3-2018

The relevance of sleep and circadian misalignment for procrastination among shift workers

Jana KUHNEL
Ulm University

Sabine SONNENTAG
University of Mannheim

Ronald BLEDOW
Singapore Management University, RBLEDOW@smu.edu.sg

Klaus G. MELCHERS
Ulm University

DOI: https://doi.org/10.1111/joop.12191

Published in Journal of Occupational and Organizational Psychology, 2017 October
https://doi.org./10.1111/joop.12191

The relevance of sleep and circadian misalignment for procrastination among shift workers

Jana Kühnel[1,2]*, Sabine Sonnentag[2], Ronald Bledow[3] and Klaus G. Melchers[1]

[1]Work and Organizational Psychology, Ulm University, Germany
[2]Department of Psychology, University of Mannheim, Germany
[3]Lee Kong Chian School of Business, Singapore Management University, Singapore

This daily diary study contributes to current research uncovering the role of sleep for employees' effective self-regulation at work. We focus on shift workers' effective self-regulation in terms of their general and day-specific inclination to procrastinate, that is, their tendency to delay the initiation or completion of work activities. We hypothesized that transitory sleep characteristics (day-specific sleep quality and sleep duration) and chronic sleep characteristics in terms of circadian misalignment are relevant for procrastination. Sixty-six shift workers completed two daily questionnaires over the course of one work week, resulting in 332 days of analysis. Results of multilevel regression analyses showed that on days when shift workers slept better and longer—compared to days when they slept worse and shorter—they had more energy and willpower available after sleep and subsequently were less prone to procrastination. Moreover, the more work times (permanent shift) were misaligned with employees' sleep–wake preferences (chronotype) the more pronounced was shift workers' inclination to procrastinate at work. The present findings provide important implications for shift workers' effective functioning at work.

Practitioner Points

- To promote shift workers' effective functioning at work, when scheduling shift work, circadian principles should be taken into account, and work times should be aligned with workers' chronotypes.
- Day-specific sleep quality and duration co-vary with procrastination at work. Thus, on days on which procrastination would be especially harmful, sleep of good quality and of sufficient duration should be obtained.

Willpower and the availability of energy are important for effective functioning at work. Willpower ensures that employees can allocate cognitive and energetic resources to work tasks at hand and successfully enact intentions to pursue work goals (Beal, Weiss, Barros, & MacDermid, 2005; Lord, Diefendorff, Schmidt, & Hall, 2010). However, willpower and energy become depleted, which creates the necessity of periods during which willpower and energy can be restored. Sleep is a particularly important period that offers the

*Correspondence should be addressed to Jana Kühnel, Work and Organizational Psychology, Ulm University, 89069 Ulm, Germany (email: jana.kuehnel@uni-ulm.de).
We are grateful to Julia Günzer for help with collecting data and to Stefan Diestel for helpful comments on an earlier version of this manuscript.

opportunity to restore willpower and energy and thereby provides the foundation for employees to be able to successfully address issues of the upcoming work day (Barnes, 2012; Baumeister, Muraven, & Tice, 2000). Unfortunately, recent polls have indicated that sleep and its potential to restore willpower and energy are at risk. According to the National Sleep Foundation (2014), 58 per cent of surveyed Americans rate their sleep quality as 'poor' or 'only fair'. Furthermore, data from the United States, Canada, Mexico, United Kingdom, Germany, and Japan revealed that between 40 and 66 per cent of respondents indicated that they get less sleep than needed on work days (National Sleep Foundation, 2013). Particularly affected are shift workers who suffer from sleep loss and potential misalignment between their biological rhythms and imposed sleep–wake behaviour (Åkerstedt, 2003; Åkerstedt & Wright, 2009; Vetter, Fischer, Matera, & Roenneberg, 2015).

This study investigates the role sleep plays for effective functioning of shift workers. We focus on shift workers' effective functioning in terms of their general and day-specific inclination to procrastinate at work. Procrastination is the tendency to delay the initiation or the completion of activities (Howell, Watson, Powell, & Buro, 2006; Lay, 1986). From a self-regulation perspective, procrastination indicates that a specific volitional function—the ability of an individual to move from intention to action—is impaired (Beswick & Mann, 1994; Kuhl & Beckmann, 1994). Procrastination is a prevalent form of self-regulatory failure (Harriott & Ferrari, 1996; Steel, 2007) that can result in adverse consequences and thus is relevant for employees and employers alike. For employees, procrastination is frustrating because it implies a discrepancy between intentions and actions, and thus, it impedes the positive experience of making progress on work tasks and of getting things done (Amabile & Kramer, 2011; Deci & Ryan, 2000). Unfinished work tasks may remain in employees' minds and hamper the enjoyment of leisure time after work, which is known to be related to burnout, health complaints, and lower life satisfaction (Sonnentag & Fritz, 2015). Moreover, procrastination may result in work of inferior quality (Ariely & Wertenbroch, 2002; Steel, Brothen, & Wambach, 2001). Procrastination poses further risks when certain actions that are relevant for safety—for example, repair and maintenance work—are delayed or postponed (Reynolds & Schiffbauer, 2004).

