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Divergent effects of detachment from work: a day-level study on employee creativity

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ABSTRACT
Detachment from work during non-work time is generally related to a decrease in work-related strain. However, it might also hamper employees’ generation of new and useful ideas about work by completely shutting off work-related thoughts and/or feelings outside of work. In this day-level study, we used a within-person design to investigate the role of cognitive and emotional detachment from work during non-work time in relation to equivalent types of job demands and job resources, in the prediction of employee creativity. Cognitive detachment from work refers to mentally disconnecting from work and no longer thinking about job-related issues, whereas emotional detachment from work refers to affectively disconnecting from work and no longer experiencing job-related emotions. Survey data were gathered over the course of eight consecutive days from 151 health care employees. Multi-level analyses revealed that: (1) cognitive detachment was positively related to creativity, irrespective of the level of cognitive job demands and resources; (2) high emotional job demands in combination with either low levels of emotional detachment or high levels of emotional job resources were positively related to creativity. This day-level study provides insight into the relation between detachment from work and creativity from a process perspective, by showing specific conditions under which different types of detachment from work benefit employee creativity.

After a hard day’s work, should employees set their work aside and detach from it to enhance their generation of new and useful ideas about work? Or is employee creativity rather enhanced by letting work-related thoughts and/or feelings linger during non-work time? Employee creativity can be defined as the generation of new and useful ideas about work by employees (Amabile, 1988; George & Zhou, 2001). Employees’ creative thoughts and ideas are of great importance, because they are the building blocks for organizational innovation, problem-solving, change, and competitiveness (e.g., Amabile, 1988; Woodman, Sawyer, & Griffin, 1993). The importance of employee creativity applies to all sorts of jobs and organizations, as day-to-day problems occur in any job (cf. Dul & Ceylan, 2011). Especially in a dynamic economic environment, organizations rely on the creativity and flexibility of their personnel to survive. Therefore, research into factors that can either block or enhance employee creativity is highly relevant.

Although research on recovering from job stress during non-work time extensively demonstrated the positive effect of disengaging from work on health and well-being (e.g., Sonnentag, Binnewies, & Mojza, 2010), recent studies suggest that the link between detachment from work and performance outcomes, such as employee creativity, may not be that straightforward (e.g., Binnewies, Sonnentag, & Mojza, 2009; De Jonge, Spoor, Sonnentag, Dormann, & Van den Tooren, 2012; Fritz, Yankelevich, Zarubin, & Barger, 2010). Detachment from work is defined as an “individual’s sense of being away from the work situation” (Etzion, Eden, & Lapidot, 1998, p. 579). Thus, it refers to a self-reported employee experience that occurs during non-work time. When detaching from work during non-work time, bodily systems that have been activated during work can return to baseline levels. In other words, detachment from work provides employees an opportunity to reduce strain, by recovering resources that were lost due to coping with job demands (cf. Fritz et al., 2010). However, distancing oneself from work might also impede one’s reflection on work-related issues during non-work time, thereby blocking employees’ creative processes and opportunities to deal with these issues (cf. Sonnentag & Kruel, 2006). To gain insight into this suggested potential side effect of detachment from work, in this study we examine effects of detachment from work during non-work time on employees’ daily creativity levels.

Literature suggests that time away from a problem (e.g., working on another task, taking a shower, exercising) helps elicit new problem-solving ideas (Madjar & Shalley, 2008; Sio & Ormerod, 2009), a phenomenon commonly referred to as incubation. However, consistent empirical support for such incubation effects is scarce and the underlying psychological processes remain unclear (Madjar & Shalley, 2008; Sio & Ormerod, 2009; Vul & Pashler, 2007). It is not clear, for instance, whether incubation effects result from unconscious problem-solving processes during the time away from the...
problem or from sustained conscious reflective thinking (cf. Cohen & Ferrari, 2010), which would, respectively, plead in favour or against detachment from work for employee creativity. In a cross-sectional survey study, De Jonge et al. (2012) found that a lack of detachment predicted active learning behaviour and employee creativity. Thus, not totally “switching off” after work was related to positive performance outcomes. Binnewies et al. (2009) reported a similar relation in a longitudinal survey study: positive work reflection, as opposed to the complete absence of work-related thoughts, predicted an increase in creativity at work 6 months later. These findings indeed suggest that complete detachment from work might not always be exclusively beneficial, in that it may block the generation of new and useful work-related ideas. However, due to limitations of these studies’ designs, important information about the process of detachment is lost (cf. Demerouti, Bakker, Geurts, & Taris, 2009). For example, the question remains whether there is a difference in daily employee creativity directly before and after detachment takes place. Moreover, it remains unclear how detachment effects are influenced by the specific working conditions (i.e., particular job resources and job demands) that employees encountered during the day, and whether different working conditions require different levels and/or kinds of detachment.

The aim of this study is to provide more insight into the relation between detachment and creativity from a process perspective, by examining the effect of detachment from work on day-level employee creativity. Such a day-level approach enables us to learn more about variations in levels of creativity during the day and the underlying processes in terms of daily changing circumstances (see also Ohly, Sonnentag, Niessen, & Zapf, 2010). Further, we will use the Demand-Induced Strain Compensation Recovery (DISC-R) Model (De Jonge & Dormann, 2003, 2006; De Jonge et al., 2012) as a theoretical framework for this study. This model provides the opportunity to investigate the influence of specific daily work conditions on detachment effects, because along with detachment, it incorporates job demands and job resources. Moreover, the model allows for a more detailed elaboration on the interplay between the study variables, because it differentiates between cognitive, emotional, and physical aspects of job demands, resources, and detachment. However, as creativity is an inherently cognitive phenomenon, which is primarily associated with determinants of cognitive and affective nature (e.g., De Dreu, Baas, & Nijstad, 2008; George & Zhou, 2002, 2007), our focus will solely be on the cognitive and emotional components of the model. In sum, we will investigate the role of two different types (i.e., cognitive and emotional) and combinations of job demands, resources, and detachment in the explanation of day-level fluctuations in employee creativity.

