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Job design, work engagement and innovative work behavior: A multi-level study on Karasek's learning hypothesis**

As employees' behaviour is a crucial factor for organizational success, the question on how to promote the engagement of employees in their work and boost their implication in the innovation process is central for companies. In this article we study this question building on the Karasek model suggesting that employees in jobs with high autonomy and time pressure will be more engaged and more innovative. The results of the multi-level regression analyses confirm that such a combination is associated with high employee innovation. For work engagement, the job autonomy helps in buffering the negative effects of time pressure.

Key words: **job design, innovative behaviour, work engagement, autonomy, time pressure** (JEL: J24, J81, O15, O35)

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Introduction

For companies and countries to remain competitive, one of the imperatives is to innovate (Van Hootegem, 2012). The companies' workforce is an essential partner in each innovation process. They are the sources of ideas, responsible for the implementation or can render innovation attempts futile when dissatisfied. The asset of an engaged and innovative workforce is obvious from various innovation management studies (Janssen, 2000; Oldham & Cummings, 1996; Robinson & Schroeder, 2004; Teerikangas & Valikangas, 2012) and the academic interest is consequently focused on how to enable employees to innovative and to be engaged in their work (De Spiegelaere, Van Gyes, & Van Hootegem, 2014).

For both work engagement and Innovative Work Behaviour (IWB), the job design is identified as a crucial factor. In their meta-analysis, Hammond, Neff, Farr, Schwall, and Zhao, (2011) even found the job design to be most important factor for explaining employee innovativeness. In the work engagement literature, a ubiquitous amount of studies integrate job design in their models. In these last studies, the analysis frequently considers joint effects of job characteristics. This is not the case in the employee innovation literature. Although job characteristics have been under reasonable attention (e.g. Axtell, Holman, Unsworth, Wall, Waterson, & Harrington, 2000; Ohly & Fritz, 2009), the focus predominantly lay on the effects of single job characteristics on outcomes such as IWB. This is surprising as the job design literature itself largely stresses the importance of combined effects (interaction effects) of job characteristics. Already some decades ago, Karasek and Theorell (1990) developed an argument that the magic of the job design is to be found in the combination of sufficient demands and control. According to the learning hypothesis of the Karasek model, the combination of high demands and control would result in highly motivated and innovative employees. In this article, we will test this essential learning hypothesis by looking at the combined effect of job autonomy and time pressure on innovative work behaviour on the one hand and work engagement on the other.

In doing so, this paper uses multilevel regression models as an analysis technique. The bulk of the studies into IWB focus on a single, individual level and consequently use single level regression analyses. Such techniques are appropriate when all observations are independent of each other regarding the variables of interest. In the case of IWB, one can nevertheless suspect a company level effect on the prevalence of innovative activities of employees. In this case, using normal regression on multi-company data can lead to a misspecification of the estimate of the standard errors (Goldstein, 2010; Snijders & Bosker, 2011). As a consequence, multiple authors of the field have made calls for the use of multi-level research designs (Anderson, Dreu, & Nijstad, 2004; Janssen, Van de Vliert, & West, 2004; Zhou & Shalley, 2003) and others actually applied multilevel techniques in their data analysis such as Reuvers, van Engen, Vinkenburg, and Wilson-Evered (2008), De Jong and Den Hartog (2010) or Baer and Frese (2003). However, in their review of the innovation literature Anderson, Dreu, and Nijstad (2004) conclude that much work is to be done on the field of using multilevel analysis in innovation research.

This paper focuses on the effect of job design on Innovative Work Behaviour (IWB) in a test of the famous Job Demands-Control (JD-C) model of Karasek and Theorell (1990). The focus is primarily on so-called *'learning hypothesis'* of the Karasek model which assumes that the combination of high demands and control will result in engaged and innovative staff. In doing so, this paper contributes to the literature in several ways. First, it answers to frequent calls to perform more multi-level research in organizational behaviour analysis by taking into account the company effect on individual outcomes. Second, we explicitly test Karasek's learning hypothesis which has received a lot of attention in the practitioner's literature, but have been overlooked in the academic literature. Third, we study the learning hypothesis simultaneously for IWB and work engagement which enables us to see where innovative behaviour and engagement go together and where it doesn't.

Literature

The Karasek Model and the learning hypothesis.

The Job Demand-Control model developed by Karasek (1979) is a leading model for studying the effect of job characteristics on employee well-being, health and performance (Luchman & Gloria, 2013). Depending on the levels of job demands and control experienced by the employee, workers will have different outcomes in terms of job strain and active learning. Job demands are defined by Karasek and Theorell (1990) as the psychological costs necessary to carry out the task. The central component is 'workload'. Job control refers to the degree in which the worker can decide himself how to meet the job demands. Traditionally, distinction is made between two sub-dimensions referring to 'decision latitude' and 'skill discretion'.

