



## How can mindfulness be promoted? Workload and recovery experiences as antecedents of daily fluctuations in mindfulness

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While previous work on mindfulness has focused predominantly on the benefits of mindfulness and of mindfulness interventions, the present article addresses the question of how natural experiences of mindfulness can be promoted in the context of work. Accordingly, this article sheds light on day-to-day fluctuations in workload and recovery experiences (psychological detachment and sleep quality) as antecedents of state mindfulness. Furthermore, this study extends extant research that has documented beneficial effects of mindfulness on subsequent recovery experiences by arguing that the relationship between mindfulness and recovery experiences is reciprocal rather than unidirectional. Using an experience-sampling design across five workdays and involving three daily measurement occasions, we found that sleep quality and workload were related to subsequent levels of mindfulness. While not displaying a significant direct relationship with mindfulness, psychological detachment was indirectly related to mindfulness via sleep quality. Fatigue was identified as an important mechanism explaining these relationships. Furthermore, findings confirmed that the relationship between mindfulness and recovery experiences is reciprocal rather than unidirectional. Taken together, this study contributes to an enriched understanding of the role of mindfulness in organizations by shedding light on factors that precede the experience of mindfulness and by pointing to the existence of gain spirals associated with recovery experiences and mindfulness.

### Practitioner points

- Organizations seeking to promote mindfulness among their workforce should try to keep workload to a manageable degree.
- Organizations may also pay attention to care for employees' day-to-day recovery as it has been shown to facilitate mindfulness.

Over the last years, mindfulness – a state of consciousness, in which individuals pay attention to present-moment experiences (Brown & Ryan, 2003) – has garnered increasing attention in the work and organizational psychology literature (for reviews,

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see Good *et al.*, 2016; Hafenbrack, 2017; Hyland, Lee, & Mills, 2015; Jamieson & Tuckey, 2016). Specific attention has been placed on investigating the benefits of mindfulness for employee health and well-being. Accordingly, studies have revealed that mindfulness facilitates work-family balance (Allen & Kiburz, 2012; Kiburz, Allen, & French, 2017; Michel, Bosch, & Rexroth, 2014), stress reduction (Wolever *et al.*, 2012), personal and work-related well-being (Hülshager, Alberts, Feinholdt, & Lang, 2013; Reb, Narayanan, & Ho, 2015), and successful day-to-day recovery (Hülshager, Feinholdt, & Nübold, 2015; Hülshager *et al.*, 2014; Querstret, Copley, & Fife-Schaw, 2016). These studies have employed different operationalizations of mindfulness. While most have focused on mindfulness as a trait that varies naturally between individuals (Allen & Kiburz, 2012; Hülshager *et al.*, 2014; Reb *et al.*, 2015), some studies have focused on more dynamic aspects of mindfulness as a state that fluctuates within individuals (Hülshager *et al.*, 2013, 2014). A third group of studies have used mindfulness interventions to investigate the benefits of mindfulness for worker health and well-being (Hülshager *et al.*, 2013, 2015; Michel *et al.*, 2014; Wolever *et al.*, 2012). Common to these studies is a focus on outcomes of mindfulness in the context of work. Yet, apart from the fact that mindfulness can be enhanced through mindfulness interventions, little is known about the factors that facilitate the experience of mindfulness. This applies to mindfulness research in general and to mindfulness research in work and organizational psychology in particular. Already in 2003, Brown and Ryan noted that ‘the question remains of how this form of consciousness naturally develops and what psychological and social conditions support and hinder its dispositional and state level, or momentary expression’ (p. 844). Their observation still applies, almost 15 years later. This is striking, as a comprehensive understanding of psychological phenomena requires knowledge about consequences and antecedents alike.

The primary purpose of the present article is therefore to extend knowledge about the role of mindfulness in the context of work by shedding light on work-related and individual characteristics that may promote the experience of mindfulness. Gaining insights into the antecedents of mindfulness is indispensable for a comprehensive understanding of the nature of mindfulness in general as well as in the context of work. These insights are not only theoretically relevant but they also have important practical implications. Organizations seeking to increase mindfulness among their workforce have started offering mindfulness-based training programmes. While this has proven to be an effective way of enhancing mindfulness through regular mindfulness practice (e.g., Wolever *et al.*, 2012), it places the responsibility of increasing mindfulness exclusively on the employees themselves. However, mindfulness-based training programmes may not be the only way to promote mindfulness in organizations. Learning more about the influence of individual and work characteristics on the experience of mindfulness has the potential to unravel alternative or supplemental ways to bolster mindfulness in employees. Such knowledge is indispensable for organizations that wish to do more to foster mindfulness among their workforce than simply offering mindfulness trainings.

In a first endeavour to close this research gap, we will link mindfulness with conservation of resources theory (COR; Hobfoll, 1989). Specifically, we consider the central role of attention regulation in mindfulness (Bishop *et al.*, 2004) and propose that by threatening energetic resources, high workload hinders the experience of mindfulness while recovery experiences promote subsequent mindfulness by helping to replenish resources. By investigating workload and the recovery experiences of psychological detachment and sleep quality as antecedents to mindfulness, we consider an antecedent residing in the work environment as well as antecedents residing in the individual.

Workload refers to the amount of work and required speed to fulfil job tasks. Furthermore, we focus on the two recovery experiences of psychological detachment and sleep quality that have been identified to be central in driving day-to-day recovery (Sonnentag & Fritz, 2015). Psychological detachment after work describes an 'individual's sense of being away from the work situation' (p. 579; Etzion, Eden, & Lapidot, 1998), and it captures the extent to which individuals manage to disengage from work-related activities, feelings, and thoughts (Sonnentag & Fritz, 2007, 2015). Furthermore, sleep quality is vital for day-to-day recovery as sleep serves the restoration of human brain capacity (Gander, Graeber, & Belenky, 2011).

For a comprehensive understanding of how workload and recovery experiences help or hinder the experience of mindfulness, we focus on the role of fatigue as a mediating mechanism. Fatigue refers to a person's momentary level of energy, and it is characterized by feelings of exhaustion, tiredness, and lack of motivation to exert further effort (Sonnentag & Zijlstra, 2006; Zijlstra, Cropley, & Rydstedt, 2014). Fatigue is therefore considered to be a reliable indicator of lack of self-regulatory capacities (Barnes, Schaubroeck, Huth, & Ghumman, 2011; Trougakos, Hideg, Cheng, & Beal, 2013). As workload drains while recovery experiences help replenish self-regulatory capacities, they will be differentially related to fatigue which is expected to mediate relationships with mindfulness.

As a second purpose of this study, we built upon and extend previous research that has shown that state mindfulness promotes subsequent recovery experiences such as psychological detachment and sleep quality (Hülshager *et al.*, 2014, 2015; Michel *et al.*, 2014; Querstret *et al.*, 2016). Specifically, we suggest that the relationship of mindfulness with recovery experiences of psychological detachment and sleep quality is reciprocal rather than unidirectional. We therefore simultaneously consider both potential pathways: first, a pathway from state mindfulness to subsequent recovery experiences as suggested in previous research (Hülshager *et al.*, 2014, 2015), and second, a pathway from recovery experiences to subsequent levels of state mindfulness as suggested in this study. For a comprehensive understanding of the role of mindfulness in the recovery process, such knowledge is important as it may point to the existence of gain spirals associated with mindfulness and the recovery experiences of psychological detachment and sleep quality.

