

Work characteristics, challenge appraisal, creativity, and proactive behavior: A multi-level study

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Summary

Work characteristics such as time pressure and job control can be experienced as a challenge that is positively associated with performance-related behaviors. Using experience-sampling data from 149 employees, we examined the relationships between these work characteristics and creativity and proactive behavior on a daily level. Results from multilevel analyses indicate that time pressure and job control are perceived as challenging, and that challenge appraisal in turn is related to daily creativity and proactive behavior. Furthermore, cross-level mediation analyses revealed that daily work characteristics act as the mechanism underlying the relationships between chronic work characteristics and challenge appraisal. This study supports the view of time pressure as a challenge-related stressor that leads to favorable outcomes. Copyright © 2009 John Wiley & Sons, Ltd.

Introduction

High levels of work demands are prevalent in many occupations in Europe as well as in the U.S. (Dhondt, Kraan, & van Sloten, 2002; Robinson & Godbey, 1996), and are associated with impairments in health and well-being. However, recent research also points to possible positive effects of demands on performance (LePine, Podsakoff, & LePine, 2005) and job-related attitudes (Podsakoff, LePine, & LePine, 2007) suggesting a more positive role of certain demands in employees' experiences at work. However, recent meta-analyses on the relationships between stressors and job performance (Gilboa, Shirom, Fried, & Cooper, 2008; LePine et al., 2005) revealed contradictory results concerning the role of high demands. Le Pine and colleagues classified high quantitative demands as a challenge-related stressor, and challenge-related stressors were positively related to performance. In contrast, Gilboa and colleagues found no relationship between demands (role overload) and three out of four indicators of job performance. Therefore, it remains unclear if high demands are experienced as challenging and in fact lead to high levels of performance. In addition, the processes by which chronic work characteristics translate into momentary experiences and affect day-to-day performance, are not yet fully understood. For example, research linking challenging work characteristics to performance-related behaviors has

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not yet examined the actual challenge appraisal as the mediating process (LePine, LePine, & Jackson, 2004). Furthermore, this literature has been disconnected from research on work design which has examined the effects of work characteristics on various motivational states, including intrinsic motivation (Hackman & Oldham, 1976), self-efficacy, and felt responsibility (Parker, Turner, & Williams, 2006). Therefore, the aim of this study is to examine challenge appraisal as an additional mechanism to explain relationships between work characteristics and performance-related behaviors (proactive behavior and creativity, see below).

According to Lazarus and Folkman (1984), a situation is perceived as a challenge when it is taxing, but at the same time offers potential for personal gain, such as mastery, learning, or personal growth. Challenge appraisal indicates that with effort, the demands of a situation can be mastered (Skinner & Brewer, 2002). Challenge appraisal refers to the momentary judgment of a situation and therefore can be seen as a state-like variable (i.e., as opposed to a trait-like variable; Luthans & Youssef, 2007). Hence, challenge appraisal needs to be assessed as a state (e.g., on the day-level) rather than as a trait.

An influential model of work stress and work design has looked at the levels of job control and job demands to explain employees' active job behavior (e.g., proactive behavior; Karasek, 1979). The attractive idea behind this model is that this behavior benefits from work situations in which job control and job demands are both high, and that employees do not necessarily suffer from high job demands. Time pressure as one job demand is the extent to which employees feel they have insufficient time to finish their work tasks, or the need to work at a pace faster than usual (Baer & Oldham, 2006; Kinicki & Vecchio, 1994). Job control, also called job autonomy, refers to individual freedom of how to carry out given tasks (Jackson, Wall, Martin, & Davids, 1993) and is often considered a job resource. Although positive consequences of time pressure and job control have been demonstrated in meta-analyses (for time pressure, see LePine et al., 2005; Podsakoff et al., 2007; for job control, see Fried & Ferris, 1987; Spector, 1986), empirical research showing that these work characteristics are indeed perceived as challenging is lacking. An exception is a study by Boswell, Olson-Buchanan, and LePine (2004) which shows that perceived challenge mediates the relationship between work characteristics and favorable work attitudes as well as retention. However, they did not assess challenge appraisal as a momentary experience, and thus it remains unclear if employees will experience their job as challenging on a daily basis. Furthermore, because their study did not examine performance-related behaviors, the relationship between challenge appraisal and performance outcomes has not yet been tested.

Job performance is a multi-dimensional construct (Campbell, 1990). In addition to core task performance, a number of behaviors are seen as relevant for organizational effectiveness. Two aspects of performance-related behaviors that are increasingly important in today's work organization are proactive behavior and creativity (Griffin, Neal, & Parker, 2007; Pulakos, Arad, Donovan, & Plamondon, 2000). Proactive behavior is described as self-starting and change- or future-oriented (Crant, 2000; Frese & Fay, 2001; Unsworth & Parker, 2003) and can include actively attacking problems, suggesting improvements, or taking charge of a long-term issue. Creativity is the production of novel and useful ideas (Amabile, 1988) and can either be part of an individuals' job requirement or go beyond them (Unsworth, 2001). As an example of creativity, imagine an engineer coming up with several valid novel solutions for designing the work flow, as a part of his job requirement. A less creative engineer would come up with only one novel solution, or the solutions would be of little quality. Furthermore, this person is proactive when noticing a misspecification in the assignment, and takes the necessary action to correct the misspecification, in order to prevent future problems from occurring based on this misspecification. The person would be less proactive when he or she waits to the next weekly meeting to tell others about the problem.

Recently, researchers have argued that daily variations in performance levels are "substantial and meaningful" (Beal, Weiss, Barros, & MacDermid, 2005, p. 1055), and have studied predictors of

performance-related behaviors on a daily level (Amabile, Barsade, Mueller, & Staw, 2005; Sonnentag, 2003). At least three reasons speak to the importance of examining day-level creativity and proactive behavior (Fritz & Sonnentag, 2009): First, it helps understand which situations initiate these daily behaviors. Second, when studying day-level behavior researchers are able to see if the factors that facilitate or impair such behavior are the same or different from those that facilitate or impair the behavior in the long term. Third, assessing these factors on a daily level allows for measurements that are closer to the actual experience and behavior and are less biased by retrospective recall. For example, one might only be able to assess the momentary feeling of challenge on a daily basis. Accordingly, we will examine the relationships between work characteristics, and the experience of challenge, daily creativity, and daily proactive behavior to test if employees show more proactive behavior and creativity on days when they feel challenged and have high levels of job control and time pressure. To explain how chronic work characteristics can translate into momentary positive experiences, such as positive mood (Fisher, 2002; Saavedra & Kwun, 2000), Affective Events Theory was developed (AET; Weiss & Cropanzano, 1996). AET suggests that the work environment exerts its influence on momentary experiences through specific work events, such as attaining one’s goals or receiving a reward. Certain work characteristics make these events more likely (Fisher, 2002). For example, when individuals are working under time pressure, they might be more likely to attain work-related goals (LePine et al., 2005). AET further assumes that chronic work characteristics may not be linked directly to positive experiences at work. One may argue that studies showing such relationships have committed a logical error comparable to what can be called an “ecological fallacy” (Robinson, 1950) by drawing inferences about momentary processes based on aggregated level data. Because work characteristics are not completely stable (Butler, Grzywacz, Bass, & Linney, 2005) we assess both chronic and day-level work characteristics to examine the extent to which both measurements are associated with challenge appraisal. Figure 1 shows the conceptual framework of this study. In the following, we will discuss the relationships depicted in this framework in more detail. First we will discuss how work

