The Demands-Control-Support model, locus of control and job dissatisfaction: a longitudinal study

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The Job-Demands-Control model (Karasek, 1979) has been widely studied in the job stress field, but the results obtained are frequently contradictory. Therefore, some investigations have expanded the model by including social support and personality characteristics such as locus of control. However, results obtained with these elaborated models have not been conclusive either. The present study sets out to integrate both types of expansions by simultaneously including social support at work and the employee’s locus of control in a longitudinal multi-national study among 342 administrative personnel from Belgium, England, Spain, Italy and Israel. Hierarchical moderated multiple regression showed a significant 4-way interaction term (Demands × Control × Social support × Locus of control) on the change in job dissatisfaction. This effect is qualified by the interactions between job demands and control only for an internal locus of control with high social support. Contrary to the prediction of the JDC model, which posits that high control has a buffering effect on job dissatisfaction, the study result indicates a damaging effect of excess control (perceived job control and high internal locus of control), specifically in high social support situations.

1. Introduction

One of the most widely studied theoretical approaches of job stress is the so-called Job-Demands-Control (JDC) model (Karasek, 1979; Karasek and Theorell, 1990). The basic tenet of the JDC model is that job control or decision latitude is a crucial resource that moderates the potential negative effects of job stress. Hence, increasing employee’s control prevents the occurrence of job strain, that is, job stress will not affect employee’s physical and/or mental health when sufficient levels of control exist. In the past two decades numerous investigations on the JDC model have been carried out, but the results are contradictory (for recent reviews see De Jonge, and Kompier, 1997; Tetley, and Jimmison, 1999, Van der Doef, and Maes, 1999). Amongst others, the JDC model has been criticized

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for being too simplistic (Baker, 1985; Hobfoll, 1988; Johnson, 1989; Parkes, 1991; Puletch, Walsh, Mangone, and Jennings, 1994). For instance, job control is just one of many potential psychosocial resources and Johnson (1986) has argued that social support plays a similar important role as job control in moderating the stressor (i.e., demands)-strain relationship. So the original JDC model was expanded by including social support. This revised so-called Job-Demands-Control-Support (JDCS) model was used to investigate cardiovascular disease (Johnson, and Hall, 1988; Johnson, Hall, and Theorell, 1989), somatic complaints and psychological strain (Andries, Kompier, and Smulders, 1996; De Jonge, Jansen, and Van Breukelen, 1996; Landsbergs, Schnall, Diertz, Friedman, and Pickering, 1992, Melamed, Kushnir, and Meir, 1991; Parkes, Mendham, and Von Rabenau, 1994; Schaubroeck, and Fink, 1998; Vahtera, Pentti, and Utela, 1996). In addition, it has been pointed out that individual characteristics might play a role. For instance, Parkes (1991) argued that a possible explanation for the contradictory results of the JDC model is that individuals have different styles of adaptation to the job environment. She suggests that locus of control interacts with job demands and job control to predict job strain. Accordingly, some studies have expanded the JDC model by including locus of control (Daniels, and Guppy, 1994; Newton, and Keenan, 1990; Parkes, 1991).

The current study takes both previously mentioned criticisms into account by simultaneously incorporating into the original JDC model social support at work as well as the employee's locus of control. Next, the literature will be reviewed in greater detail for the JDC model and social support and locus of control.

1.1. The JDC model and social support
The literature suggests that social support at work may either have a direct effect on the level of strains independent of the level of job stressors (Andries et al., 1996; Loscocco, and Spitze, 1990; Parasuraman, Greenhaus, and Granrose, 1992, Payne, and Jones, 1987, Roxburgh, 1996) or a buffering effect by moderating the stressor-strain relationship (Beckr, King, and King, 1990; Cohen, and Wills, 1985; Greller, Parsons, and Mitchell, 1993; LaRocco, House, and French, 1980; Terry, Nielsen, and Perchard, 1993; Viswesvaran, Satche, and Fisher, 1999). The stress-buffering hypothesis assumes that resources (i.e., social support of others) are effectively mobilized to counteract job stress so that negative consequences of job stress are prevented (Gore, 1985). Based on this reasoning and in accordance with the JDCS model of Johnson, and Hall (1988), it is expected that low support combined with high strain conditions (i.e., high demands and low control) will give rise to a decrease in mental health, relative to either low support and low strain conditions or high support and high strain conditions (Hypothesis 1).