The aim of our study was to identify factors explaining why shift workers procrastinate more on some days than on others, and who is especially prone to procrastination. To do so, we investigate both transitory, day-specific sleep characteristics (sleep quality and sleep duration) and chronic sleep characteristics (circadian misalignment) as precursors of procrastination at work. Our study thereby contributes to the literature in several ways. First, we investigate procrastination as a construct that shows meaningful variation both between persons and across days, that is, within persons. Thus, our study adds to research on procrastination as a relatively stable behavioural tendency and the aim to identify more stable predictors of procrastination (e.g., Steel, 2007; Van Eerde, 2003) as well as to research on procrastination as varying within individuals over time and the aim to identify co-varying states (e.g., Claessens, Van Eerde, Rutte, & Roe, 2010; Kühnel, Bledow, & Feuerhahn, 2016). Second, we contribute to research elucidating the benefits of sleep for a wide array of phenomena related to the ability to self-regulate (for example, unethical behaviour, incivility, cyberloafing; e.g., Barber & Budnick, 2016; Wagner, Barnes, Lim, & Ferris, 2012) by drawing researchers' attention to procrastination at work as another significant outcome of poor and misaligned sleep. Third, we focus on permanent shift workers, an understudied group of employees who are of particular risk when it comes to the restoration of resources (Folkard, 2008; Pilcher, Lambert, & Huffcutt, 2000). Moreover, this sample allowed us to employ the chronotype paradigm (see Schmidt, Collette, Cajochen, & Peigneux, 2007) to investigate how the chronic misalignment between individuals' biological sleep–wake preferences (chronotype) and time of day (shift) impacts work behaviour *in the field*. So far, studies investigating the misalignment between chronotype and time of day were mainly conducted in the laboratory (Schmidt *et al.*, 2007), and/or laboratory tasks were employed in the field (e.g., vigilance tests, Vetter, Juda, & Roenneberg, 2012).

In the next sections, we first argue that daily sleep quality and duration matter for procrastination at work. We then turn to characteristics of the individual and the job as joint antecedents of individual differences in procrastination. More specifically, we argue that circadian misalignment—that is, a mismatch between individuals' biological preferences for sleep–wake times and work times—determines who is at risk of procrastination. Our research model is depicted in Figure 1.

Day-specific sleep and availability of energy and willpower after sleep as antecedents of procrastination at work

Sleep is an important mechanism for replenishing depleted resources (Åkerstedt, Nilsson, & Kecklund, 2009; Baumeister *et al.*, 2000). With 'resources', we refer to employees' level of energy and willpower they have at their disposal. Referring to work on categorization schemes of various resources (ten Brummelhuis & Bakker, 2012; Halbesleben, Neveu, Paustian-Underdahl, & Westman, 2014), employees' level of energy and willpower are personal, transient resources, belonging to the category 'energies'. Having energy and willpower available should enable employees to initiate and complete actions at work and should prevent procrastination (Gröpel & Steel, 2008). We argue that sleep ensures that employees have energy and willpower available on the following day (Barnes, 2012; Engle-Friedman, 2014). We characterize sleep by the subjective quality of sleep, and by duration, that is, by the number of hours an employee spent sleeping. High quality of sleep entails the experience of restorative sleep, no or just a few awakenings during the night, and no or little difficulties in falling asleep (Åkerstedt, Hume, Minors, & Waterhouse, 1994).