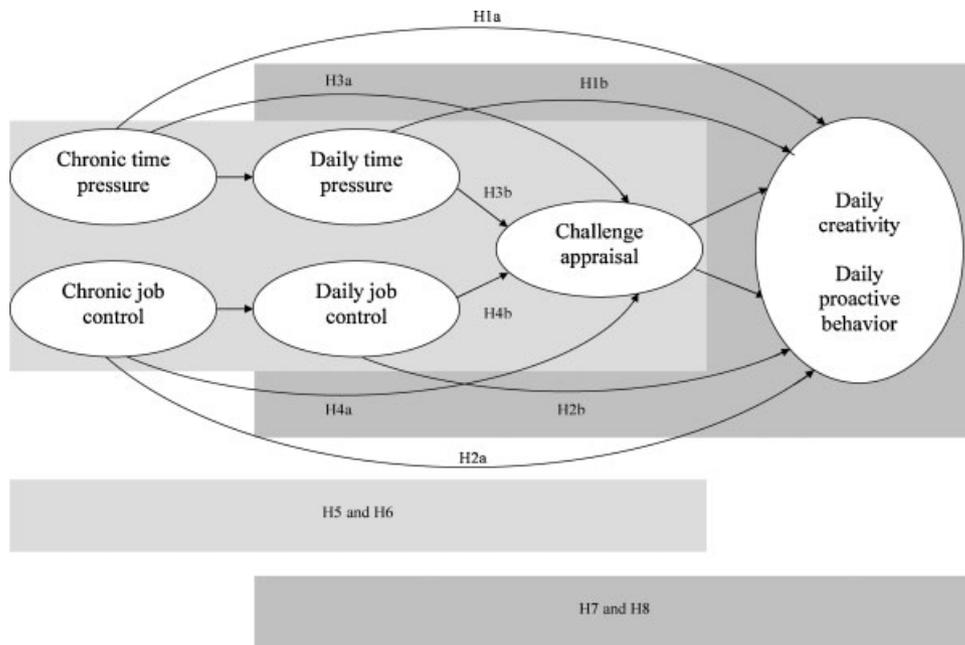


Figure 1. Theoretical framework of the present study

characteristics are related to daily creativity and daily proactive behavior. Second, relationships between work characteristics and challenge appraisal will be discussed. Here, we also argue for the mediating role of daily work characteristics in the relation between chronic work characteristics and challenge appraisal. Finally, we will argue for the mediating role of challenge appraisal in the relations between work characteristics with daily creativity and daily proactive behavior.

Work characteristics, creativity, and proactive behavior

Models of creativity have stressed the importance of work context among the factors affecting creativity (Amabile, 1988; Woodman, Sawyer, & Griffin, 1993). A recent meta-analysis indicates the relevance of work characteristics for predicting creativity at work (Harrison, Neff, Schwall, & Zhao, 2006) and they have also been linked to proactive behavior (Fay & Sonnentag, 2002; Frese, Kring, Soose, & Zempel, 1996; Parker et al., 2006). As noted above, we will examine both chronic work characteristics and daily work characteristics. Chronic work characteristics are assumed to be trait-like characteristics of a job, and are the focus of a large body of research (e.g., Fried & Ferris, 1987). Daily work characteristics, on the other hand, are more state-like by describing a given job on a given day, and have been the focus of more recent research. (e.g., Butler et al., 2005). In the following, we will first present evidence and arguments for the relationship between time pressure and creativity and proactive behavior, and will then refer to the relationships between job control and each of these outcomes.

Jex (1998), after reviewing the available empirical evidence and finding negative, positive, and no relationships between time pressure (work load) and job performance, concluded that the nature of this relationship may depend on the nature of the task and the type of performance outcome examined. With regard to creativity as performance-related behavior, research on the role of time pressure has produced inconsistent results. Baer and Oldham (2006) summarized field studies on the relationship between time pressure and creativity and concluded that results are generally weak and inconclusive. Two contradictory views on the relation between time pressure and creativity exist. On the one hand, it has been argued that time is needed to work on a task and to have creative insights (Runco, 1999). This notion suggests creativity would suffer under high time pressure because individuals do not have enough time to work on different options and solutions and to wait for creative insights. Amabile and colleagues (Amabile, Conti, Coon, Lazenby, & Herron, 1996) reviewed laboratory research on time pressure and creativity and concluded that time for exploration is needed for individuals to be creative.

On the other hand, activation theory (Gardner, 1986; Scott, 1966) suggests that an increase in time pressure results in higher levels of activation and individuals are optimally stimulated to show favorable responses such as creativity. Furthermore, it has been argued that creative insights are unnecessary for everyday creativity (Runco, 1999). This argument would suggest that in jobs that constantly require creativity, long periods of time for incubation might be unnecessary, and that activation through time pressure might prevail. Thus, the relationship between time pressure and creativity would be positive.

Recent meta-analytic evidence suggests a wide variability in the relationship between time pressure and creativity, supporting the idea that under certain conditions there might be a positive relationship (Harrison et al., 2006). It has been suggested that the burden imposed by time pressure can be counteracted by increased effort and concentration on core tasks (Hockey, 1993). In occupations where creativity is required as part of the job (e.g., scientists, engineers), the concentration on core tasks thus increases creativity. In fact, the relationship has been found to be linearly positive for scientists, even with a time lag of 1 year (Andrews & Farris, 1972). Thus, we suggest that high creative requirement in a job (as in our sample) is a condition where a positive relationship between time pressure and creativity can be expected.

Next, time pressure has consistently been found to be positively related to proactive behavior in a wide range of occupations (Binnewies, Sonnentag, & Mojza, 2009; Fay & Sonnentag, 2002; Sonnentag, 2003). One explanation for this positive relationship could be that being proactive is a way of coping with high job demands (Fay & Sonnentag, 2002). Time pressure indicates suboptimal work situations that call for change. As a consequence, time pressure triggers proactive behaviors that counteract these suboptimal work situations. Consistent with the explanation provided with regard to creativity, time pressure might alternatively lead to activation, and this activation may in turn lead to favorable responses such as proactive behavior. Thus, we expect a positive relationship between time pressure and proactive behavior (Ohly, Sonnentag & Pluntke, 2006). Although previous research has focused on chronic work characteristics, it is conceivable that the mechanisms described above will equally apply to daily work characteristics. We thus expect chronic, as well as daily, time pressure to be positively related to daily performance-related behaviors.

H1a: Chronic time pressure will be positively related to mean levels of daily creativity and daily proactive behavior.

H1b: Daily time pressure will be positively related to daily creativity and daily proactive behavior.

