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Take a Break! Benefits of Sleep and Short Breaks for Daily Work Engagement

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Abstract

The current study investigates the benefits of a good night's sleep and short work breaks for employees' daily work engagement. It is hypothesized that sleep and self-initiated short breaks help restore energetic and self-regulatory resources which, in turn, enable employees to experience high work engagement. A daily diary study was conducted with 107 employees who provided data twice a day (before lunch and after work) over five work days (453 days in total). Multilevel regression analyses showed that sleep quality and short breaks were beneficial for employees' daily work engagement. After nights employees slept better, they indicated higher work engagement during the day. Moreover, taking self-initiated short breaks from work in the afternoon boosted daily work engagement, while taking short breaks in the morning failed to predict daily work engagement. Taking short breaks did not compensate for impaired sleep with regard to daily work engagement. Overall, these findings suggest that recovery before and during work can foster employees' daily work engagement.

Keywords: work breaks, sleep, work engagement, recovery, energy management

Take a Break! Benefits of Sleep and Short Breaks for Daily Work Engagement

Most people spend a considerable share of their lifetime at work. It is thus desirable that they enjoy working, feel enthusiastic, and experience a sense of meaningfulness while working. Over the last years, the concept of work engagement has gained increasing interest as a psychological state (Bakker, 2014; Sonnentag, Dormann, & Demerouti, 2010). State work engagement describes how employees experience their work in the moment – as stimulating and energizing (vigour component), as a significant and meaningful pursuit (dedication component), and as something they are fully concentrated on (absorption component; Bakker, 2014; Bakker, Schaufeli, Leiter, & Taris, 2008). Besides being a positive experience for employees, work engagement is also of great interest for organizations, because it predicts important organizational outcomes (e.g., daily financial returns, Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2009). Research has identified transitory situational and personal factors as predictors of work engagement (for reviews, see Bakker, 2014; Sonnentag et al., 2010). For instance, daily fluctuations in job resources (e.g., social support) and in personal resources (e.g., self-efficacy, optimism, state of being recovered in the morning) explain daily fluctuations in work engagement (e.g., Kühnel, Sonnentag, & Bledow, 2012; Sonnentag, Mojza, Demerouti, & Bakker, 2012). The current study adds to this body of knowledge by investigating if and how recovery periods before and during work can explain why employees feel more engaged on some days and less engaged on others.

Recovery can occur in the absence of work stressors (Meijman & Mulder, 1998), that is, during time employees are not working. During off-job-time, sleep is an important and essential recovery period (for a review, see Banks & Dinges, 2007). But recovery can also occur during the time employees spend on the job – when taking breaks from work. Both off-the-job recovery periods (i.e., sleep) and on-the-job recovery periods (i.e., short work

breaks) should thus be crucial for employees' work engagement. The aim of this study is to investigate the joint effect of both kinds of recovery periods. We posit that work engagement should be higher on days employees come to work with restored energetic and self-regulatory resources by having slept sufficiently and well, and on days employees manage to refresh their resources during the working day by taking short breaks from work.

By examining whether sleep on a given day is related to subsequent engagement at work, our study contributes to the growing body of research that reveals the significance of sleep characteristics for organizational behaviour (e.g., Barnes, 2012; Kühnel, Bledow, & Feuerhahn, 2016; Lanaj, Johnson, & Barnes, 2014). Additionally, our study contributes to research on on-the-job recovery by examining the "largely understudied but common phenomenon" of taking short breaks from work (Kim, Park, & Niu, in press). Although research on breaks from work is growing, much is still to be learned about how people manage their energetic and self-regulatory resources while at work. We therefore focus on effective self-regulation at work by investigating self-initiated short breaks from work, taken in the morning and/or in the afternoon of the work day. In today´s knowledge economy, employees are increasingly expected to manage their own working time and to schedule their breaks themselves. Self-initiated breaks (as opposed to prescheduled, other-initiated breaks) should have the greatest potential to assist employees in actively managing their resource levels during the work day, because self-initiated breaks can be taken when they are needed (Sianoja, Kinnunen, De Bloom, & Korpela, 2015). Thus, employees can initiate a short break from work when they experience that energetic and self-regulatory resources needed to pursue their tasks are lacking. Accordingly, gaining knowledge on the benefits of self-initiated breaks is of vital importance for employees as well as their employers. Taken together, this study will lead to a better understanding of day-specific factors that contribute to work engagement. This is valuable because such factors can be acted upon to foster work

engagement on days when work engagement is especially needed – such as a day when a consultant has to present an idea in a board meeting or a scientist has to finish a revision.

The Role of Recovery for Work Engagement

Rothbard and Patil (2012) defined work engagement as employees' "strong focus of attention, intense absorption, and high energy toward their work related tasks" (p. 56). Off-the-job and on-the-job recovery ensure that employees have energetic and self-regulatory resources at their disposal, which help them direct their attentional focus to work, to be immersed in their work, and to feel energetic and vigorous while working—that is, to experience work engagement. We build our theoretical line of argument on the basic ideas of the effort-recovery model (Meijman & Mulder, 1998) and the conservation of resources framework (Gorgievski & Hobfoll, 2008; Hobfoll, 1998), as well as theorizing on work breaks by Trougakos and Hideg (2009). According to these theoretical perspectives, recovery occurs when employees refrain from engaging in behaviours that drain their energetic and self-regulatory resources. More specifically, the effort-recovery model proposes that employees have to invest effort in the face of job stressors. When these stressors are removed, recovery can occur—that is, psychobiological systems can return to their pre-stressor level. Similarly, Trougakos and Hideg (2009) argue that self-regulatory resources can be replenished when the degree of required self-regulation (that is, "effortful attempts to control and alter naturally occurring behaviours or mental states", Beal, Weiss, Barros, & MacDermid, 2005, p. 1058) is (temporarily) reduced. Thus, during periods employees engage in activities they like to engage in and that they prefer, self-regulatory resources can be replenished. We focus on sleep and short breaks from work because these recovery periods both have an equivalent function insofar as they enable restoration of energetic and self-regulatory resources.