We will perform this study within the health care sector because health care employees in particular are often imposed with highly demanding cognitive and emotional work tasks. Various scholars have indicated that having novel and useful ideas is indeed important in health care professions such as nursing jobs, also with respect to organizational functioning (e.g., Chan, 2013; Hughes, 2006). Health care workers such as nurses often have to be creative enough to overcome and solve various challenges, such as securing funding, obtaining supplies, dealing with patients from all walks of life and different medications and medical equipment (Boucher, 2005). Specific examples of nurses’ novel and useful ideas that were reported in a study of Binnewies, Ohly, and Sonnentag (2007) are the introduction of eating in small groups for patients who had problems eating their meals alone and new ways of putting patients to bed, using new material.

By looking at day-level fluctuations in the study variables, our study addresses the need for research into the role of time in the relation between off-job recovery, job demands, job resources, and performance-related outcomes (Binnewies & Wörnlein, 2011; De Jonge et al., 2012). In terms of practical implications, the study sheds light on more precise conditions under which detachment from work can foster employee creativity.

**DISC-R Model**

The DISC-R Model is a current work stress model that comprises four central elements: job demands, job resources, detachment from work, and work-related outcomes (De Jonge, Demerouti, & Dormann, 2014). According to this model, each of these elements encompasses a cognitive, emotional, and physical component. This three-factor structure has been confirmed in various empirical studies (e.g., Bova, De Jonge, & Guglielmi, 2013; De Jonge et al., 2012; Van den Tooren & De Jonge, 2008). However, as previously mentioned, the physical components are left out of consideration in this study. Cognitive job demands are work-related tasks that primarily require cognitive effort, whereas emotional job demands are work-related tasks that primarily require emotional effort (Van den Tooren, 2010). Examples of cognitive and emotional job demands are complex tasks and confrontations with aggressive clients, respectively. Job resources are instrumental or psychological means at work that employees can use to deal with their job demands (Van den Tooren, De Jonge, & Dormann, 2012), such as access to useful information or emotional support from colleagues.

Parallel to job demands and job resources, detachment can also be divided into a cognitive and an emotional component (De Jonge et al., 2012). Cognitive detachment implies mentally disconnecting from work and no longer thinking about work, for instance, by directing one’s thoughts to something else. Emotional detachment means affectively disconnecting from work and no longer experiencing work-related emotions, for example, by taking distance from emotionally aggravating situations at work. Although these two types of detachment from work may to some extent overlap and/or occur simultaneously, a conceptual difference exists with respect to their underlying bodily processes (cf. De Jonge & Dormann, 2003). Following DISC-R theory and earlier theory on effort–recovery processes (e.g., Sonnentag & Niessen, 2008), it is assumed that a full degree of off-job recovery is attained when the employee feels that cognitive, emotional, and physical systems that were used during work have returned to their baseline levels after work. In this sense, cognitive detachment primarily impinges on cognitive bodily systems (i.e., human information processing), whereas emotional detachment primarily impinges on emotional bodily systems (i.e., emotion
regulation). Thus, rather than unique processes, cognitive and emotional detachment represent different dimensions of the same higher order construct. Generally speaking, detachment can help the restoration of individual resources that were lost due to job demands (cf. Fritz et al., 2010).

A fundamental assumption of the DISC-R Model is employees’ functional self-regulatory behaviour in combating job demands (De Jonge et al., 2014; De Jonge & Dormann, 2006): employees will generally try to cope with states of psychological imbalance induced by stressors at work (cf. Pomaki & Maes, 2002), by activation of functional matching job resources and detachment. The most easily available and best matching resources will be activated first. If matching resources are not available or depleted, employees may apply less-matching or non-matching job resources as replacement, which may also help to cope with high demands. According to the DISC-R Model, however, they are less effective. For instance, an employee with an emotionally demanding job (e.g., aggressive clients) is likely to use emotional resources (e.g., emotional support from colleagues) to deal with those high demands. If emotionally supportive colleagues are not available, other job resources can be useful to some extent, for example, protocols of how to deal with problematic clients. In addition, if internal resources are depleted due to high demands, employees will generally be inclined to restore those resources by detaching from work. In the foregoing example, it is likely that an employee will try to engage in leisure activities that are not emotionally draining.

Regarding the relation between demands, resources, and detachment on one hand, and work-related outcomes on the other, an important distinction can be drawn between additive and interactive (i.e., moderation) effects (cf. Häusser, Mojzisch, Niesel, & Schulz-Hardt, 2010). Additive effects assume that demands, resources, and detachment are independently related to outcomes. The DISC-R Model, on the other hand, proposes interaction effects with resources and detachment moderating the relation between demands and work-related outcomes (De Jonge et al., 2012). Moreover, based on functional self-regulatory principles, the model’s matching principle assumes that interactive relations between job demands, job resources, detachment, and work-related outcomes are stronger if they are within the same dimension (e.g., cognitive or emotional) (Daniels & De Jonge, 2010; De Jonge & Dormann, 2006). For example, to prevent emotional exhaustion, it is particularly important that emotional job demands (e.g., aggressive patient) are accompanied by emotional job resources (emotional support from colleagues) and emotional detachment, that is, taking distance from negative emotions experienced during the day. Statistically, the given example would be represented by a matching three-way interaction between emotional job demands, emotional job resources, and emotional detachment from work.

**Detachment and creativity**

According to the DISC-R Model, job demands, resources, and detachment are related to both health and performance-related outcomes, including employee creativity. An activating and stimulating (work) situation (e.g., challenging job demands) is believed to enhance creativity (cf. Amabile & Mueller, 2008; Zhou, Hirst, & Shipton, 2012). Cognitive job demands (such as complex work problems) in particular are considered useful to initiate employees’ creativity, but only under the condition that employees have sufficient cognitive resources at their disposal (cf. De Jonge & Dormann, 2003; De Jonge et al., 2012). Only if there are sufficient cognitive resources (such as access to useful information), there is room for thinking about problems and developing new ideas about how to deal with the job demands (cf. Ohly, Sonnentag, & Pluntke, 2006).

Still, the question remains how the relation between job demands, resources, and creativity is influenced by detachment from work during non-work time, and if different types of detachment (i.e., cognitive and emotional) have different effects. With respect to cognitive detachment, one could reason that not thinking about work (i.e., high cognitive detachment) in leisure time does not benefit work-related problem-solving attempts, because it refrains from actively exploring new and useful ideas about work. This is in line with Binnewies et al. (2009) and Baas, Dreu, and Nijstad (2008), who found that complete (mental) relaxation (and absence of work-related thoughts) during leisure time was not conducive to creativity, whereas cross-sectional survey research by De Jonge et al. (2012) showed that, in cases of high cognitive job demands and resources, low cognitive detachment was positively associated with employee creativity. In other words, these findings suggest that thinking about work during free time might be a condition for the generation of novel and useful work-related ideas.