We now turn to the relationship between job control and proactive behavior. Previous research indicates positive relationships between job control and performance in general (Fried & Ferris, 1987; Spector, 1986), as well as different forms of proactive behaviors (Axtell, Holman, Unsworth, Wall, & Waterson, 2000; Frese et al., 1996; Ohly et al., 2006; Parker et al., 2006). There are a number of explanations for why job control is related to proactive behavior. First, job control might enhance self-efficacy and felt responsibility, which, in turn, may increase proactive behavior (Parker et al., 2006). Second, being able to exert control at work is intrinsically satisfying (Ryan & Deci, 2000), which makes additional engagement at work more likely (Hackman & Oldham, 1976). As Sonnentag (2003) argued: “When dedicated to their work and enthusiastic about it, individuals will more likely engage in proactive actions to keep the work situation a positive one and to further improve it.” (p. 520) Third, job control is necessary to translate feelings of activation into behavior. Only if an individual has control over working methods can he or she react to feelings of activation by showing initiative. Fourth, job control can be experienced as challenging (see below).

Similar mechanisms may be underlying the relationship between job control and creativity. In addition, job control enables employees to experiment in the workplace and thereby allows employees to generate and enhance creative ideas at work (Ohly et al., 2006). Furthermore, a high level of job control may make employees feel more responsible for developing creative ideas in order to solve problems. Accordingly, Amabile and colleagues (Amabile et al., 1996, p. 1161) assume that “Creativity is fostered when individuals [. . .] have relatively high autonomy in the day-to-day conduct of the work and a sense of ownership and control over their own work”. Indeed, job control has been found to be positively related to creativity in recent meta-analyses (Eder & Sawyer, 2007; Harrison et al., 2006). Again, although previous research has focused on chronic work characteristics, the same mechanisms should apply for daily work characteristics. We thus expect chronic as well as daily job control to be positively related to daily performance-related behaviors.

H2a: Chronic job control will be positively related to mean levels of daily creativity and daily proactive behavior.

H2b: Daily job control will be positively related to daily creativity and daily proactive behavior.

Work characteristics and challenge appraisal

In the following, we will describe the assumed relationships between time pressure, job control, and challenge appraisal. Lazarus and Folkman (1984) argued that a situation not only perceived as challenging when it is taxing but also provides the opportunity for personal gain. Challenge is a precondition for the experience of flow (Csikszentmihalyi & LeFevre, 1989), and is linked to positive affect (Skinner & Brewer, 2002) as well as intrinsic motivation (Elliot & Harackiewicz, 1996). Thus, challenge is related to but still distinct from intrinsic motivation. Whereas challenge appraisal results from a judgment of how much is at stake, intrinsic motivation is defined as “the motivation to engage in work primarily for its own sake because work itself is interesting, engaging or in some way satisfying” (Amabile, Hill, Hennessey, & Tighe, 1994, p. 950) without a reference to something being at stake. Thus, any task, easy or difficult, when appealing to an individual, can elicit intrinsic motivation, but may not necessarily be associated with the experience of challenge. Furthermore, challenge is only one of two preconditions of flow (Csikszentmihalyi & LeFevre, 1989).

Traditionally, demands such as time pressures are seen as detrimental to individuals' well-being and performance. However, based on Lazarus and Folkman's (1984) theorizing, LePine and colleagues argued that individuals under time pressure will increase their effort because the demand is appraised as a challenge which has the potential for personal growth, and which is linked to positive emotions as well as to an active problem-solving style. Due to these experiences, individuals are thought to be highly motivated and show high levels of performance (LePine et al., 2005). Accordingly, time pressure is classified as a challenge-related stressor, which is positively related to performance. In addition, empirical evidence suggests that challenge-related stressors in general and time pressure in particular can result in positive work experiences such as enjoyment (Freedman & Edwards, 1988), and challenge appraisal (Boswell et al., 2004).

Work in general is taxing on personal resources (Meijman & Mulder, 1998), but individuals with high job control are better able to cope with work-related demands (Parker & Sprigg, 1999; Van Yperen & Hagedoorn, 2003). Also, job control prevents employees' disengagement from work (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001). According to Lazarus, a person judges a situation based on how much is at stake and how controllable the situation is. Seeing a high-stake situation as controllable leads to challenge appraisal (Folkman & Lazarus, 1985; Lazarus & Folkman, 1984). In contrast, lack of job control is expected to lead to the appraisal of a situation as a threat rather than a challenge (Lazarus & Folkman, 1984). Thus, in a controllable situation, individuals focus on the potential gain, whereas in uncontrollable situation, individuals focus on potential losses (Lazarus & Folkman, 1984). Therefore, it is conceivable that under high job control, work is more likely to be appraised as challenging. In the only study we are aware of that reports an empirical test of this relationship, job control was positively related to challenge ($r = .30$; Boswell et al., 2004). Thus, we hypothesize that time pressure as well as job control are positively associated with challenge appraisal. Again, we assume that this will be the case for chronic as well as day-level time pressure and control.

H3a: Chronic time pressure will be positively related to mean levels of challenge appraisal.

H3b: Daily time pressure will be positively related to challenge appraisal.

H4a: Chronic job control will be positively related to mean levels of challenge appraisal.

H4b: Daily job control will be positively related to challenge appraisal.

We now turn to the mediating role of daily work characteristics in the relations between chronic work characteristics and challenge appraisal. Previous research has linked chronic work characteristics such

as autonomy and task significance to pleasant states experienced over the past week (Saavedra & Kwun, 2000). Analyses of this kind rest on the assumption that work characteristics are experienced similarly on a day-to-day basis. However, it has been shown that the levels of time pressure (Teuchmann, Totterdell, & Parker, 1999), as well as job control (Butler et al., 2005) may vary from day to day, and it has been argued that chronic work characteristics do not reveal what is actually happening in work situations (Elfering, Grebner, Semmer, Kaiser-Freiburghaus, Lauper-Del Ponte, & Witschi, 2005). Daniels (2006) introduced the term “enacted” work characteristics to refer to the features of a job on a daily basis, and to explain how chronic work characteristics produce outcomes. For example, for jobs high in chronic time pressure, the time pressure is enacted on a daily basis by a manager setting tight deadlines. A job that is high in chronic job control will be experienced as such on a daily basis by events in which the individual has control over working methods. Thus, chronic and daily work characteristics are closely related. In addition, daily work characteristics are the focus of appraisal (Daniels, 2006). That is, an individual will feel challenged on a given day based on the level of the daily work characteristics. Together, these arguments suggest that daily work characteristics mediate the relationship between chronic work characteristics and challenge appraisal.

H5: The relationship between chronic time pressure and challenge appraisal will be mediated by daily time pressure.

H6: The relationship between chronic job control and challenge appraisal will be mediated by daily job control.

Work characteristics, challenge appraisal, and creativity and proactive behavior

We will now argue for the mediating role of challenge appraisal in the relationships between work characteristics and creativity and proactive behavior. It has been argued that challenge appraisal facilitates performance through the direction, level and persistence of effort toward work goals. The appraisal of a situation as challenging should lead to the belief that if certain demands are met by exercising effort, valued outcomes will occur (LePine et al., 2005). More specifically, it has been argued that the sense of having challenging work stimulates creativity (Amabile et al., 1996), and that individuals under a promotion focus see their tasks as a challenge which in turn is linked to a cognitive style that enhances creative thought (Higgins, 1997). However, only a few studies support the role of challenge appraisal in the relationship between work characteristics and performance, and most failed to assess challenge as a momentary experience. So far research indicates that projects rated as highly creative scored higher on challenge (Amabile et al., 1996), and challenge—subsumed under stimulants for creativity—was related to creativity in a high-technology firm (Amabile & Conti, 1999). With regard to the momentary experience, individuals who appraised a task as challenging exhibited more effort and displayed higher performance (Tomaka, Blascovich, Kelsey, & Leitten, 1993, Study 2). Furthermore, individuals with a promotion focus showed better creative performance (Friedman & Forster, 2001). Because challenge appraisal is related to positive affect (Lazarus & Folkman, 1984; Skinner & Brewer, 2002), some indirect evidence for the performance-enhancing effect of challenge appraisal stems from research linking positive affect to performance-related behaviors such as creativity (Amabile et al., 2005) and proactive behavior (Fritz & Sonnentag, 2009) assessing both affect and behavior on a momentary basis. Thus, we assume that challenge appraisal acts as a mediator in the relationship between work characteristics and creativity and proactive behavior.