According to the first *strain hypothesis*, employees will experience negative consequences of strain in terms of health and well-being when their job is a so-called 'high strain job'. These high-strain jobs are characterized by high levels of demands and low levels of control. Employees in these jobs are required to live up to high demands, while lacking the sufficient control mechanisms that would enable them to reach the predefined demands. As such, three sub hypotheses can be deduced from this *strain hypothesis:* two referring to the effects of job demands and job control, and a third one to the joint (additive or interaction) effect between the two variables (De Witte, Verhofstadt, & Omey, 2007). This joint effect can be interpreted both as a combined, additive effect in which the mere combination of high demands and low control is associated to the highest levels of strain. Yet, another interpretation states that the combination of high demands and low control leads to more strain then the simple sum of the two effects (an interaction effect) (de Lange, Taris, Kompier, Houtman, & Bongers, 2003; De Witte, Verhofstadt, & Omey, 2007). Previous research generally confirmed that high levels job control are related to better health, while high levels of job demands are related to worse health outcomes (Belkic, Landsbergis, Schnall, & Baker, 2004; de Jonge & Kompier, 1997). Evidence for the joint-effect is more limited. De Lange et al. (2003) showed that longitudinal studies rarely find combined effects and an article of Taris (2006) showed that most studies could not find evidence for an interaction effect.

While the strain-hypothesis enjoyed wide interest, the other main hypothesis of the Karasek model attracted less attention: *the learning hypothesis*. This hypothesis states that so-called *active jobs* which combine high demands and high control will "*predict motivation, new learning behaviors, and coping pattern development'* (Karasek, Brisson, Kawakami, Houtman, Bongers, & Amick, 1998). As in the strain hypothesis, three sub-hypotheses can be constructed on the effects of individual variables and combined effects on employee outcomes. As such, the two individual effects of job demands and job control on the employee outcomes are assumed to be positive. The third sub-hypothesis further suggests that the combination of high demands with high control will be associated with the highest levels of motivation, new learning behavior and coping.

As previously mentioned, less attention has been given to the learning hypothesis then to the strain hypothesis. A review of Taris and Kompier (2004) suggests that the existing studies generally confirmed the hypotheses on the individual effects, but rarely studied the combined (interaction) effects between the two variables. A later study of De Witte et al. (2007) did include the interaction effects and found supporting evidence for all three sub-hypotheses of the learning hypothesis.

Dependent variables

We here go beyond the existing research findings by relating the year-old learning hypothesis of Karasek to two more recently developed concepts: work engagement and innovative work behavior (IWB). In parallel with the definition of innovation by West and Farr (1990), Innovative Work Behavior can be defined as:

> "all employee behavior directed at the generation, introduction and/or application (within a role, group or organization) of ideas, processes, products or procedures, new to the relevant unit of adoption that supposedly significant benefit the relevant unit of adoption"

IWB thus includes behavior of employees that directly and indirectly stimulates the development and introduction of innovations at the workplace. IWB is distinguishable from concepts like employee creativity for two main reasons. First, creativity focuses exclusively on the 'idea generation' phase, while IWB encompasses all employee behavior related to different phases of the innovation process. Second, creativity traditionally refers to the creation of something 'absolutely new'. IWB on the contrary focuses on something new, *for the relevant unit of adoption*. Employees who take the initiative to copy successful work habits from other departments, for example, are staging important 'innovative behavior', while not at all engaging in workplace creativity (De Spiegelaere, Van Gyes, & Van Hootegem, 2014).

Work engagement is defined as '*a positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption'* (Schaufeli & Bakker, 2004). Work engagement is not a momentary mood, but a more persistent state of mind and is not directly focused on a particular object, event, individual or behavior (Bakker & Demerouti, 2008; Salanova, Agut, & Peiro, 2005). Traditionally, three dimensions are identified. *Vigor*, refers to a mental state of employees characterized by high levels of energy, resilience, willingness to invest effort and persistence in the face of problems. Next, *dedication* is characterised by an employee's enthusiasm and pride about the work, the feeling of getting inspiration and an overall sense of significance related to the work. At last, *absorption* refers to a state of mind in which the employee is highly concentrated

and engrossed by his/her work. Time flies and one has difficulties to get detached from work.

Work engagement is an important employee outcome in itself, yet also is a strong antecedent for employee behavioral outcomes. As such, research found positive relations of work engagement with work performance (Salanova, Agut, & Peiro, 2005), pro-active behavior and learning (Sonnentag, 2003) and organization oriented organizational citizenship behavior (OCBO) (Saks, 2006).

Hypotheses

Karasek and Theorell (1990) put forward the importance of *job control* as an enabling and motivating job characteristic. In their studies they mostly refer to *job discretion* or *decision latitude* in the operationalization of job control, which makes it very similar to what has been earlier identified as job autonomy (Breaugh, 1985; Hackman & Oldham, 1980). Job autonomy is *"[T]he degree to which the job provides substantial freedom, independence, and discretion to the individual in scheduling the work and in determining the procedures to be used in carrying it out*" (Hackman & Oldham, 1976). Since long, job autonomy has been linked to various positive work related outcomes such and work engagement (Halbesleben, 2010) or employee innovativeness (Hammond et al., 2011). Job autonomy gives employees (a sense of) control over how they do the work which enables them to find and develop fitting ways to perform the work tasks. As a consequence, the employees will not only do a better job, but will also be more engaged and involved in doing the job. Moreover, for employees to be able to be creative and innovative, they need the necessary space to do so. Innovative behavior is all about experimenting with different alternatives in order to find a new, better fitting approach. Autonomy over work processes is therefore crucial for employees to be able to demonstrate innovative behaviors. In line with the Karasek's theoretical framework and recent empirical insights we therefore suggest the following two first hypotheses.