In our study, we adopt a within-person perspective and focus on the short-term dynamics of workload, state mindfulness, and recovery experiences as they unfold within a workday and from one workday to the next (Sonnentag & Fritz, 2015). Accordingly, although we acknowledge that workload, mindfulness, and recovery variables also have trait-like aspects (Brown & Ryan, 2003; Sonnentag & Fritz, 2007), our focus is on the day-to-day fluctuations in workload, mindfulness, and recovery experiences as they unfold in the daily ebb and flow of everyday life. Importantly, in seeking to capture the recovery process comprehensively, we consider a full cycle of rest, work, and rest. In their seminal review of the literature, Sonnentag and Fritz (2015) observed that extant research has focused predominantly on immediate benefits of recovery at the same evening or next morning and they called for more research on the consequences of recovery for the following work period. We respond to this call: Rather than focusing on outcomes of recovery experiences at the same day or following morning, we consider recovery experiences as predictors of workers' levels of mindfulness at the end of the following work day.

In the remainder of the theoretical introduction, we first introduce workload and recovery experiences as antecedents of mindfulness at the end of the next workday. Then,

we build upon previous work showing that mindfulness benefits subsequent recovery experiences and argue that the relationship between recovery experiences and mindfulness is indeed reciprocal. The overall conceptual model and hypotheses are depicted in Figure 1.

### **Antecedents of state mindfulness: Workload, psychological detachment, and sleep quality**

While knowledge about the effectiveness of mindfulness interventions and the consequences of mindfulness in the context of work has been accumulating in recent years (Good *et al.*, 2016), knowledge about the work-related or personal factors that facilitate the experience of mindfulness in everyday life is scarce. The two studies that we are aware of focused on between-person differences in trait mindfulness: A behavioural genetic study revealed that 32% of interindividual differences in trait mindfulness are due to genetic differences, while 66% are due to non-shared environmental influences (Waszczuk *et al.*, 2015). Furthermore, a cross-sectional study revealed that organizational constraints and task routineness were negatively, while supervisor support was positively related to trait mindfulness (Reb *et al.*, 2015). These studies provided first insights into the sources of interindividual differences in individuals' general tendency to be mindful. Apart from these chronic between-person differences in mindfulness, mindfulness fluctuates from day to day, moment to moment. Even experienced mindfulness practitioners and long-term meditators report to experience periods of absentmindedness (Siegel, 2010). In other words, mindfulness also has a state-like component and fluctuates within individuals (Brown & Ryan, 2003; Hülshager *et al.*, 2013). What causes these natural ups and downs in people's ability to be aware of present-moment experiences? With this study, we address this important question, by studying the role of daily workload and recovery experiences during the previous work period as distal predictors of mindfulness and individual's momentary levels of fatigue as a mediating mechanism. In arguing that workload is negatively while recovery experiences are positively related to state mindfulness, we combine COR theory (Hobfoll, 1989) with theoretical work on mindfulness that has identified the self-regulation of attention as a core element of mindfulness.

#### *Mindfulness and the role of self-regulation of attention*

According to theoretical work on mindfulness in the clinical literature, a cornerstone of mindfulness is the self-regulation of attention, involving sustained attention, flexibility of attention, and non-elaborative processing (Bishop *et al.*, 2004; see also Good *et al.*, 2016; Shapiro, Carlson, Astin, & Freedman, 2006; Williams, 2010). By regulating the focus of attention to the present moment, individuals observe their sensations, feelings, and thoughts, and they become aware of current moment experiences. As the human mind tends to wander, *sustained attention* is required to maintain awareness of a particular experience or activity over longer periods of time. Mindfulness also involves the *flexibility of attention*, allowing to deliberately shift the focus of attention from one object or experience to another (Bishop *et al.*, 2004). Thirdly, self-regulation of attention is required for *non-elaborative processing of thoughts, feelings, and sensations* as they arise from moment to moment. To allow the direct experience of thoughts, feelings, and sensation, secondary elaborative processing of these thoughts, feelings, and sensations is inhibited. This is not to be confused with suppression of thoughts. As they arise, they are

observed as part of the ongoing stream of consciousness, they are acknowledged, and then, attention is directed back to the actual experience (Bishop *et al.*, 2004).

For instance, sustained attention can be directed at a specific work task such as writing: One fully focuses on writing without being distracted by thoughts about other tasks that are due or by checking mails in between. Flexibility of attention is involved when one is interrupted by a colleague who seeks help and one manages to deliberately switch attention from writing towards listening to the colleague with full attention and awareness. An example for non-elaborative processing is when one has received negative feedback and pays attention to the experience of anger, frustration, or sadness without getting caught up in ruminative thoughts about the event, in trying to derive meaning from it, or in thinking about potential career implications.

#### *Workload and recovery experiences as antecedents of mindfulness*

Following COR theory (Hobfoll, 1989), individuals seek to protect valued resources that help them attain their goals. While COR theory considers different kinds of resources (e.g., contextual vs. personal) (ten Brummelhuis & Bakker, 2012), the resources that are of interest here are personal resources, specifically energetic resources that are necessary for the regulation of attention involved in mindfulness.

Workload is a quantitative job demand that requires sustained cognitive effort (Bakker & Demerouti, 2007). From the variety of job demands that have been discussed in the literature, workload was chosen for the current investigation because it is a core job demand and because it shows a clear theoretical and empirical link with individuals' energetic resources (Lee & Ashforth, 1996; Nixon, Mazzola, Bauer, Krueger, & Spector, 2011). When individuals face high workload, they need to expand energetic resources in order to address these demands, leading to a loss of energetic resources and self-regulatory capacities (Hobfoll & Shirom, 2000; Ilies, Huth, Ryan, & Dimotakis, 2015). Referring to exhaustion and a lack of motivation to exert further effort (Sonnetag & Zijlstra, 2006; Zijlstra *et al.*, 2014), fatigue is a frequently used indicator of a person's momentary availability or lack of energetic resources (Barnes *et al.*, 2011; Ilies *et al.*, 2015; Trougakos *et al.*, 2013). Accordingly, previous research has documented meaningful relationships between workload and fatigue or exhaustion at the between-person level of analysis (for meta-analyses see Lee & Ashforth, 1996; Nixon *et al.*, 2011). Similarly, daily workload has been shown to be related to subsequent levels of fatigue at the within-person level of analysis (Ilies *et al.*, 2015), supporting the idea that workload is associated with an immediate loss of energetic resources.