H7: The relationship between daily time pressure and creativity and proactive behavior will be mediated by challenge appraisal.

H8: The relationship between daily job control and creativity and proactive behavior will be mediated by challenge appraisal.

Method

We used interval contingent experience-sampling (cf. Ilies, Scott, & Judge, 2006; also called ecological momentary assessment; Beal, Weiss, Barros, & MacDermid, 2005) to test the hypotheses presented above. Study participants provided ratings of their daily work characteristics, challenge appraisal, and daily creativity as well as daily proactive behavior over the course of several days. Daily creativity was rated twice daily, once in the morning and once in the afternoon because we assumed that having ideas is a short and transient cognitive process and therefore may be harder to report retrospectively. In contrast, we assumed that proactive behavior takes up more time and is more overt behavior which is easier to remember. Thus, to reduce burden on our participants, proactive behavior was assessed once retrospectively for the whole day in the afternoon. In addition, they rated the levels of chronic work characteristics (see details below).

Procedure

All employees of a department of production planning in an automotive manufacturer received an email asking for participation in a study on “Optimization in production planning.” After employees declared their interest to participate in the study, they received email reminders on several days and were asked to fill out a questionnaire that was posted on the organization’s intranet. Specifically, chronic work characteristics and demographic variables were assessed on a Thursday. The following Tuesday to Thursday, each day, daily work characteristics, challenge appraisal, and creativity were rated in the morning (between 9 am and 11.30 am), and creativity and proactive behavior were rated in the afternoon (between 2 pm and 3.30 pm). A second round of data collection was arranged 2 weeks later to enable participation of those who were unable to participate in the first round. Because of a technical error, participants from the first round were not deleted from the mailing list, so they were contacted again, leading to a maximum of daily responses of six per person¹.

Participants

The task of the engineers in production planning is to implement the product innovations developed in R&D departments into mass production. To this end, they develop new tools and machinery, and arrange the production flow. Creativity is required in this job. One hundred ninety-nine employees agreed to participate and provided ratings of chronic work characteristics and demographic variables, representing 36.22 per cent of those who were contacted. However, 50 individuals failed to respond to

¹Analyses indicating the appropriateness of including all responses are reported below.

any of the daily questionnaires, leaving 149 individuals for the analyses. Of these, 136 individuals were male (88.6 per cent), 128 were engineers (85.9 per cent), 21 individuals were support staff or did not indicate their occupation, and 15 had a leadership positions (10.1 per cent). The mean age was 41.3 years (SD = 7.8) and mean job experience was 15.8 years (SD = 9.4 years). The frequency of responses to the daily questionnaire varied between 1 and 6 ($M = 2.95$, $SD = 1.43$). Specifically, 19 individuals responded to one daily survey (12.8 per cent; 4 matching responses to morning and afternoon measures), 42 individuals responded to 2 (28.2 per cent; 41), 57 individuals to 3 (38.3 per cent, 102), 3 individuals to 4 (2.0 per cent, 5), and 14 individuals each to 5 and 6 daily surveys (9.4 per cent each, 33 and 57 matching responses). Participants who did report daily measures generally did not differ from those who did not report daily measures in demographic variables or other background variables (general level of creativity or proactive behavior) with the following exceptions: Individuals who did not report daily measures reported higher chronic time pressure ($M = 3.70$, $SD = 0.56$) and higher general creativity ($M = 5.08$, $SD = 1.01$) than those who reported daily measures ($M = 3.39$, $SD = 0.72$, $t = 2.53$, $p = .01$ for time pressure; $M = 4.52$, $SD = 1.15$, $t = 2.87$, $p < .01$ for creativity). Among the respondents to the daily questionnaire, frequency of responding was unrelated to any study variable, except for gender: Women responded less frequently ($M_{\text{male}} = 3.07$, $M_{\text{female}} = 2.06$, $t = 2.80$, $p < .01$). In total, $k = 351$ for morning assessments and $k = 352$ for afternoon assessments. Matching morning and afternoon measures lead to $k = 243$ for some of the analyses.

Individuals participating only in the second round had a higher level of chronic time pressure ($M = 3.60$, $SD = 0.63$) than individuals participating in the first round ($M = 3.25$, $SD = .76$, $t = -2.99$, $p < .01$). There were no other differences between the two groups of participants, and because it is desirable to have a sample with a broad range of time pressure, the data collection strategy was successful.

Measures

All measures were administered in German. Cronbach’s α s of all measures were satisfactory and are shown in Table 1; for daily measures, these are based on all ratings ($k = 351$ resp. $k = 352$).

Chronic work characteristics. Two scales developed by Semmer and colleagues (Semmer, 1984; Semmer, Zapf, & Duncel, 1995) were used to measure time pressure and job control. The scales were developed to assess work characteristics independent of individual performance and the individual

Table 1. Means, standard deviations, and relationships between all study variables

	<i>M</i>	<i>SD</i>	% Level 1 variance	1	2	3	4	5	6	7
1 Chronic time pressure	3.42	.72	—	(.72)	—	—	—	—	—	—
2 Chronic job control	3.54	.62	—	.11	(.85)	—	—	—	—	—
3 Daily time pressure	2.64	1.11	35.50	.55***	.04	(.90)	-.15*	.26***	.15**	.18**
4 Daily job control	3.85	.73	39.83	.00	.55***	-.19*	(.88)	.26**	.16**	.12*
5 Challenge	4.02	1.28	32.60	.33***	.30***	.42***	.20*	(.84)	.28***	.16*
6 Daily creativity	3.81	1.39	23.32	.25**	.39***	.18	.22*	.48***	(.96)	.51***
7 Daily proactive behavior	4.90	1.12	43.11	.15	.16	.22*	.18	.42***	.66***	(.88)

Note: Correlations below the diagonal represent between-individual (aggregated) scores ($115 < n < 136$ due to missing values). Values above the diagonal are standardized coefficients obtained from hierarchical linear modeling for one predictor and one criterion ($243 < n < 341$). Cronbach’s α shown in the diagonal.

* $p < .05$; ** $p < .01$; *** $p < .001$.

level of work experience (Semmer & Zapf, 1989). These self-reported work characteristics show medium to high correlations with expert ratings of the job (Semmer, Zapf, & Dunckel, 1999). All items were answered on a 5-point scale. Specifically, *job control* was assessed with five items that referred to the extent an individual can influence the methods of doing his or her job. A sample item is: "To what extent can you influence the way you accomplish your tasks?" with ratings given from 1 = "very little" to 5 = "very much."