Unfortunately, studies on the JDCS model, though limited, have not been unanimous in their results. As with the original JDC model, predicted results are obtained particularly with cardiovascular disease (Astrand, Hanson, and Isacson, 1989, Johnson, 1986; Johnson, and Hall, 1988; Johnson et al., 1989), whereas for somatic complaints and psychological strain, results are contradictory. For instance, a study by Andries et al. (1996) claimed to support the JDCS model, they merely compared different combinations of the three variables and did not specifically test the 3-way multiplicative interaction term. However, the stress-buffering role of social support was not found in other studies (De Jonge et al., 1996; Melamed et al., 1991, Vahtera et al., 1996) Furthermore, the results of the study by Parkes et al. (1994) were mixed, the model 'worked' for somatic symptoms but not for job satisfaction. Finally, Landsbergs et al. (1992) found a significant interaction between
demands, control and social support but did not replicate the expected stress-buffering effect of social support. The results of their study showed that in active jobs that are characterized by high demands and high control, poor social support was related to job dissatisfaction. However, contrary to expectations, in high-strain jobs that are characterized by high demands and low control, high support is related to job dissatisfaction. Similar results were found by Schauhoeck, and Fink (1998), who suggest that workers facing demanding job situations coupled with high control and low support, or low control and high support will tend to experience difficulties in coping because one key ingredient for successful coping (control or support) is missing. Employees in such jobs will also tend to make harmful internal attributions for their distress because they believe that they have the potential to cope with the situation although they fail to do so.

1.2 The JDC model and locus of control

Locus of control is the generalized belief that behavioural outcomes are under one's personal control (internal locus) rather than depending on outside forces, luck, or powerful others (external locus) (Rotter, 1966). According to Kahn, and Byosiere (1992) it is important to include the concept of locus of control in job stress research because it predicts that those with an internal locus of control are more likely to cope actively with job stress, whereas those with an external locus of control are more likely to refrain from action since they believe that changing the situation is beyond their power. Consequently, those with an internal locus in contrast to those with an external locus are expected to show higher levels of health and well-being when they are confronted with job stress. Moreover, and consistent with the previous reasoning, it has been argued that control is only likely to have a beneficial effect for individuals with an internal locus of control (Dansels, and Guppy, 1992; Frese, 1989; Kahn, and Byosiere, 1992; Parkes, 1989). In a similar vein, Parkes (1989) has pointed out that control is more likely to be perceived when objective control is high and the employee's locus of control is internal. Hence, it is expected that the stress-buffering effect of control will be exclusively observed in employees with an internal locus of control (Hypothesis 2).

Although in those studies on the JDC model that include locus of control significant interactions are found between demands, control and locus, results are not conclusive. For instance, some studies indeed observed that the moderator effect of control was exclusively found in those with an internal locus of control (Dansels, and Guppy, 1994; Vahtera et al., 1996). In fact, Dansels, and Guppy (1994) found that the JDC model only 'works' as expected for those with an internal locus of control, whereas for those with an external locus of control the results showed an inverse buffering effect of control. Vahtera et al. (1996) expanded the JDC model by including sense of coherence (a concept similar to locus of control) in predicting sickness absence spells. Although the results depended on gender they, in general, seem to support the model for internal locus of control. However, in contrast, in two studies carried out by Parkes (1991), the JDC model only 'works' for an external locus of control, and because of this the author points out the need for taking into account locus of control in the JDC model.

1.3. The JDC model, social support and locus of control

Given the evidence on the effect of job control, Kohlberg (1989) recommends that future studies explore the interaction of control with other dimensions, such as social support or locus of control. Several authors suggest the exploration of relations and interactions
between the different variables that affect the job demands-psychological strain relationship. Job control, social support and intrapersonal control beliefs such as locus of control are among such variables, they are resources that may interact to promote or inhibit resistance to stress (Holahan, and Moos, 1990, cf. Vahtera et al., 1996). So, use of higher-order interactions can help to explain equivocal results such as those obtained with the introduction of locus of control or social support in the JDC model.

In a similar vein, Parkes (1991, p. 309) states that further research is needed to clarify the extent to which social support and locus of control overlap as moderators of stress-outcome relations in general, and as moderators of demand-discretion effects in particular.

Although several studies have analysed second-order interactions, to date no study has simultaneously considered higher order interactions between job demands, job control, social support, and locus of control. For instance, significant interaction effects have been found of locus of control, social support and stressors on well-being. More specifically, it appeared that the buffering effect of social support occurs, basically, for those with an internal locus of control (Cummins, 1989, Fussler, Ganster, Mayes, and Bronston, 1987, Lefcorth, Marton, and Saleh, 1984; Sandler, and Lakey, 1982).

However, these studies did not include job control and, in addition, they refer to life stressful events rather than to job stress. Two studies do include control and were carried out in a work setting. Nevertheless, neither of them has explicitly tested the 4-way interaction between job demands, job control, locus of control, and social support. The first study is the longitudinal investigation by Danels, and Guppy (1994) Their results showed a significant 3-way interaction between job demands, locus of control, and social support. Those with internal locus of control with high social support were less likely to have decreased their psychological well-being when experiencing the effects of higher levels of demands. In addition, they found another interesting result: a ‘floor’ effect for the external locus of control with low social support, that is, an external locus of control and low social support was related to poor well-being, independently of the level of job demands. The second study tested a modified JDC model in which social support and sense of coherence were expected to modify the interaction between demands and job control (Vahtera et al., 1996). It was found that in employees who work in active jobs and who have a strong sense of coherence (related to internal locus) and experience a high level of support have less sickness spells than those in active jobs with a weak sense of coherence and low level of support. Unfortunately, these results are based on cross-sectional data and higher-order interactions were not tested. Nevertheless, these studies show the interrelation between the four variables of interest: demands, control, social support, and locus of control.