Hyp 1a: Autonomy will be positively related to IWB

Hyp 1b: Autonomy will be positively related to Work Engagement

As for job demands, in the Karasek model reference is made to the idea of *work load* or *time pressure*. The role of work pressure on employee outcomes is a matter of theoretical and empirical debate. Theoretically, time pressure can have both good and negative effects on work engagement. Faced with a high workload, employees can develop different coping strategies which Begley (1998) categorized in three different types of coping: (1) adapting to the stressor, (2) changing the stressor and (3) disengage. Depending on the chosen coping strategy, time pressure can thus negatively affect work engagement (disengagement), have a negligible effect (adapting) or have a positive effect on innovative work behaviour (changing). The theoretical ambiguousness regarding the effect of time pressure on employee outcomes is reflected in the empirical studies. In a meta-analysis, Lee and Ashforth (1996) showed that a sustained exposure to a high degree of time pressure can lead to exhaustion with employees (Lee & Ashforth, 1996). At the same time, some studies find weak positive relations (Mauno, Kinnunen, & Ruokolainen, 2007) or no relations at all

(Schaufeli & Bakker, 2004). As for innovative work behaviour, time pressure might indeed serve as a trigger for employees to find better, more efficient ways of dealing with the work (Andrews & Farris, 1972; Sonnentag, 2003). But it can equally undermine the capacity of employees to experiment and think creatively (Baer & Oldham, 2006) or to engage in a sort of 'play' which can cause creative thinking (Mainemelis & Ronson, 2006).

Whether time pressure has a positive or negative effect on work engagement and IWB consequently depends on the chosen coping strategy and thus on the contextual variables influencing this coping strategy. According to the Karasek model, it is the amount of job control that will choose for a disengagement strategy (when control is low – stress hypothesis) or for a changing strategy (when control is high – learning hypothesis). In a study based on a small sample of Spanish employees, Martín, Salanova, and Maria Peiro (2007) found confirmation for such an effect with regards to individual innovation. As for work engagement, an study of Bakker, van Veldhoven, and Xanthopoulou (2010) found a negative a significant interaction effect of workload with autonomy on the degree of task enjoyment one felt.

Given that both the theoretical and empirical literature on the effect of time pressure on work engagement or IWB suggest to focus on interaction effects with work autonomy, we suggest the following two hypotheses.

Hyp 2a: The combination of high time pressure and high autonomy lead to the highest levels of IWB (interaction effect)

Hyp 2b: The combination of high time pressure and high autonomy lead to the highest levels of work engagement (interaction effect)

Methodology

Data

The hypotheses were tested using data from large samples of employees nested in companies. A total of 3098 employees from 76 companies from various industries of the Flemish region in Belgium were surveyed. The response rate was 61%. 68% of the employees were engaged as full-time workers, 51% of the respondents had a degree of maximum higher secondary education. The sample consists predominantly of executive and professional employees (44%), employees in nursing or teaching jobs (15%) and skilled workers (15%) next to smaller proportions of unskilled workers and staff. The average age was 39 years old.

Measures

The measures used are all based on the 'Nova-Weba' survey (Schouteten & Benders, 2004). The respondents could answer using 5 point Likert scales. The measure for autonomy included 8 items like *'I can arrange my own work pace' and 'I can decide for myself how I perform my work'*. Time pressure is measured using four items including questions like *'I have to hurry on my job'* and *'I have to work under time pressure'*. Innovative work behavior is measured using a 4 item adaption of the questions used by Scott and Bruce (1994), Janssen (2000) and De Jong and Den Hartog (2010). Although the scales of Janssen (2000) and De Jong and Den Hartog (2010) had more

items and were aimed at distinguishing different dimensions of IWB; this article chose to research IWB as a uni-dimensional concept as is a confirmed practice in various other studies (e.g. Aryee, Walumbwa, Zhou, & Hartnell, 2012; Reuvers, van Engen, Vinkenburg, & Wilson-Evered, 2008).

Respondents indicated how much something occurred in their job, ranging from 'very rarely' to 'very frequent'. Sample items are '*finding original solutions for work related problems'* and *'developing innovative ideas into practical applications'*. Work engagement is measured using a nine item scale developed by Salanova and Schaufeli (2008) including questions like *'If I'm working I'm feeling fit and strong'* and '*I'm proud on the work I'm doing'*. Table 1 includes the Cronbach alpha's of the different scales. All scales proved reliable with Cronbach alpha levels higher than 0.70. Using exploratory principal factor analysis (promax rotation), alternative dimensionalities were checked in the data. No such alternative dimensionalities were found. Factor scores were used to compute the scales which consequently all have a mean of zero and a standard deviation of one (Cohen, Cohen, West, & Aiken, 1983; DiStefano, Zhu, & Mindrila, 2009).

For control variables, we included gender, educational level, job status, job insecurity and creativity as a job requirement. For educational level, distinction is made between employees with a lower secondary degree (ISCED 0-2), employees with a upper secondary to first stage tertiary degree (ISCED 3-5) and employees with a higher education (ISCED 6-8). For job status we distinguished between blue-collar, white-collar and employees that are members of the management. Job insecurity was measured using three items (e.g. *I am afraid that I will be fired*) having a good internal reliability (α: 0.77). Job insecurity was included as a control variable as various studies showed that it has a significant effect on IWB and is related to job autonomy (De Spiegelaere, Van Gyes, De Witte, Niesen, & Van Hootegem, 2014; Probst, Stewart, Gruys, & Tierney, 2007). Next, creativity as a job requirement was measured using a single item (*my job requires creativity*). Creativity as a job requirement is generally conceived as a primary driver of innovative work behaviour (Shalley, Gilson, & Blum, 2000; Unsworth & Clegg, 2010).