Time pressure was measured with five items that referred to high quantitative workload. A sample item is: "How often do you work under time pressure?" with ratings given from 1 = "very rarely" to 5 = "very often").

Daily measures Daily creativity was rated twice daily by the employees on a 7-point rating scale ranging from 1 = "not true" to 7 = "totally true" using nine items from Tierney, Farmer, and Graen (1999). The original English items were translated and back-translated independently by two bilingual individuals, and ambiguities in item wording were resolved through discussion. Participants were instructed to rate the extent to which they had novel and useful ideas at work during the morning or the afternoon. A sample item is "I demonstrated originality in my work." Ratings of these items were averaged to indicate ratings of daily creativity.

Daily proactive behavior was measured with seven items targeting personal initiative (Frese, Fay, Hilburger, Leng, & Tag, 1997) on a 7-point scale ranging from 1 = "not true" to 7 = "totally true". Respondents were asked to indicate their level of daily personal initiative (cf. Sonnentag, 2003). A sample item is "Today, I actively attacked a problem."

To determine if our outcome measures represent two different constructs, we conducted confirmatory factor analyses. Latent state-trait theory (Schermelleh-Engel, Keith, Moosbrugger, & Hodapp, 2004; Steyer, Schmitt, & Eid, 1999) suggests that a repeatedly measured variable is composed of the latent construct and its measurement occasion. Therefore, a three-factor solution was expected to show the best model fit with all creativity items loading on one factor, items for proactive behavior loading on a second factor and items assessed in the afternoon loading on a third factor representing the measurement occasion. Because the same items were used to measure creativity in the morning and in the afternoon, the errors of identical items were allowed to pairwise be correlated. This latent construct model was compared to plausible alternative models using the AIC which can be used to compare non-nested models (Schermelleh-Engel, Moosbrugger, & Müller, 2003). Alternative models include: (a) A three-factor model with creativity assessed in the morning and creativity assessed in the afternoon representing two separate factors; b) a two-factor model with behaviors measured in the afternoon collapsed into one factor, and creativity in the morning representing a second factor (collapsed afternoon), and (c) a one-factor-solution. The latent construct model showed good model fit ($\chi^2 = 590.48$, $df = 249$, $CFI = 0.97$, $NFI = 0.98$, $RSMEA = .08$, $AIC = 742.48$). This solution was superior a) to a three-factor model ($\chi^2 = 940.55$, $df = 263$, $CFI = 0.98$, $NFI = 0.97$, $RSMEA = .08$, $AIC = 1064.55$) and b) to the collapsed afternoon model ($\chi^2 = 985.29$, $df = 265$, $CFI = 0.97$, $NFI = 0.96$, $RSMEA = .11$, $AIC = 1105.29$) and c) to the 1-factor-model ($\chi^2 = 2878.77$, $df = 266$, $CFI = 0.92$, $NFI = 0.91$, $RSMEA = .21$, $AIC = 2996.77$). Thus, the ratings of creativity and proactive behavior seem to represent distinct constructs while creativity ratings represent one construct.

Daily time pressure was measured using three of the items used for chronic time pressure. We chose the three items that could be adapted to daily measurements. Specifically, participants were asked to indicate their agreement with the following statements "Today I am under time pressure." "Today I need to work faster than usual to get my work done." and "My work today requires me to work at high speed." Answers were given on a 5-point scale ranging from 1 = "strongly disagree" to 5 = "strongly agree."

Daily job control was measured with the same five items as chronic job control, but adapted to the time frame of the specific day. A sample item is "Today I can decide on my own how to do my job." Ratings were given on a 5-point scale ranging from 1 = "strongly disagree" to 5 = "strongly agree."

Challenge appraisal was assessed daily with four items based on Boswell et al. (2004) and Tomaka et al. (1993). Specifically, items assessing challenge appraisal targeted the degree to which respondents felt work was demanding but not overtaxing their abilities, and bringing them closer to their personal goals. Item wordings are: “I feel challenged,” “I view my tasks today as challenging,” “My work today brings me closer to the accomplishment of personal goals,” “The work tasks today are adequate for my personal skills.” Principal component analyses with oblimin rotation of the challenge appraisal items and four items designed to measure threat appraisal resulted in two factors. The four challenge items had factor loadings $>.74$ on the first factor. A fifth item designed to measure challenge appraisal (“The work tasks today demand my personal skills”) was omitted due to low factor loading on the first factor.

Analysis

Each study participant provided data at the person level (e.g., chronic work characteristics, level 2) and at the day level (e.g., daily work characteristics, daily creativity; level 1). Day-level data were nested within individuals. Multilevel analyses (HLM 6.01; Raudenbush, Bryk, & Congdon, 2005) were used to test the hypotheses because they take the dependence of our observations on the day level into account. In these analyses, the predictors on level 2 (chronic work characteristics) are linked to the mean levels of our outcome variables across days (e.g., challenge appraisal) to test H1a to H4a. In models linking predictors on level 1 (daily work characteristics) of the outcome variables, the daily covariation between predictors and outcomes is tested (H1b to H4b). All individuals who provided at least one day of matching morning and afternoon assessments were included in the analyses as it is desirable to have a large number of level 2 units to test cross-level relationships (Snijders, 2005). To test cross-level mediation it is necessary to keep between-person variance (Hofmann & Gavin, 1998), we therefore used grand-mean centering (for details see Mathieu & Taylor, 2007, p. 147, Footnote 4). Following Snijders and Bosker, the effect size of adding predictors to the model is defined as the proportional reduction of error in prediction. Because variance components exist on two levels in our analyses, two estimates will be reported: R_1^2 for the effect size on level 1, and R_2^2 for the effect size on level 2, using the formulas provided by Snijders and Bosker (1999, pp. 102–103). Specifically, the effect sizes are computed as follows:

$$R_1^2 = 1 - (\sigma^1 + \tau^1) / (\sigma^0 + \tau^0)$$

$$\text{and } R_2^2 = 1 - (\sigma^1/n + \tau^1) / (\sigma^0/n + \tau^0)$$

with σ^1 and τ^1 being the variance components on each level in the current model, and σ^0 and τ^0 being the variance components on each level in the previous model. n is the mean number of level 1 units on which the analyses are based. For every Model 1, R_1^2 and R_2^2 are based on the comparison with the empty model, for every Model 2, they are based on the comparison with Model 1. We also report the differences in deviance as an indicator of model fit. The deviance is defined as minus twice the natural logarithm of the likelihood produced by the maximum likelihood method and can be regarded as a measure of lack of fit between model and data (Snijders & Bosker, 1999).

To test Hypotheses 5 and 6, we followed the procedure outlined by Mathieu and Taylor (2007; Exhibit 1) for cross-level mediation with a lower-level mediator. Mediation is tested by showing relationships between antecedents and outcomes, between antecedents and mediator, and between mediator and outcomes using multilevel analyses. Finally, when entering the mediator and the antecedents in the model predicting the outcome, the mediator, but not the antecedents, must be

significant. We also tested the significance of the indirect effects proposed in Hypotheses 5–8 using Sobel tests (Sobel, 1982).