As individuals lose resources, it is more difficult for them to invest resources. In addition, they become more defensive and seek to protect their remaining resources (Halbesleben, Neveu, Paustian-Underdahl, & Westman, 2014). Based on COR theory, we therefore argue that high workload depletes individual's energetic resources (as indicated by increased levels of fatigue), thereby limiting their ability and willingness to invest remaining resources into other self-regulatory activities that require resources. Although being mindful may ultimately lead to a resource gain (Good *et al.*, 2016), it also requires the investment of resources, specifically of mental energy, because it involves self-regulation of attention. We therefore expect that individuals are less mindful when being confronted with high workload. Furthermore, we expect that the relationship between workload and mindfulness is explained by individuals' availability of energetic resources as indicated by momentary levels of fatigue. Previous research has successfully established that momentary levels of fatigue mediate the relationship between workload and more

distal outcomes, such as work-family conflict (Ilies *et al.*, 2015). We therefore hypothesize:

*Hypothesis 1:* There is a negative within-person relationship between workload and state mindfulness.

*Hypothesis 2:* The negative within-person relationship between workload and state mindfulness is mediated by fatigue.

According to the resource investment principle of COR theory, the more resources individuals dispose of, the more likely they are to invest resources in order to gain additional resources and to protect themselves against future resource loss (Halbesleben *et al.*, 2014). Research on recovery suggests that energetic resources are replenished when individuals experience high psychological detachment and sleep quality during periods of respite (Demsky, Ellis, & Fritz, 2014; Zijlstra *et al.*, 2014). Psychological detachment, the mental disengagement from work during off-job time (Sonnentag & Fritz, 2015), preserves mental energy by suspending the mental occupation with work stressors. Although during off-job time, work stressors are not actually present, they can be mentally present during off-job time when individuals think and worry about work-related issues. Doing so is taxing and drains mental energy. When individuals psychologically detach from work, they get a break from the demands of work and mental energy can thereby be replenished. Psychological detachment after work has therefore been shown to be negatively related to subsequent feelings of fatigue (Sonntag, Binnewies, & Mojza, 2008; for a recent meta-analysis see Wendsche & Lohmann-Haislah, 2017). Notably, in addition to psychological detachment, the recovery literature has identified the recovery experiences of relaxation, mastery experiences, and control (Sonntag & Fritz, 2007). Yet, among these, psychological detachment has been described to be a ‘particularly powerful recovery experience’ (p. 72; Sonntag & Fritz, 2015). In contrast to the other recovery experiences, psychological detachment has consistently been shown to be meaningfully related to indicators of energetic resources, such as exhaustion and fatigue (Sonntag & Fritz, 2007; Wendsche & Lohmann-Haislah, 2017). We therefore chose to focus on psychological detachment in the present investigation.

Furthermore, sleep plays a central role in replenishing energetic resources (Barnes *et al.*, 2011; Baumeister, 2002). Sleep is key to the recovery of biological functions and in restoring the capacity of the human brain (Gander *et al.*, 2011; Saper, Scammell, & Lu, 2005). Sleep consequently not only replenishes physical but also mental energy that is necessary for any kind of self-regulatory behaviour, including attention regulation. Accordingly, brain imaging studies have documented that cerebral metabolism in the pre-frontal cortex is hampered when people suffer from poor sleep (cf. Barnes *et al.*, 2011). These findings support the idea that sleep quality is related to self-regulatory capacity because the pre-frontal cortex plays an important role in executive functions involved in self-regulation. Accordingly, event-sampling studies have revealed that sleep quality is inversely related to fatigue on the next day (Barnes *et al.*, 2011; Hülshager, 2016; Scott & Judge, 2006; Sonntag *et al.*, 2008).

In addition, there is direct empirical evidence for the role of sleep for the self-regulation of attention, specifically sustained attention: Neuropsychological studies revealed that performance in a sustained-attention reaction time task was significantly reduced under conditions of chronic sleep restriction (Van Dongen, Maislin, Mullington, & Dinges,

2003). Similarly, Salmi *et al.* (2005) concluded that poor sleep sensitizes brain mechanisms involved in involuntary attention switching.

Taken together, these findings suggest that psychological detachment and sleep quality help replenish energetic resources and are inversely related to feelings of fatigue. Following COR theory (Hobfoll, 1989), in situations in which resources are present, individuals are willing and able to invest resources in order to gain additional resources. As argued above, the availability of resources should therefore benefit the experience of mindfulness which involves effortful self-regulation of attention. We therefore expect a positive relationship of psychological detachment and sleep quality with the experience of mindfulness on the following work day. Furthermore, we expect that this relationship is mediated by fatigue on the next work day, an indicator of a person's level of energetic resources.

*Hypothesis 3:* There is a positive within-person relationship of (a) psychological detachment and (b) sleep quality with state mindfulness experienced on the following work day.

*Hypothesis 4:* The positive within-person relationships of (a) psychological detachment and (b) sleep quality with state mindfulness on the next work day are mediated by fatigue on the next work day.

### **Psychological detachment and sleep quality as outcomes of mindfulness**

While our theoretical argumentation and Hypothesis 3a/b suggests that psychological detachment and sleep quality in the previous recovery period benefit mindfulness on the following work day, mindfulness theory suggests that psychological detachment and sleep quality may not only function as antecedents but also as outcomes of mindfulness. In fact, previous work on mindfulness in the context of work has provided theoretical and empirical evidence that mindfulness conceptualized as a trait, a state, or an intervention promotes psychological detachment and sleep quality in workers (Hülshager *et al.*, 2014, 2015; Michel *et al.*, 2014; Querstret *et al.*, 2016). The positive role of mindfulness for psychological detachment and sleep quality can be explained with a core element of mindfulness and mindfulness practice that is referred to as 'cognitive decentering', 're-perceiving', or 'decoupling of the self from experiences' (Bishop *et al.*, 2004; Good *et al.*, 2016; Shapiro *et al.*, 2006; see also Hülshager *et al.*, 2015). It describes the way individuals process information when they are mindful: Rather than thinking about external or internal stimuli, trying to derive meaning from them, evaluating them, and pondering on future implications, the focus is on experiencing what is in a pure and non-conceptual way. Mindful information processing has therefore been described to be experiential as opposed to conceptual in nature (Good *et al.*, 2016). The focus is on observing what we experience in an open and receptive way. These experiences can be external (e.g., an angry customer, an uncivil colleague, or negative feedback) as well as internal (e.g., our thoughts, emotions, physiological sensations that develop as a result of the angry customer, uncivil colleague, or negative feedback). This way of attending to external and internal events in a more objective rather than self-absorbed way promotes adaptive appraisals of stressful events and prevents radical emotional and behavioural reactions (Weinstein, Brown, & Ryan, 2009). As a consequence, mindful individuals are better able to cope with potentially stressful events at work, reducing negative spillover from work to home which facilitates psychological detachment from work during non-work time.

In a similar way, mindfulness is expected to benefit sleep quality. Mindfulness helps individuals to attend to workplace events with an open and receptive attitude. They are therefore better able to cope with potentially stressful events successfully during work and are less likely to experience negative arousal before going to bed. As negative arousal hinders sleep quality (Broomfield & Espie, 2003), mindfulness helps individuals to sleep well. Furthermore, clinical research and practice suggests that difficulties falling asleep often result from relentless attempts to enforce sleep. Trying to control sleep, however, increases cognitive activity, arousal and negative activation which hinders sleep (Broomfield & Espie, 2003; Ong, Cardé, Gross, & Manber, 2011). By promoting a receptive and non-judgemental attitude towards present-moment experiences (here not being able to fall asleep), individuals may be better able to let go and fall asleep naturally. In this study, we seek to replicate previous empirical findings on the relationship of mindfulness with subsequent psychological detachment and sleep quality (Hülshager *et al.*, 2014, 2015). Accordingly, we propose the following hypotheses:

*Hypothesis 5:* There is a positive within-person relationship of state mindfulness with (a) psychological detachment and (b) sleep quality in the subsequent recovery period.