In short, the JDJCS model predicts a stress-buffering effect of social support. On the other hand, an internal locus of control seems to make a more effective use of both the received support (Cummins, 1989; Fussler et al., 1987; Sandler, and Lakey, 1982) and control (Daniels, 1992, Phares, 1976). Therefore, we expect that the JDC model will ‘work’ with high social support and internal locus, that is to say, control will have a more beneficial effect when social support is high and when the employee has an internal locus (Hypothesis 3).

1 4. The present study

Four issues need further clarification. First, since distress is related to age (Blanchard-Fields, and Fredi, 1988, Dodd-McCue, and Wright, 1996; Sevastos, Snuth, and Cordery, 1992)
as well as to gender (Banks, and Jackson, 1982, Jick, and Mitz, 1985, Warr, and Jackson, 1983), the present study controls for these demographic variables that may act as confounders.

Second, one of the criticisms of Karasek's research on the JDC model is that he used heterogeneous samples that come from different occupations and, therefore, the results may have been confounded by socioeconomic status (Sheffield, Dobbie, and Carroll, 1994). In order to control for this potential confounding effect, the ideal sample should be homogeneous as far as occupation is concerned. The present study takes this into consideration by including a homogeneous sample.

Third, as Brief, Butcher, George, and Link (1993) note, different facets of mental health may be differentially affected by different personality factors, situational circumstances, and their interaction. Original tests of the model (Karasek, 1979) found that decision latitude, demands, and their interaction were related to exhaustion, depression, and life and job dissatisfaction. However, Warr (1987) states that job factors are likely to have a greater significance to job-related mental health, such as job satisfaction, than to context-free mental health, which concerns life in general. On this issue, Melamed et al. (1991) point out that job dissatisfaction is widely used as a marker of psychological stress. In fact, the main measure of job-related well-being used to test the job demand-control (-support) model is job satisfaction (Van der Doef, and Maes, 1999). Therefore, this study uses job satisfaction as an indicator of job-related mental health.

Finally, Beehr, and Newman (1978) suggested the use of longitudinal designs because they are superior to cross-sectional designs when it comes to testing causal relations. Despite the fact that the use of longitudinal designs is common suggestion in discussions of many papers (Carayon, 1993, Ganster, 1989; Johnson, 1989; Kazl, 1978, Martocchio, and O'Leary, 1989, Pitzch et al., 1994), it is only rarely adopted (Carayon, Yang, and Lum, 1995, Danels, and Guppy, 1994, Parke, 1991, Parkes et al., 1994). The present study uses a longitudinal design.

In summary, the aim of the present study is to test longitudinally an expanded JDC model, which incorporates social support and locus of control. More specifically, three hypotheses are tested:

1. **Hypothesis 1** Low support combined with high strain conditions gives rise to an increase in job dissatisfaction compared to either low support and low strain conditions or high support and high strain (Demands × Control × Social support interaction).

2. **Hypothesis 2** The stress-buffering effect of control is exclusively observed in employees with an internal locus of control (Demands × Control × Locus of control interaction).

3. **Hypothesis 3** Job control has a more beneficial effect when social support is high and when the employee has an internal locus compared to the remaining conditions (Demands × Control × Social support × Locus of control interaction).

### 2. Method

2.1. **Design**

The data used in the present study were collected as part of a larger longitudinal international project that investigated the early work role developmental period, the 'Work of Youth Socialization' (WOSY) project (WOSY International Research Group, 1989a). The WOSY project conceives of work role development as systematic, organized and successive changes.
(and stability) in youth, including work values and experiences, behavioural strategies, and work outcomes (Fej, Whitely, Peró, and Taris, 1995, Touzard, 1992).

The WOSY project used a three-wave panel. At Time 1, the participants were employed for 3 to 9 months in their first full-time employment, which coincides with the common probationary period in Europe. This criterion is consistent with work and organizational psychology research that indicates that such a period is necessary for behaviours, preferences and performance to stabilize (Katz, 1982). Time 2 data were collected 9–12 months later, and Time 3 outcome was assessed about 2 years after the initial assessment.

All data were obtained through self-report measures. The same questionnaire has been used at all times in the form of an individual interview. Interviews were conducted at the home of the subject by trained graduate psychology students. The interview schedule was developed through a series of pilot studies conducted in each country. In these pilot studies, the selected questions and scales were evaluated with respect to their applicability for the population in question and their reliability (for further details on the questionnaire and procedures, see Whitely, Peró, and Sarchielli (1992) and WOSY International Research Group (1989b)).

