and Correlations Among the Study Variables

Variables	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
Outcome variables												
1. Affective strain at work	2.18	0.53	(.88)									
2. Musculoskeletal pain	2.44	1.19	.38**	(.71)								
Control variables												
3. Age	38.15	10.56	−.16	.06	–							
4. Sex[a]	0.64		.04	−.12	.15	–						
5. Neuroticism	2.79	0.68	.38*	.08	−.01	.07	(.77)					
6. Night work[b]	0.17		−.01	.24*	.21*	.17	−.05	–				
Predictor variables												
7. Job stressors	2.95	0.48	.44**	.23*	.12	.03	.10	.01	(.67)			
8. Job control	3.01	0.95	−.04	.06	.05	.14	−.05	−.23*	.10	(.89)		
9. Locus of control[c]	4.99	0.83	−.42**	−.24*	.04	−.01	−.51**	−.06	−.29**	.21*	(.84)	
10. Self-efficacy	4.36	0.68	−.32**	.01	.03	.04	−.51**	.15	−.09	.10	.40**	(.80)

Notes. $N = 96$. Cronbach's Alphas are indicated in parentheses.
[a] 0 = female, 1 = male.
[b] 0 = no, 1 = yes.
[c] High scores indicate internal locus of control.
* $p < .05$. ** $p < .01$.

Table 2
Combined Regression Results with Locus of Control and Self-Efficacy as Moderator: Standardized Regression Coefficients

	Musculoskeletal pain				Affective strain at work			
	Locus of control		Self-efficacy		Locus of control		Self-efficacy	
	β in	Final β	β in	Final β	β in	Final β	β in	Final β
Step 1								
Age	.04	.03	.04	.01	−.17†	−.18*	−.17†	−.19*
Sex[a]	−.18†	−.19†	−.18†	−.21†	.03	.04	.03	.01
Neuroticism	.11	−.08	.11	.11	.37*	.20*	.37*	.27*
Night work[b]	.26*	.24*	.26*	.29*	.03	.01	.03	.04
ΔR^2	.10		.10		.17		.17	
ΔF	2.39†		2.39†		4.59*		4.59*	
*Df*s	(4, 91)		(4, 91)		(4, 91)		(4, 91)	
Step 2								
Job stressors	.15	.28*	.21*	.21*	.40*	.48*	.44*	.42*
Job control	.18	.06	.13	.11	−.02	−.12	−.04	−.05
Control belief (locus of control[c], resp. self-efficacy)	−.22†	−.23†	.04	.04	−.15	−.25*	−.15	−.11
ΔR^2	.10		.07		.20		.21	
ΔF	3.52*		2.34†		9.55*		9.70*	
*Df*s	(3, 88)		(3, 88)		(3, 88)		(3, 88)	
Step 3								
Job stressors x Job control	−.15	.06	−.13	−.12	−.18*	−.23*	−.18*	−.12
ΔR^2	.02		.02		.03		.03	
ΔF	2.19		1.56		4.56*		4.61*	
*Df*s	(1, 87)		(1, 87)		(1, 87)		(1, 87)	
Step 4								
Job stressors x Control belief	−.10	−.21†	.04	.04	.09	−.04	.08	.10
Job control x Control belief	−.01	.13	.04	.04	−.09	.06	−.09	.09
ΔR^2	.01		<.01		.01		.01	
ΔF	0.37		0.17		0.97		0.80	
*Df*s	(2, 85)		(2, 85)		(2, 85)		(2, 85)	
Step 5								
Job stressors x Job control x Control belief	−.34*	−.34*	−.04	−.04	−.39*	−.39*	−.18*	−.18*
ΔR^2	.05		<.01		.07		.03	
ΔF	6.21*		0.10		12.23*		4.11*	
*Df*s	(1, 84)		(1, 84)		(1, 84)		(1, 84)	
ΣR^2	.27*		.18†		.49*		.44*	

Notes. β in = Beta coefficient of the particular step at which the variable initially entered the equation. Final β = Beta coefficient in the final (5th) step.
[a] 0 = female, 1 = male.
[b] 0 = no, 1 = yes.
[c] High scores indicate internal locus of control.
* $p < .05$. † $p < .10$.