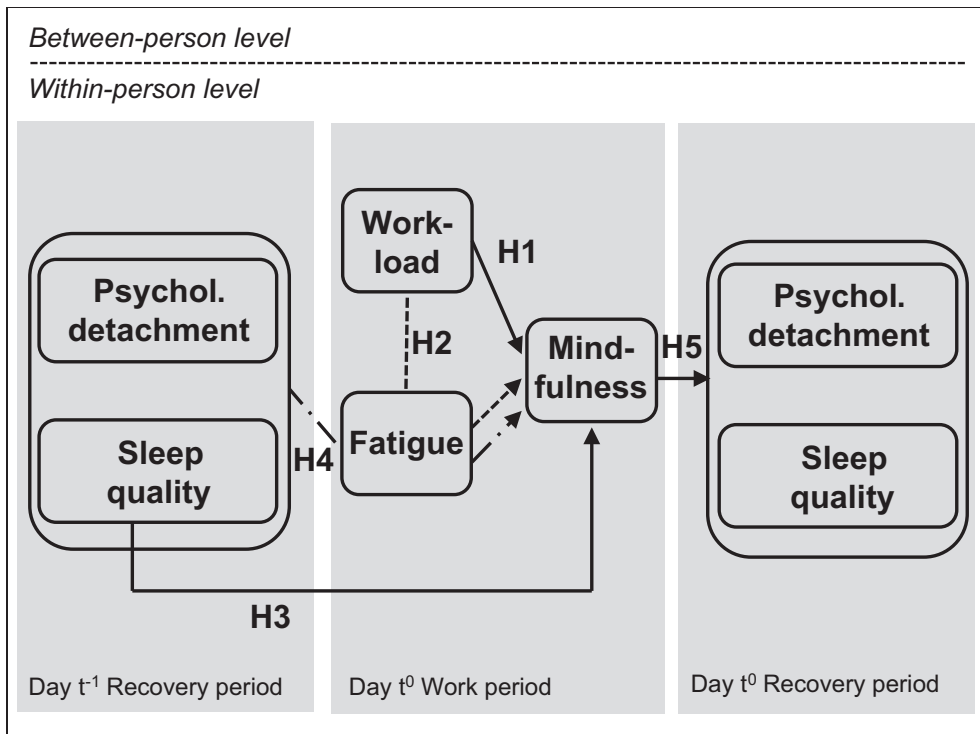
Considering Hypothesis 5a/b in conjunction with Hypothesis 3a/b allows us to test the underlying idea that the relationships of mindfulness with the recovery experiences of psychological detachment and sleep quality are reciprocal. In testing this overall idea we focus on a full cycle of rest, work, and rest, considering psychological detachment and sleep quality as predictors of mindfulness on the following work day, which, in turn, is considered as a predictor of psychological detachment and sleep quality in the following recovery period. Taken together, this set of hypotheses addresses a basic tenet of COR theory, namely that resources are dynamic in nature and change over time. An initial resource gain leads to a greater availability of resources. This allows for future investments of resources which, in turn beget future research gains. This process is referred to as 'gain spiral' (Chen, Westman, & Hobfoll, 2015; Halbesleben *et al.*, 2014; Hobfoll, 1989; Mäkikangas, Bakker, Aunola, & Demerouti, 2010). The tenet of gain spirals entails that resources can strengthen each other over time in a reciprocal way and result in increasing resource gains. Outside the mindfulness literature, research has provided evidence for the existence of such gain spirals, for instance between job resources and work-related flow (Mäkikangas *et al.*, 2010), between recovery levels and work engagement (Sonnentag, Mojza, Demerouti, & Bakker, 2012), or between co-worker helping behaviour and employee perceived co-worker support (Halbesleben & Wheeler, 2015). In this study, we test the idea of gain spirals by investigating reciprocal relations between recovery experiences and mindfulness. We expect that recovery experiences help replenish resources, thereby allowing individuals to invest resources into mindful attention regulation which, in turn, benefits subsequent recovery experiences. An overview of hypotheses is provided in Figure 1.

## Method

### *Sample and procedure*

Data were collected in spring 2015 in Germany using various recruitment strategies, including direct recruitment of employees at their workplaces, presentations in organizations, and the use of the recruitment team's personal network. Furthermore, the snowballing technique was used, that is, individuals known to the recruitment team





**Figure 1.** Conceptual model.

were asked to forward the study invitation via mail to people they know (Gosserand & Diefendorff, 2005; Grandey, Fisk, & Steiner, 2005). The study was described broadly as a study on workplace well-being, without further mention of specific topics like workload, sleep, or mindfulness. Participants were offered to receive a report of the findings after completion of the study. No other incentives were offered. Individuals were eligible for study participation when they worked at least 4 days a week and at least 32 hrs per week. Potential participants were approached first via mail, social media, or in person. If they expressed interest in participating in the study, they were contacted again and received the paper and pencil diary booklet.

A total of 239 individuals expressed interest in the study and received the diary booklet, 168 of which filled it in and returned it, resulting in a response rate of 70.3%. Study participants were predominantly female (60.1%), had a mean age of 34.9 ( $SD = 10.8$  years), and worked on average 41.9 hrs per week ( $SD = 7$ ). The sample included a broad range of occupations, including consultants, teachers, doctors, HR practitioners, medical practitioners, and engineers.

### Measures

Data collection was paper-based and consisted of a general questionnaire and a diary booklet. Participants were asked to fill in the general questionnaire before starting with the diary part. Demographics were assessed in the general questionnaire. Diary

questionnaires were filled in on five workdays, three times a day: during work (i.e., in the first work break), after finishing work, and before going to bed. In the instructions of the paper and pencil survey, participants were informed about the importance of filling in the daily surveys at the indicated time points. To further underline this, they were asked to report the date and time of filling in every individual survey.

Sleep quality was assessed in the first daily survey, that is, in the first work break. Workload, mindfulness, and fatigue were assessed in the first and second daily survey (i.e., after finishing work). Psychological detachment was assessed in the third daily survey before going to bed.

#### *Sleep quality*

The respective single item of the Pittsburgh Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989; see also Sonnentag *et al.*, 2008) was used to assess sleep quality in the preceding night on a 5-point Likert scale (1–5): ‘How do you evaluate this night’s sleep?’.

#### *Quantitative workload*

Day-specific workload was assessed with the respective 11-items scale of the Questionnaire on the Experience and Evaluation of Work (Van Veldhoven & Meijman, 1994; see also Bakker, van Veldhoven, & Xanthooulou, 2010) that is based on the Job Content Questionnaire (Karasek, 1985). Items were answered on a 4-point Likert scale (1–4) referring to the working time before filling in the survey. Items assessed the extent to which participants had ‘too much work to do’, ‘to work very fast’, or ‘to work under time pressure’.