Statistical analysis

The hypotheses were studied using multi-level analysis in the SAS software (proc mixed) using the restricted maximum likelihood (REML) estimation procedure. This type of statistical analysis gives us the opportunity to study relations at the individual level, taking into account the hierarchical character of the data and therefore provides more correct estimates and standard errors. We restrained the multi-level analysis to a so-called 'random intercept' model as our primary interest goes to the overall relation between the individual level variables and the individual level outcomes. Possible inter-firm variations in these relations fall outside the scope of this study. Several models were fitted (see table 2). A first null model included only the random intercept and no fixed effects. This model provides information on the need for a multilevel analysis and the amount of variance that can be attributed to the different levels. This null model showed that for both IWB and work engagement a significant amount of variance can be attributed to the company level (around 10% for

IWB and 6% for work engagement). This shows that the 'independence of observations' assumption of a single-level regression model does not hold in this data. At the same time, this analysis show that the bulk of the explanation for differences in work engagement and IWB are to be sought on the individual, rather than on the company level. In the second model the direct effects are included and in a third model the interaction terms are added to the analyses as a product of the two variables (see: Cohen, Cohen, West, & Aiken, 1983). Attention goes to the significance of the individual parameters, but also to the general fit of the model. For all models, the deviance is checked and compared to the previously fitted models. Descriptive statistics are shown in Table 1 and the regressions results in Table 2.

Table 1: Correlations between the variables of this study

		Cr a	1	2	3	4	5
1	Autonomy	0,85					
2	Time Pressure	0,7	0,05***				
3	IWB	0,87	0,33***	0,17***			
4	Work Engagement	0,94	0,23***	-0,01	0,41***		
5	Job insecurity	0,77	-0,16***	0,09***	-0,11***	-0,19***	
6	Creativity as a job requirement		0,24***	*0,18***	0,50***	0,40***	-0,06***

* p < 0,1, ** p <0,05, ** p <0,001

Results

Using the outcomes of the multilevel regression analysis, the hypotheses can be controlled. First of all, we see that the included control variables are almost all (except for gender) significantly related to both work engagement and IWB. Hypothesis 1a and hypothesis 1b on the effect of autonomy on IWB and work engagement are both confirmed. Job autonomy is positively related to both IWB (β 0.165, SE: 0.017) and work engagement (β (β 0.127, SE: 0.019). In the model without interaction effect, the effect of time pressure is also significant for work engagement and IWB, but has a different sign. For IWB, work pressure is positive (β 0.068, SE: 0.017) while it is negative for work engagement (β -0.060, SE: 0.019).

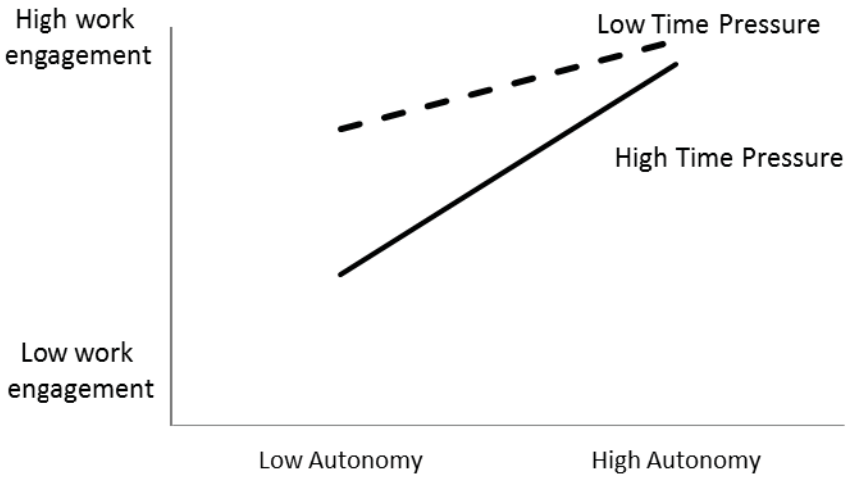
Regarding the interaction effects between job autonomy and time pressure (hypothesis 2a and 2b), the results of the analysis show that for innovative work behaviour (β 0.018, SE: 0.016) the estimate is statistically not significant while that of work engagement (β 0.051, SE: 0.017) is. In order to fully assess the relevance of an estimate, Hox (1995) also suggest to look at the change in deviance and the change in the individual level variation. For both work engagement and innovative work behaviour, the deviance is significantly lower in the models including the interaction effects and we see a small decrease in individual level variability. These indicators thus suggest that the interaction effects are significant and relevant yet, the sizes of the different indicators are rather small.

For ease of interpretation, we plot this interaction effect (Cohen, Cohen, West, & Aiken, 1983) in Figure 1. The pattern shows that the level of job autonomy has a considerable effect on the relation between time pressure and work engagement. When job autonomy is low, time pressure is negatively related to work engagement while this is not so when job autonomy is high.