In line with the earlier findings and with the matching principle of the DISC-R Model, we hypothesize that employee creativity is higher on days with both high cognitive job demands and high cognitive job resources during the work day (i.e., activating work situation), as well as low cognitive detachment from work afterwards. This assumption is reflected by a statistical three-way interaction effect of matching cognitive demands, resources, and detachment (cf. Van Vegchel, De Jonge, & Landsbergis, 2005).

**Hypothesis 1:** Employee creativity is higher on days with both high cognitive job demands and high cognitive job resources during the day, followed by low cognitive detachment from work (matching three-way interaction; see also Figure 1).

Less is known about the role of emotional detachment from work in relation to employee creativity. In their cross-sectional survey study, De Jonge et al. (2012) found a positive association between high emotional detachment from work and employee creativity. This may seem counterintuitive, given that literature has shown that, besides cognitive aspects of the work situation, emotions can also elicit cognitive activation (Baas et al., 2008; De Dreu et al., 2008), and that positive affect, in particular, fosters creativity (Amabile, Barsade, Mueller, & Staw, 2005).

However, Ilies et al. (2007) demonstrated that negative moods induced by job characteristics are carried home at
the end of the day. As such, negative experiences at work can negatively impact employees’ home experiences. In addition, not taking distance from these negative emotions may lead to negative sustained activation in the human brain (Brosschot, Gerin, & Thayer, 2006) and (further) depletion of internal resources (cf. Fritz & Sonnentag, 2006). This, in turn, could hamper employee creativity. Emotional detachment, then, may buffer the negative spillover from work to the home domain. As such, it may allow for more positive experiences in the home domain to occur and help restore internal resources needed for the generation of new and useful ideas about work. In short, it is plausible that emotional detachment is a precondition for employee creativity. Thus, following the earlier line of reasoning and DISC-R theory (i.e., matching job resources and detachment are most functional in balancing domain-specific demands and restoring domain-specific energy reservoirs), our expectation is that high emotional job demands in combination with high emotional resources might lead to more creativity (i.e., an activating, challenging work situation), especially under the condition of high emotional detachment.

**Hypothesis 2:** Employee creativity is higher on days with both high emotional job demands and high emotional job resources during the day, followed by high emotional detachment from work (matching three-way interaction; see Figure 1).

**Methods**

**Procedure and sample**

We conducted a daily survey study in two Dutch nursing homes and four departments of a Dutch general hospital (i.e., nursing department, laboratory, operating room department, emergency room) with health care workers completing daily surveys on handheld devices over eight consecutive days. The total group of participants mainly consisted of nurses (64.5%), anaesthesiologist assistants and surgical nurses (20.4%), and laboratory workers (12.5%). Participants had to be active in their current job position for at least 3 months at the start of the data collection. In addition, participants had to work at least 16 h within the course of the data collection to guarantee a sufficient amount of daily working day observations for data analysis. Because these eligibility criteria are based upon specific individual information of employees, we recruited participants in consultation with the heads of all participating units. To encourage participation, monetary incentives were offered to participants completing the study.

Out of 160 employees who were asked to participate, 157 employees agreed to be part of the study. During the study, four devices broke down (e.g., battery and software failures) and lost all their data. One respondent only filled out the surveys on non-work days and is, therefore, not included in the analysis. Moreover, one respondent did not fill out any of the surveys. The result is a final sample of 151 participants (94.4% of 160 people).

Participants received both face-to-face and printed instructions in small groups (2–7 persons) and signed an informed consent form. Participants were also told that during the study they could call one of the researchers, in case they would need help. The respondents were asked to fill out surveys on their device for eight consecutive days on each working day, directly after work (T1) and at bedtime (T2). Due to shift work and differences in contract types, the number as well as the sequence of working days differed among participants. The average number of recorded working days was 4.3. This number is quite satisfactory, given that the majority of the sample worked part time. Only 8% of the total sample turned out to have worked 1 (n = 2) or 2 days (n = 10) during the course of the data collection. Records where any model variable (person-level or day-level) had a missing value were listwise deleted. Furthermore, preliminary analyses based on time-stamps and additional comments of participants showed a few uncommon responses (e.g., a second Time 1 survey because the participant thought the first Time 1 survey was not recorded). These records were also deleted from the dataset. The remaining data, however, indicated good compliance of the participants with the instructions regarding completing the surveys at the specified times (i.e., Time 2 following Time 1 within the same day). The analyses in this study are based on a total of 368 days of completed surveys (i.e., pairs of T1 and T2).

A week before the start of the study, every participant received a handheld device containing the surveys. The daily diary survey tools assigned identification numbers to each unique device. The device numbers were linked to the participants in a separate data file, which was only available to the researchers. The identification numbers were retained and used for analysis purposes and follow-up measures.

The participants’ age ranged from 19 to 61 years (M = 39.9; SD = 11.3) and 84.6% of the group was female. With respect to education level, 23.7% completed high school, 41.6% completed (intermediate) vocational education, and 34.7% obtained a university degree. Over the course of 8 days, 24.6% of all the work shifts of the participants were irregular, and 26.9% of the irregular work shifts were nightshifts (6.6% of all the work shifts).

**Measures**

The daily surveys were based on items of existing scales for measuring job demands, job resources, detachment, and
employee creativity, which are used in regular survey studies. With minor adjustments, the items were made suitable for daily diary research (e.g., from “I need to display high levels of concentration and precision at work” to “Today, I needed to display high levels of concentration and precision at work”).

The selection of items in this study is based on factor analyses on data collected with the longer scales in several regular survey studies. The highest loading items were selected. Final selections were based on close inspection of the internal consistency coefficients, to guarantee sufficient internal reliability of the shortened measures (i.e., reliability coefficients ≥ .60).

As a result, all constructs were measured with one to three items. The items were rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). To assess the reliability of the scales in this study, we calculated Cronbach’s alpha for the three-item scales and the Spearman–Brown coefficient for the two-item scales, as the latter is the most appropriate reliability coefficient for a two-item scale (Eisinga, Te Grotenhuis, & Pelzer, 2013). Due to divergent numbers of measured cases per day, the reliability coefficients reported in the next section are averaged over 8 days (cf. Sonnentag, Binnewies, & Mojza, 2008).