#### *Mindfulness*

Momentary levels of state mindfulness at the time of filling in were assessed with the 5-item state version of the Mindfulness Attention and Awareness Scale (MAAS; Brown & Ryan, 2003) which was answered on a 5-point Likert scale (1–5). Sample items of the MAAS state version are ‘I find it difficult to stay focused on what’s happening in the present’, ‘I find myself doing things without paying attention’.

#### *Fatigue*

Momentary levels of fatigue at the time of filling in were assessed with four items (fatigued, tired, exhausted, and spent) from the Profiles of Mood Scales (McNair, Lorr, & Droppelman, 1971). Fatigue items were answered on a 5-point Likert scale (1–5).

Because of high intercorrelations between the mindfulness and the fatigue measure at the between-person level (see Table 1), we conducted a multilevel confirmatory factor analysis (CFA) to verify the distinctiveness of the two measures. In doing so, we followed procedures recommended in the literature (Heck, 2001; Heck & Thomas, 2015). At the between-person level as well as at the within-person level, the four fatigue items were used to define the latent fatigue factor and the five mindfulness items were used to define the latent mindfulness factor. Both factors were allowed to correlate. In addition, the error variance of the first indicator of the fatigue factor was fixed to 0 at the between-person level for model convergence. Overall, the model showed acceptable to good fit: CFI: .951,

**Table 1.** Correlations among study variables

	Cronb. alpha (range)	M	SD	Intraclass coefficients	2	3	4	5	6	7
1 Psychological detachment previous day <sup>a</sup>					.21***	.02	-.07	.02	—	-.04
2 Sleep quality previous night	—	3.42	.73	.46		-.08*	-.29***	.16**	.08	—
3 Workload during work	.86–.89	2.42	.46	.78	-.43***		.20***	-.13**	-.11*	-.13**
4 Fatigue during work	.90–.93	2.42	.79	.59	-.66***	.46***		-.27***	-.05	.07
5 Mindfulness end of work	.86–.92	3.60	.71	.59	.53***	-.47***	-.76***		.25***	.19***
6 Psychological detachment after work	.89–.94	3.23	.76	.53	.42***	-.49***	-.47***	.51***		.18**
7 Sleep quality following night <sup>b</sup>										

Notes. Correlations at the between-person level are indicated below the diagonal; they were computed by aggregating daily measures to the person level (N = 167–168). Correlations at the within-person level are indicated above the diagonal; analyses are based on 168 persons and 4.68–4.86 days per person, on average. Cronbach's alpha was calculated individually for every day.

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

<sup>a</sup>This is a time-shifted variable computed from variable no 6.

<sup>b</sup>This is a time-shifted variable computed from variable no. 2.

TLI: .933. SRMR values further revealed that while the two-factor model showed acceptable fit at the between-person level (SRMR: .060), it showed good fit at the within-person level (SRMR: .027). Notably, as study hypotheses focus on within-person relationships exclusively, model fit at the within-person level is of primary interest here. We therefore also focused on the within-person level when inspecting standardized loadings on the fatigue factor and on the mindfulness factor. They were all substantial and significant, ranging from .64 to .86 for the fatigue factor and from .55 to .74 for the mindfulness factor. Taken together, the multilevel CFA empirically confirmed the distinctiveness of the two measures.

#### *Psychological detachment*

For measuring day-specific psychological detachment after work, we used the four-item subscale of the Recovery Experience Questionnaire (Sonnentag & Fritz, 2007). Participant answered the items on a 5-point Likert scale (1–5) referring to the time after work, before going to bed. An example item is: ‘I did not think about work at all’.

#### **Compliance check, data clean-up, and completion rates**

Before starting with hypothesis testing, we inspected whether participants complied with filling in the surveys during the indicated time frames, by inspecting the self-reported times of filling in the three daily surveys and by calculating the time elapsed between subsequent daily surveys. Observations were omitted from analyses in the following cases: when self-indicated times of filling in a diary survey suggested (1) that daily surveys were filled in at the same time or (2) that a later measurement occasion (e.g., the 3rd daily measurement) was filled in before an earlier occasion (e.g., the 2nd measurement). This led to the exclusion of 41 observations. An analysis of the remaining cases revealed that the majority of first daily surveys was filled in between 9.00 and 15.00 (91.2% of observations), the majority of the second daily surveys between 15.00 and 21.00 (90.3%) and the majority of the third daily surveys after 21.00 (97.7%). On average, 6.6 hrs ( $SD = 2.4$ ) elapsed between the first and the second daily survey and 4.8 hrs ( $SD = 1.9$ ) elapsed between the second and the third survey.

We also inspected completion rates of daily surveys based on the cleaned dataset (i.e., after excluding the 41 observations reported above). Of a total of 840 possible daily observations (168 persons  $\times$  5 days), the final dataset included the following number of observations per daily variable: 784 (sleep quality), 743 (psychological detachment), 782 (job demands), 783 (fatigue), 744 (mindfulness). Valid completion rates thus ranged from 88.5% (psychological detachment) to 93.3% (sleep quality).

#### **Analyses**

With days nested in persons, data had a hierarchical structure and were therefore analysed with multilevel modelling techniques in MPlus (Muthén & Muthén, 1998–2017). Using a structural equation modelling framework allowed us to apply recommended procedures to test multilevel mediation effects (Preacher, Zhang, & Zyphur, 2011; Preacher, Zyphur, & Zhang, 2010). Specifically, we tested a 1-1-1 mediation model in which predictor, mediator, and outcome variables are all assessed on Level 1, the day level. As recommended in the literature, Level 1 predictor variables were centred at the person mean (Enders & Tofighi, 2007). With this centring scheme, estimates at Level 1 inform