In the present study, only data from the final two waves were employed. The reason for this is that we were interested in predicting the change in job dissatisfaction between T2 and T3, after the young employees have been in their first jobs for at least 1 year. Research suggests that possible effects of role stress (our indicator of job demands; see later) occur in later periods of the work socialization process (Whitely, Dougherty, and Dreher, 1992).

Changes in job dissatisfaction—the dependent variable in our study—have been studied by controlling for T2 baseline levels when performing regression analyses with T3 levels of job dissatisfaction.

2.2. Sample

The cross-national character of the investigation means that the conditions that define the sample have been elaborated with meticulous detail, so that they are similar in all participant countries, ensuring in this way the comparability of the outcomes. So, the sample is not intended to be representative of either national or regional labour forces, but it is a target group that allows the work role development to be analysed more clearly.

The sample was composed of naive users or operators of complex information systems (office technology) who were in their first full-time employment. The sample was standardized in all countries in terms of kinds of occupations to include or exclude. So, the group consisted of youth beginning employment in office automation at Time 1, and their jobs were mainly concerned with dealing with data. The group included job titles such as word processor operators, typists, micro or mini computer operators, clerks, and other data processing machine operators. Note that it excluded more complex jobs such as software writers and computer science personnel. Respondents may work in public or private organizations.

Respondents were approached via vocational training schools or by employers. A total of 1351 young employees were interviewed at Time 1, 72% and 60% of the Time 1 sample were followed up at Time 2 (N=973) and Time 3 (N=814), respectively. Complete data were available for 542 respondents at all three assessments, these respondents make up the sample in the present study.

Participants who provided complete data at all points in time differed from those who
failed to provide complete data at Time 3. Results from the t-tests showed that the former group reported higher job demands ($t = 7.423, p < .01$), lower control ($t = 19.216, p < .001$), lower support from supervisors and co-workers ($t = 7.331, p < .01$), a more external locus ($t = 57.205, p < .001$) and lower job satisfaction ($t = 6.822, p < .01$) than the latter group at T1. In other words, the drop-outs scored more positive on all variables concerned, which leaves a relatively less ‘positive’ group for testing our hypotheses.

So, the sample in the present study was composed of 171 men (31.6%) and 371 women (68.4%). Ages ranged from 18 to 36 years (mean = 22.6 years; SD = 3.1 years). The participants came from five countries: Belgium ($N = 92$; 17%), England ($N = 134$; 25%), Spain ($N = 123$; 23%), Italy ($N = 134$, 25%), and Israel ($N = 59$, 11%).

2.3. Measures

2.3.1. Sociodemographic variables: Age was measured in years and gender was codified as a dummy variable (0 = female, 1 = male).

2.3.2. Job demands: These have been assessed using a well-validated 5-item scale of role conflict (Raza, House, and Litzman, 1970), whose content is rather similar to the original job demands concept used by Karasek (1979) (e.g. ‘On my job, I can’t satisfy everybody at the same time’, ‘I never seem to have enough time to get everything done on my job’) and has been used in several studies to operationalize job demands (Sargent and Terry, 1998; Schaufel, and Fink, 1998, Westman, 1992). Respondents are asked to rate their present job on a 5-point Likert scale ranging from 1 = not applicable to 5 = very much applicable.

2.3.3. Job control: Job control has been measured by the Autonomy in Decision Making scale developed by the WOSY International Research Team (1989b). Its content refers to the ‘decision authority’, one of the two components of the ‘decision latitude’ concept used by Karasek (1979). The scale consisted of three items about the autonomy of the subject who has to decide what to do in his/her work (tasks and responsibilities), the way to do his/her work (procedures or methods) and the timing or the sequence in which to do his/her work (tasks or assignments). The items have a 5-point Likert answering format, ranging from 1 = never to 5 = very at all.

2.3.4. Social support at work: Perceptions of work-related social support were assessed using a 6-item scale derived from the Supervisor and Co-worker Relation scales, from the Minnesota Satisfaction Questionnaire (Weiss, Dawis, England, and Lofquist, 1965). The scale consisted of six, 5-point items with a Likert answering format, ranging from 1 = not applicable to 5 = very much applicable. The first four items refer to the relationships with the supervisor (e.g. ‘My supervisor provides me with helpful advice on how to do my work tasks’), whereas the last two items refer to the relationships with the co-workers (e.g. ‘My co-workers have taught me how to cope with pressures or conflicting demands in my job’). A total score was calculated from all six items.