**Job demands and job resources**

Cognitive and emotional job demands and job resources were measured right after work (T1), with one to two items for each construct. The items were taken from the well-validated DISC-Questionnaire Short Version (DISQ-S 2.0; De Jonge et al., 2007). An example item measuring cognitive demands (two items in total) is “Today, I had to do a lot of mentally taxing work” (Spearman–Brown coefficient = .71). Emotional demands were measured with one item: “Today, I had to do a lot of emotionally draining work.” For cognitive resources we used one item: “Today, I had access to useful information to solve complex problems.” Emotional resources were measured with two items, for example: “Today, I was able to count on emotional support from others if a threatening situation at work occurred.” The Spearman–Brown coefficient of emotional resources was .87.

**Detachment from work**

Cognitive and emotional detachments from work during non-work time were measured at bedtime (T2). The items were derived from well-validated scales developed by De Jonge et al. (2012), who confirmed the existence of empirically different dimensions of detachment from work. Each detachment component was measured with two items: “After work, I put all thoughts of work aside” (cognitive); “After work, I mentally distanced myself from work” (cognitive); “After work, I put all emotions from work aside” (emotional), and “After work, I emotionally distanced myself from work” (emotional). The Spearman–Brown coefficients of the cognitive and emotional detachment items were .80 and .88, respectively.

**Employee creativity**

The focus of this study lies on the immediate effect of detachment after work on creativity. To isolate this effect, we assessed the creativity level after detachment (i.e., before going to bed) while controlling for the creativity level before detachment (i.e., directly after work), following the regressor variable approach (i.e., residualized regression) for change analyses (Allison, 1990; Taris, 2000). Thus, employee creativity at T2 is the dependent variable, and employee creativity at T1 is used as a control variable. We used the following three items from a well-validated Dutch scale for employees' self-ratings of creativity (e.g., De Jonge, Le Blanc, Peeters, & Noordam, 2008) that was based on George and Zhou’s (2001) scale for employee creativity (cf. Dul & Ceylan, 2011): “My head is full of creative solutions to problems at work,” “My head is full of new and innovative ideas about work,” and “My head is full of suggestions about new ways of performing work tasks.” The average Cronbach’s alpha was .89 for the measurement right after work, and .92 for the one before going to sleep.

**Control variables**

Next to employee creativity at T1, we controlled for gender, age, and education level because prior research has indicated that these variables may affect employee creativity (e.g., Amabile, 1988; Binnewies & Wörnlein, 2011). Finally, the time participants had available to detach from work between the end of the workday and bedtime was not always the same due to shiftwork. Therefore, we also included irregular shifts (evening shifts or night shifts) as control variables in our analyses.

**Data analysis**

To analyse our data, we used a multi-level linear modelling approach with MLwiN 2.25 software (Rasbash, Browne, Healy, Cameron, & Charlton, 2012). Data collected in this study can be distinguished on two levels: a day-level (level 1) and a person-level (level 2). Day-level data, such as scores on job demands, can vary within persons from day to day. On the other hand, person-level data, such as age and sex, cannot vary within persons from day to day. The focus of this study lies on the question whether a higher or lower level of job demands, job resources, and detachment a person experiences on a specific day (in comparison to the average personal score over 8 days) is related to an increase or decrease of that person’s creativity before going to sleep. Therefore, we centred all day-level predictor and control variables (level 1; i.e., job demands, job resources, detachment, and creativity at T1) at the respective person mean (cf. Sonnentag, Binnewies, & Mojza, 2008). The person-level control variables (level 2; i.e., age and education) were centred at the grand mean. Hence, all between-person variance is removed, hereby ruling out interpretations of our results referring to individual differences (e.g., personality or differences in workplace). Finally, gender and irregular shifts (i.e., evening and night shifts) were included in the analysis as dummy-coded control variables.

To test the hypotheses (i.e., three-way interactions between matching job demands, job resources, and detachment), different models were tested and compared. Model 0 only included the intercept. In Model 1, control variables on person-level (gender, age, education, type of shift) and on day-level (creativity T1) were added. In Model 2, the different types of job demands, resources, and detachment (main effects)
were entered. Subsequently, two-way interactions between job demands, resources, and detachment were added to Model 3. Finally, Model 4 also contained three-way interactions between the DISC-R components. Following the main assumption of the theoretical model, all interactions were of matching kind (cf. De Jonge et al., 2012), resulting in 6 two-way interactions and two three-way interactions. Within the models, only the intercept varied on person-level (level 2) (cf. Sonnentag, Binnewies, & Mojza, 2008). Therefore, the assumption was that the level of creativity at T2 varies between persons, but that the strength of the relation between job demands, resources, and detachment on the one hand, and creativity on the other, is the same for every individual.

**Results**

**Preliminary analysis**

Before testing our hypotheses, we examined whether creativity before going to bed varies within persons. By calculating the intra-class coefficient, it turned out that 63.3% (0.342/0.342 + 0.198 = 0.633) of the variance in creativity at T2 can be explained by differences between persons. The remaining 39.7% of variation in creativity at T2 can be explained by differences within persons. For creativity after work, job demands, job resources, and detachment, the within-person variation ranged from 49.8% to 66.6%. These substantial proportions support the choice for multi-level analysis.

Table 1 displays day-level means, standard deviations, and correlations between the study variables. As expected, creativity at T1 and T2 were relatively strongly associated \(r = .70, p < .01\). Regarding the control variables, only age was negatively related to T2 creativity \(r = -.11, p < .01\). Furthermore, cognitive and emotional resources were each positively related to creativity after work (respectively: \(r = .23, p < .01\); \(r = .21, p < .01\)) and to T2 creativity (respectively: \(r = .19, p < .01\); \(r = .20, p < .01\)). There were no significant correlations between different kinds of job demands and detachment on one hand and both measures of creativity on the other.