Self-efficacy. The three-way-interaction of job stressors, job control, and self-efficacy was not significant for musculoskeletal pain, β = −.04, p = .754. Hypothesis 1b therefore was not supported.

Three-Way Interactions: Affective Strain

Locus of control. The three-way interaction with job stressors and job control was significant

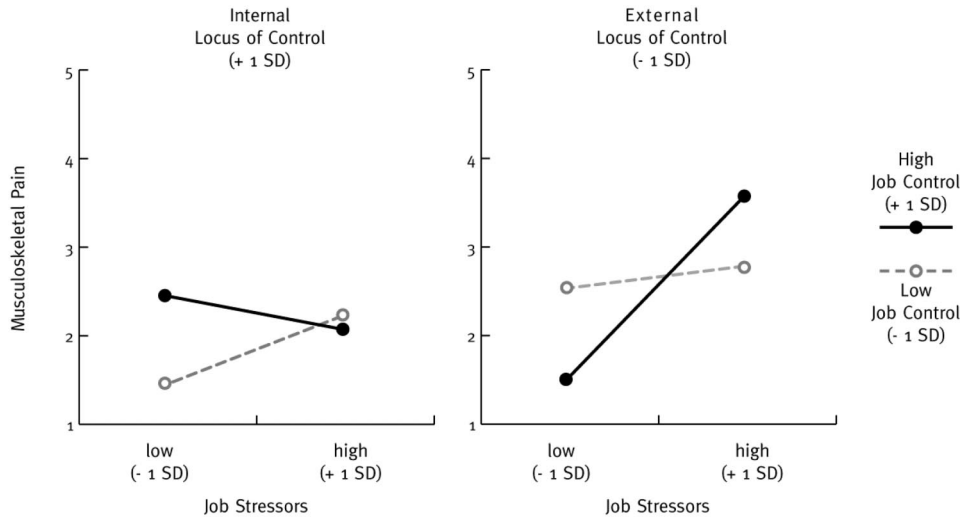

Figure 1. Interactions between job stressors and control predicting musculoskeletal pain for individuals with internal and external locus of control.

for locus of control ($\beta = -.39$, $p = .001$), explaining an additional 7% of the variance. For individuals with an internal locus of control, job stressors were not related to negative affective well-being under conditions of high job control ($\beta = .07$, $p = .615$), but were significantly related to negative affective well-being under conditions of low job control ($\beta = .81$, $p < .001$) (see Figure 2). Further, the two slopes differed significantly from each other ($t = 3.84$, $p < .001$).

By contrast, for participants with an external locus of control, job stressors were related to negative

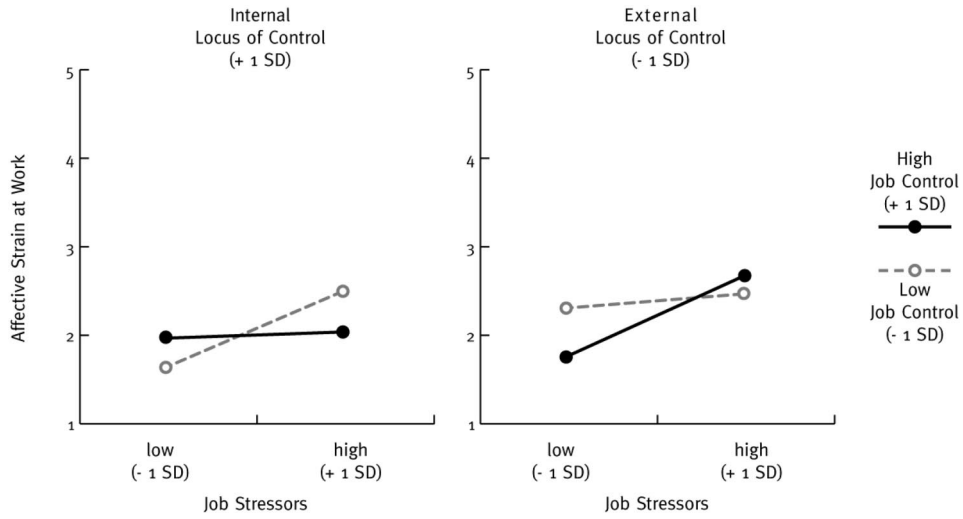

Figure 2. Interactions between job stressors and control predicting affective strain at work for individuals with internal and external locus of control.

affective well-being under conditions of high job control ($\beta = .87$, $p = .006$), but not under conditions of low job control ($\beta = .16$, $p = .403$; see Figure 2). The two slopes differed marginally significantly from each other ($t = 1.87$, $p = .064$). Hypothesis 2a is therefore supported.