2.3.5. Locus of control: This has been measured by a unidimensional scale adapted to work situations, according to the suggestion of Spector (1988), developed by the WOSY International Research Team (1989b). Respondents were asked to indicate the extent to which they agree with five statements about work and employment (e.g. ‘Being successful at work is just a matter of luck’). The items had a 5-point response scale, ranging from 1 = strongly disagree to 5 = strongly agree. High scores represent externality.
2.3.6. Job dissatisfaction: Job dissatisfaction was measured by a 5-item scale derived from the Minnesota Satisfaction Questionnaire (Weiss et al., 1965). The items have a 5-point Likert answering format, ranging from 1 = not satisfied to 5 = extremely satisfied. Four items stem from and focus on specific facets of the job, such as salary, security, friendly relationships with co-workers, and the competence of the supervisor in making decisions. The fifth item refers to the general job satisfaction. A total score was calculated from the five items where high scores represent high job dissatisfaction. Job dissatisfaction was assessed at Time 2 and Time 3.

2.4. Data analysis procedure
Moderated multiple regression was the main statistical technique used in this study. To test for interaction terms, we developed a hierarchical regression model in which the independent variables were entered in a predetermined sequence so that 'terms of lower order are paralled from those of higher order and not vice versa' (Cohen, 1978). Interaction terms were entered after main effects (Cohen, and Cohen, 1983). The interaction is carried by the product of all constituent variables (Cohen, and Cohen, 1983). Following suggestions made by several authors (Cohen, and Cohen, 1983; Cronbach, 1987; Finney, Mitchell, Cronkite, and Moos, 1984; Jacard, Turnis, and Wan, 1990), centred scores (deviations from the mean) have been used as a means of addressing the problem of multicollinearity. Since tolerance indexes in all the cases are higher than .65, multicollinearity should not be considered to be a problem.

The longitudinal design of the present study has enabled the authors to follow the method recommended by several authors for analysing change in most non-experimental studies (Cohen, and Cohen, 1983; Finkel, 1995; Markus, 1979). The Time 2 outcome scores were entered as a first step predictor. So, initial levels of job dissatisfaction have been controlled for. Such a design serves to strengthen the argument that predictor variables play a causal role in relation to changes in job dissatisfaction (Cohen, and Cohen, 1983; Finkel, 1995; Kasl, 1987; Plews, 1985).

3. Results
3.1. Preliminary analyses
The correlations among the variables and their respective means, standard deviations and reliabilities (Cronbach’s \( \alpha \)) are shown in Table 1.

Except for job dissatisfaction at T2 and locus of control, all values of \( \alpha \) meet the criterion of \( 0.70 \) (Nunally, 1978).

The results show a significant positive correlation between age and job demands, job dissatisfaction and gender (the men are older than the women). Likewise, there exists a significant negative correlation between age and social support and a significant positive correlation between support and job control. Moreover, compared to women, men experience more job demands (role conflict) and more job control.

In relation to job dissatisfaction, the correlations indicate that the higher job demands, the lower control, the lower social support, and the more external locus of control, the higher is job dissatisfaction.

Finally, the correlation between the level of job dissatisfaction at T2 and at T3 is also significant, showing considerable test-retest reliability of stability across time.
### Table 1: Descriptive statistics of the study variables (reliability on the diagonal of the correlation matrix)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Age (years)</td>
<td>22.63</td>
<td>3.08</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Gender</td>
<td>-</td>
<td>-</td>
<td>.09*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Demands</td>
<td>2.50</td>
<td>.88</td>
<td>15**</td>
<td>.16**</td>
<td>(.80)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Control</td>
<td>3.71</td>
<td>.84</td>
<td>- .04</td>
<td>10*</td>
<td>03</td>
<td>(.77)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Social</td>
<td>3.00</td>
<td>.80</td>
<td>15**</td>
<td>- .01</td>
<td>- .02</td>
<td>21**</td>
<td>(.75)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Locus dissatisfaction (T2)</td>
<td>2.57</td>
<td>.53</td>
<td>- .03</td>
<td>- .01</td>
<td>.06</td>
<td>- .07</td>
<td>- .03</td>
<td>(.52)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Job dissatisfaction (T2)</td>
<td>2.71</td>
<td>.64</td>
<td>12**</td>
<td>- .01</td>
<td>13**</td>
<td>- 14**</td>
<td>- .26**</td>
<td>.07</td>
<td>(.65)</td>
</tr>
<tr>
<td>8</td>
<td>Job dissatisfaction (T3)</td>
<td>2.71</td>
<td>.66</td>
<td>15**</td>
<td>00</td>
<td>.20**</td>
<td>- .23**</td>
<td>- .48**</td>
<td>10*</td>
<td>.51**</td>
</tr>
</tbody>
</table>

Gender: 0 = female, 1 = male  
*p < .05, **p < .01

### 3.2. Hypothesis testing

In order to test the three hypotheses stated, we carried out a moderated hierarchical regression analysis where the interactions between the variables concerned are entered: Job demands × Control × Social support (hypothesis 1), Job demands × Control × Locus of control (hypothesis 2), and Job demands × Control × Social support × Locus of control (hypothesis 3). Likewise, because of the moderate internal consistency of the measurement of locus of control used, some supplementary analyses have been conducted by using the latent variable derived from the items in the locus of control scale, to attempt to correct for measurement error. That is, factor scores resulting from a principal components analysis have been used in the moderated regression. The results obtained with these scores were similar to those obtained in the standard moderated regression. The results are shown in Table 3.