The conservation of resources framework suggests that employees will be more inclined to invest their resources into work after episodes during which they recovered their energetic and self-regulatory resources (Gorgievski & Hobfoll, 2008; Hobfoll, 1998). In contrast, when individuals do not feel recovered and lack energetic and self-regulatory resources, they will be less able and willing to invest resources in their work tasks. In the following sections, we will further elaborate on why we propose that sleep during off-job time and short breaks from work are crucial for employees' work engagement on a daily basis.

Sleep at Night and Work Engagement

Sleep constitutes the recuperative process of the central nervous system and, accordingly, is an indispensable process for human beings (Åkerstedt, Nilsson, & Kecklund, 2009). During sleep, people's energetic and self-regulatory resources are restored and at employees' disposal when they return to work the next day, enabling them to experience work engagement. Sleep is a period during which resources needed during wakefulness can be restored (Åkerstedt, Kecklund, & Gillberg, 2007; Baumeister, Muraven, & Tice, 2000). Sleep research indicates that both quantity and subjective quality are important dimensions of sleep (Åkerstedt, Hume, Minors, & Waterhouse, 1994; Pilcher, Ginter, & Sadowsky, 1997). Quantity of sleep captures how many hours an employee spent sleeping. Subjective quality of sleep captures the experience of (non)restorative sleep, awakenings during the night, and difficulties of falling asleep (Åkerstedt et al., 1994; Mullins, Cortina, Drake, & Dalal, 2014). Summing up research on sleep, Barnes (2012) concluded that both sleep of good quality and of sufficient duration should be important for the restoration of energetic and self-regulatory resources (see also Baumeister et al., 2000). Consistently, field and lab studies showed that sleep deprivation led to a reduction in self-regulatory resources (e.g., Barnes, Schaubroeck, Huth, & Ghumman, 2011; Christian & Ellis, 2011; Welsh, Ellis, Christian, & Mai, 2014).

When coming back to work after a night with sufficient and qualitatively good sleep, energetic and self-regulatory resources are at employees' disposal. Self-regulatory resources ensure that employees can direct their focus of attention on work tasks (Beal et al., 2005) and invest their energetic resources, which should enable them to feel vigorous, dedicate themselves to work, and be absorbed in work tasks, that is, to experience high levels of work engagement. Despite the solid theoretical foundations of this line of reasoning, there is only scarce research on the link between sleep and state work engagement. So far, only one daily diary study (Diestel, Rivkin, & Schmidt, 2015) found support for a positive effect of sleep quality on work engagement. In two daily diary studies, Lanaj et al. (2014) did not find significant direct relationships between day-specific sleep duration and work engagement, but showed that day-specific sleep duration was negatively related to morning ego depletion (i.e., shorter sleep was associated with low self-regulatory resources in the morning), and that morning ego depletion, in turn, diminished daily work engagement. Indirect support for our line of reasoning comes from a study of Barnes, Lucianetti, Bhave, and Christian (2015). They examined cross-over effects of sleep quality and showed that supervisors' sleep quality was indirectly related to subordinates' work engagement via supervisors' ego depletion and abusive supervision.

We hypothesize that employees should experience greater work engagement after a night with qualitatively good sleep as compared to a night with poor sleep. Similarly, employees should show higher work engagement after a night of longer sleep as compared to a night of shorter sleep.

Hypothesis 1: After nights employees slept longer, they show higher work engagement during the day.

Hypothesis 2: After nights employees slept better, they show higher work engagement during the day.

On-the-Job Recovery and Work Engagement

Besides restoring energetic and self-regulatory resources during sleep at night, restoration of resources is also possible during breaks from work. A break is an episode of the workday during which employees shift their attention away from work tasks (Hunter & Wu, in press). During the break, self-regulatory resources necessary to maintain one's focus of attention on-task (Beal et al., 2005) are no longer taxed, and energetic resources can be restored by, for instance, napping, relaxing, getting fresh air, and consuming caffeine (Demerouti, Bakker, Sonnentag, & Fullagar, 2012; Trougakos, Hideg, Cheng, & Beal, 2014; Tucker, 2003). Research on work breaks is still scarce but growing (Fritz, Ellis, Demsky, Lin, & Guros, 2013). Trougakos et al.'s (2014) research on the relationship between characteristics of lunch breaks and end-of-workday fatigue demonstrated that relaxing lunch break activities were related to less fatigue at the end of the workday. Employees who engaged in work and social activities during lunch breaks were especially likely to feel fatigued when they had low lunch break autonomy. Investigating various types of work breaks, Hunter and Wu (in press) found that breaks during which employees pursued more activities they preferred were positively related to employees' level of energy, motivation, and concentration after the breaks. However, other characteristics of breaks such as length of break, whether employees engaged in effortful activities or low-effort activities, and whether they were outside the office or not, were unrelated to employees' resource levels after the break. Two studies examined links between work breaks and vigour and vitality: A daily diary study by Demerouti et al. (2012) investigated the relationship between the experience of recovery after a break (i.e., being full of energy after a pause) and vigour at the end of the work day. The study revealed that the experience of recovery after a break was unrelated to vigour, but that the combined experience of recovery after a break and of enjoyment while working predicted daily vigour. Findings by Zacher, Brailsford, and Parker (2014) suggest

that taking micro-breaks during the work day positively predicted subsequent vitality (i.e., feeling energetic and vigorous). So far, research did not examine links between taking short breaks from work and work engagement.