**Effects on employee creativity**

The results of the multilevel analyses are depicted in Table 2, including model fit information (-2*log likelihood), estimates for fixed parameters, and estimates for the variance components. The stepwise inclusion of variables in Models 1–3 resulted in an increasingly better model fit, indicating that for each of these models the additional variables contributed significantly to the prediction of T2 creativity with Model 3 being the best fitting model. Contrary to our expectations, the model that included three-way interactions (Model 4) did not show significant improvement compared to the model containing two-way interactions (Model 3; \(\Delta-2*\log = 3.425, \Delta df = 2, ns\)). As a consequence, both hypotheses were rejected. Nevertheless, the improved fit of Model 3 compared to Model 2 (\(\Delta-2*\log = 13.840, \Delta df = 6, p < .05\)), indicated that the matching two-way interactions between job demands, resources, and detachment did significantly contribute to the prediction of creativity at T2. In the following, the results of Model 3 are discussed in more detail.

As expected, creativity after work contributed significantly to the prediction of creativity at T2 \(t = 7.19, p < .01\). None of the person-level control variables (level 2) had a significant effect. Of all the particular kinds of job demands, resources, and detachment, only cognitive detachment had a positive main effect on T2 creativity \(t = 2.63, p < .01\). In other words, more cognitive detachment was related to higher creativity levels. The three matching cognitive interactions did not show significant effects. However, the interactions between emotional demands on one hand, and emotional resources and detachment on the other hand, turned out to be significant \(t = 3.33, p < .01\; t = -2.05, p < .05\).

The high correlation between the two detachment constructs \(r = .72\) may raise issues of potential multicollinearity. Although the correlation does not exceed the determined cut-off point of .85 for poor discrimination between predictor variables (Brown, 2006; Kline, 2005), we also separately tested the models for the cognitive and emotional predictors. These analyses yielded virtually the same results: for the cognitive predictors, we again found a main effect of cognitive detachment on employee creativity (Model 2). For the emotional predictors, we found the same two-way interaction terms of emotional demands on the one hand, and emotional detachment and emotional resources on the other (Model 3). The directions of all effects remained unaltered. These additional analyses support the reliability of the models tested and indicate that the reported results are not attributable to multicollinearity.

<table>
<thead>
<tr>
<th>Variable</th>
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<td>2. Gender*</td>
<td>0.85</td>
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<td>–15**</td>
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<td>3. Education</td>
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<td>–0.07</td>
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<td>0.11*</td>
<td>–</td>
<td>–</td>
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<td>4. Evening shift</td>
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<td>0.36</td>
<td>0.03</td>
<td>0.02</td>
<td>0.11*</td>
<td>–</td>
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<td>5. Nightshift</td>
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<td>–0.02</td>
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<td>6. Cognitive demands</td>
<td>3.80</td>
<td>0.76</td>
<td>0.09</td>
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<td>–0.05</td>
<td>0.06</td>
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<tr>
<td>7. Emotional demands</td>
<td>3.04</td>
<td>1.09</td>
<td>0.02</td>
<td>–0.02</td>
<td>–0.38**</td>
<td>0.05</td>
<td>0.00</td>
<td>0.32**</td>
<td>–</td>
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<tr>
<td>8. Cognitive resources</td>
<td>3.47</td>
<td>0.85</td>
<td>–0.22**</td>
<td>–0.03</td>
<td>0.14**</td>
<td>0.08</td>
<td>–0.05</td>
<td>0.16**</td>
<td>0.14**</td>
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<tr>
<td>9. Emotional resources</td>
<td>3.57</td>
<td>0.75</td>
<td>–0.18**</td>
<td>0.11*</td>
<td>0.19**</td>
<td>0.11*</td>
<td>–0.17**</td>
<td>0.11*</td>
<td>0.00</td>
<td>0.38**</td>
<td>–</td>
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<tr>
<td>10. Cognitive detachment</td>
<td>3.87</td>
<td>0.88</td>
<td>–0.11*</td>
<td>0.16**</td>
<td>0.17**</td>
<td>0.04</td>
<td>–0.12*</td>
<td>–0.10</td>
<td>–0.25**</td>
<td>0.20**</td>
<td>0.31**</td>
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<tr>
<td>11. Emotional detachment</td>
<td>3.90</td>
<td>0.83</td>
<td>–0.12*</td>
<td>0.16**</td>
<td>0.13*</td>
<td>0.11*</td>
<td>–0.14**</td>
<td>–0.04</td>
<td>–0.23**</td>
<td>0.12*</td>
<td>0.26**</td>
<td>0.72**</td>
<td>–</td>
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<tr>
<td>12. Employee Creativity T1</td>
<td>2.91</td>
<td>0.71</td>
<td>–0.07</td>
<td>0.09</td>
<td>–0.05</td>
<td>–0.06</td>
<td>0.00</td>
<td>0.09</td>
<td>0.04</td>
<td>0.23**</td>
<td>0.19**</td>
<td>0.04</td>
<td>0.03</td>
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<tr>
<td>13. Employee Creativity T2</td>
<td>2.79</td>
<td>0.73</td>
<td>–0.11*</td>
<td>0.02</td>
<td>–0.02</td>
<td>–0.05</td>
<td>0.06</td>
<td>0.07</td>
<td>0.02</td>
<td>0.21**</td>
<td>0.20**</td>
<td>0.07</td>
<td>0.02</td>
<td>0.70**</td>
<td></td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.01 level (2-tailed); * correlation is significant at the 0.05 level (2-tailed).**

\(\alpha = 0; \beta = 1\).
To obtain a closer understanding of the significant interaction effects, we plotted the slopes and performed simple slope tests (Aiken & West, 1991; Preacher, Curran, & Bauer, 2006), as depicted in Figures 2 and 3. First, when emotional resources were low, an increase in emotional demands was associated with a decrease in creativity (resources $-1SD$; $t = -3.49$, $p < .01$). In the case of a high level of emotional resources, an increase in emotional demands was related to higher creativity levels (resources $+1SD$; $t = 2.15$, $p < .05$). Putting it differently, whereas emotional demands were positively related to creativity on days that emotional resources were high, they were negatively related to creativity on days that emotional resources were low.

Second, when emotional detachment was low, the level of emotional job demands did not predict any changes in the level of creativity (detachment $-1SD$; $t = 0.81$, ns). However, in a situation with high emotional detachment from work, emotional demands were associated with lower creativity levels (detachment $+1SD$; $t = -2.33$, $p < .05$). In other words, on a day with high emotional demands, complete emotional detachment after work time was not beneficial to creativity.