Table 2: Multi-level regression results

	Innovative Work Behaviour				Work Engagement			
	Model 1		Model 2		Model 1		Model 2	
Fixed part	β	SE	β	SE	β	SE	β	SE
Control variables								
Intercept	-0,984	0,083	-0,991	0,083	-1,175	0,094	-1,191	0,094
Gender (ref: women)	0,148	0,032	0,148	0,032	-0,080	0,037	-0,080	0,037
Education								
Up to lower secondary	-0,003	0,055	-0,005	0,055	0,436	0,061	0,430	0,061
Up to higher secondary	-0,027	0,038	-0,026	0,038	0,162	0,042	0,162	0,042
Higher education	ref.	ref.	ref.	ref.	ref.	ref.	ref.	ref.
Status								
Blue-collar	-0,518	0,064	-0,510	0,064	-0,300	0,072	-0,294	0,072
White-collar	-0,328	0,052	-0,321	0,053	-0,285	0,058	-0,270	0,059
Management	ref.	ref.	ref.	ref.	ref.	ref.	ref.	ref.
Job Design								
Job insecurity	-0,046	0,016	-0,045	0,016	-0,154	0,018	-0,149	0,018
Creativity as a job requirement	0,353	0,015	0,353	0,015	0,351	0,017	0,352	0,017
Autonomy	0,165	0,017	0,165	0,017	0,127	0,019	0,125	0,019
Time Pressure	0,068	0,017	0,068	0,017	-0,060	0,019	-0,071	0,019
Autonomy*Time Pressure			0,018	0,016			0,051	0,017
Random Part								
Company level variance	0,012		0,011		0,039		0,038	
Individual level variance	0,569		0,568		0,685		0,682	
Explained variance	28,65%		0,30%		22,38%		0,41%	
2 log likelihood	6875		6818,8		7461,9		7454,9	
Δ Deviance	1284,5		56,2		981,5		7	
Log likelihood ratio test	< 0.01		< 0.01		< 0.01		<0,01	

Figure 1: Interaction effect of autonomy and time pressure on work engagement



Discussion

In this study, we focused on the learning hypothesis of the Karasek model. This learning hypothesis proposes that a combination of high demands and high control will lead to high motivation and new learning behaviors. As developed, this learning hypothesis can be interpreted as a combined, additive effect; or as an interaction effect in which the combination of time pressure and autonomy would result in an additional effect on the outcome. The results of this study on the effect of autonomy and time pressure on innovative work behaviour and work engagement confirm the learning hypothesis of the Karasek model. For IWB the learning hypothesis is confirmed as an additive effect of the positive relations between autonomy and IWB on the one hand and time pressure and IWB on the other. No significant interaction effect is found.

For work engagement, the interaction term was significant and showed that time pressure is negatively related to work engagement, when job autonomy is low.

For innovative work behaviour, the results confirm Karasek's learning hypothesis in the sense that there is active jobs are associated to the highest levels of IWB thanks to an *additive* positive effect of high autonomy and high time pressure. At the same time, the results show that employees indeed react to high work pressure by focusing on changing the work (innovative work behaviour) independently of whether they have a high or low degree of control over their work.

For work engagement, the results of the analysis clearly show that time pressure is a potential danger for the employee's work engagement. Yet, when given sufficient autonomy, the negative effect of time pressure can be effectively buffered. This finding is not completely in line with Karasek's model which suggested that the combination of time pressure and autonomy would lead to higher levels of work engagement. In terms of coping strategies, our findings suggest that when employees have low autonomy, they cope with high time pressure by disengaging. When they have high au-

tonomy on the other hand, their strategies might shift towards adapting or changing the stressor with no damage to work engagement of the employee.

Taken together these results suggest that employee react to high time pressure by trying to change the work, independently of whether they have autonomy to do so or not. Yet, when they lack sufficient autonomy, this innovative effort can go together with a low level of work engagement. When employees have sufficient autonomy such a change oriented coping strategy will presumably not affect the engagement of the employee. Innovative work behaviour is therefore not always an inequivalent sign that employees are motivated and engaged. In the creativity literature, it is nevertheless frequently assumed that all creativity or innovative efforts of employees are consequences of the motivation and engagement of the staff (Shalley & Gilson, 2004; Shalley, Zhou, & Oldham, 2004). Our results suggest that this assumption should be further scrutinized.

This article also contributes to the literature as we used a large dataset of employees nested in organizations. Through the use of multi-level regression analysis, this nested character of the data is accounted for. At the same time, the regression results give an indication of the importance of the different levels in explaining the individual level variability in IWB and work engagement. As we saw before, the company level accounted for about 10% of the total variability in IWB and for about 6% of the total variability of work engagement. Multi-level models are thus necessary for obtaining correct estimates and standard errors (and significance levels as a consequence). The large majority of the explanation of IWB is nevertheless not to be found on the company level. Future research could potentially include the team-level as an extra layer that might account for a more considerable amount of variability.

Conclusion

As innovation is central in the current discourse on how to keep the European companies competitive and affluent, the individual innovative contribution of employees has to be stimulated. The meta-analysis of Hammond et al. (2011) stressed the central role of job design in explaining employee innovativeness. Yet the literature on the relation between employee innovativeness is limited. As such the focus is mostly on individual effects and rarely takes into account the complex interaction of different job characteristics on employee outcomes.