We add to previous work on potential energetic benefits of breaks, by focusing on whether employees take self-initiated short breaks from work in the morning and in the afternoon. A self-initiated short break is an interruption of employees' job activity that takes a few minutes, and during which employees may make private phone calls, go for a coffee, smoke a cigarette, go for a walk, surf news websites, and the like (Fritz, Lam, & Spreitzer, 2011). We focus on *self-initiated* short breaks because we are interested in how employees actively manage their resources at work (Zacher et al., 2014). According to the conservation of resources framework, employees need to take time to refuel their resource reservoirs in order to be continuously engaged (Gorgievski & Hobfoll, 2008). When employees notice that their capacity to concentrate and to focus attention on work tasks diminishes, and when they experience low levels of energy, they may self-initiate a short break from work. During this short break, demands on energetic and self-regulatory resources needed to focus on-task are removed. The higher level of resources after short breaks (Demerouti et al., 2012; Hunter & Wu, in press) should result in higher subsequent work engagement, because employees are able to focus on work again and willing to invest their resources into work. We focus on self-initiation as a critical feature of short breaks, because when employees take self-initiated short breaks, they actively manage their resources during the work day to sustain work engagement. Thus, we expect that short breaks matter for experiences at the day-level.

Hypothesis 3a: On days employees self-initiate a short break in the morning, they experience higher work engagement.

Hypothesis 3b: On days employees self-initiate a short break in the afternoon, they experience higher work engagement.

The Joint Effects of Sleep at Night and Short Breaks from Work

Taking self-initiated short breaks should be especially important after nights employees slept shorter and after nights sleep quality was lower, whereas taking short breaks should be less important after nights employees slept longer and after nights sleep quality was higher. When employees come to work after a night of short sleep or after a night of bad quality sleep, employees' resource reservoirs should be less filled (Baumeister et al., 2000). On these days, self-initiating short breaks from work to refill resources should be especially important in order to be engaged at work (Gorgievski & Hobfoll, 2008). Taking short breaks may offset the insufficient restoration of resources during sleep at night and may thus be especially valuable for employees after a night of short or poor sleep (Hobfoll, 1989). Thus, sleep characteristics and taking self-initiated short breaks from work should have a joint and interactive effect on work engagement: We hypothesize that the positive relationship between taking self-initiated short breaks and work engagement should be stronger after a night of shorter sleep compared to a night of longer sleep. Similarly, we hypothesize that the positive relationship between taking self-initiated short breaks and work engagement should be stronger after a night with poor sleep compared to a night with qualitatively good sleep.

Hypothesis 4: After nights with shorter sleep duration (as compared to nights with longer sleep duration), self-initiating a short break (a) in the morning and (b) in the afternoon should be stronger positively related to work engagement.

Hypothesis 5: After nights with poor sleep quality (as compared to nights with good sleep quality), self-initiating a short break (a) in the morning and (b) in the afternoon should be stronger positively related to work engagement.

Job Characteristics and Work Engagement

In line with the job demands-resources model (Bakker & Demerouti, 2007; Demerouti, Bakker, Nachreiner, & Schaufeli, 2001), day-specific job characteristics may be

precursors of daily work engagement. To show that sleep characteristics and short breaks from work *incrementally* predict daily work engagement over and above day-level predictors that were identified in previous research on work engagement (Bakker, 2014), we control for time pressure and job control. Previous research has shown that these job characteristics show meaningful within-person variability that is related to daily work engagement (Kühnel et al., 2012). Moreover, by taking into account job control, we can rule out the alterative explanation that daily job control might be a third variable explaining the relationship between taking breaks and work engagement. Because job control might be positively related both to the opportunity to take breaks from work as well as to work engagement, the relationship between taking breaks and work engagement might be spurious.

Method

Sample and Procedure

Employees from companies operating in diverse industries participated in our study. They were recruited by psychology students who received credits for recruiting participants as part of a research seminar (Wheeler, Shanine, Leon, & Whitman, 2014). To motivate employees to take part in the study, we offered lottery prizes (vouchers for an online retailer) and feedback on the results of the study. Employees who gave their consent to participate could either fill in online questionnaires or paper-and-pencil questionnaires. Participants who decided to fill in online questionnaires received several emails containing links to the online questionnaires. Participants first completed a general online questionnaire that assessed socio-demographic characteristics and asked participants to indicate at what time they will go to lunch and at what time they will quit working the next five working days. Over the course of these five working days, participants received personally scheduled emails containing links to online questionnaires. Each day, participants were asked to answer two daily questionnaires, the first one before their daily lunch break and the second one at the end of

the working day. We separately assessed short breaks in the morning time frame and the afternoon time frame to reduce recall-bias (having to remember short breaks that were taken during the morning at the end of the working day), and to separate measurement occasions of predictor variables (sleep duration, sleep quality, short breaks in the morning) and the criterion variable work engagement (Beal, 2015). To match participants' data of the general questionnaire and the daily questionnaires, participants had to indicate a code each time they filled in a questionnaire. Due to incomplete data (e.g., answering the daily questionnaire before lunch break but failing to provide the second daily questionnaire at the end of the working day) or because participants did not complete the electronic questionnaires at the instructed points in time (e.g., belatedly completing the daily questionnaires all at once), 186 daily entries had to be excluded. Participants who filled in the paper-and-pencil questionnaires received a booklet containing all the questionnaires described above with detailed instructions when to fill out which part of the booklet. Of the 23 booklets we send out, 18 were returned (due to incomplete data, three day-specific entries had to be excluded).

The final sample comprised 107 employees who, in total, provided complete data on 453 days (906 daily observations). One-hundred and sixty employees were contacted to participate in this study. They could have provided data on 800 days (160 times 5 days). Our final response rate is thus 67% on the level of participants (107 out of 160) and 57% on the level of days (453 out of 800). Employees were working in various industries: manufacturing (33 percent), service (30 percent), education (10 percent), public administration (6 percent), and others (21%). Forty-four percent of the sample were women; average age was 36 years (*SD* = 13); and 36 percent had children. Participants had on average 13 years of professional experience, thereof 8 years of professional experience in their current organization. Weekly working time was 40 hours (*SD* = 7).