**Discussion**

Previous studies have provided ample evidence that detachment from work during non-work time can prevent work-related health complaints (e.g., Sonnentag et al., 2010). Research into the relation between detachment and job performance, however, has rendered indications for a side effect

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Table 2. Multilevel estimates for models predicting employee creativity at Time 2.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 0 Estimate</th>
<th>Model 0 SE</th>
<th>Model 1 Estimate</th>
<th>Model 1 SE</th>
<th>Model 2 Estimate</th>
<th>Model 2 SE</th>
<th>Model 3 Estimate</th>
<th>Model 3 SE</th>
<th>Model 4 Estimate</th>
<th>Model 4 SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Intercept</td>
<td>2.761**</td>
<td>0.053</td>
<td>2.734</td>
<td>0.156**</td>
<td>2.718**</td>
<td>0.158</td>
<td>2.692**</td>
<td>0.159</td>
<td>2.708**</td>
<td>0.158</td>
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<td>2 Control variables</td>
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<tr>
<td>Employee creativity (T1)</td>
<td>0.416**</td>
<td>0.048</td>
<td>0.386**</td>
<td>0.054</td>
<td>0.381**</td>
<td>0.053</td>
<td>0.370**</td>
<td>0.053</td>
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<td>Gender (F)</td>
<td>-0.010</td>
<td>0.168</td>
<td>0.030</td>
<td>0.171</td>
<td>0.032</td>
<td>0.172</td>
<td>0.016</td>
<td>0.172</td>
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<tr>
<td>Age</td>
<td>-0.005</td>
<td>0.005</td>
<td>-0.006</td>
<td>0.005</td>
<td>-0.006</td>
<td>0.005</td>
<td>-0.005</td>
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<tr>
<td>Education</td>
<td>0.035</td>
<td>0.048</td>
<td>0.024</td>
<td>0.049</td>
<td>0.027</td>
<td>0.049</td>
<td>0.031</td>
<td>0.049</td>
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<td>Evening shift</td>
<td>-0.016</td>
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<td>-0.018</td>
<td>0.080</td>
<td>0.011</td>
<td>0.079</td>
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<tr>
<td>Nightshift</td>
<td>0.074</td>
<td>0.239</td>
<td>-0.327</td>
<td>0.318</td>
<td>-0.294</td>
<td>0.313</td>
<td>-0.278</td>
<td>0.312</td>
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<tr>
<td>3 Independent variables</td>
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<tr>
<td>Cognitive demands</td>
<td>0.032</td>
<td>0.048</td>
<td>0.040</td>
<td>0.048</td>
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<tr>
<td>Emotional demands</td>
<td>-0.029</td>
<td>0.037</td>
<td>-0.057</td>
<td>0.037</td>
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<tr>
<td>Cognitive resources</td>
<td>-0.013</td>
<td>0.041</td>
<td>-0.008</td>
<td>0.040</td>
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<td>Emotional resources</td>
<td>-0.056</td>
<td>0.048</td>
<td>-0.048</td>
<td>0.047</td>
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<tr>
<td>Cognitive detachment</td>
<td>0.122*</td>
<td>0.048</td>
<td>0.129**</td>
<td>0.049</td>
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<td></td>
<td>0.142**</td>
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<tr>
<td>Emotional detachment</td>
<td>-0.060</td>
<td>0.058</td>
<td>-0.087</td>
<td>0.058</td>
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<td>-0.095</td>
<td>0.058</td>
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<tr>
<td>4 Two-way interactions</td>
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<tr>
<td>Cog. Dem. × Cog. Res</td>
<td>-0.020</td>
<td>0.070</td>
<td>0.079</td>
<td>0.089</td>
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<tr>
<td>Cog. Dem. × Cog. Det.</td>
<td>-0.009</td>
<td>0.081</td>
<td>-0.029</td>
<td>0.081</td>
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<tr>
<td>Cog. Res. × Cog. Det.</td>
<td>0.011</td>
<td>0.061</td>
<td>0.006</td>
<td>0.061</td>
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<tr>
<td>Emo. Dem. × Emo. Res.</td>
<td>0.260**</td>
<td>0.078</td>
<td>0.248**</td>
<td>0.078</td>
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<tr>
<td>Emo. Dem. × Emo. Det.</td>
<td>-0.125*</td>
<td>0.061</td>
<td>-0.130*</td>
<td>0.063</td>
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<tr>
<td>Emo. Res. × Emo. Det.</td>
<td>0.040</td>
<td>0.101</td>
<td>0.049</td>
<td>0.101</td>
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<td>5 Three-way interactions</td>
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<tr>
<td>Cog. Dem. × Cog. Res. × Cog. Det.</td>
<td>-0.186</td>
<td>0.103</td>
<td>-0.070</td>
<td>0.125</td>
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<tr>
<td>Δ−2*LL</td>
<td>897.468</td>
<td>683.577</td>
<td>611.418</td>
<td>597.578</td>
<td>594.153</td>
<td>3.425</td>
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<td>Δdf</td>
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<tr>
<td>Level 1 intercept variance (SE)</td>
<td>0.342</td>
<td>0.048</td>
<td>0.357</td>
<td>0.054</td>
<td>0.341</td>
<td>0.054</td>
<td>0.348</td>
<td>0.055</td>
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<tr>
<td>Level 2 intercept variance (SE)</td>
<td>0.198</td>
<td>0.015</td>
<td>0.175</td>
<td>0.015</td>
<td>0.172</td>
<td>0.015</td>
<td>0.162</td>
<td>0.014</td>
<td>0.161</td>
<td>0.014</td>
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*p < .05; **p < .01; LL: log likelihood.

![Figure 2](image2.png)

Figure 2. Interaction effect of emotional job demands and emotional job resources in the prediction of creativity.