Using data from a multi-level dataset of employees nested in organizations, this article uses the traditional Job Demands-Control model of Karasek and Theorell's (1990) and its learning hypothesis to study the relation between job design, innovative work behavior and work engagement. The results firstly show that autonomy has a positive relation with both IWB and work engagement. Time pressure is positive for IWB and for work engagement there is an interplay between autonomy and time pressure. For work engagement, high autonomy can effectively buffer the negative effect of time pressure. The results show that for IWB, Karasek's learning hypotheses is confirmed in the sense that high autonomy and high time pressure are associated with high IWB (additive effect). For work engagement, we see that autonomy can buffer the negative effect of time pressure, but that the combination of high autonomy and high time pressure is not associated with supreme levels of work engagement. These

results suggest that employees react to high time pressure with efforts to change the job (innovative work behaviour) independent of the level of autonomy, but that their work engagement might suffer from it if they do not enjoy sufficient levels of work autonomy.

Strengths and limitations

The major strength of the study is the methodology used: multi-level modeling. Notwithstanding the calls of various authors to use more multi-level methodologies in analyzing individual employee innovation (see: Anderson, Dreu & Nijstad, 2004; Janssen, Van de Vliert & West, 2004; Zhou & Christina E. Shalley, 2003), such models are still rarely used in practice. Ignoring the multi-level character of the data and thus ignoring the dependency of the data, can nevertheless lead to misspecified estimates of the standard errors (Hox, 1995).

This study however also faces some limitations. The primary limitation is the cross-sectional character of the study, which makes causal statements difficult. Reverse causality or simultaneous causation of two variables cannot be ruled out in our model. It could well be that employees who behave innovatively receive more autonomy in their workplace. The literature on job crafting even suggest that innovative employees might recreate their job so that it enables innovative work behaviour (Lyons, 2008). Next, this study measured IWB as a unitary concept while some recent literature stresses the need to distinguish between different dimensions of IWB (de Jong & Den Hartog, 2010; Kleysen & Street, 2001). Further, a single method is used to measure all concepts. Different authors suggested that this could inflate associations between concepts, yet others state that this problem has been overestimated (Spector, 2006). Moreover, some research showed that the likeliness of problematic common method bias is rather low when research finds significant (hypothesized) interaction effects (Siemsen, Roth, & Oliveira, 2010). Nevertheless the survey implemented some strategies to limit the risk of common method variance, in line with the recommendations of Podsakoff, MacKenzie, Lee, and Podsakoff (2003). As such, all points in the response scale were labeled, questions were kept short and simple and negatively worded questions were used (avoiding double negations). Further, post-hoc statistical tests such as a Harman's single factor test were conducted. Future research should nevertheless further develop the presented model and confirm the findings using multi-source data.

References

Anderson, N., Dreu, C. K. W. D., & Nijstad, B. A. (2004). The routinization of innovation research: A constructively critical eeview of the state-of-the-science. *Journal of Organizational Behavior*, *25*(2), 147-173.

Andrews, F. M., & Farris, G. F. (1972). Time pressure and performance of scientists and engineers: A five-year panel study. *Organizational Behavior and Human Performance*, *8*(2), 185-200.

Aryee, S., Walumbwa, F. O., Zhou, Q., & Hartnell, C. A. (2012). Transformational leadership, innovative behavior, and task performance: Test of mediation and moderation processes. *Human Performance*, *25*(1), 1-25. http://doi.org/10.1080/08959285.2011.631648.

Axtell, C. M., Holman, D. J., Unsworth, K. L., Wall, T. D., Waterson, P. E., & Harrington, E. (2000). Shopfloor innovation: Facilitating the suggestion and implementation of ideas. *Journal of Occupational and Organizational Psychology*, *73*, 265-285.

Baer, M., & Frese, M. (2003). Innovation is not enough: climates for initiative and psychological safety, process innovations, and firm performance. *Journal of Organizational Behavior*, *24*(1), 45-68. http://doi.org/10.1002/job.179.

Baer, M., & Oldham, G. R. (2006). The curvilinear relation between experienced creative time pressure and creativity: Moderating effects of openness to experience and support for creativity. *Journal of Applied Psychology*, *91*(4), 963-970.

Bakker, A. B., & Demerouti, E. (2008). Towards a model of work engagement. *Career Development International*, *13*(3), 209-223. http://doi.org/10.1108/13620430810870476.

Bakker, A. B., van Veldhoven, M., & Xanthopoulou, D. (2010). Beyond the demand-control model. *Journal of Personnel Psychology*, *9*(1), 3-16. http://doi.org/10.1027/1866-5888/a000006.

Begley, T. M. (1998). Coping strategies as predictors of employee distress and turnover after an organizational consolidation: A longitudinal analysis. *Journal of Occupational and Organizational Psychology*, *71*(4), 305-329. http://doi.org/10.1111/j.2044-8325.1998.tb00679.x.

Belkic, K. L., Landsbergis, P. A., Schnall, P. L., & Baker, D. (2004). Is job strain a major source of cardiovascular disease risk? *Scandinavian Journal of Work, Environment & Health*, *30*(2), 85-128. http://doi.org/10.2307/40967343

Breaugh, J. A. (1985). The measurement of work autonomy. *Human Relations*, *38*(6), 551-570. http://doi.org/10.1177/001872678503800604.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences*. New Jersey: Lawrence Erlbaum Associates.