Results

Demographic variables such as age, gender or occupation (engineer or other) were not related to challenge appraisal, daily creativity or daily proactive behavior (all $ps > .10$). Therefore, they were not included as control variables in the test of the hypotheses. Before testing the hypotheses, we ran null models to determine the amount of variance between and within persons. The percentage of level 1 variance of the total variance is shown in Table 1. Results reveal that between 23.32 and 43.11 per cent of the variance are due to daily variations, indicating that the analyses on a daily level is appropriate, and that cross-level mediation can be tested (Mathieu & Taylor, 2007). Table 1 shows the relationships of all study variables. Both person-level and day-level relationships are displayed. For the person-level relationships, the daily measures were averaged across all days. The day-level relationships were obtained from hierarchical linear modeling for one predictor and one criterion.

Relationships between work characteristics and creativity and proactive behavior

Hypotheses 1a and 2a stated that chronic time pressure and chronic job control are positively related to mean levels of daily creativity and daily proactive behavior. To test the hypotheses, we entered both chronic work characteristic as level 2 predictors for daily creativity and daily proactive behavior into the equation. Results are shown in Table 2. Our results indicate that chronic time pressure and chronic job control were positively related to daily creativity and daily proactive behavior. These results support Hypotheses 1a and 2a. Furthermore, these results demonstrate that the antecedents and outcomes stipulated in Hypotheses 7 and 8 are related.

Table 2. Multilevel estimates for chronic work characteristics predicting creativity and proactive behavior

	Daily creativity			Daily proactive behavior		
	Est.	SE	<i>t</i>	Est.	SE	<i>t</i>
Intercept	3.80	.09	42.68	4.93	.09	52.88
Chronic time pressure	.55	.13	4.33***	.34	.13	2.58*
Chronic job control	.73	.12	5.97***	.30	.14	2.19*
Deviance	968.24			1029.99		
Δ Deviance	44.65***			7.72**		
df	2			2		
Level 1 variance σ	0.42			0.70		
Level 2 variance τ	0.97			0.83		
R_2^2	.27			.09		

R_2^2 is the proportional reduction in prediction error on level 2, compared to the empty model (deviance = 1012.89, $\sigma = 0.42$, $\tau = 1.37$ for daily creativity; deviance = 1037.71, $\sigma = 0.71$, $\tau = 0.93$ for daily proactive behavior).

Est. = Estimate.

* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 3. Multilevel estimates for models testing mediation of challenge, predicting daily creativity

	Model 1			Model 2		
	Est.	SE	<i>t</i>	Est.	SE	<i>t</i>
Intercept	3.88	.10	39.66	3.89	.09	42.94
Daily time pressure	.21	.06	3.53**	.14	.06	2.33*
Daily job control	.39	.08	5.06***	.27	.08	3.37**
Challenge	—	—	—	.26	.06	4.14***
Deviance	743.73			723.39		
Δ Deviance	269.17***			20.35***		
Df	2			1		
Level 1 variance σ	0.31			0.32		
Level 2 variance τ	1.15			0.95		
R_1^2	.19			.13		
Sobel time pressure				3.14**		
Sobel job control				3.12**		

$k = 436$. R_1^2 is the proportional reduction in prediction error on level 1. In Model 1, this is in comparison to the empty model (deviance = 1012.89, $\sigma = 0.42$, $\tau = 1.37$); in Model 2, the comparison is to Model 1.

Est. = Estimate.

* $p < .05$; ** $p < .01$; *** $p < .001$.

Hypotheses 1b and 2b stated that daily time pressure and daily job control are positively related to daily creativity and proactive behavior. To test these hypotheses, we entered both daily work characteristics as level 1 predictors of daily creativity and daily proactive behavior. Results are shown in Table 3 for daily creativity and in Table 4 for daily proactive behavior (Model 1). Results indicate that higher levels of daily time pressure and job control were associated with higher levels of creativity and proactive behavior on the same day. Thus, Hypothesis 1b and 2b were supported.

Table 4. Multilevel estimates for models testing mediation of challenge, predicting daily proactive behavior

	Model 1			Model 2		
	Est.	SE	<i>t</i>	Est.	SE	<i>t</i>
Intercept	4.92	.10	50.08	4.92	.09	52.15
Daily time pressure	.28	.07	3.85***	.23	.08	3.04**
Daily job control	.29	.10	2.93**	.24	.10	2.33*
Challenge				.16	.07	2.33*
Deviance	755.826			750.813		
Δ Deviance	281.88***			5.02*		
Df	2			1		
Level 1 variance σ	0.863			0.888		
Level 2 variance τ	0.642			0.547		
R_1^2	.08			.06		
Sobel time pressure				2.10*		
Sobel job control				2.09*		

$k = 243$. R_1^2 is the proportional reduction in prediction error on level 1. In Model 1, this is in comparison to the empty model (deviance = 1037.71, $\sigma = 0.71$, $\tau = 0.93$); in Model 2, the comparison is to Model 1.

Est. = Estimate.

* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 5. Testing the mediation of chronic work characteristics through daily work characteristics on challenge appraisal

	Model 1			Model 2		
	Est.	SE	<i>t</i>	Est.	SE	<i>t</i>
Intercept	3.98	.10	41.42	3.96	.09	43.71
Chronic time pressure	.47	.13	3.55**	.24	.14	1.79
Chronic job control	.52	.16	3.27**	.33	.17	1.98
Daily time pressure	—	—	—	.29	.08	3.77***
Daily job control	—	—	—	.35	.09	3.77***
Deviance	1012.19			976.47		
Δ Deviance	25.28***			35.73***		
Df	2			2		
Level 1 variance σ	0.780			0.577		
Level 2 variance τ	0.999			0.857		
R_1^2	.04			.19		
R_2^2	.13			.28		
Sobel time pressure				2.58**		
Sobel job control				2.42*		

115 < n < 132. R_1^2 is the proportional reduction in prediction error on level 1. R_2^2 is the proportional reduction in prediction error on level 2. In Model 1, this is in comparison to the empty model (deviance = 1037.47, σ = 0.61, τ = 1.25); in Model 2, the comparison is to Model 1.

Est. = Estimate.

* p < .05; ** p < .01; *** p < .001.

Relationships between work characteristics and challenge appraisal

Hypotheses 3a and 4a stated that chronic work characteristics are positively related to mean levels of challenge appraisal. To test these hypotheses, we entered both chronic work characteristics as level 2 predictors of challenge appraisal. Results can be seen in Table 5 (Model 1). Chronic time pressure and chronic job control were both significantly related to challenge appraisal, thereby supporting Hypotheses 3a and 4a. Furthermore, these results demonstrate that antecedents and outcomes stipulated in Hypotheses 5 and 6 are related.

Hypotheses 3b and 4b stated that daily work characteristics are positively related to daily challenge appraisal. To test these hypotheses, we entered both daily work characteristics as level 1 predictors of challenge appraisal. Daily time pressure (coefficient = .34, SE = .07, t = 4.84, p < .001) and daily job control (coefficient = .43, SE = .09, t = 4.76, p < .001) were significantly related to challenge appraisal, thereby supporting Hypotheses 3b and 4b.