![Figure 3](image3.png)

Figure 3. Interaction effect of emotional detachment and emotional job demands in the prediction of creativity.
of detachment: the effects of complete detachment from work might not always be beneficial to performance outcomes, such as employee creativity (Binnewies et al., 2009; De Jonge et al., 2012). The current daily survey study addressed this enigma by shedding light on the interplay of different kinds of detachment, job demands, and resources, as predictors of daily fluctuations in employee creativity levels. In this context, employee creativity refers to the generation of novel thoughts and ideas about work (Amabile, 1988; George & Zhou, 2001). We expected that, in cognitively active jobs, no complete mental detachment from work might enhance the generation of novel thoughts and ideas about work, and hence, foster employee creativity. For emotionally active jobs, however, we expected that putting one’s (negative) work-related emotions aside might benefit employee creativity because it may prevent negative sustained activation in the human brain and make room for positive experiences to occur in the home domain. More specifically, we hypothesized that the combination of high cognitive demands, high cognitive resources, and low cognitive detachment would be positively related to creativity, as well as the combination of high emotional demands, high emotional resources, and high emotional detachment. Neither of these hypotheses was confirmed by our daily survey data: we found the main effect of cognitive detachment on creativity to be in the opposite direction (i.e., positive), and none of the interactions between the cognitive predictor variables were significant. In addition, analyses showed that the combination of low emotional detachment and high emotional demands was conducive to creativity, as well as the combination of high emotional demands, high emotional resources, and high emotional detachment. Although the specific hypotheses were not confirmed in this study, our findings do demonstrate that, indeed, detachment from work is not always beneficial to creativity, depending on the specific job demands encountered during work and the specific type of detachment.

A possible reason for not finding significant effects for cognitive resources in the prediction of daily employee creativity levels is that cognitive job resources are not sufficient for the generation of new and useful ideas (cf. Binnewies, Ohly, & Niessen, 2008). More specifically, rather than having a “stand-alone” effect, cognitive resources may contribute to creativity in combination with other factors. According to Amabile (1988, 2013), individual creativity is not only influenced by the external environment, but also by a person’s domain-relevant skills, creativity-relevant skills, and intrinsic motivation. That is, these individual factors may be necessary to take advantage of cognitive job resources and, consequently, generate new and useful ideas about work.

Nonetheless, we did find that high cognitive detachment from work was associated with higher rather than lower employee creativity, thereby not supporting the previous findings of Binnewies et al. (2009) and De Jonge et al. (2012). The mixed findings might be due to the fact that, as opposed to more static study designs, we investigated short-term within-person fluctuations in creativity from a dynamic process perspective. Alternatively, the mixed findings might also suggest that the relation between cognitive detachment and creativity is more complicated. Although thinking about work during non-work time can be a condition for the generation of new and useful ideas about work, a study of Wiley and Jarosz (2012) showed that too much focus or attentional control may actually limit creative problem solving—it may limit the scope of solutions that are explored and lead solvers to adopt or persist in suboptimal strategies. According to the authors, a more diffuse or leaky attentional state may be better for creative problem solving. It is also plausible that seemingly problem-solving thoughts about work associated with low cognitive detachment from work can easily become repetitive and unintentional and, as such, turn into worrying or rumination. Ruminaton is defined as repetitive and unintentional perseverative thoughts in the absence of obvious external cues (Martin & Tessier, 1996), which is associated with energy depletion and even with emotional exhaustion (Donahue et al., 2012). The conceptual difference between both types of thoughts about work lies in whether they are adaptive or maladaptive to problem solving. This argumentation is in line with Treynor, Gonzalez, and Nolen-Hoeksema (2003), who made a distinction between “reflective pondering” and maladaptive “brooding.” They defined reflective pondering as an adaptive cognitive problem-solving strategy, which is utilized by the individual to confront and alleviate depressive symptoms. In contrast, brooding refers to the passive comparison of one’s predicament against an unachieved standard. Most likely, the latter type of thoughts about work will predominately impede employee creativity. This suggests a need to more closely tap into the specifics of employees’ cognitive problem-solving strategies in future research.

With respect to the emotional DISC-R components, high emotional demands in combination with either high emotional resources or low emotional detachment were associated with an increase in creativity. These results support the assertion that an emotionally activating and stimulating (work) situation (i.e., challenging job demands) leads to more creativity (Zhou et al., 2012). Nevertheless, in order to deal with high emotional demands, employees also need a large amount of emotional resources (e.g., emotional support from colleagues), which is consistent with DISC-R Model’s matching principle. Furthermore, high emotional job demands were associated with a decrease in creativity only if emotional detachment from work was high. This finding is not in accordance with the cross-sectional findings of De Jonge et al. (2012), who found that high emotional detachment from work was associated with more creativity. Our finding, on the other hand, suggests that after an emotionally demanding day at work, completely emotionally “switching off” from work might not be the best strategy to produce new (problem-solving) ideas about work.

Next to the difference in study designs, emotion regulation literature points toward another possible explanation for the current results. Emotional detachment implies taking distance from one’s emotions, which are elicited by the work situation. On a day with high emotional demands, however, a high degree of emotional detachment could resemble emotion suppression. Suppression involves attempting to conceal or contain the emotion after the individual has fully begun to experience it (Wallace, Edwards, Shull, & Finch, 2009). Research has shown that suppression is not only strongly related to psychological distress (Kashdan, Barrios, Forsyth, & Steger,
suppressing emotions might also inhibit the urge to create ideas about new solutions to problems at work. Therefore, employees might be better off using another emotion regulation strategy (such as positive reappraisal), when facing highly emotionally demanding situations. Evidently, an active approach to regulating emotions implies not completely emotionally detaching from work. Moreover, Bledow, Rosing, and Frese (2013) recently found that creativity increases if a person experiences an episode of negative affect that is followed by a decrease in negative affect and an increase in positive affect (i.e., affective shift). According to the authors, an episode of negative affect can lay the foundation for high creativity at a later point in time, whereas the regulation of negative affect plays a key role for achieving high levels of creativity. Applying their findings to this study, it could very well be that the experience of high emotional demands during the day, followed by the regulation of associated negative emotions after work (i.e., low emotional detachment), represents such an affective shift, and thereby contributes to creativity.