First, it can be noted that job dissatisfaction at T2, job demands, control and social support significantly predict job dissatisfaction at T3. Increases in job demands, decreases in control and decreases in social support increase job dissatisfaction. These significant main effects are consistent with the JD Small model.

Second, hypothesis 1 and hypothesis 2 are not supported by the data. The interaction between job demands, control, and social support is not significant, therefore it is not corroborated that low support combined with high strain conditions gives rise to an increase in job dissatisfaction compared to either low support and low strain conditions or low support and high strain (hypothesis 1). In a similar vein, the interaction between job demands, control, and locus of control is not significant; therefore the assumption that the stress-buffering effect of control is exclusively observed in employees with an internal locus of control (hypothesis 2) is not corroborated. However, the results do show a significant interaction between job demands, control, social support, and locus of control (p ≤ .05). In order to clarify the nature of the interaction effects, a graphical representation is presented in Figure 1. Independent regression lines have been plotted to represent the relationship between job demands and the change in job dissatisfaction, taking values of control, social support, and locus of control of 1 SD above and below the mean (Figure 1).
Table 2. Results for the demands-control-social support-locus model.

<table>
<thead>
<tr>
<th>Source</th>
<th>$R^2$ increment</th>
<th>$F$</th>
<th>$\beta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job dissatisfaction at Time 2</td>
<td>265</td>
<td>194.95***</td>
<td>39.47***</td>
</tr>
<tr>
<td>Age†</td>
<td>0.09</td>
<td>3.33</td>
<td>-0.03</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td>0.11***</td>
</tr>
<tr>
<td>Job demands†</td>
<td>0.40</td>
<td>15.63***</td>
<td>-0.06*</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td>-0.29***</td>
</tr>
<tr>
<td>Social support†</td>
<td>0.11</td>
<td>51.54***</td>
<td>0.07</td>
</tr>
<tr>
<td>Locus of control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job demands × Control†</td>
<td></td>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td>Job demands × Social support</td>
<td></td>
<td></td>
<td>-0.05</td>
</tr>
<tr>
<td>Job demands × Locus of control</td>
<td></td>
<td></td>
<td>0.03</td>
</tr>
<tr>
<td>Control × Social support</td>
<td></td>
<td></td>
<td>0.01</td>
</tr>
<tr>
<td>Control × Locus of control</td>
<td></td>
<td></td>
<td>-0.07</td>
</tr>
<tr>
<td>Social support × Locus of control</td>
<td>0.01</td>
<td>1.71</td>
<td>-0.08</td>
</tr>
<tr>
<td>Job demands × Control × Social support†</td>
<td></td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Job demands × Control × Locus</td>
<td></td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Job demands × Social support × Locus</td>
<td></td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Control × Social support × Locus</td>
<td>0.003</td>
<td>&lt;1</td>
<td>0.02</td>
</tr>
<tr>
<td>Job demands × Control × Support × Locus†</td>
<td>0.005</td>
<td>4.70**</td>
<td>-1.11*</td>
</tr>
<tr>
<td>Overall $R^2$</td>
<td>444</td>
<td>23.21***</td>
<td></td>
</tr>
</tbody>
</table>

$\beta$ are the unstandardized regression coefficients from the final stage of the regression analysis.† Indicates a new step in the hierarchical analysis. Results do not change when country is controlled for.

First, a clear main effect of social support appears. A high social support gives rise to a decrease in job dissatisfaction in all conditions.

However, the relationship between the other variables concerned depends on the level of social support. When social support is low, there is no interaction between demands, control and locus of control, indicating additive effects only; the regression lines in figure 1 are practically parallel. Increases in job demands, decreases in control and an external locus of control increase job dissatisfaction. Besides, there is a 'ceiling' effect; employees with low social support, external locus, and low control are those who have the highest job dissatisfaction.

On the other hand, when social support is high, the relationship between demands and control depends on the locus of control. The relationship is additive for external people. In this case, both high job demands and low control produce an increase in job dissatisfaction. For those with an internal locus of control there is an interaction between job demands and control. However, this interaction is opposite to that predicted by the JDC model. When job demands increase, increases in job control give rise to increases in job dissatisfaction, while low job control has a beneficial effect. Therefore, these results do not support hypothesis 3, which states that job control has a more beneficial effect when social support is high and when employees have an internal locus compared to the remaining conditions.