Hypotheses 5 and 6 stated that the relationship between chronic work characteristics and challenge appraisal would be mediated by daily work characteristics. The relationships between daily work characteristics and challenge appraisal have been shown above. Thus, mediators and outcome are related. Table 1 reveals that chronic work characteristics were also related to daily work characteristics, demonstrating a relationship between antecedent and mediators. Specifically, chronic time pressure is significantly related to daily time pressure, and chronic job control is significantly related to daily job control (both r = .55, p < .001).

To test for mediation, daily work characteristics were entered as predictors of challenge in addition to chronic work characteristics. Results are shown in Table 5 (Model 2). The coefficients of chronic time pressure and chronic job control became non-significant when daily time pressure and daily job control were introduced as predictors, and both daily work characteristics were significantly related to challenge appraisal. The Sobel tests indicate that both the indirect effect of chronic time pressure on challenge

appraisal through daily time pressure, and the indirect effect of chronic job control on challenge appraisal through daily job control were significant (Table 5), lending support to Hypotheses 5 and 6.

The mediating role of challenge appraisal in the relationships between work characteristics and creativity and proactive behavior

Hypothesis 7 stated that the relationships between daily work characteristics and creativity are mediated by challenge appraisal. It has already been established that daily time pressure and daily job control are related to challenge appraisal (see above) thereby linking antecedents to the mediator. Challenge appraisal is significantly related to daily creativity (see Table 1), establishing that the mediator is related to the outcome. To test for mediation, daily work characteristics and challenge appraisal are entered simultaneously in the prediction of daily creativity. Results are shown in Table 3 (Model 2). Both daily time pressure and daily job control were significantly related to daily creativity. When introducing challenge appraisal as a predictor, the significance of the work characteristic predictors was reduced (from $p < .01$ to $.05$ for daily time pressure, and from $p < .001$ to $.01$ for daily job control), and challenge appraisal was a significant predictor. The Sobel tests indicate that the indirect effects of daily time pressure and daily job control through challenge appraisal on daily creativity were significant (Sobel_{time pressure} = 3.18, $p < .01$; Sobel_{job control} = 2.97, $p < .01$). However, work characteristics remained significant predictors, indicating only partial mediation.

Hypothesis 8 stated that the relationships of daily work characteristics and daily proactive behavior are mediated by challenge appraisal. It has already been established that daily time pressure and daily job control are related to challenge appraisal (see above) thereby linking antecedents to the mediator. In addition, challenge appraisal is related to proactive behavior (see Table 1), establishing that the mediator is related to the outcomes. To test for mediation, daily work characteristics and challenge appraisal are entered simultaneously as predictors of proactive behavior. Results are shown in Table 4 (Model 2). Both daily time pressure and daily job control were significantly related to proactive behavior. When introducing challenge appraisal as a predictor, the significance of the work characteristic predictors were reduced (from $p < .001$ to $.01$ for time pressure; from $p < .01$ to $.05$ for job control), and challenge appraisal was a significant predictor. The Sobel tests indicate that the indirect effects of daily time pressure and daily job control through challenge appraisal on proactive behavior were significant (Table 4). However, daily work characteristics remained significant predictors, indicating only partial mediation.

Additional analyses

Because the relationship between daily work characteristics and creativity was only partially mediated by challenge appraisal, and because one could argue that higher levels of proactive behavior lead to increases of creativity by means of increased effort and better problem identification, we explored the role of proactive behavior as a mediator by including it as an additional predictor. Daily proactive behavior was a significant predictor of daily creativity (coefficient = .53, SE = .05, $t = 10.75$, $p < .001$), and daily time pressure was no longer significant ($p = .94$). However, daily job control was still a significant predictor of daily creativity (coefficient = .21, SE = .08, $t = 2.54$, $p < .05$). These results indicate that proactive behavior mediates the relationship between daily time pressure and daily creativity, but not between daily job control and daily creativity.

Discussion

The results of our study support the view that work characteristics such as time pressure and job control are challenging and have positive consequences (LePine et al., 2005; Podsakoff et al., 2007). Using experience-sampling data, we found positive relationships between chronic as well as daily time pressure and job control on the one hand, and challenge appraisal, daily creativity and daily proactive behavior on the other hand. The relationships between chronic work characteristics and challenge appraisal were mediated by daily measurements of work characteristics. Furthermore, the relationships between daily work characteristics and daily creativity and daily proactive behavior were partially mediated by challenge appraisal. These results suggest that higher levels of perceived challenge because of high levels of job control and time pressure on a workday is associated with more proactive and creative behavior on the same day.

Our finding supports the classification of time pressure as a challenge-related stressor which can have positive effects on performance. Gilboa et al. (2008) examined role overload, a concept similar to time pressure, and concluded that it might have both positive and negative consequences for performance, depending on the appraisal of the individual. Based on the inconsistent meta-analytical findings regarding the relationships between role overload and performance, they argue that role overload might consist of several dimensions such as quantitative and qualitative demands which may be perceived differently by the employee. Our study supports the view that quantitative demands are experienced as challenging which is associated with higher levels of performance. It would be interesting to test in future research if the qualitative demands are indeed perceived as threatening which is detrimental for performance.

Our findings also help explain how chronic work characteristics may elicit positive experiences at work—such as the experiences of challenge—and translate into daily performance-related behavior. Previous studies have found similar relationships between chronic work characteristics and positive affect (e.g., Fisher, 2002), but have neglected the mediating processes. We showed that individuals who perceive that they generally have high control over their work in general are also more likely to perceive job control in their daily work, and this perception in turn is related to the appraisal of their work as challenging. Similarly, individuals who have high chronic time pressure at work are more likely to experience time pressure on a specific day, which in turn is related to seeing work as challenging.

Our study was one of the first to examine the process underlying the relationship between chronic work characteristics and day-level experiences at work. Whereas one previous study failed to find evidence for situational characteristics mediating the relationship between chronic work characteristics and outcomes (Elfering et al., 2005), we found that daily work characteristics fully mediated the relationship between chronic work characteristics and challenge appraisal. Affective events theory (Weiss & Cropanzano, 1996) proposed an additional mechanism to the one tested in our study: Affect-eliciting events as being more or less likely to occur under certain working conditions. Future research needs to examine work events (e.g., disruptions, goal attainment; Zohar, Tzischinski, & Epstein, 2003) as mediators of the relationship between (chronic) work characteristics and positive work experience.

We replicated previous findings showing a positive relationship between time pressure and creativity (Andrews & Farris, 1972). Our results thus show that the same factors that have been linked to stable performance-related behavior are also underlying these daily performance-related behaviors (cf. Fritz & Sonnentag, 2009). Among highly educated employees whose job is to be creative, time pressure seems to facilitate creativity. Accordingly, research indicates that differences in creative requirements (Unsworth, 2001; Unsworth, Wall, & Carter, 2005) or education level may explain a differences in the relationships between time pressure and creativity (meta-analysis; Harrison et al., 2006). Specifically, time pressure might only be detrimental if creativity is not required in a given job, or if employees are

not well educated. The joint effect of high demands and education or skill levels is also recognized in Csikszentmihalyi's flow theory (e.g., Csikszentmihalyi & LeFevre, 1989), as well as in theories of job stress (e.g., Karasek, 1979). Alternatively, time pressure could be detrimental when employees find it illegitimate, for example resulting from bad work organization or unreasonably high expectations (Semmer, McGrath, & Beehr, 2005).