Self-efficacy. For self-efficacy, the three-way interaction was significant, $\beta = -.18$, $p = .048$, and explained an additional 3% of variance. As shown in Figure 3, the pattern for high self-efficacy was very similar to the pattern for internal locus of control. For individuals with high self-efficacy beliefs, job stressors were not related to negative affective well-being under conditions of high job control ($\beta = .18$, $p = .286$), but were significantly related to negative affective well-being under conditions of low job control ($\beta = .85$, $p < .001$). Further, the two slopes differed significantly from each other ($t = 2.96$, $p = .004$).

For participants with low self-efficacy beliefs, job stressors were related to negative affective well-being under conditions of high job control ($\beta = .41$, $p = .049$), but not under conditions of low job control ($\beta = .21$, $p = .340$). These two slopes did not differ significantly from each other ($t = .59$, $p = .557$). Hypothesis 2b is therefore supported.

To summarize, the expected effect was found for both dependent variables when locus of control was the moderator, and for one dependent variable (affective strain), when self-efficacy was the moderator. Among individuals with an internal locus of control, job stressors were associated more strongly with both dependent variables under conditions of low, as compared to high, job control. Job stressors were not related to well-being if the employees had much job control and high control beliefs. The finding that internals reported much musculoskeletal pain under conditions of high control and low demands was unexpected and will be discussed later. Among individuals with an external locus of control, job control did not buffer the effects of high stressors. High stressors were associated more strongly with back, neck, and shoulder pain and with negative affective well-being under conditions of high than low job control.

For self-efficacy, the postulated effects were found for affective strain only. For participants with high self-efficacy, results mirrored those for internal locus of control, as stressors were associated with low well-being only under conditions of low job control. For participants with low self-efficacy, stressors were associated with lower well-being under conditions of high job control only, again reflecting the results for locus of control. The difference between high and low job control was not significant, however, for those low in self-efficacy.

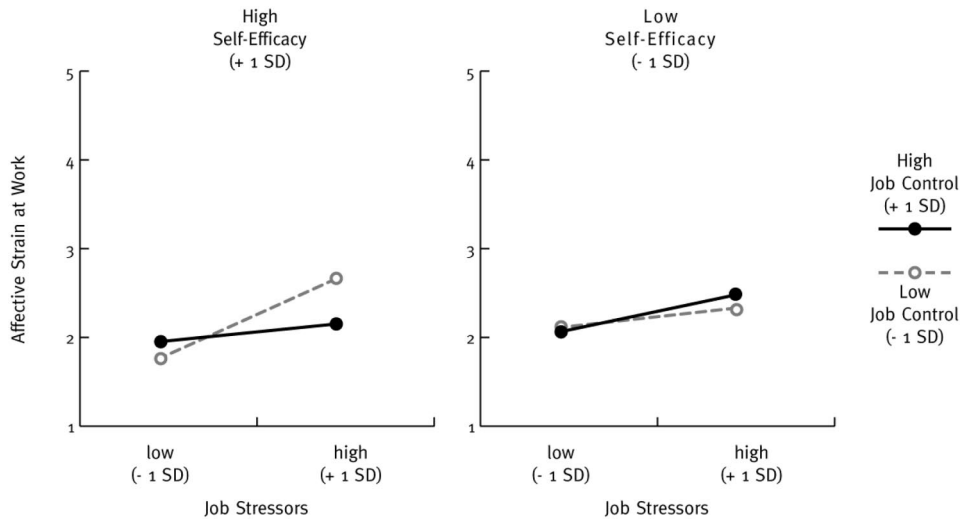

Figure 3. Interactions between job stressors and control predicting affective strain at work for individuals with high and low self-efficacy.