4. Discussion

The JDC model has generated numerous investigations, which have found contradictory results. Likewise, the model has been criticized for several reasons. One of the most
common criticisms is that it is too simplistic (Baker, 1985; Hobfoll, 1988; Johnson, 1989, Parkes, 1991; Pitch et al., 1994). In order to tackle this problem of excessive simplification, several authors have expanded the original model to include social support (Johnson, and Hall, 1988, Johnson et al., 1989; Landsbergis et al., 1992), or locus of control (Daniels, and Guppy, 1994; Newton, and Keenan, 1990; Parkes, 1991).

However, results from both expanded models are also equivocal. Several authors have suggested the exploration of relations and interaction between the different variables which affect the job demands-psychological strain relationship (Kasl, 1989; Parkes, 1991; Van der Doef, and Maes, 1999), such as job control, social support and locus of control. However, as far as we know, no study has simultaneously explored the interactions between these variables, although they could help to explain the equivocal results obtained.

Based on a review of the literature, three hypotheses have been formulated and empirically tested. First, low support combined with high strain conditions gives rise to an increase of job dissatisfaction compared to either low support and low strain conditions or high support and high strain. Second, the stress-buffering effect of control is exclusively observed in employees with an internal locus of control. Finally, job control has a more beneficial effect when social support is high and when the employee has an internal locus compared to the remaining conditions.
Although job–demands, job control, and social support showed the expected main effects, their interaction was not significant (hypothesis 1), which supports the results by De Jonge et al. (1996), Melamed et al. (1991) and Vahtera et al. (1996). Parkes et al. (1994) did not find a significant interaction for job satisfaction, although the JDCS model significantly predicted somatic symptoms. However, the present results are opposite to those of Andres et al. (1996), but these authors did not test the mathematical interaction. Likewise, Landsbergs et al. (1992) and Schaubroeck, and Fink (1998) found a significant effect of such interaction but some results were opposite to those predicted by the JDCS model. As De Jonge et al. (1996) suggest, the model should be expanded to a new direction. They suppose that the fact that personality characteristics are ignored in the JDCS model may confound the relationship between job conditions and job strain. In a similar vein, Parkes et al. (1994) suggest that further research, incorporating personality factors, such as locus of control, would be valuable in extending their findings.

The job demands–job control–locus of control interaction was not significant either (hypothesis 2). These results are opposite to those found by Daniels, and Guppy (1994), Parkes (1991) and Vahtera et al. (1996). However, whereas Daniels, and Guppy (1994) and Vahtera et al. (1996) found that the JDC model ‘worked’ for those with an internal locus of control, Parkes (1991) found that it ‘worked’ for those with an external locus of control. Alternatively, it is possible that the conflicting findings could be due to an important psychosocial characteristic (i.e., social support) that has been ignored. As Parkes (1994) points out, personality–stressor interactions may also be moderated by further psychosocial variables, such as social support. So, Lefcourt et al. (1984) suggest that interaction between social support and locus of control is one of the more reliable findings that may help to clarify the role that locus of control plays in determining how persons react to stress. Parkes (1991) suggests that further research is needed to clarify the extent to which social support and locus of control overlap as moderators of stress–outcome relations in general and as moderators of demand–discretion effects in particular.

These conjunctive moderator effects have been studied in the present study and the results show indeed a significant interaction between job demands, job control, social support and locus of control, but not in the same way as stated in hypothesis 3. It seems that in job environments with poor support, job demands, job control and locus of control have additive effects. So, a ‘ceiling effect’ has been found: employees with the highest job dissatisfaction are those with low social support, low job control and an external locus, that is to say, employees with low social support, low job control and who hardly believe in their ability to control their job environment.

Results are different for job environments with high social support, the relationship between job demands and control being dependent on locus of control. For external loci of control the relationship is additive. However, for internal loci of control, a significant interaction was observed between job demands and control that is opposite to that predicted by the JDC model. When job demands increase, increases in control give rise to higher job dissatisfaction, whereas low control has a beneficial effect. These results suggest a detrimental impact on job satisfaction of experiencing an excess of control in one’s job. Furthermore, since social support may provide a means of changing the environment, social support can be argued to represent, in some circumstances, an aspect of control, which may be obtained by requesting and/or receiving help from others (Daniels, and Guppy, 1994). Accordingly, the highest level of control is observed when social support and perceived control are high and when, in addition, employees believe that they have the ability to control their job environment (internal locus). If, in spite of this, demands
remain high, then this experience has a negative effect because 'too much control, relative to abilities, promotes threatening feelings of personal incompetence' (Bizerman, 1982, cf. Schaubroeck, and Fink, 1998, p. 190) and therefore it could increase job dissatisfaction. In a somewhat similar vein, De Rijk, LeBlanc, Schaufeli, and de Jonge (1998) found that a misfit between the experiences level of job control and individual coping style intensified the stress-enhancing experience of job demands.