Measures

Daily questionnaires before lunch. ***Sleep duration.*** Following the procedure of the Pittsburgh Sleep Diary (Monk et al., 1994), we calculated day-specific sleep duration from participants' daily responses regarding the point in time when they fell asleep the preceding evening and the point in time they woke up in the morning. Thus, we used a score of the number of hours and minutes participants slept every night based on participants' self-reports. Barnes (2012) concluded that subjective measures of sleep duration overestimate sleep duration by about 6 to 7 percent (Barnes et al., 2011; O'Donnell et al., 2009), but that subjective and objective measures of sleep duration correlate very strongly.

Sleep quality. We assessed day-specific sleep quality with a single item ("How do you evaluate this night's sleep?") derived from the Pittsburgh Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). Participants rated their overall sleep quality on a 5-point scale ranging from 1 = *very poor* to 5 = *excellent*. This item has been used successfully in similar diary studies (e.g., Hülsheger et al., 2014; Sonnentag, Binnewies, & Mojza, 2008). Subjective ratings of sleep quality are closely reflected in objective measures of sleep quality obtained in sleep laboratories (sleep continuity measured with polysomnography, Åkerstedt et al., 1994).

Self-initiated short break in the morning. Participants were asked whether they took a self-initiated short break in the morning. To ensure that participants had a common understanding what was meant by a "short break", we defined it as "an interruption of your job activity that took a few minutes, e.g., making a private phone call, going for a coffee, smoking a cigarette, going for a walk, surfing news websites, and the like". Examples were adapted from Fritz et al. (2011). Self-initiated was explained as "you decided on your own to take the break". When participants took a self-initiated break in the morning, this was scored with 1 (versus 0 = *no self-initiated break in the morning*).

Daily questionnaires at the end of the working day. ***Work engagement.*** Day-specific work engagement was assessed with the nine-item version of the UWES (Schaufeli, Bakker, & Salanova, 2006). Items had to be answered with respect to how work engaged a person was during the present day. Vigour (e.g., "Today, I felt bursting with energy at my work"), dedication (e.g., "Today, I was enthusiastic about my job"), and absorption (e.g., "Today, I got carried away when I was working") were captured with three items each. Items had to be answered on a 7-point Likert scale ranging from 1 = *strongly disagree* to 7 = *strongly agree*. Following recommendations of Schaufeli et al. (2006), we computed an overall work engagement factor score. Cronbach's alpha ranged from .93 to .95 across days.

Self-initiated short break in the afternoon. Similar to asking for self-initiated breaks in the morning, participants were asked whether they took a self-initiated short break in the afternoon. When participants took a self-initiated short break in the afternoon, this was scored with 1 (versus 0 = *no self-initiated break in the afternoon*).

Time pressure and job control. Day-specific time pressure and job control were assessed as day-specific control variables with items developed by Semmer, Zapf, and Dunckel (1999). Items had to be answered on a 5-point scale ranging from 1 = *never/very rarely* to 5 = *frequently* and from 1 = *very little* to 5 = *very much*, respectively. Correlations of the two items assessing time pressure (e.g., "How often were you pressed for time today?") ranged between .76 and .87 over the days. To capture job control, we used two items capturing autonomy in task organization (e.g., "Today, to what extend could you influence the way how you accomplished your tasks?") and three items capturing autonomy in scheduling (e.g., "Today, to what extend were you able to autonomously schedule your working day?"). Cronbach's alpha ranged from .89 to .93 across days.

Results

Descriptive Statistics

[Table 1 about here]

Table 1 shows means, standard deviations, and intercorrelations of the variables. For all variables, we ran null models with the Hierarchical Linear Modelling (HLM) 7.01 software package (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2011) to calculate the proportions of variance that were within-person and between-person (see intraclass correlations provided in Table 1). Forty-seven percent of the variance in work engagement resided at the within-person level and 53% of the variance was between-person. Thus, work engagement showed substantial day-to-day (within-person variance) and between-person variation.

The between-person correlations below the diagonal in Table 1 show that work engagement was positively related to sleep quality and time pressure. Participants who, on average across days, indicated better sleep quality and higher time pressure indicated higher work engagement than participants who indicated lower sleep quality and lower time pressure ($r = .29$, $p < .01$, and $r = .23$, $p < .05$, respectively).

The within-person correlations among the day-specific variables (shown above the diagonal in Table 1) show that work engagement was significantly related to several variables of interest. On days employees indicated higher work engagement at the end of the work day compared to other days, they more likely took a self-initiated short break in the afternoon ($r = .13$, $p < .01$), they indicated a longer day-specific sleep duration during the previous night ($r = .17$, $p < .001$), better day-specific sleep quality during the previous night ($r = .19$, $p < .001$), and higher day-specific job control ($r = .24$, $p < .001$). Taking a self-initiated short break in the morning, however, was unrelated to day-specific work engagement ($r = .06$, $p = .21$).

Test of Hypotheses

We conducted multilevel analyses using the HLM 7.01 software package (Raudenbush et al., 2011). Results of these analyses are presented in Table 2. We centred day-level predictor variables around the respective person mean (group-mean centring), because we were interested in how an employee's day-specific experiences and actions—in comparison to his or her other days—predict work engagement. We specified and compared hierarchical linear models to predict day-specific work engagement: a null model, a model that included only the day-level predictor variables (Model 1), and a model including the predictor variables and the control variables time pressure and job control (Model 2). To test Hypotheses 4 and 5, we included the interaction terms between sleep characteristics and short breaks (Model 3 and Model 4). Model 3 presents analyses without control variables; Model 4 presents analyses including the control variables time pressure and job control. We thus followed recommendations about using control variables in organizational research (Becker et al., in press; Spector & Brannick, 2011) and present all analyses with and without the control variables.