De Jonge, J., & Kompier, M. A. J. (1997). A critical examination of the demand-control-support model from a work psychological perspective. *International Journal of Stress Management*, *4*(4), 235-258. http://doi.org/10.1023/B:IJSM.0000008152.85798.90.

De Jong, J., & Den Hartog, D. (2010). Measuring innovative work behaviour. *Creativity and Innovation Management*, *19*(1), 23-36.

De Lange, A. H., Taris, T. W., Kompier, M. A. J., Houtman, I. L. D., & Bongers, P. M. (2003). "The very best of the millennium": Longitudinal research and the demand-control-(support) model. *Journal of Occupational Health Psychology*, *8*(4), 282-305. http://doi.org/10.1037/1076-8998.8.4.282.

De Spiegelaere, S., Van Gyes, G., De Witte, H., Niesen, W., & Van Hootegem, G. (2014). On the relation of job insecurity, job autonomy, innovative work behaviour and the mediating effect of work engagement. *Creativity and Innovation Management*, *23*(4), 318-330.

De Spiegelaere, S., Van Gyes, G., & Van Hootegem, G. (2014). Innovatief Werkgedrag als concept: definiëring en oriëntering. *Gedrag & Organisatie*.

De Witte, H., Verhofstadt, E., & Omey, E. (2007). Testing Karasek's learning and strain hypotheses on young workers in their first job. *Work & Stress*, *21*(2), 131-141. http://doi.org/10.1080/02678370701405866.

DiStefano, C., Zhu, M., & Mindrila, D. (2009). Understanding and using factor scores: Considerations for the applied researcher. *Practical Assessment, Research & Evaluation*, *14*(20), 1-11.

Goldstein, H. (2010). *Multilevel statistical models* (4th ed.). Wiley.

Hackman, J. R., & Oldham, G. R. (1976). Motivation through the design of work: test of a theory. *Organizational Behavior and Human Performance*, *16*(2), 250-279. http://doi.org/10.1016/0030-5073(76)90016-7.

Hackman, J. R., & Oldham, G. R. (1980). *Work redesign*. Addison-Wesley.

Halbesleben, J. R. B. (2010). A meta-analysis of work engagement: Relationships with burnout, demands, resources, and consequences. In A. B. Bakker & M. P. Leiter, *Work engagement: A handbook of essential theory and research* (pp. 102-117). New York, NY, US: Psychology Press.

Hammond, M. M., Neff, N. L., Farr, J. L., Schwall, A. R., & Zhao, X. (2011). Predictors of individual-level innovation at work: A meta-analysis. *Psychology of Aesthetics, Creativity, and the Arts*, *5*(1), 90-105. http://doi.org/10.1037/a0018556.

Hox, J. J. (1995). *Applied multilevel analysis*. Amsterdam: TT-Publicaties.

Janssen, O. (2000). Job demands, perceptions of effort-reward fairness and innovative work behaviour. *Journal of Occupational and Organizational Psychology*, *73*(3), 287-302.

Janssen, O., Van de Vliert, E., & West, M. (2004). The bright and dark sides of individual and group innovation: a Special Issue introduction. *Journal of Organizational Behavior*, *25*(2), 129-145.

Karasek, R. (1979). Job demands, job decision latitude, and mental strain: Implications for job redesign. *Administrative Science Quarterly*, *24*(2), 285-308. http://doi.org/10.2307/2392498.

Karasek, R., Brisson, C., Kawakami, N., Houtman, I., Bongers, P., & Amick, B. (1998). The Job Content Questionnaire (JCQ): An instrument for internationally comparative assessments of psychosocial job characteristics. *Journal of Occupational Health Psychology*, *3*, 322-355.

Karasek, R., & Theorell, T. (1990). *Healthy work. Stress, productivity, and the reconstruction of working life*. New York: Basic Books.

Kleysen, R. F., & Street, C. T. (2001). Toward a multi-dimensional measure of individual innovative behavior. *Journal of Intellectual Capital*, *2*(3), 284-296. http://doi.org/10.1108/EUM0000000005660.

Lee, R. T., & Ashforth, B. E. (1996). A meta-analytic examination of the correlates of the three dimensions of job burnout. *Journal of Applied Psychology*, *81*(2), 123-133. http://doi.org/10.1037/0021-9010.81.2.123.

Luchman, J. N., & Gloria, M. (2013). Demands, control, and support: A meta-analytic review of work characteristics interrelationships. *Journal of Occupational Health Psychology*, *18*(1), 37-52. http://doi.org/10.1037/a0030541.

Lyons, P. (2008). The Crafting of Jobs and Individual Differences. *Journal of Business and Psychology*, (23), 25-36.

Mainemelis, C., & Ronson, S. (2006). Ideas are born in fields of play: Towards a theory of play and creativity in organizational settings. *Research in Organizational Behavior*, *27*, 81-131. http://doi.org/10.1016/S0191-3085(06)27003-5.

Martín, P., Salanova, M., & Maria Peiro, J. (2007). Job demands, job resources and individual innovation at work: Going beyond Karasek' s model? *Psicothema*, *19*(4), 621-626.

Mauno, S., Kinnunen, U., & Ruokolainen, M. (2007). Job demands and resources as antecedents of work engagement: A longitudinal study. *Journal of Vocational Behavior*, *70*(1), 149-171. http://doi.org/10.1016/j.jvb.2006.09.002.