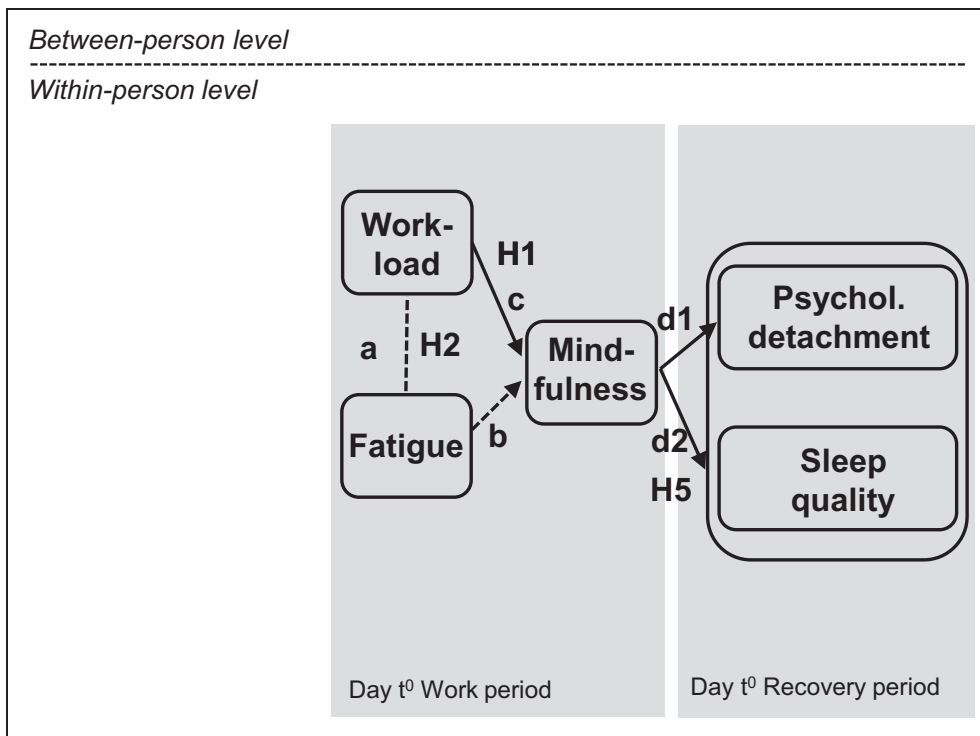
about relationships at the within-person level, that is, how a person's daily deviations from his/her own mean level relate to the outcome variable of interest. Due to its complexity, and in order to avoid using psychological detachment and sleep quality as a predictor and outcome simultaneously, the conceptual model depicted in Figure 1 was tested in two steps. We first tested Hypotheses 1, 2, and 5 (see Figure 2 and Table 2) and then tested Hypotheses 3 and 4 (see Figure 3 and Table 3).

It is worth noting that workload, fatigue, and mindfulness were assessed twice per day, respectively (i.e., during work and after finishing work). In our model, we chose to use measures of workload and fatigue assessed during work and measures of mindfulness after finishing work. Separating the timing of the predictor/mediator and outcome variable measurement helps reduce concerns of common method bias (Ployhart & Ward, 2011).

## Results

Intercorrelations between study variables at the person- and at the within-person level and intraclass coefficients (ICC) are depicted in Table 1. ICC values revealed that day-to-day within-person variation in study variables ranged from 22% (workload), 41% (fatigue), 41% (mindfulness) to 47% (psychological detachment) and 54% (sleep quality).

Results of analyses testing Hypotheses 1, 2, and 5 are reported in Table 2. The paths that are central for the evaluation of hypotheses are depicted in Figure 2 and are referred to in Table 2 in order to ease readability. For the sake of transparency, we report results of



**Figure 2.** Model tested in Table 2.

**Table 2.** Multilevel models predicting mindfulness, psychological detachment, and sleep quality

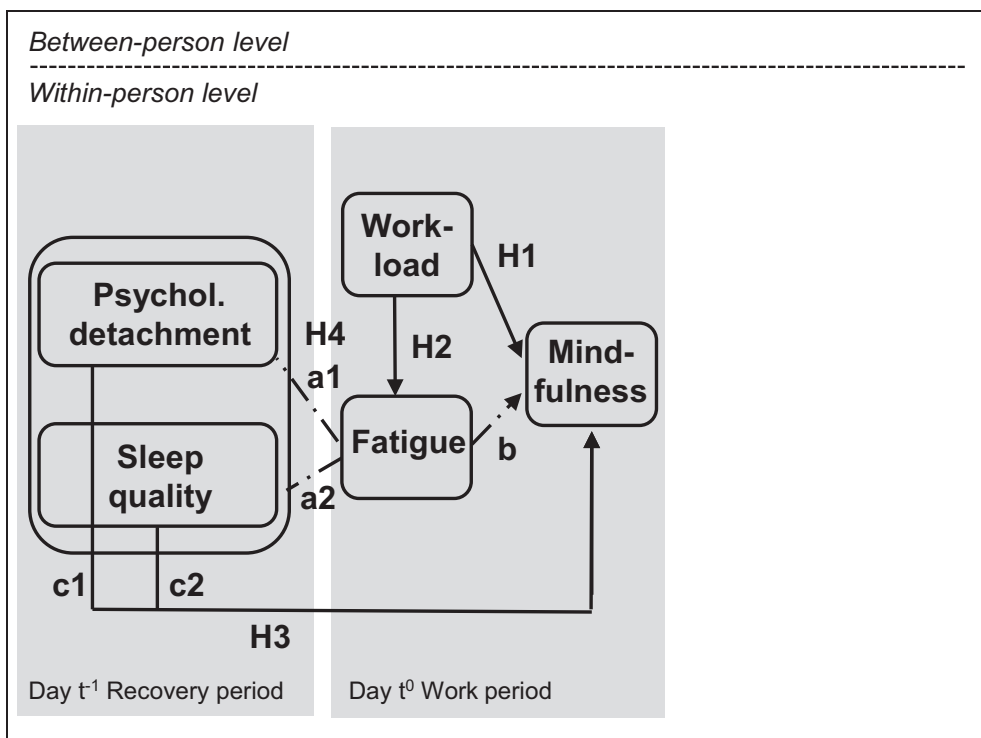
	Model 1	Model 2	Model 3	Model 4
Within-person level (Level 1)				
Path a: Workload → fatigue		.56*** (.13)		.50** (.16)
Path b: Fatigue → mindfulness		-.23*** (.06)		-.26*** (.07)
Path c: Workload → mindfulness		-.19* (.10)		-.13 (.12)
Path d1: Mindfulness → psychological detachment			.28*** (.06)	.28*** (.07)
Path d2: Mindfulness → sleep quality	-.32** (.10)		.24*** (.06)	.28*** (.07)
Workload → psychological detachment				-.16 (.15)
Workload → sleep quality				-.41** (.15)
Fatigue → psychological detachment				.00 (.06)
Fatigue → sleep quality				.18** (.07)
Psychological detachment ↔ sleep quality			.05* (.02)	.06* (.02)
Residual variance mindfulness	.30*** (.03)	.28*** (.03)		.20*** (.02)
Residual variance fatigue		.27*** (.02)		.23*** (.02)
Residual variance psychological detachment				.36*** (.04)
Residual variance sleep quality				.44*** (.04)
Indirect effect: a × b		-.13*** (.04)		-.13* (.05)
Variance explained in mindfulness (R <sup>2</sup> )	.01 (.01)	.06* (.03)		.09* (.04)
Variance explained in fatigue (R <sup>2</sup> )		.05* (.02)		.04 (.03)
Variance explained in psychological detachment (R <sup>2</sup> )			.05* (.02)	.05* (.02)
Variance explained in sleep quality (R <sup>2</sup> )			.03* (.01)	.05** (.02)
Between-person level (Level 2)				
Mean mindfulness	3.6*** (0.06)	3.6*** (0.06)		
Mean psychological detachment				3.2*** (0.05)
Mean sleep quality				3.5*** (0.06)
Psychological detachment ↔ sleep quality			.24*** (0.04)	.23*** (0.04)
Variance mindfulness	.44*** (.05)	.44*** (.05)		
Variance psychological detachment				.51*** (.06)
Variance sleep quality				.46*** (.06)
Number of persons (average number of days per person) included in analysis	168 (4.42)	168 (4.42)	166 (3.43)	166 (3.42)

Notes. The models tested here are shown in Figure 2. \*\*\*p < .001; \*\*p < .01; \*p < .05; †p < .10 (two-tailed).

simpler models first (Model 1, Model 2, Model 3) and results of the overall model including all outcome and mediating variables simultaneously in Model 4.