From a more general perspective, our unexpected findings may also indicate that the current premises of the underlying theoretical model need further exploration. Because detachment from work has recently been included in the DISC-R Model, so far there is only a relatively small body of research to draw on. Based on our findings, one might argue whether the current positioning of detachment from work in the DISC-R Model is warranted. A recent study of Nils, Gevers, De Jonge, and Houtman (2015) showed support for the idea that the particular combination of detachment and job resources may counterbalance high job demands. A remaining question, however, is whether the off-job recovery concept of detachment from work and job resources can simultaneously moderate the relation between job demands and employee outcomes (i.e., three-way interaction). De Jonge et al. (2012) did find such a matching three-way interaction in which both cognitive detachment and cognitive resources moderated the relation between cognitive demands and active learning. Nevertheless, as also mentioned in the introduction section of the manuscript, their study was solely based on cross-sectional survey data. Perhaps on a daily basis, one does not necessarily need both matching job resources and matching detachment from work to effectively deal with specific types of job demands. In addition, results of this study indicate that effects of detachment from work are content and context dependent. It is plausible that particularly emotional detachment from work is somewhat less functional in situations that are characterized by highly negative or positive affective experiences. In line with the previous paragraph, such experiences may call for either active emotion regulation or savouring, rather than emotional detachment (see also Sonnentag & Binnewies, 2013; Sonnentag & Fritz, 2015). Obtaining true insight into these issues may also require that we take into account potential differential effects of detachment depending on affective content, for instance by differentiating between positive and negative as well as activating and deactivating affective states based on the circumplex model of affect (Russell, 1980; Russell & Barrett, 1999). Evidently, more research on the DISC-R Model that incorporates insights from relevant theories on cognitive problem-solving strategies, affective states, and emotion regulation is needed to further investigate these issues.

**Study limitations**

Despite the strong day-level design and the relatively large sample size for this kind of study, there are a few limitations to the study’s scope and method. First, no strong inferences about causality can be drawn. Although the suggested causal ordering was theoretically driven and assessed by temporal sequence between the measured study variables, possible influences of third variables cannot be ruled out. Second, because all data are assessed with self-report measures, there is a possibility of common method variance (Podsakoff, MacKenzie, & Podsakoff, 2012). However, we minimized this problem by centring the day-level variables (level 1) around the person-mean, hereby eliminating all between-person variance that could be attributed to individual response tendencies (e.g., social desirability). Moreover, concerns with common-method variance are smaller with diary research because not all variables are measured at the same moment (Podsakoff et al., 2012). Third, due to space limitations and reduced filling-out time combined with daily triple measurement, we had to use single-item scales, which can jeopardize construct validity. Nevertheless, other studies on work and recovery have shown that the use of one-item scales does not have to be problematic (e.g., Van Hooff, Geurts, Kompier, & Taris, 2007). This is in line with Wanous, Reicher, and Hudý (1997), who stated that when the construct of interest is relatively narrow or is unambiguous to respondents, a single-item measure may be more appropriate. Another limitation is that we only tested matching interactions. Nonmatching (cross-domain) interactions might also account for part of the variance in day-level creativity, although this has theoretically been assumed and also empirically been shown to be less likely (De Jonge et al., 2012). The added value of testing nonmatching interactions in this study is, therefore, assumed to be marginal. Finally, as our study is based on a health care sample, it is possible that our findings are unique to this occupational group. More research is clearly needed to add to the generalizability of the current results.

**Directions for future research**

In our study, we focused on off-job recovery (i.e., detachment from work) during non-work time. It would be interesting for future researchers to investigate the relation between “on-job” recovery (i.e., recovery during work breaks), creativity, and other work-related variables, too (cf. Trougakos, Beal, Green, & Weiss, 2008). This could provide specific guidelines about how to use work breaks in the most beneficial way, regarding employee creativity levels and health outcomes.

Another possible research direction concerns the role of the emotional valence (positive vs. negative) of work-related thoughts in the relation between detachment from work and job performance outcomes. Although we found that high cognitive detachment predicts higher creativity, other studies
have shown that thinking about one’s job in a positive way during leisure time was positively related to performance outcomes, such as proactive behaviour, creativity, and the pursuit of learning something new at work (e.g., Binnewies et al., 2009; Fritz & Sonnentag, 2005). In the study of Binnewies et al. (2009), negative work reflection was unrelated to work performance. However, no distinction was made between a ruminative form and a problem-focused form of negative work reflection (cf. Croteau & Zijlstra, 2011). The latter type, as also described earlier in this section, may enhance job performance, because it motivates the individual to solve work-related problems (Binnewies et al., 2009). It is not inconceivable that, despite a negative content of reflective work-related thoughts, the accompanying emotion of problem-solving thoughts can have a positive valence and, thus, foster creativity (cf. Amabile et al., 2005).

Finally, as we were interested in what happens directly before and after detachment from work takes place, the focus of our study was on relatively short-term time intervals (cf. Niks et al., 2015). Future research, however, could extend this study by investigating how effects of detachment and creativity unfold overnight. It would be very relevant, for instance, to find out how sleep might influence this process (cf. Zijlstra & Sonnentag, 2006) and whether employees actually make use of their creative problem-solving ideas at some later point in time. In fact, there are indications that creative thoughts on a particular day may develop overnight, increasing the probability of creative thoughts the following (work) day (Amabile et al., 2005).

**Implications for practice**

Our daily survey study has several important implications for practice. First, high-level job demands can lead to higher work pressure, but, as seen in the current and extant research (e.g., Amabile & Mueller, 2008; De Jonge et al., 2012), can also stimulate positive outcomes, such as employee creativity. This is in accordance with Crawford, LePine, and Rich (2010), who showed that job demands can be divided into hindering demands and challenging demands, implying that the concept of job demands by itself is not positive or negative by nature. It is important, however, that employees are provided with enough job resources and opportunities to recover, so that job demands can be perceived as challenging rather than hindering.

A second practical implication is that detachment from work not only benefits health (e.g., Sonnentag et al., 2010), but, in the case of cognitive detachment, is also positively associated with employee creativity. Supervisors and employees should pay attention to detachment from work as an important predictor and/or sustainer of health, but in the case of emotionally demanding work, they should be aware that not completely switching off one’s emotions after work is related to higher employee creativity levels. This finding might be particularly important for the service sector, because emotional labour is one of its key characteristics. In general, supervisors could stimulate effective detachment from work in several ways: by acting as role models, by showing how detachment can be most effective (De Jonge et al., 2012); by setting clear guidelines for separating work and non-work life (cf. Sonnentag, Binnewies, Mojza, & Scholl, 2008); and by providing employees with workshops how to adequately detach from work, preferably in a cognitive and emotional way.

In conclusion, effects of detachment from work on employee creativity seem to be divergent. Whether detaching from work is conducive to employee creativity largely depends on the specific type of detachment and the particular work situation one encounters during the day. The ability to detach in a cognitive way, by not thinking about work in leisure time, seems beneficial at all times. However, on emotionally demanding days, not disregarding work-related emotions seems to be the best strategy to produce new and useful ideas about work.

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