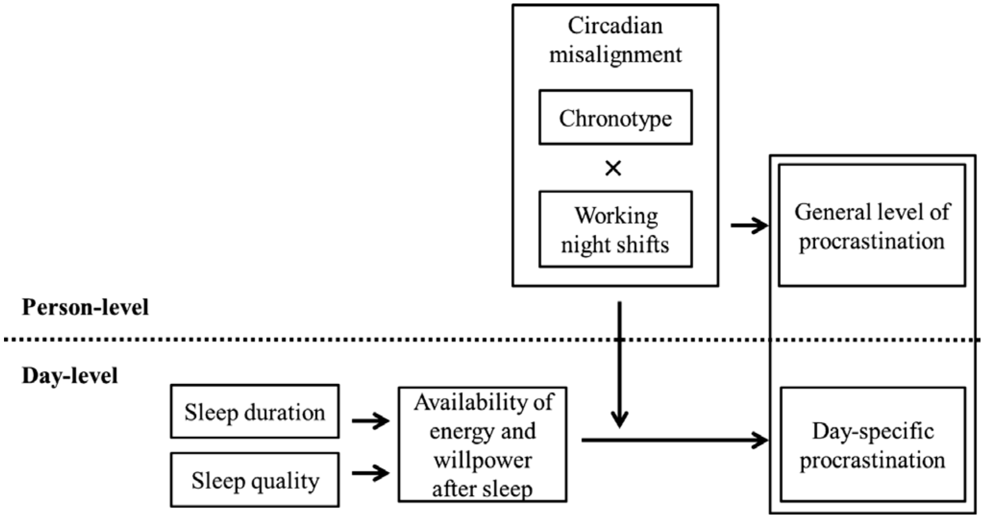

Figure 1. Research model.

Empirically, sleep of good quality and of sufficient duration has been shown to be related to a higher ability to self-regulate (Barnes, Lucianetti, Bhave, & Christian, 2015; Lanaj, Johnson, & Barnes, 2014; Welsh, Ellis, Christian, & Mai, 2014) and to the availability of energy after sleep (Clinton, Conway, & Sturges, 2016; Schmitt, Belschak, & Den Hartog, 2017; Sonnentag, Binnewies, & Mojza, 2008). Having willpower and energy available, in turn, should be related to employees' ability to translate intentions into actions at work. Employees are less likely to procrastinate because they should be less vulnerable to distractions evoked by off-task concerns that interfere with the initiation and accomplishment of tasks (Beal *et al.*, 2005; Harrison & Horne, 2000). Moreover, employees should be able to encourage themselves to perform less attractive and highly demanding tasks (Diestel & Schmidt, 2012). Research has shown that the availability of energy and willpower before work is related to indicators of effective functioning at work, for example, being highly engaged at work (Kühnel, Sonnentag, & Bledow, 2012; Lanaj *et al.*, 2014), showing higher levels of daily task performance, personal initiative, and organizational citizenship behaviour, and spending less compensatory effort to fulfil tasks (Binnewies, Sonnentag, & Mojza, 2009). Taken together, we hypothesize that on days with good and sufficient sleep, shift workers will less likely postpone important work tasks and will less likely fail to finish tasks because good and sufficient sleep ensures that they have willpower and energy available that enable them to initiate and pursue actions at work.

Hypothesis 1: After having slept (a) better and (b) longer, compared to having slept worse and shorter, employees procrastinate less.

Hypothesis 2: The relationship between sleep quality (a) and sleep duration (b) and procrastination is mediated by the availability of energy and willpower after sleep.

Circadian misalignment: sleep–wake preferences (chronotype) and work times (shift) as joint antecedents of procrastination at work

Shift workers' general level of procrastination should depend on the match between individuals' biological sleep–wake preferences and their work times. In the case of a mismatch, shift workers should procrastinate more. Endogenous circadian clocks control humans' daily rhythms in fundamental aspects of physiology and behaviour, such as sleep–wake behaviour (Czeisler & Gooley, 2007; Roenneberg, Wirz-Justice, & Merrow, 2003). Circadian clocks are entrained to the 24-hr/day–night cycle predominantly driven by sunlight (Roenneberg, Kumar, & Merrow, 2007). The exact phase of entrainment is specific for each individual, resulting in a continuum of different chronotypes (Roenneberg *et al.*, 2003). The continuum of chronotypes represents individuals' preferences in the timing of sleep and wake. It ranges from early 'larks', who prefer to go to bed earlier in the evenings and get up earlier in the mornings to late 'owls', who prefer to go to bed later in the evenings and get up later in the mornings (this preference is also referred to as morningness–eveningness; see Horne & Østberg, 1976). Differences in phase of entrainment between extreme early and late chronotypes can be as much as 12 hr (Roenneberg *et al.*, 2003; Roenneberg, Kühnle, *et al.*, 2007).

Along with these preferences in the timing of sleep and wake, the optimal time of day for exerting willpower and for cognitive performance differs between individuals. Sleep research has shown that performance on tasks that involve controlled, non-automatic processes—in contrast to tasks that merely require access to or production of familiar, well-learned material—is dependent on both chronotype and time of day (for reviews, see Carrier & Monk, 2000; Schmidt *et al.*, 2007). In their review about the relevance of sleep for attention, memory, and executive functions, Schmidt *et al.* (2007) concluded that controlled, non-automatic processes that rely upon prefrontal cortex activity are especially affected by chronotype and time of testing. If participants' optimal time of day (indicated by their chronotype) matches time of testing, participants perform best in tasks measuring attentional capacities, memory, and executive functioning. Performance at a non-optimal time of day, however, suffers from circadian-related deficits in attentional capacities, memory, and executive functions, for example, from failure to suppress irrelevant information, and difficulties in restraining or preventing dominant responses that are undesirable or inappropriate.