Additional Analyses

As suggested by an anonymous reviewer, we reran our analyses with the stressors separately. For two of them—time pressure and concentration demands—results exactly mirrored those for the index, with three out of four three-way interactions being significant. For two of them—performance constraints and uncertainty—one three-way interaction was significant. Only for one scale—work interruptions—was the three-way interaction not significant. Of note, none of the three-way interactions were significant for the combination of self-efficacy and musculoskeletal pain, again mirroring results for the index. Thus, the individual analyses do reflect the overall pattern in that results are more consistent for locus of control, and absent for self-efficacy as a moderator with regard to musculoskeletal pain. Results of these analyses can be obtained from the first author.

Discussion

The present study presents further evidence that personal dispositions moderate the stress buffering effect of job control proposed by Karasek (1979). Whereas job control can have positive, that is, stress buffering, effects for some individuals, it may not be helpful, and even can accentuate the negative effects of stressors, for others.

For both negative affective well being and musculoskeletal pain there was a buffering effect of job control for individuals reporting an internal locus of control. This is in line with our expectations, as the presence of control matches their convictions about the controllability of events. By contrast, working under conditions of high demands and having no control represents a mismatch for internals, resulting in more affective strain and in higher levels of musculoskeletal pain as the level of stressors increases. A different pattern was found for externals. Job demands had a stronger negative impact on affective well-being and musculoskeletal pain under conditions of high, as compared to low, job control. For this group, having high job control represents the mismatch, as it does not correspond to their convictions about the controllability of events. Thus, our results support the role of locus of control as a possible moderator of the demand-control interaction. This is important, as the evidence so far is (1) very limited and (2) rather mixed with regard to field studies. In addition, our results point to the importance of general locus of control, which is especially important for studies that do not include, or go beyond, the work domain. However, further research is needed that incorporates measures of general as well as measures of work-related locus of control to test the unique contribution of a more specific measurement.

Although our hypotheses with regard to self-efficacy followed basically the same logic as those for locus of control, results are only partly supportive. The postulated effect for self-efficacy was found with regard to affective strain. For people with high self-efficacy, control buffered the effects of stressors as expected, whereas for those with low self-efficacy, the effect was reversed. Stressors impaired affective well-being even more strongly when these individuals could decide (or perhaps felt they needed to decide) how and when to cope with the demands of the situation. For them, job control seems to be an additional stressor under already demanding conditions. The three-way interaction could not be found, however, for musculoskeletal pain. Note, however, that the pattern for musculoskeletal pain was similar to the other results, although it did not reach conventional levels of statistical significance.

As mentioned above, self-efficacy is a concept that originally was meant to be very specific. Perhaps we would have found stronger effects with a more specific measure, but further research is needed on this issue. One has to keep in mind, however, that the likelihood for all effects that are present in the population to be detected in a given sample is rather small, even in reasonably large samples (Maxwell, 2004). The possibility of a Type II error therefore cannot be ruled out, given that the pattern of results is similar across all four analyses.

Some may question the effects for self-efficacy on affective strain on the grounds that the three-way interaction, while statistically significant, explains only an additional 3% of the variance. Note, however, that interactions in general tend to explain only rather small amounts of additional variance, yet may be important (Aiken & West, 1991). This argument applies even more to higher order interactions, so we are confident that the statistically significant effects we found, including that for self-efficacy, are not trivial.

The discussion has so far concentrated on the differences in slopes. Another issue concerns levels. With regard to levels, there were two findings that are somewhat unexpected. First, the high levels of musculoskeletal pain and affective strain reported by externals under conditions of low control are surprising, because externals with low control should experience a good fit and therefore report lower levels of

pain and negative affective well-being than externals with high control. Second, it is quite surprising that, among internals, the highest level of back and shoulder pain is reported by participants with high control and low demands, whereas people with low control and low demands report the lowest level of back and shoulder pain.

With regard to the first issue, we think it is plausible that high control is beneficial even for externals as long as it is not associated with high stressors. Under conditions of high stressors, the possibility to make decisions may be experienced as a necessity to make decisions, and therefore increase stress reactions because of perceived overload. It is interesting to note that de Rijk et al. (1998) found a pattern similar to ours, although for a different personal characteristic (i.e., active coping). Among participants low in active coping, those who had high control reported lower levels of emotional exhaustion than those with low control under conditions of low demands; but their level of exhaustion was comparable when demands were high.