[Table 2 about here]

Hypothesis 1 was not supported, because previous night's sleep duration was not significantly related to work engagement during the day (Estimate = 0.09, *SE* = 0.05, *t* = 1.93, *p* = .054). In line with Hypothesis 2, Model 1 shows that after nights employees slept better, they showed more work engagement during the day (Estimate = 0.16, *SE* = 0.06, *t* = 2.61, *p* < .01). Contrary to expectations, taking a self-initiated break in the morning was unrelated to work engagement (Estimate = 0.12, *SE* = 0.12, *t* = 1.018, *p* = .309). In line with expectations, taking a short break in the afternoon fostered work engagement (Estimate = 0.25, *SE* = 0.12, *t* = 2.05, *p* < .05). Thus, Hypothesis 3a was rejected, whereas Hypothesis 3b was supported.

Model 2 shows that the control variables day-specific time pressure and day-specific job control were both significantly related to work engagement. Participants indicated higher work engagement on days with higher time pressure (Estimate = 0.15, *SE* = 0.06, *t* = 2.63, *p* < .01) and with higher job control (Estimate = 0.35, *SE* = 0.07, *t* = 4.74, *p* < .001). Sleep quality and taking a self-initiated short break in the afternoon were significantly related to day-specific work engagement over and above these control variables. Thus, results were very similar when control variables were included.

Model 3 shows that none of the interaction terms between sleep characteristics and taking short breaks significantly predicted work engagement. The pattern of results remained the same when control variables were included (Model 4) and when each interaction term was separately tested (self-initiated short break in the morning × sleep duration: Estimate = -0.02, *SE* = 0.16, *t* = -0.14, *p* = .884; self-initiated short break in the afternoon × sleep duration: Estimate = -0.04, *SE* = 0.15, *t* = -0.30, *p* = .760; self-initiated short break in the morning × sleep quality: Estimate = 0.09, *SE* = 0.25, *t* = 0.38, *p* = .699; self-initiated short break in the afternoon × sleep quality: Estimate = -0.03, *SE* = 0.19, *t* = -0.19, *p* = .848). Thus, our hypotheses on interactions between sleep characteristics and taking short breaks (Hypotheses 4 and 5) were not supported.

Additional Analyses

We conducted a number of additional analyses to further explore our data and to examine the robustness of our findings.

Interactions between sleep duration and sleep quality. It may be possible that good sleep quality compensates for shorter sleep duration and vice versa. However, our data did not support this idea as the interaction term between day-specific sleep quality and day-specific sleep duration was not a significant predictor of work engagement (Estimate = -0.02, *SE* = 0.06, *t* = -0.42, *p* = .675).

It may be possible that the optimum sleep duration lies somewhere between a very short sleep duration and a very long sleep duration. We thus explored the possibility that sleep duration is non-linearly related to work engagement by examining the curvilinear term of sleep duration. The curvilinear term was not a significant predictor of work engagement (Estimate = -0.03, *SE* = 0.03, *t* = -1.13, *p* = .258). Moreover, the interaction between day-specific sleep quality and the curvilinear term of sleep duration was not a significant predictor of work engagement (Estimate = 0.01, *SE* = 0.02, *t* = 0.51, *p* = .605).

Alternative coding of self-initiated short breaks. The finding that taking a self-initiated break in the afternoon positively predicted work engagement, whereas taking a self-initiated break in the morning failed to predict work engagement, might be due to the shorter time lag between measurement occasions. We ran additional analyses with an alternative coding of self-initiated short breaks. We combined morning and afternoon breaks in one variable that was coded 0 = *no short breaks during the day*, 1 = *either short break in the morning* or *in the afternoon*, and 2 = *short break in the morning* and *in the afternoon*. Results showed that this combined breaks variable positively predicted work engagement (Estimate = 0.18, *SE* = 0.08, *t* = 2.28, *p* < .05).

Reverse causation. We tested whether work engagement is not only a consequence of previous night's sleep but a precursor of sleep as well. Additional analyses ($N_{\text{employees}}$ = 81, N_{days} = 265) showed that our data did not support this idea. Day-specific work engagement did neither predict sleep duration the following night (Estimate = -0.01, *SE* = 0.07, *t* = -0.23, *p* = .811) nor sleep quality the following night (Estimate = 0.09, *SE* = 0.06, *t* = 1.42, *p* = .155).

Activities pursued during breaks. We assessed what participants did during their short breaks (activities taken from Fritz et al., 2011). During morning breaks/during afternoon breaks, participants had a snack (during 57%/48% of short breaks), went to toilet

(56%/66%), checked in with a friend or family member (55%/50%), drank caffeinated beverages (51%/44%), drank water (45%/56%), surfed the web (21%/25%), smoked a cigarette (17%/16%), did some form of physical activity, including walks or stretching (13%/23%), looked out of the window (13%/14%), made plans for the evening (5%/9%), napped (1%/2%), and/or did relaxation exercises (0%/2%). Of the activities, only smoking cigarettes during the morning was significantly related to work engagement (r = -.10, p = .044).

Discussion

This study shed light on the benefits of sleep and short breaks for employees' daily work engagement. Employees felt more engaged on days on which they got a good night's sleep and initiated short breaks from work in the afternoon. By simultaneously taking into account short breaks from work and sleep characteristics, this study showed that both on-the-job and off-the-job recovery periods incrementally contribute to employees' experience of being engaged at work.

This study thus contributes to current research revealing the benefits of good and sufficient sleep for employees' work-related well-being and organizational behaviour (e.g., Barnes et al., 2015; Kühnel et al., 2016; Wagner, Barnes, Lim, & Ferris, 2012), showing that off-the-job experiences matter for what happens on the job on a day-to-day basis. When taking both sleep quality and sleep duration into account, only previous night's sleep quality mattered for work engagement during the day. Within-person correlations showed that both day-specific sleep duration and quality were significantly correlated with work engagement, and that these correlations were similar in magnitude (r = .17, p < .001, and r = .19, p < .001, respectively). This result suggests that the variability in sleep duration that is critical for work engagement is (partly) captured in ratings of sleep quality (the within-person correlation between sleep quality and sleep duration was .36, p < .001). Sleep quality, on the other hand,

captures more than simple sleep duration, and is therefore the prominent predictor of work engagement when both sleep duration and sleep quality are simultaneously taken into account.