We argue that deficits in executive functions—defined as 'the ability to plan and coordinate a wilful action in the face of alternatives, to monitor and update action as necessary and suppress distracting material by focusing attention on the task at hand' (p. 464, Jones & Harrison, 2001)—become apparent in procrastination. Research has shown that chronotype and time of day jointly predict diverse outcomes relevant for the work setting that rely on executive functions. For example, in a field study with rotating shift workers, both an individual's chronotype and time of day modulated shift workers' performance on vigilance tests they took several times across their shift on pocket PCs (Vetter, Juda, & Roenneberg, 2012). In two experiments, Gunia, Barnes, and Sah (2014) found that ethical behaviour was predicted by the alignment between an individual's chronotype and time of day. Late chronotypes displayed more ethical behaviour at their optimal time of the day, that is, the evening, whereas early chronotypes displayed more ethical behaviour at their optimal time of the day, that is, in the morning. Ingram *et al.* (2016) replicated this finding with ribonucleic acid (RNA)-based chronotyped individuals: Late chronotypes were more likely to behave unethically in the morning, and early chronotypes were more likely to behave unethically in the evening. Moreover, Ingram *et al.* found that early chronotypes took more risks at their suboptimal time of the day, that is, in the evening. Finally, Bodenhausen (1990) observed that misalignment plays a role in stereotyping. He found that people increasingly rely on stereotypes instead of engaging in more effortful, systematic thought during their non-optimal times of the day.

Curtis, Burkley, and Burkley (2014) reviewed research covering a wide range of domains, including cognitive performance, emotion regulation, interpersonal relationships, and social influence. They concluded that when people's chronotype matches the time of day, a so-called synchrony effect occurs, and performance relying on executive functions is at its peak. When there is a mismatch between people's chronotype and time of day, people are more likely to display self-regulatory failures and give in to temptations. Based on our theoretical considerations above and supporting empirical results, we propose that shift workers who experience higher circadian misalignment should be especially prone to procrastination. To the best of our knowledge, our study is the first to test the idea that circadian misalignment of shift workers plays a role in procrastination at work. The more employees' work time (night shift vs. day shift) overlaps with employees' biologically preferred sleep window (indicated by their chronotype), the greater the circadian misalignment (Vetter *et al.*, 2015). Accordingly, among people working night shifts, earlier chronotypes experience greater circadian misalignment than later chronotypes. Thus, working night shifts should be more problematic for employees with an earlier chronotype and less problematic regarding the enactment of planned behaviour for employees with a later chronotype. Accordingly, we hypothesize:

Hypothesis 3: Working night shifts and chronotype should jointly predict procrastination (two-way interaction). For employees working night shifts, chronotype should be negatively related to procrastination, that is, later chronotypes should procrastinate less. For employees working day shifts, chronotype should be positively related to procrastination, that is, later chronotypes should procrastinate more.

Sleep–wake preferences (chronotype), work times (shift), and day-specific availability of energy and willpower as joint antecedents of procrastination

Employees working in misalignment with their circadian preference should be especially dependent on having day-specific energy and willpower available. Put differently, misaligned shift workers should be especially vulnerable to day-specific decrements in their levels of energy and willpower after sleep. We argue that the reason for this vulnerability to day-specific fluctuations in levels of energy and willpower is that misaligned employees suffer from chronically lower levels of energy and willpower. Misaligned employees have to work during times their circadian pacemaker prepares the body for sleep, and they have to sleep during times their circadian pacemaker prepares the body for wakefulness (Dijk & Lockley, 2002). Thus, they have to operate against their circadian rhythm, which depletes energy and willpower during wakefulness (Wittmann, Dinich, Merrow, & Roenneberg, 2006) and threatens the restorative character of sleep (Åkerstedt, Hume, Minors, & Waterhouse, 1997; Juda, Vetter, & Roenneberg, 2013). As a consequence, employees working and sleeping in misalignment with their circadian preferences should suffer from chronically lower levels of energy and willpower. Thus, we expect them to be especially vulnerable to day-specific decrements in their levels of energy and willpower after sleep. On days when they have less energy and willpower available after sleep than usual, they should show especially high levels of procrastination compared to days when they experience having more energy and willpower available after sleep.