As can be seen from Model 1, Hypothesis 1 was supported: There was a negative direct relationship between workload and state mindfulness (estimate =  $-.32, p < .01$ ). As can be seen from Model 2, Hypothesis 2 regarding the mediated relationship of workload with mindfulness via fatigue was also supported: Workload was positively related to fatigue (estimate =  $.56, p < .001$ ) and fatigue was, in turn, negatively related to state mindfulness (estimate =  $-.23, p < .001$ ). The indirect effect of workload on state mindfulness via fatigue was also significant (estimate =  $-.13, p < .01$ ). The pattern of results remained the same when psychological detachment and sleep quality were included as distal outcome variables (Model 4).

Results regarding Hypotheses 3 and 4 are reported in Table 3 (see also Figure 3). Model 1 informs about the direct relationship of psychological detachment and sleep quality with mindfulness at the end of the next work day. The relationship was significant for sleep quality (estimate =  $.11, p < .01$ ), but not for psychological detachment (estimate =  $-.02, p = .70$ ). Hypothesis 3b was thus supported, while Hypothesis 3a was not. Model 2 informs about the role of fatigue as a mediator in the psychological detachment-/sleep quality-mindfulness relationships. The indirect effect of psychological detachment on mindfulness via fatigue was not significant (indirect effect =  $.00, p = .93$ ) due to a missing link between psychological detachment after work and fatigue during the next work period (estimate =  $-.01, p = .93$ ). As expected, however, sleep quality was negatively related to fatigue during the next work period (estimate =  $-.29, p < .001$ ) and



**Figure 3.** Model tested in Table 3.

**Table 3.** Multilevel mediation models predicting mindfulness

	Model 1	Model 2
Within-person level (Level 1)		
Path a1: Psychological detachment → fatigue		-.01 (.05)
Path a2: Sleep quality → fatigue		-.29*** (.05)
Path b: Fatigue → mindfulness		-.18** (.07)
Path c1: Psychological detachment → mindfulness	-.02 (.05)	-.02 (.05)
Path c2: Sleep quality → mindfulness	.11** (.04)	.06 (.04)
Psychological detachment ↔ sleep quality	.06** (.02)	.06** (.02)
Workload → fatigue		.48** (.15)
Workload → mindfulness	-.24* (.10)	-.16 (.10)
Psychological detachment ↔ workload	.00 (.01)	.00 (.01)
Sleep quality ↔ workload	-.01 <sup>†</sup> (.01)	-.01 <sup>†</sup> (.01)
Residual variance mindfulness	.29*** (.04)	.28*** (.03)
Residual variance fatigue		.24*** (.02)
Indirect effect 1: a1 × b		.00 (.01)
Indirect effect 2: a2 × b		.05* (.02)
Variance explained in mindfulness ( $R^2$ )	.02 <sup>†</sup> (.01)	.05 <sup>†</sup> (.03)
Variance explained in fatigue ( $R^2$ )		.14* (.04)
Between-person level (Level 2)		
Mean mindfulness	3.62*** (0.06)	3.62*** (0.06)
Residual variance mindfulness	.48*** (.05)	.48*** (.05)
Number of persons (average number of days per person) included in analysis	168 (3.38)	168 (3.38)

Notes. Models tested here are shown in Figure 3.

\*\*\* $p < .001$ ; \*\* $p < .01$ ; \* $p < .05$ ; <sup>†</sup> $p < .10$  (two-tailed).

fatigue was negatively related to mindfulness at the end of the next work period (estimate =  $-.18$ ,  $p < .01$ ). Results further confirmed an indirect effect of sleep quality on mindfulness via fatigue (indirect effect =  $.05$ ,  $p < .05$ ), confirming Hypothesis 4b. Hypothesis 4b was thus supported while Hypothesis 4a was not.

Results regarding Hypothesis 5 are reported in Table 2, Model 3. Mindfulness after finishing work was significantly related to psychological detachment and sleep quality in the following recovery period (psychological detachment: estimate =  $.28$ ,  $p < .001$ ; sleep quality: estimate =  $.24$ ,  $p < .001$ ). When considering all predictor and outcome variables jointly in one overall model (Model 4), the pattern of results remained the same. Hypothesis 5a/b was thus confirmed.

### Supplementary analysis

Hypotheses 3a and 4a concerning the direct and indirect relationships between psychological detachment and mindfulness were not supported. One may argue that psychological detachment in the previous evening is a more distal antecedent to mindfulness on the following day than sleep quality. In fact, a number of studies have argued and shown that psychological detachment after work facilitates subsequent sleep quality (Åkerstedt, Nordin, Alfredsson, Westerholm, & Kecklund, 2012; Cropley, Dijk, & Stanley, 2006; Hülshager *et al.*, 2014; Querstret & Cropley, 2012). It may therefore be



informative to study whether there is an indirect relationship of psychological detachment with mindfulness at the end of the next work period via sleep quality. An extension of Model 2, specifying a sequential indirect effect of psychological detachment on mindfulness via sleep quality and via fatigue provided some support for this idea: Psychological detachment was significantly related to subsequent sleep quality (estimate = .20,  $p < .01$ ) and the specified indirect effect via sleep quality and fatigue reached significance at a  $p$ -level of .059 (estimate = .01). Considering that a directed hypothesis would allow using one-tailed testing, the estimate can be considered to be statistically significant ( $p < .05$ ).

## Discussion

The present study set out to broaden insights into the role of mindfulness in the context of work. Doing so, we addressed the following research questions: First, do recovery experiences after the previous work period and workload predict state mindfulness? Second, can this effect be explained by the availability of energetic resources? Third, is the relationship between mindfulness and recovery experiences reciprocal rather than unidirectional? In the remainder, we will discuss findings regarding these research questions.

Research on the antecedents of mindfulness is generally scarce across psychological disciplines. Focusing on trait mindfulness, extant research has identified genetic dispositions as well as organizational constraints, task routineness and supervisor support as antecedents of differences between individuals' trait levels of mindfulness (Reb *et al.*, 2015; Waszczuk *et al.*, 2015). In the present study, the focus was on antecedents of day-to-day fluctuations in state mindfulness, that is, daily deviations from a person's general tendency to be mindful. Results confirmed that workload was negatively, while sleep quality was positively related to state mindfulness. Although not directly related, psychological detachment in the previous recovery period was indirectly related to next day state mindfulness through sleep quality. This finding suggests that not being able to detach from work-related thoughts during non-work time leads to a mental continuation of work demands and thereby hinder a good nights' sleep (Hülsheger *et al.*, 2014; Querstret & Cropley, 2012). Poor sleep quality, in turn, hinders the experience of mindfulness on the next day.