It is more difficult to explain the comparatively high levels of musculoskeletal pain among internals with high control and low stressors. However, these results are similar to those obtained by Schaubroeck and Merritt (1997), where people with high self-efficacy with low demands had higher blood pressure under conditions of high than low control. It is conceivable that internals who have high control and low demands get frustrated because their job control implies the possibility to change things and to demonstrate competence, yet the absence of high demands—which also can imply an absence of challenge—makes it difficult to actually do so. Job control, in this case, may involve control over trivial issues.

We are cautious, however, in accepting this interpretation, since other studies report levels that differ from ours (e.g., de Rijk et al., 1998). Further, there are many other influences on the dependent variables, such as other resources (e.g., social support) and the specific nature of stressors, which may influence the specifics of these regression lines. Given this complexity, however, the rather consistent pattern we found for slopes is actually quite remarkable. Yet, further research should give more attention to the problem of levels.

The general conclusion from these results may be formulated in terms of a match between internal, or personal resources, and external resources. Internal resources, such as locus of control or self-efficacy, are needed to be able to use job control effectively. In terms of the P-E-Fit model (Edwards, 1996), without internal resources, job control is, at best, an excess supply that does not offer any advantage. At worst, job control may even become a stressor, turning from a supply to a demand, and introducing a Demands-Ability misfit.

Our results are more convincing for locus of control. This is important, given the limited and conflicting evidence for the moderating role of this variable. They are less convincing for self-efficacy, where more research is needed, not least with regard to the issue of specificity versus generality of this variable.

Concerning dependent variables, our results are consistent for affective strain. Negative affective reactions are very characteristic for the experience of stress (Lazarus, 1999; van Katwyk et al., 2000). Theoretically, it is therefore plausible to assume that repeated or continuous experience of stress may result in a more generalized tendency to experience affective strain. Affective strain, therefore, suggests itself as an especially pertinent dependent variable. Accordingly, it has been used very often in occupational stress research. It therefore is important to collect evidence concerning this variable also with regard to the possible moderating role of dispositions. Musculoskeletal pain has been added because of its epidemiological importance, and because there is evidence that it is related to stress at work (Hurrell, 2001), presumably because the stress experience is associated with muscular tension (Lundberg et al., 2002). Showing that locus of control moderates the interaction between stressors and control for this variable, therefore, adds evidence for a dependent variable that has, to our knowledge, never been investigated with regard to this three-way interaction, and it shows that this effect does not only apply to dependent variables with a strongly affective tone. At the same time, however, results are less consistent for musculoskeletal pain than for affective strain. It is conceivable that the three-way interaction would have been found for musculoskeletal pain for subgroups with specific occupational characteristics (e.g., blue-collar workers), but the sample size is too small to test this possibility. Note, however, that there are main effects for stressors as well as for night work with regard to musculoskeletal pain. Thus, our results do confirm the role of working conditions for musculoskeletal pain, even though the three-way interaction is found only for one of the two moderators.

We obtained our results while controlling for another personal disposition, that is, neuroticism. Although the merit of partialing out the effects of neuroticism is controversial (Spector et al., 2000), we felt

it was appropriate because of its strong association with affective strain, locus of control, and self-efficacy. That the effects were found when neuroticism was controlled for is thus important, and it lends credibility to the results. Note also that there is no main effect of neuroticism on musculoskeletal pain, which is a variable with less affective content, and, therefore, is one that should show smaller associations with a variable that has often been labeled as "negative affectivity."

One final point relates to the potential overlap between control beliefs and job control. Both may not be independent because (1) control beliefs may influence the perception of job control, and (2) control beliefs may influence actual job control, as people with high control beliefs may actually obtain jobs with more control options. The positive association between the control beliefs and job control (see Table 1) is in accordance with such an interpretation. However, the coefficients are not high enough to suggest that we are not dealing with distinct constructs. Furthermore, with a very high overlap it would be very difficult to obtain a mismatch between control beliefs and actual job control and to find an interaction between the two. The probability of obtaining a statistically significant interaction between variables that are highly correlated is very low (Aiken & West, 1991). Altogether, therefore, it is unlikely that our results are because of an overlap between job control and control beliefs. Nevertheless, studies that assess job control by other means than self-report are needed.