Hypothesis 4: Working night shifts and chronotype should jointly moderate the negative relationship between day-specific availability of energy and willpower and procrastination (three-way interaction). For employees experiencing more circadian misalignment, the negative relationship between day-specific availability of energy and willpower and procrastination should be stronger than for employees experiencing less circadian misalignment.

Method

Sample and procedure

Participants of this study were employees working in various functions (e.g., operations, human resources[1]) in a distribution centre of a large logistics company. They were recruited by a psychology student as part of her Master's thesis. Data collection took place in 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 filled in a paper-and-pencil booklet consisting of several questionnaires. Participants first completed the part of the booklet that assessed

---

[1] *In our sample, only a few respondents might come from other divisions than operations because we mainly recruited employees working in operations. Because issues related to confidentiality and anonymity were of great concern for the logistics company in which we collected our data, we were not allowed to ask for job titles and accordingly, we do not have information on how jobs compare over the shifts. To nevertheless investigate whether jobs compare over the shifts, we investigated whether employees in day vs. night shift differed with respect to work characteristics. We found that night versus day shift workers did not differ regarding experienced time pressure, dependency on work of co-workers, uncertainty, and job autonomy.*

sociodemographic variables, employees' chronotype, and work times. Over the course of one work week, participants were asked to answer two questionnaires each day, the first one before the shift and the second one at the end of the shift. We used two questionnaires each day to separate measurement occasions of predictor variables (sleep duration, sleep quality, and availability of energy and willpower after sleep) and the criterion variable procrastination. Of the 150 employees we approached, 110 agreed to participate. Of the 110 booklets we distributed, 81 booklets were returned. Of the 81 participants returning the booklets, 10 participants had to be excluded due to exclusion criteria of the chronotype questionnaire: Chronotype cannot be calculated for individuals who do not report their 'unrestricted' sleep times (Roenneberg, 2012), that is, for respondents who use an alarm to wake up on free days or for respondents whose naturally occurring sleep on free days is prematurely terminated because of pets or small kids requiring attention. Another five participants had to be excluded because they did not provide enough information about their work times and/or did not answer the scale assessing procrastination. Thus, in total, 15 participants had to be excluded.

The final sample comprised 66 employees who, in total, provided complete data on 332 days (664 daily observations). Thus, our final completion rate is 60% for the level of participants (66 of 110). Participants worked during permanent (that is, non-rotating) shifts that were distributed across the 24-hr day. Accordingly, starting and end points of shifts differed between employees. In addition, starting and end points of shifts also slightly differed within employees because they might start an hour earlier and/or work an hour longer on days with higher workload. Based on the information employees provided about their work time, we calculated the mid-point of each employee's shift across the days and accordingly categorized employees as working morning (6 a.m. to 2 p.m.), evening (2 p.m. to 10 p.m.), or night shift (10 p.m. to 6 a.m.). Accordingly, 42% of the sample was working permanent morning shifts, 26% was working permanent evening shifts, and 32% was working permanent night shifts. Fifty-nine per cent of the sample were female; average age was 43 years (SD = 11); and 36% of the participants had children. Participants had, on average, 17 years of professional experience in their current organization, with 9 years of professional experience in their current job (shift work). Participants worked, on average, 27 hr/week (SD = 10) for the current organization.

Measures

Munich chronotype questionnaire (MCTQ)

Chronotype was assessed with the Munich ChronoType Questionnaire (Roenneberg *et al.*, 2003). The MCTQ determines chronotype based on typical sleep behaviour. The questionnaire consists of simple questions about typical sleep timing on work days and on work-free days, allowing for the calculation of the mid-point between sleep onset and offset. Chronotype is defined as the mid-point of sleep on free days, corrected for 'oversleep' on free days.[2] Higher values represent a later mid-point of sleep and a later chronotype. For example, a person whose sleep onset and sleep offset on free days are at 12 midnight and at 9 a.m., respectively, has a mid-point of sleep at 4:30 a.m. and a chronotype of 4.5. Mid-point of sleep on free days shows high test-retest reliability (r = .88, Kühnle, 2006) and correlates strongly with sleep logs and wrist actimetry

[2] *The MCTQ corrects for oversleep on free days because most individuals' sleep is cut short on work days. Thus, they accumulate a sleep debt over the work week. To compensate for this sleep debt, individuals commonly oversleep on free days (Roenneberg, Allebrandt, Merrow, & Vetter, 2012; Roenneberg, Kühnle,* et al.*, 2007).*

(r = .92, Kühnle, 2006), as well as with the biochemical marker melatonin (r = .89 with dim light melatonin onset, Martin & Eastman, 2002). Thus, the MCTQ is a valid and reliable instrument to assess non-shift workers' and permanent shift workers' chronotype (for rotating shift workers, the MCTQ^{shift}, developed by Juda, Vetter, & Roenneberg, 2013, should be applied; T. Roenneberg, personal communication).