Another plausible interactive effect is involved in challenge appraisal. One could argue that the challenging effect of time pressure is greater when individuals have sufficient skills to deal with the demand. Thus, individuals will not automatically assume that positive consequences will occur when they exert effort when dealing with a demand, as argued by LePine et al. (2005). They will only see a demand as challenging when they feel capable of dealing with it (e.g., high skill level, high self-efficacy; Jerusalem & Schwarzer, 1992) or when they are generally high in optimism. Such possible boundary conditions will need to be explored in future studies. Furthermore, one could argue that challenge appraisal is also directly influenced by factors other than work characteristics. Again, self-efficacy is a likely candidate: Individuals who feel that they are capable to execute the courses of actions necessary to attain their goals are more likely to see their work as challenging.

Time pressure was also positively related to proactive behavior, indicating that individuals who experience time pressure on a given day are more likely to show self-starting, change-, or future-oriented behavior. Our findings mirror the results of other studies (Binnewies et al., 2009; Fay & Sonnentag, 2002; Ohly et al., 2006), and go beyond them by demonstrating the importance of challenge appraisal. It was previously assumed that stressors such as time pressure indicate a suboptimal working condition, which needs to be acted upon, thereby making proactive behavior more likely. Although we did not directly test this explanation, it seems plausible that individuals perceiving a need for change at the same time appraise a situation as challenging. Future research will need to assess the perception of the work situation as suboptimal or as needing change, and to test if these perceptions are indeed related to challenge appraisal, or if they represent distinct mechanisms. Because challenge appraisal only partially mediated the relationships between work characteristics and our outcomes, the examination of additional mediating mechanisms seems worthwhile. Interestingly, proactive behavior might be one of the mechanisms translating high levels of time pressure into creativity because individuals exert more effort and anticipate problems that need to be solved.

Research on work design has focused on the effects of work characteristics on various motivational states, including intrinsic motivation (Hackman & Oldham, 1976), self-efficacy, and felt responsibility (Parker et al., 2006). Affective events theory highlights the role of appraisal processes at work that explain how certain work events can lead to positive experiences. We linked a prominent work characteristic, namely job control, to challenge appraisal, thereby examining an additional motivational state. Research on classifications of stressors (LePine et al., 2004, 2005) has been largely disconnected from research on work design. By showing that a common motivational state, challenge appraisal, mediates the relationships between both time pressure and job control and creativity and proactive behaviors, our study provides a starting point for the integration of two previously unrelated streams of research.

In the present study, we tested the relationships between positive experiences (challenge appraisal) and day-level behavior. Previous studies testing lagged effects of positive experiences such as positive affect or daily job satisfaction have shown mixed findings (Amabile et al., 2005; Fritz & Sonnentag, 2009; Fisher & Noble, 2004; Ilies et al., 2006). In our study, we found lagged relationships between challenge appraisal assessed in the morning and proactive behavior in the afternoon. A number of explanations for the mixed findings are possible, including the assessment of positive experience as work-related vs. general, or the nature of the performance outcome examined (extra-role or in-role). Clearly, more studies about the immediate and lagged effects of positive experiences on daily performance-related behaviors as well as on task performance are needed to clarify this issue.

Implications for practice and research

Our results support the view of time pressure as a challenge-related stressor that can have positive consequences (LePine et al., 2005; Podsakoff et al., 2007). However, because challenge-related stressors such as time pressure and high work load are also associated with impairments in health and well-being (Houkes, Jansen, De Jonge, & Bakker, 2003; LePine et al., 2004; Teuchmann et al., 1999), recommendations to use high levels of time pressure as a way to foster performance would be premature. With regard to this “dilemma,” research on recovery from work demands may be important as it indicates possible processes underlying the impairment in health (Eden, 2001). This line of research indicates that specific activities and experiences during off-job time (e.g., Fritz & Sonnentag, 2005; Fritz & Sonnentag, 2006; Sonnentag, 2001) increase employees’ well-being and enhance performance capabilities. Thus, when time pressure is irreducible or inescapable, employees could be educated in strategies to unwind from work demands during leisure time. Because no comparable negative effects of job control needs to be feared, and job control actually has demonstrated positive effects on well-being and performance (de Lange, Taris, Kompier, Houtman, & Bongers, 2003; Fried & Ferris, 1987; Spector, 1986) measures to increase job control for example by decreasing the number of rules and regulations or transferring decision authority from managers to employees are advocated. Our results also suggest that if more permanent redesign of work is not feasible, creativity and proactive behavior can be fostered by temporarily enhancing job control (or time pressure). This could be accomplished by introducing special projects that allow for more autonomy than ordinary work projects.

Based on our findings and the discussion presented above, future research is needed on additional mechanisms of how work characteristics and positive work experiences or time pressure and proactive behavior are related. We discussed the role of work events and the perception that the work situation needs change, respectively. Future research also needs to test potential moderating effects in the relationship of time pressure with creativity, namely creative requirements and the perceived legitimacy of time pressure. Finally, more studies are needed on the immediate and lagged effects of positive experiences on daily performance.

Limitations

One limitation of our study is the fact that our study is based on self-report only. Therefore, the relationships may be inflated by same-source bias (cf. Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) and causal inferences would be premature. Specifically, it might be that third variables such as job complexity or personality are underlying the relationships in our study. However, temporal separation is one means of reducing same-source bias (Podsakoff et al., 2003) and most of our variables were assessed at different points in time, separated by at least a few hours. Because of the time lag, certain rating biases (consistency bias) are less likely to affect the relationships in this study. Furthermore, the nature of our study minimizes the threat of retrospective recall and of implicit theories affecting the relationships: Ratings were given in close proximity to when the appraisal or behavior occurs, and leave little time to think how variables should be related. Therefore, we are confident that our results are not seriously distorted due to same-source bias. Nevertheless, validating findings of self-report event-sampling studies using external rating sources (e.g., coworker, supervisor, significant others) is advisable. This could also help to rule out alternative explanations such as third variables underlying the relationships.

One might be concerned about how the low response rate and the differences in our final sample with regard to chronic time pressure and general creativity have affected our results. However, because

individuals high in time pressure and high in creativity dropped out, it is unlikely that the linear relationship between time pressure and creativity was affected. It has also been argued that response rates does not seriously affect study findings (Schalm & Kelloway, 2001). We therefore feel that self-selection and low response rate do not invalidate our findings.

Some of our findings might be specific to the sample (mostly highly educated engineers who are required to be creative in their job). Specifically, work might not be appraised as challenging if the work tasks are more routine than in our sample, even if the individuals work under time pressure and have high job control. However, previous meta-analytic research has demonstrated positive effects of time pressure (conceptualized as challenge-related stressor) on job performance and job attitudes (LePine et al., 2005; Podsakoff et al., 2007) across a range of occupations. Therefore, it might be that the routine nature of tasks weakens but does not eliminate the effect.

Conclusions

The results of our study suggest that chronic as well as day-level work-characteristics can be experienced as challenging, and that challenge appraisal in turn is related to performance-related behaviors such as daily creativity and proactive behavior. Thus, our findings indicate the relevance of stable as well as short-term aspects of the work environment. In addition, our results shed some light on processes underlying relationships between factors of the work environment and performance. Beyond those contributions our study raises new research questions that are worth examining in more detail to help understand creativity and proactive behaviors at work.

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