Furthermore, this study contributes to the growing body of research revealing the benefits of taking short breaks from work. Adding to research on work breaks, our study explicitly focused on self-initiated short breaks from work. So far, research has examined different types of breaks (e.g., lunch breaks, micro-breaks) and a variety of aspects of work breaks, but much is still to be learned about breaks. Some studies examined different activities employees pursued during breaks (e.g., Kim et al., in press; Zacher et al., 2014), recovery experiences during the break (e.g., Trougakos, Beal, Green, & Weiss, 2008; Trougakos et al., 2014), or the feeling of being recovered after breaks (e.g., Demerouti et al., 2012), whereas other studies investigated characteristics of breaks such as their length and frequency (e.g., Hunter & Wu, in press). One reason for these different focal points of research and complimentary results is, of course, the abundance of research options due to the diversity of breaks from work and the necessity to prioritize when doing field research on "naturally" occurring work breaks. Our study emphasized the agency of employees to self-initiate short breaks from work. Although self-initiated short breaks constitute only a small component of the work day whose impact might be limited, whether they were taken or not mattered for employees' daily level of work engagement.

What also seems to matter are the specific activities employees engage in during the short breaks. For example, the study of Kim and colleagues (in press) revealed that engaging in cognitive activities such as reading nonwork-related books during afternoon breaks was not related to improved end-of-work affect. Our study showed that overall, taking short breaks mattered for work engagement, irrespective of what employees did during the breaks. Thus, results of our study suggest that overall, employees seem to be able to choose break

activities that restore energetic and self-regulatory resources and help them to become work engaged again.

We found that taking short breaks in the afternoon was positively related to daily work engagement, whereas, contrary to expectations, taking short breaks in the morning was unrelated to daily work engagement. If one had to decide whether to take a break in the morning *or* in the afternoon, based on our results, we would thus recommend taking a self-initiated short break in the afternoon instead of taking a break in the morning of the working day. Interestingly, results of a recent study by Hunter and Wu (in press) seem to suggest the contrary. These researchers showed that breaks that were taken earlier in the day were more positively related to employees' level of resources after the break than breaks that were taken later in the day (specifically, time of break was negatively related to employees' level of resources after the break, controlling for employees' level of resources before the break; r = -.14). However, it is important to point out that Hunter and Wu's study compared the effects of breaks that were taken at different points in time of the day. In contrast, in our study, we compared days differing from each other with regard to whether self-initiated breaks were taken or not taken. Breaks taken later in the day may restore a smaller amount of resources than breaks taken earlier in the day, but nevertheless they may be especially useful to counteract dips in employees' alertness and performance in the afternoon (i.e., the post-lunch dip, see Carrier & Monk, 2000). One might argue that the importance of taking short breaks from work increases as the temporal distance to the recovery-providing sleep period gets larger. Early in a day self-regulatory resources that were replenished during sleep may still be available. Thus, breaks taken in the afternoon may be crucial to maintain work engagement during the afternoon and thus be of greater importance for the overall level of work engagement during a work day than breaks taken in the morning.

Our additional analyses on the combined breaks measure suggests that it seems to be better to take short breaks from work *both* in the morning and in the afternoon, compared to taking a break *either* in the morning or in the afternoon or to taking no break at all. Thus, future research might want to investigate whether it is frequency of short breaks that matters and/or whether short breaks from work should be distributed over the working day.

Contrary to expectations, our results suggest that benefits of good sleep and short breaks from work are additive rather than compensatory. That is, we found no support for the idea that taking short breaks from work substitutes for short or impaired sleep. Sleep and short breaks seem to have distinct functions for maintaining and restoring employees' level of energetic and self-regulatory resources. We conclude that sleep as well as breaks are necessary on days on which high work engagement is needed, and that endeavours to replace one with the other might not work out as expected.

Although it was not the focus of this study, we note that day-specific time pressure was a *positive* predictor of daily work engagement. This finding may suggest that time pressure is something desirable that should be fostered in order to raise day-specific work engagement. However, time pressure is a challenge stressor (Cavanaugh, Boswell, Roehling, & Boudreau, 2000; LePine, LePine, & Jackson, 2004; Prem, Ohly, Kubicek, & Korunka, in press) that might operate quite differently at the within-person level compared to the between-person level (see Sonnentag, 2015). At the within-person level, experiencing high time pressure on one day may have an energizing effect and may necessitate the employee to invest compensatory effort in order to meet the demands of the current work day (Hockey, 1997). This does not imply, however, that enduring high day-specific time pressure is related to an increase in work engagement over time between-persons. Rather, enduring time pressure might exhaust employees' energetic resources and impair their well-being and health in the long run. Indeed, results of between-person studies showed that challenge stressors

"tend to be unrelated to an increase in work engagement over time" (Sonnentag, 2015, p. 281).

It could be argued that taking self-initiated short breaks and day-specific job characteristics are highly related to each other. For example, employees may be more likely to take short breaks from work on days on which they are less pressed for time and on which they are able to make their own decisions about how to schedule their tasks. However, the correlations between taking short breaks and day-specific job control were rather small (r = .06 and r = .09 in the morning and in the afternoon, respectively).[1] Similarly, the correlations between taking short breaks and day-specific time pressure were small (r = -.08 and r = -.14 in the morning and in the afternoon, respectively). Thus, the relationships pointed in the expected directions, but we can rule out that taking short breaks solely depended on these day-specific job characteristics. Similarly, employees might take breaks from work especially (or only) on days with bad sleep quality or short sleep duration. However, the correlations between taking short breaks and sleep characteristics were small (ranging between r = -.04 and r = .07), and thus we can rule out that taking short breaks solely depended on these day-specific sleep characteristics. So what predicts whether employees take short breaks or not? Future research might investigate potential predictors of taking short breaks. For example, employees might initiate short breaks after tasks that required particularly high levels of effort, before starting a new task that is perceived to be effortful, or just because the weather outside makes a short walk in the sun appealing.