Findings also supported the idea that the availability of energetic resources is an important prerequisite for the experience of mindfulness: Workers' momentary levels of fatigue – indicating a lack of energetic resources – were negatively related to state mindfulness. Taken together, our findings lend support to our proposition that workload hampers while sleep quality facilitates the experience of mindfulness and that the availability of energetic resources is an important mechanism that drives these relationships. Our study therefore has taken an important first step towards answering a question that Brown and Ryan (2003) raised more than a decade ago about the psychological and social conditions that help or hinder mindfulness at the state level. Notably, these findings are not only theoretically relevant in that they contribute to a more holistic understanding of the role of mindfulness in the context of work, but they also have important practical implications for individuals and organizations that will be discussed below.

Our results also add to a growing body of evidence documenting that the subjective affective experience of fatigue signals the lack of energetic and self-regulatory resources

and therefore plays an important role in understanding the complex interplay between the work environment and the individual. On the one hand, work demands and stressors drain employees' resources and lead to feelings of fatigue (Ilies *et al.*, 2015; the present study) which has implications for employees' private life (Ilies *et al.*, 2015). On the other hand, personal activities and experiences during leisure time, such as sleep and psychological detachment are related to next day feelings of fatigue (Barnes *et al.*, 2011; Hülsheger *et al.*, 2014). This, in turn, affects employees' work-related behaviour, including unethical behaviour (Barnes *et al.*, 2011) and mindfulness at work (the present study).

A second objective of the present work was to shed light on the nature and directionality of the mindfulness–recovery relationship. Considering a full cycle of rest, work, and rest, our study showed that successful recovery from the previous work period drives subsequent levels of mindfulness, which in turn facilitates subsequent recovery experiences in terms of psychological detachment and sleep quality. Our findings thereby contribute to an incipient body of evidence supporting a central tenet of COR theory, namely that resource gains lead to even greater gains, resulting in gain spirals (Halbesleben & Wheeler, 2015; Halbesleben *et al.*, 2014; Hobfoll & Shirom, 2000). While previous studies addressing this tenet of COR theory have investigated gain spirals over relatively long time intervals of months (Mäkikangas *et al.*, 2010) and years (Hakanen, Perhoniemi, & Toppinen-Tanner, 2008; Weigl *et al.*, 2009), our day-level design allowed us to provide evidence for relatively short-term gain spirals that occur on a day to day basis (see also Halbesleben & Wheeler, 2015). Furthermore, while many investigations have focused on gain spirals involving job resources or work engagement (Hakanen *et al.*, 2008; Mäkikangas *et al.*, 2010; Weigl *et al.*, 2009), our study shed light on mindfulness, a personal resource that may trigger gain spirals and that is amenable to training.

Similarly, COR theory proposes that resource losses can result in loss spirals. Our study revealed that workload hampers the experience of mindfulness as well as subsequent recovery experiences. High workload may therefore trigger such a loss spiral that not only drains energetic resources but also stands counter to the replenishment of resources through, for example, mindfulness and successful recovery after work.

### **Practical implications**

Apart from advancing our theoretical understanding of the role of mindfulness in the workplace, the present study also has practical implications for individuals and organizational decision-makers. Most importantly, the present study suggests that organizations seeking to promote mindfulness may not only offer mindfulness-based training programmes but may consider bolstering these initiatives by creating work environments that facilitate the experience of mindfulness. Specifically, the present study points to the importance of keeping workload to a manageable degree. Our findings thus suggest that 'being mindful' is not only a matter of personality, a stable disposition, or the result of regular practice but that it is also a function of the (work) situation. As a consequence, organizations aspiring a mindful workforce should not exclusively place the responsibility of becoming more mindful in the employees' hands by offering mindfulness trainings, but should also consider adapting their work circumstances accordingly.

Employees may also be given the discretion to take short breaks when they feel that the demands of work are overwhelming in order to replenish their resources (Troughakos

*et al.*, 2013). Those who are trained in mindfulness practice may take this opportunity to bring their attention back to the present moment by conducting brief mindfulness practices such as the 3-minute breathing exercise. In addition, the present study highlighted the role of sleep in promoting mindfulness. Indirectly, psychological detachment may also benefit next day mindfulness by promoting sleep (Åkerstedt *et al.*, 2012; Cropley *et al.*, 2006; Hülshager *et al.*, 2014). Psychological detachment in turn may be facilitated by leisure time activities such as endurance and fitness training or team sports (Feuerhahn, Sonnentag, & Woll, 2014).

### **Limitations and future directions**

A limitation of the present study is that data were collected with paper and pencil surveys. As these do not yield electronic time stamps, we cannot rule out that some participants may have filled in some diaries in batches. While this is a notable shortcoming of collecting diary data with paper and pencil surveys, they do also have certain advantages over electronic forms of data collection, including the possibility to consider participants with no experience with or willingness to fill in questionnaires electronically. Researchers have therefore concluded that both paper and pencil as well as electronic diary methods have their advantages and disadvantages (Bolger, ShROUT, Green, Rafaeli, & Reis, 2006; Green, Rafaeli, Bolger, ShROUT, & Reis, 2006).

Another limitation is the exclusive reliance on self-report data, which raises concerns that results may have been biased by common method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Mitigating such concerns, analyses focused on relationships at the within-person level of analysis. Doing so, predictor variables are centred at the person-mean and between-person variation is removed, as a result of which findings cannot be distorted by individual difference variables. In an endeavour to further alleviate concerns of common method bias, we used predictor and outcome variables that were assessed at different times of the day (cf. Sonnentag *et al.*, 2012). Future studies, however, might use more objective measures of sleep quality, using actigraphy which also allows distinguishing between subfacets of sleep quality in terms of sleep onset latency, sleep efficiency, and sleep fragmentation (Pereira & Elfering, 2014).

Third, relationships between variables were analysed within days or between one day and the next. Despite the temporal spacing of the constructs of interest that spanned from one recovery period to the next work period and from the work period to the following recovery period, this corresponds to a cross-sectional analysis that strictly speaking does not allow drawing conclusions about causality.

Finally, future research may build upon and extend the present line of research by considering additional antecedents of mindfulness. While we focused on workload, this focus may be extended to include other work demands, for instance, situational constraints, role conflict, or customer-related social stressors as antecedents. Our findings also point to the importance of taking into consideration that relationships that have so far been considered to be unidirectional, may indeed be reciprocal. For instance, positive relationships between mindfulness and work-family balance (Allen & Kiburz, 2012; Michel *et al.*, 2014) have been interpreted as an effect of mindfulness on work-family balance, while the current findings suggest that it may be worthwhile investigating whether relationships are indeed reciprocal.

## Conclusion

While knowledge about the outcomes of mindfulness in the context of work has accumulated rapidly, to date, little is known about the personal and work-related factors that drive the experience of mindfulness. The present study addressed this important question and revealed that previous-day recovery experiences benefit while workload hampers mindfulness. These relationships are explained by the availability of energetic resources that are necessary to regulate attention to present-moment experiences. Furthermore, the relationship between recovery experiences and mindfulness was found to be reciprocal, such that the recovery experiences of psychological detachment and sleep quality benefit mindfulness which, in turn, benefits future recovery experiences.

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