Ohly, S., & Fritz, C. (2009). Work characteristics, challenge appraisal, creativity, and proactive behavior: A multi-level study. *Journal of Organizational Behavior*, *31*(4), 543-565. http://doi.org/10.1002/job.633.

Oldham, G. R., & Cummings, A. (1996). Employee creativity: Personal and contextual factors at work. *Academy of Management Journal*, *39*(3), 607-634.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879-903.

Probst, T. M., Stewart, S. M., Gruys, M. L., & Tierney, B. W. (2007). Productivity, counterproductivity and creativity: The ups and downs of job insecurity. *Journal of Occupational and Organizational Psychology*, *80*(3), 479-497.

Reuvers, M., van Engen, M. L., Vinkenburg, C. J., & Wilson-Evered, E. (2008). Transformational leadership and innovative work behaviour: Exploring the relevance of gender differences. *Creativity and Innovation Management*, *17*(3), 227-244. http://doi.org/10.1111/j.1467-8691.2008.00487.x.

Robinson, A. G., & Schroeder, D. M. (2004). *Ideas are free*. San Francisco: Berrett-Koehler Publishers.

Saks, A. M. (2006). Antecedents and consequences of employee engagement. *Journal of Managerial Psychology*, *21*(7), 600-619. http://doi.org/10.1108/02683940610690169.

Salanova, M., Agut, S., & Peiro, J. M. (2005). Linking organizational resources and work engagement to employee performance and customer loyalty: The mediation of service climate. *Journal of Applied Psychology*, *90*(6), 1217-1227.

Salanova, M., & Schaufeli, W. B. (2008). A cross-national study of work engagement as a mediator between job resources and proactive behaviour. *The International Journal of Human Resource Management*, *19*(1), 116. http://doi.org/10.1080/09585190701763982.

Schaufeli, W. B., & Bakker, A. B. (2004). Job demands, job resources, and their relationship with burnout and engagement: a multi-sample study. *Journal of Organizational Behavior*, *25*(3), 293-315. http://doi.org/10.1002/job.248.

Schouteten, R., & Benders, J. (2004). Lean production assessed by Karasek's job demand-job control model. *Economic and Industrial Democracy*, *25*(3), 347 -373. http://doi.org/10.1177/0143831X04044831

Scott, S. G., & Bruce, R. A. (1994). Determinants of innovative behavior: A path model of individual innovation in the workplace. *Academy of Management Journal*, *37*(3), 580-607.

Shalley, C. E., & Gilson, L. L. (2004). What leaders need to know: A revieuw of social and contextual factors that can foster or hinder creativity. *The Leadership Quarterly*, *15*, 33-53.

Shalley, C. E., Gilson, L. L., & Blum, T. C. (2000). Matching creativity requirements and the work environment: Effects on satisfaction and intentions to leave. *Academy of Management Journal*, *43*(2), 215-223.

Shalley, C. E., Zhou, J., & Oldham, G. R. (2004). The effects of personal and contextual characteristics on creativity: Where should we go from here? *Journal of Management*, *30*(6), 933-958.

Siemsen, E., Roth, A., & Oliveira, P. (2010). Common method bias in regression models with linear, quadratic, and interaction effects. *Organizational Research Methods*, *13*(3), 456-476. http://doi.org/10.1177/1094428109351241.

Snijders, T. A. B., & Bosker, R. (2011). *Multilevel analysis: An introduction to basic and advanced multilevel modeling* (2nd ed.). SAGE Publications Ltd.

Sonnentag, S. (2003). Recovery, work engagement, and proactive behavior: A new look at the interface between nonwork and work. *Journal of Applied Psychology*, *88*(3), 518-528.

Spector, P. E. (2006). Method variance in organizational research. *Organizational Research Methods*, *9*(2), 221-232. http://doi.org/10.1177/1094428105284955.

Taris, T. W. (2006). Bricks without clay: On urban myths in occupational health psychology. *Work & Stress*, *20*(2), 99-104. http://doi.org/10.1080/02678370600893410.

Taris, T. W., & Kompier, M. A. J. (2004). Job characteristics and learning behavior: Review and psychological mechanisms. *Research in Occupational Stress and Well-Being*, *4*, 127-166. http://doi.org/10.1016/S1479-3555(04)04004-1.

Teerikangas, S., & Valikangas, L. (2012). Engaged employees! An actor perspective of innovation. In T. S. Pitsis, A. Simpson, & E. Dehlin (Eds.), *Handbook of organizational and managerial innovation* (pp. 54-97). Cheltenham, UK: Edward Elgar Publishing Limited.

Unsworth, K., & Clegg, C. W. (2010). Why do employees undertake creative action? *Journal of Occupational and Organizational Psychology*, *83*, 77-99.

Van Hootegem, G. (2012). *Workplace innovation strategies in Europe – Challenges and opportunities for competitiveness (Vol. 2)*. Presented at the International Wellbeing at Work Conference, Manchester.

West, M. A., & Farr, J. L. (1990). *Innovation and creativity at work*. Oxford: John Wiley.

Zhou, J., & Shalley, C. E. (2003). Research on employee creativity: A critical review and directions for future research. *Research in Personnel and Human Resources Management*, *22*, 165-217. http://doi.org/10.1016/S0742-7301(03)22004-1.