An important issue regarding taking self-initiated short breaks is employees' ability to monitor their own level of resources and to initiate a break before their energetic and self-regulatory resources are depleted. For the initiation of a short break, self-regulatory competence is needed: To reach the decision to take a short break from work, employees have to know how their energy typically waxes and wanes, monitor their own level of

fatigue, anticipate future benefits of what might look like a loss of working time in the short run, and sometimes overcome social barriers to take the breaks they need. Our results suggest that employees sometimes manage and sometimes fail to self-initiate short breaks. Future research might investigate why employees sometimes fail to take short breaks when they are needed in order to recover from work.

Lastly, we acknowledge the possibility that high work engagement might not only be a consequence, but also an antecedent of taking short breaks from work. During an episode of being highly engaged at work, it is likely that work-related goals are attained. Consequently, others goals that were shielded before become accessible and might be pursued (see also Shah, Friedman, & Kruglanski, 2002). These goals could be other work goals as well as non-work related goals (e.g., returning a personal phone call, checking personal instant messages). Employees might reward themselves for having been highly work engaged with pursuing a personal goal and taking a break. Subsequently, they can become highly engaged in their work again. Results of a study by Sonnentag and colleagues (2012) can be interpreted in support of this idea. In a daily diary study, these researchers showed that employees' level of recovery before work translated into work engagement, and that work engagement, in turn, prevented a loss in recovery level throughout the day. One might speculate that on days employees came to work with a high level of resources, they were able to engage in work and to successfully manage their energetic resources during the day, for instance by taking self-initiated breaks in between episodes of being highly engaged at work. Future research might want to explore reciprocal relationships between taking short breaks at work and work engagement. Although we used a daily diary design with two measurement occasions on each day to separate the measurement of dependent and independent variables, to satisfactorily explore reciprocal relationships a research design

would be needed that more strongly gives consideration to the episodic structure of the work day (see Beal & Weiss, 2003; Beal et al., 2005).

Limitations

A limitation of our study that needs to be pointed out is that results are limited to employees with jobs that provide the opportunity to self-initiate short breaks from work. Thus, we cannot generalize to employees holding jobs that do not allow employees to self-initiate short breaks, such as air traffic controllers or employees performing control and monitoring activities for automated manufacturing lines and power plants.

A second limitation of our study is that our design does not allow us to draw definitive conclusions about the direction of causality. Sleep might not only be a precursor of work engagement, but a consequence of work engagement as well: On days with high work engagement as compared to days with low work engagement, at the end of the working day, employees might have less unfinished tasks that have the potential to stick to employees' minds and diminish their subsequent sleep (Syrek & Antoni, 2014). Although additional analyses did not support reverse causation (see additional analyses section), we cannot fully rule out that sleep and work engagement are reciprocally related.

A third limitation is that we used a single-item measure to assess sleep quality. This item of the Pittsburgh Sleep Quality Index (Buysse et al., 1989) is considered to be the core subjective sleep quality indicator (Krystal & Edinger, 2008), and has been used successfully in similar diary studies (Hülsheger et al., 2014; Kühnel et al., 2016). Nevertheless, future field studies might want to triangulate the measurement of sleep quality by obtaining objective indicators of sleep quality via wrist actimetry.

A final limitation of the present study is that we did not measure energetic and self-regulatory resources as explanatory mechanisms of the relationships of sleep and short breaks with work engagement. Future research could add to this line of research by measuring self-

regulatory resources (e. g., with scales on self-regulatory strength, see Lanaj et al., 2014) and energetic resources. However, we would like to emphasize that self-regulatory and energetic resources are closely tied to physiological processes and only partly accessible through verbal self-report. Thus, future researchers might consider obtaining implicit and physiological measures as well.

Practical Implications

We started by pointing out that most people spend a considerable share of their lifetime working, and that it is thus desirable to enjoy work, feel enthusiastic, and experience a sense of significance while working to the greatest extent possible. To foster this positive experience of being engaged at work, results of this study suggest different starting points. First, especially before days on which high work engagement is needed, employees should seek sleep of high quality. Unfortunately, especially when employees anticipate that the next day will be very demanding and energetic resources are needed, employees' sleep quality appears to suffer (Kecklund & Åkerstedt, 2004). We thus recommend to follow guidelines such as not drinking caffeinated beverages before going to bed, not using the bed for activities such as eating or watching television, and not planning and thinking about important matters in bed, in particular on evenings before days on which high engagement is needed (Mastin, Bryson, & Corwyn, 2006). To get sufficient sleep, we could recommend going to bed earlier. However, going to bed earlier does not necessarily result in the desired outcome, because the circadian drive for wakefulness peaks just before habitual bedtime (Czeisler & Gooley, 2007)—in other words, it is especially difficult to fall asleep in the time frame before habitual bedtime. The remaining option to prolong time in bed and to get sufficient sleep—which is admittedly more difficult to realize—is thus to shift appointments and meetings in the early morning to a later point in time.

The second starting point to foster work engagement is to take short breaks from work. Especially on days on which high work engagement is needed, employees should self-initiate short breaks. What first seems contradictory, because working time is "lost" during breaks, enables employees to focus on and engage in work later during the day. To enable employees to take short breaks, employers should allow employees to self-initiate short breaks when they are needed. Moreover, it is important that a recovery-friendly climate is established at work so that employees actually make use of opportunities to take short breaks. Supervisors could encourage employees to monitor their own level of energy and encourage employees to take short breaks from work accordingly. This implies accepting that employees might differ in their need for short breaks and with regard to the point(s) in time they prefer to take short breaks. For employees, we do *not* recommend to take short breaks from work a lot but rather, to self-initiate a short break from work when it is needed. To self-initiate a short break, it is crucial to recognize when a break is needed. Thus, employees may foster their awareness of their own state of fatigue, for example by enrolling in mindfulness-based trainings (e.g., Klatt, Buckworth, & Malarkey, 2009; Wolever et al., 2012).