A second issue is interesting to note and although the amount of variance explained is small (0.5%) this does not deny the theoretical relevance of the results and it does not mean that the interaction effect has little substantive significance (Frese, and Zapf, 1988; Wall, Jackson, Mullarkey, and Parker, 1996). The size of effect is attenuated by measurement error and this is greatly exacerbated when variables are multiplied together to form a cross-product term as required to test interactions in regression analysis (Aiken, and West, 1991, cf. Wall et al., 1996). In spite of it, the interaction shows significant effects. Moreover, despite that, because of sampling bias, restriction of range on the independent variables might have occurred, it is noteworthy that many expected results were obtained.

The results obtained acquire greater relevance if the longitudinal character of the study is taken into account. Few studies about this issue have used a longitudinal methodology (Dameis, and Guppy, 1994; Parkes, 1991, Parkes et al., 1994) and it is especially important because it not only allows identification of the relationship between variables but also it explains the change in the dependent variable. So, baseline job dissatisfaction levels were controlled prior to examining the extent to which the predictive model explained T3 job dissatisfaction. This strengthens the argument that the variables concerned play a causal role in relation to changes in job dissatisfaction.

In conclusion, our results support the basic tenet that the JDC model is too simplistic to adequately explain the job satisfaction of workers. The assumption of Karasek (1979) that giving job control to workers will prevent negative consequences of stress is not supported by the present results. The stress process is very complex and includes a lot of variables, some of them, such as locus of control and social support, have been analysed in the present study. This increasing complexity of the model suggests that research on stress would benefit from a new approach. However, the results from our study show that locus of control and social support play a significant role in bringing about the beneficial or detrimental effect of control at work. This result is important from a theoretical view but likewise it has practical repercussions in order to design intervention strategies to prevent and manage job stress. Interventions can be carried out at an organizational or individual level (Quick, Quick, Nelson, and Hurrell, 1997). The former consists of changing work conditions so that they are less harmful for workers. The second focus on increasing the resistance of people to work stressors. Organizational psychologists have traditionally tried to reduce the effects of stress more than the presence of stressors at work. As a consequence, the main focus of interventions has been on people instead of on job context (Kahn, and Byosiere, 1992; Peiró, and Salvador, 1993, Quack et al., 1997). However, these authors point out that it is necessary to emphasize interventions at an organizational level that foster primary prevention, thus using strategies to reduce stressors is critical. On this issue, our results point out that increasing control is not always an effective way to prevent the harmful outcomes of job stress. In fact, individual difference moderators, as locus of control, suggest that organizational interventions do not produce uniformly positive effects (see the review by Briner, and Reynolds, 1999). In sum, the moderator role of locus of control, together with the fact that social support seems to have a beneficial effect for job satisfaction, suggests that a micro approach has to be considered in addition to macro interventions. Therefore managers should be trained to be sensitive to local or individual reactions to work conditions.
On the other hand, the present study has several limitations that contribute to clarify their scope and offer suggestions for future studies.

First, this study was designed to analyse specific groups instead of being a representative sample. The use of a specific occupational group has the advantage of avoiding the confounding effects of occupational differences but it has the disadvantage that results cannot be generalized to other occupations. Therefore, replication of these results in several different occupational groups is necessary.

Second, all measurements used are self-reports, which raises questions about the common method variance. However, both main and interactive effects have been assessed and whereas the former may be due to the effects of method, the interactive relationships cannot be easily attributed to method variance. As pointed out by Wall et al. (1996), the impact of common method variance would be to inflate the main effects at a cost to the detection of interaction effects. In spite of this, it would be important to use multmethod measurements. Investigations are needed which combine self-report measurements of control and more objective measures in order to study effects of work conditions that objectively differ in terms of control (Parkes, 1989).

Third, several researchers (Brief, Burke, George, Robinson, and Webster, 1988; Payne, 1988) have recommended that negative affectivity should be controlled in job stress research because of the correlation between this and other variables. However, Spector, Zapf, Chen, and Frese (2000, p. 91) disagree that controlling for negative affectivity is a proper strategy, ‘because there is the danger of actually subtracting true variance from the stressor-strain relations’. On the other hand, some studies have shown that negative affectivity does not account for the relation between job stressors and job satisfaction (Moyle, 1995, Schaubroeck, Ganster, and Fox, 1992). Hence, we believe that it is unlikely that controlling for negative affectivity would have influenced the study results.

Fourth, it is necessary to consider the relatively low internal consistency of the measurement of locus of control used. However, despite its moderate consistency, it gives indications of relevant perceptions of control and points to the importance of taking into account such variables in studies about stress.

Nevertheless, the present study emphasized the importance of analysing several moderators simultaneously. As higher-order interactions are difficult to replicate, other studies are needed to establish the validity and generalizability of our findings. Finally, our study points to the fruitfulness of considering more complex models of job stress, whereby individual and organizational variables are studied simultaneously.

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Demands-Control-Support and locus of control

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Demand-Control-Support and locus of control