Daily questionnaires before the shift

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*. Being the core subjective sleep quality indicator (Krystal & Edinger, 2008), this item has been used successfully in similar diary studies (e.g., Hülsheger *et al.*, 2014; Kühnel *et al.*, 2016). 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).

Sleep duration. We used a score of the number of hours and minutes participants slept based on their daily self-reports. Barnes (2012) concluded that subjective measures of sleep duration overestimate sleep duration by about 6–7 per cent, but that subjective and objective measures of sleep duration correlate very strongly.

Availability of energy and willpower after sleep. We assessed day-specific availability of energy and willpower after sleep with the four items used by Binnewies *et al.* (2009). The scale referred to how a person felt after getting up. The four items were as follows: 'I was filled with new energy', 'I felt well rested', 'I felt physically refreshed', and 'I felt mentally refreshed'. Items had to be answered on a 5-point scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. Cronbach's alpha ranged from .93 to .96 over the days.

Daily questionnaires at the end of the shift

Procrastination. Day-specific procrastination was assessed with six items from Tuckman's (1991) procrastination scale that was slightly adapted to capture day-specific procrastination at work. Example items are 'Today, I needlessly delayed finishing jobs, even when they were important', 'Today, I was a time waster but I couldn't seem to do anything about it', and 'Today, I promised myself I'll do something and then dragged my feet'. Items had to be answered on a 5-point scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. Cronbach's alpha ranged between .85 and .95 over the days.

Results

Descriptive statistics

Table 1 shows means, standard deviations, intercorrelations between variables, and intraclass correlations. 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. All day-specific variables showed substantial day-to-day (within-person variance) and between-person variation. For example, 43% of the variance in procrastination resided at the within-person level and 57% of the variance was between-person.

The within-person correlations among the day-specific variables (shown above the diagonal in Table 1) show that procrastination was significantly related to several variables of interest. On days employees indicated higher procrastination at the end of the shift, they indicated shorter day-specific sleep duration ($r = -.22$, $p < .001$), lower day-specific sleep quality ($r = -.19$, $p < .01$), and lower availability of energy and willpower after sleep ($r = -.30$, $p < .001$). Day-specific sleep duration and sleep quality were positively related to availability of energy and willpower after sleep ($r = .49$, $p < .001$, and $r = .42$, $p < .001$, respectively). The between-person correlations below the diagonal in Table 1 show that procrastination was negatively related to availability of energy and willpower after sleep ($r = -.32$, $p < .01$). That is, participants who, on average across days, indicated having more energy and willpower available after sleep reported less procrastination in general, compared to participants who indicated having less energy and willpower available after sleep.

Analytic strategy

We used the HLM 7.01 software package to conduct multilevel analyses (Raudenbush *et al.*, 2011). For these analyses, 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—in comparison with his or her experiences on other days—predict procrastination. The person-level predictor variable chronotype was z-standardized prior to analyses. We specified and compared nested hierarchical linear models to predict day-specific procrastination (see Table 2). In Model 1, we entered the day-level predictor variables sleep duration and sleep quality. In Model 2, we entered the day-level predictor variable availability of energy and willpower after sleep. We followed best practice recommendations of Aguinis, Gottfredson, and Culpepper (2013) and built a random intercept and random slope model (Model 3) to test the prerequisite for testing cross-level interactions. That is, we investigated whether the slope of availability of energy and willpower after sleep predicting procrastination was random. In Models 4 and 5, we tested the Level-2 interaction of chronotype and night shift (two-way interaction) by entering the two variables (Model 4) and their interaction term (Model 5). In Models 6 and 7, we tested the cross-level interaction of the interaction term Chronotype × Night shift on the slope of availability of energy and willpower after sleep (three-way interaction) by entering chronotype and shift as predictors of the slope of availability of energy and willpower after sleep (Model 6) and the interaction term Chronotype × Night shift as a predictor of the slope of availability of energy and willpower after sleep (Model 7).