Limitations

Certain limitations concerning the current study have to be acknowledged. First, the cross-sectional nature of the data does not allow any clear inference of a cause-effect relationship. Second, the study was based on self-report data, and thus the question arises as to whether the size of the relationships may be overestimated because of common method variance (Semmer, Grebner, & Elfering, 2004). However, common method variance tends to make the detection of interaction effects in moderated regression (which is inherently conservative already; McClelland & Judd, 1993) even more difficult (Aiken & West, 1991), so this explanation is not very likely. The third limitation concerns the sample size. With 96 participants, it is necessary to replicate the results to have sufficient confidence in them. For nonsignificant coefficients, there is the risk of a Type II error. This is particularly true for interactions. Fourth, we do not have specific information on the type of job, except for the job characteristics we measured. (We do have information concerning the departments people belong to, and controlling for them did not alter the results.) Finally, assessing locus of control and self-efficacy on a general level, although constituting an asset with regard to the comparability of studies across domains, represents a limitation in that more specific beliefs may yield stronger results.

Directions for Further Research and Practical Implications

Our results support the notion of a match between job control on the one hand and control beliefs on the other, although support is stronger for locus of control than for self-efficacy. Further research is needed that compares control beliefs at different levels of generality. Such analyses would also enable researchers to test if there are specific relationships between different stressors and different types of control beliefs, extending the idea of optimal matches further than was possible in our analyses.

Other investigators have found similar interactions with other personal characteristics (e.g., active coping; de Rijk et al., 1998). This raises the intriguing possibility that such results may generalize to a multitude of personal resources that are known to have positive effects on health and well-being, such as active coping, optimism, a positive attribution style, and so forth (Semmer, 2003). In addition, if so, one might ask if one such personal resource can be a substitute for another one. For instance, is it equally useful to have either an internal locus of control or high optimism? Alternatively, it is conceivable that the fit between a specific resource and a specific stressor might be important (e.g., control beliefs in potentially controllable situations but optimism in uncontrollable situations).

Furthermore, in light of the diversity of findings, further research is needed with regard to the number and kind of outcome variables that will follow such a pattern. This research should include (1) the measurement of variables by means other than self-report, (2) longitudinal designs, and (3) the assessment of relevant stress-experiences on a situational basis (cf. Semmer et al., 2004). The last seems especially promising for a more in-depth understanding of the processes involved.

From a practical perspective, our results point to the necessity of having both internal (i.e., control beliefs) and external (i.e., job control) resources

available when dealing with stressful working conditions. Increasing job control is a widely recommended practice (e.g., Parker & Wall, 1998). Results like ours, if replicated, suggest, however, that increasing job control may not be very helpful, or even detrimental, for people low in control beliefs. One possibility would be to offer increased job control only for those with high control beliefs. Note, however, that people with low control beliefs typically show poorer well-being as well as poorer performance (Judge & Bono, 2001). Furthermore, research on P-E-Fit has shown that a fit at high levels is better than a "fit" at low levels (see Semmer, 2003). The most promising solution therefore would be to raise job control, and to raise control beliefs in case they are low.

This raises the question of whether control beliefs really can be altered, given that they are personal dispositions with considerable stability. Actually, there is evidence that these control beliefs can be modified through training programs (Bandura, 1986; Eden & Aviram, 1993). Findings suggest that it is easier to change self-efficacy beliefs than locus of control (Smith, 1989) and that training affects specific efficacy-beliefs more than general efficacy-beliefs (Schwoerer, May, Hollensbe, & Mencl, 2005). Therefore, training programs that enhance workers control beliefs may help protect employee health.

However, just as increasing control may not be helpful without increasing control beliefs, increasing control beliefs is not likely to be helpful if job control is low. Such a situation would, again, create a misfit (cf. Salanova et al., 2002; Schaubroeck & Merritt, 1997). Therefore, it seems most promising to enhance both internal and external resources, so that people (1) have control options that enable them to cope well, and (2) have the convictions and the skills that are necessary to use these options effectively (cf. Semmer, 2006).

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