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Footnote

[1] Job control was assessed with three items capturing autonomy in scheduling and two items capturing autonomy in task organization. When examining the correlations between taking breaks and the two facets of job control separately, autonomy in scheduling was significantly related to taking breaks at the within-person level (for taking breaks in the afternoon: $r = .11$, $p = .025$, $N = 453$) and at the between-person level (for taking breaks in the morning: $r = .24$, $p = .013$, $N = 107$; for taking breaks in the afternoon: $r = .19$, $p = .046$, $N = 107$). Autonomy in task organization was not significantly related to taking breaks.

Table 1

Means, Standard Deviations, and Correlations of Variables

Variable	*M*	*SD*	ICC	1	2	3	4	5	6	7
1. Daily work engagement	3.87	1.24	0.53		.06	.13**	.17***	.19***	.01	.24***
2. Self-initiated short break in the morning	0.59	0.49	0.45	-.04		.09	.01	-.04	-.08	.06
3. Self-initiated short break in the afternoon	0.55	0.50	0.44	-.18	.51***		.07	.03	-.14**	.09
4. Day-specific sleep duration (in hours)	6.92	1.14	0.32	.16	-.02	.05		.36***	-.06	.07
5. Day-specific sleep quality	3.44	0.91	0.31	.29**	-.00	.12	.36***		-.16**	.06
6. Day-specific time pressure	2.73	1.13	0.52	.23*	-.03	-.14	-.03	.02		-.32***
7. Day-specific job control	3.53	0.89	0.53	-.05	.19	.17	-.19*	.07	-.33***	

Note: Correlations below the diagonal are person-level correlations. Day-level data were averaged across days to compute person-level correlations (N = 107). Correlations above the diagonal are day-level correlations. Above the diagonal, day-level data were centred around the respective person-mean (N = 453). ICC = Intraclass correlation (ratio of the between-person variance to the total variance); ratio of the within-person variance to the total variance is 1-ICC. For self-initiated short break in the morning, 0 = no self-initiated short break in the morning, 1 = self-initiated short break in the morning. For self-initiated short break in the afternoon, 0 = no self-initiated short break in the afternoon, 1 = self-initiated short break in the afternoon.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 2

Results of Multilevel Analyses Predicting Daily Work Engagement

	Null Model				Model 1				Model 2			
	Est	*SE*	*t*		Est	*SE*	*t*		Est	*SE*	*t*	
Intercept	3.849	0.096	39.76	***	3.849	0.096	39.75	***	3.848	0.096	39.73	***
Day-specific time pressure									0.154	0.058	2.63	**
Day-specific job control									0.353	0.074	4.74	***
Day-specific sleep duration (SD)					0.096	0.050	1.93		0.084	0.048	1.74	
Day-specific sleep quality (SQ)					0.163	0.062	2.61	**	0.176	0.061	2.89	**
Self-initiated short break in the morning [a]					0.124	0.122	1.01		0.119	0.118	1.00	
Self-initiated short break in the afternoon [a]					0.245	0.119	2.05	*	0.242	0.116	2.08	*
Self-initiated short break in the morning × SD												
Self-initiated short break in the afternoon × SD												
Self-initiated short break in the morning × SQ												
Self-initiated short break in the afternoon × SQ												
-2*log likelihood	1322.082	(3)			1299.944	(7)			1276.649	(9)		
Δ-2*log likelihood (*df*)					22.137	(4)	***		23.295	(2)	***	
Level 1 Intercept Variance (*SE*)	0.720	(0.054)			0.676	(0.051)			0.632	(0.048)		
Level 2 Intercept Variance (*SE*)	0.823	(0.137)			0.834	(0.137)			0.845	(0.137)		

Note: Est = Estimate. [a] 0 = no self-initiated short break, 1 = self-initiated short break. Model comparisons: Model 1 vs. Null Model, Model 2 vs. Model 1, Model 3 vs. Model 1, Model 4 vs. Model 3.
$p < .05$. ** $p < .01$. *** $p < .001$.

Table 2 (continued)

Results of Multilevel Analyses Predicting Daily Work Engagement

	Model 3				Model 4			
	Est	*SE*	*t*		Est	*SE*	*t*	
Intercept	3.850	0.096	39.72	***	3.850	0.097	39.64	***
Day-specific time pressure					0.152	0.058	2.60	*
Day-specific job control					0.354	0.074	4.76	***
Day-specific sleep duration (SD)	0.094	0.050	1.86		0.081	0.048	1.66	
Day-specific sleep quality (SQ)	0.160	0.081	1.97	*	0.173	0.061	2.81	**
Self-initiated short break in the morning [a]	0.133	0.107	1.24		0.127	0.119	1.06	
Self-initiated short break in the afternoon [a]	0.245	0.131	1.87		0.241	0.116	2.06	*
Self-initiated short break in the morning × SD	-0.038	0.225	-0.17		-0.015	0.178	0.17	
Self-initiated short break in the afternoon × SD	-0.025	0.221	-0.11		-0.041	0.168	-0.24	
Self-initiated short break in the morning × SQ	0.111	0.314	0.35		0.097	0.256	0.37	
Self-initiated short break in the afternoon × SQ	-0.031	0.220	-0.14		-0.053	0.204	-0.26	
-2*log likelihood	1299.658	(11)			1276.280	(13)		
Δ-2*log likelihood (*df*)	0.286	(4)			23.377	(2)***		
Level 1 Intercept Variance (*SE*)	0.675	(0.821)			0.630	(0.794)		
Level 2 Intercept Variance (*SE*)	0.837	(0.915)			0.850	(0.922)		

Note: Est = Estimate. [a] 0 = no self-initiated short break, 1 = self-initiated short break. Model comparisons: Model 1 vs. Null Model, Model 2 vs. Model 1, Model 3 vs. Model 1, Model 4 vs. Model 3.
* $p < .05$. ** $p < .01$. *** $p < .001$.