Test of hypotheses

Model 1 shows that both day-specific sleep duration and sleep quality were significantly negatively related to procrastination (Estimate = −0.07, $SE = .03$, $t = -2.71$, $p < .01$ and Estimate = −0.07, $SE = .04$, $t = -2.01$, $p < .05$ for sleep duration and sleep quality, respectively). Thus, in support of Hypothesis 1, employees procrastinated less after

Table 1. Means, standard deviations, and correlations of variables

Variable	*M*	*SD*[a]	SD_{within}[a]	1-ICC[b]	1	2	3	4	5	6	7
1. Daily procrastination	1.43	0.72	0.43	.43		−.22***	−.19**	−.30***			
2. Day-specific sleep duration (in hours)	6.40	1.69	1.07	.50	.15		.35***	.49***			
3. Day-specific sleep quality	3.52	1.00	0.75	.71	−.22	.24		.42***			
4. Day-specific availability of energy and willpower after sleep	3.36	1.07	0.75	.62	−.32**	.24	.63***				
5. Chronotype	3.53	1.88	–	–	−.02	.41**	.02	−.16			
6. Night shift[c]	0.32	0.47	–	–	.21	−.39**	−.02	−.01	−.26*		
7. Gender[d]	0.59	0.49	–	–	−.09	−.21	−.28*	.03	−.43***	.07	
8. Age	43.36	12.33	–	–	−.13	−.06	−.16	−.02	−.31*	.17	.20

Notes. Correlations below the diagonal are person-level correlations. To calculate these person-level correlations, day-level data below the diagonal were averaged across days ($N = 66$). Correlations above the diagonal are day-level correlations ($N = 332$). Above the diagonal, day-level data were centred around the respective person mean.

[a] *SD* = standard deviation of variables. SD_{within} = standard deviation of person-mean centred variables.

[b] Intraclass correlation (ICC) = ratio of the between-person variance to the total variance, 1-ICC = ratio of the within-person variance to the total variance.

[c] Night shift: 1 = *working night shift*, 0 = *working day shift (morning or evening shift)*.

[d] Gender: 1 = *female*, 0 = *male*.

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

Table 2. Results of multilevel analyses predicting daily procrastination

	Null Model			Model 1			Model 2			Model 3		
	Est	*SE*	*t*	Est	*SE*	*t*	Est	*SE*	*t*	Est	*SE*	*t*
Intercept	1.444	.072	19.93***	1.444	.072	19.92***	1.444	.072	19.92***	1.445	.072	19.89***
Day-specific sleep duration				−0.068	.025	−2.71**	−0.032	.027	−1.21	−0.017	.021	−0.81
Day-specific sleep quality				−0.073	.036	−2.01*	−0.035	.037	−0.94	−0.019	.032	−0.60
Day-specific availability of energy and willpower after sleep (AEW)							−0.130	.039	−3.27**	−0.128	.048	−2.63*
Level-2 predictors												
Chronotype												
Night shift[a]												
Chronotype × Night shift												
Cross-level interactions on AEW												
Chronotype × AEW												
Night shift × AEW												
Chronotype × Night shift × AEW												
−2 × Log likelihood (*df*)	584.093 (3)			567.373 (5)			556.878 (6)			507.698 (8)		
Δ −2 × Log likelihood (*df*)				16.719 (2) ***			10.495 (1) **			49.179 (2)***		
Level 1 Intercept variance (*SE*)	0.228 (.019)			0.214 (.018)			0.205 (.017)			0.149 (.014)		
Level 2 Intercept variance (*SE*)	0.299 (.060)			0.302 (.060)			0.304 (.060)			0.317 (.060)		
Level 2 Slope variance (*SE*)										0.079 (.025)		
Level 2 Intercept–slope covariance (*SE*)										−0.107 (.031)		

Continued

Table 2. (*Continued*)

	Model 4			Model 5			Model 6			Model 7		
	Est	*SE*	*t*	Est	*SE*	*t*	Est	*SE*	*t*	Est	*SE*	*t*
Intercept	1.422	.085	16.73***	1.400	.082	16.89***	1.319	.085	15.36***	1.333	.085	15.57***
Day-specific sleep duration	−0.017	.025	−0.70	−0.016	.024	−0.68	−0.019	.024	−0.80	−0.019	.024	−0.80
Day-specific sleep quality	−0.019	.033	−0.59	−0.018	.033	−0.54	−0.018	.033	−0.56	−0.019	.032	−0.60
Day-specific availability of energy and willpower after sleep (AEW)	−0.130	.054	−2.40*	−0.124	.053	−2.31*	−0.018	.059	−0.31	−0.034	.058	−0.59
Level-2 predictors												
Chronotype	0.043	.066	0.65	0.273	.086	3.16**	0.236	.091	2.58*	0.163	.101	1.61
Night shift[a]	0.071	.141	0.50	−0.018	.125	−0.14	0.232	.155	1.49	0.247	.154	1.60
Chronotype × Night shift				−0.415	.117	−3.54***	−0.427	.113	−3.76****	−0.277	.143	−1.93
Cross-level interactions on AEW												
Chronotype × AEW							0.054	.042	1.27	0.138	.064	2.15*
Night shift × AEW							−0.294	.093	−3.15**	−0.292	.090	−3.24**
Chronotype × Night shift × AEW										−0.144	.084	−1.71
−2 × Log likelihood (*df*)	507.158 (10)			496.864 (11)			485.168 (13)			482.310 (14)		
Δ −2 × Log likelihood (*df*)	0.540 (2)			10.293 (1)**			21.981 (2) ***			2.857 (1)		
Level 1 Intercept variance (*SE*)	0.149 (.014)			0.150 (.014)			0.151 (.014)			0.151 (.014)		
Level 2 Intercept variance (*SE*)	0.312 (.059)			0.306 (.058)			0.288 (.055)			0.283 (.054)		
Level 2 Slope variance (*SE*)	0.079 (.025)			0.085 (.025)			0.059 (.020)			0.053 (.018)		
Level 2 Intercept–slope covariance (*SE*)	−0.104 (.031)			−0.136 (.033)			−0.119 (.028)			−0.112 (.027)		

Notes. Est = Estimate.

[a]Night shift: 1 = *working night shift*, 0 = *working day shift (morning or evening shift)*.

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

having slept better and longer compared to having slept worse and shorter. Model 2 shows that day-specific availability of energy and willpower after sleep was negatively related to procrastination (Estimate = −0.13, SE = .04, $t = -3.27$, $p < .01$). Thus, on days when employees had more energy and willpower available after sleep, they procrastinated less, compared to days when they had less energy and willpower available after sleep. After including the predictor availability of energy and willpower after sleep, day-specific sleep duration and sleep quality were no longer significant predictors of procrastination (Estimate = −0.03, SE = .03, $t = -1.21$, $p = .493$ and Estimate = −0.04, SE = .04, $t = -0.94$, $p = .556$ for sleep duration and sleep quality, respectively). Tests of indirect within-person effects (Preacher, Zhang, & Zyphur, 2011; Preacher, Zyphur, & Zhang, 2010) with MPlus 7.11 (Muthén & Muthén, 1998–2007) revealed that the indirect effect from sleep duration via availability of energy and willpower on procrastination (1-1-1 model) was significant (Estimate = −0.049, SE = .022, $t = -2.23$, $p < .05$, 95% CI [−0.092, −0.006]). The indirect effect from sleep quality via availability of energy and willpower on procrastination (1-1-1 model) was significant as well (Estimate = −0.064, SE = .029, $t = -2.23$, $p < .05$, 95% CI [−0.120, −0.008]). When both indirect effects were jointly tested in one model ([1,1]-1-1 model), the indirect effect from sleep duration via availability of energy and willpower on procrastination was significant (Estimate = −0.036, SE = .017, $t = -2.12$, $p < .05$, 95% CI [−0.069, −0.003]), and the indirect effect from sleep quality via availability of energy and willpower on procrastination was not significant (Estimate = −0.038, SE = .021, $t = -1.81$, $p = .070$, 95% CI [−0.079, 0.003]). Thus, Hypothesis 2—that availability of energy and willpower after sleep explains the relationship between sleep duration and sleep quality and procrastination—was supported.

Model 3 revealed that the model with a random slope of availability of energy and willpower after sleep fits the data better than Model 2 with a fixed slope ($\Delta -2 \times$ log likelihood = 49.18, $df = 2$, $p < .001$). This indicates that the relationship between availability of energy and willpower after sleep and procrastination shows meaningful variation between persons that can be explained by person-level variables (cross-level moderators). In Model 4, the person-level predictor variables chronotype and night shift (coded 1 = *working night shift*, 0 = *working day shift (morning or evening shift)*) were added (main effects). To test Hypothesis 3 (circadian misalignment Hypothesis), in Model 5, the interaction term between chronotype and night shift was entered. The interaction term was a significant predictor of procrastination (Estimate = −0.42, SE = .12, $t = -3.54$, $p < .001$), and Model 5 fits the data better than the previous Model ($\Delta -2 \times$ log likelihood = 10.29, $df = 1$, $p < .01$). The interaction effect between chronotype and night shift is depicted in Figure 2. We performed simple slope tests with the computational tool by Preacher, Curran, and Bauer (2006). For employees working night shifts, the slope between chronotype and procrastination was negative but not significant (simple slope = −0.14, SE = .07, $t = -1.79$, $p = .073$). That is, later chronotypes among employees working night shifts tended to procrastinate less compared to earlier chronotypes. For employees working day shifts, the slope between chronotype and procrastination was positive and significant (simple slope = 0.27, SE = .08, $t = 3.16$, $p = .001$). That is, earlier chronotypes among employees working day shifts procrastinated less compared to later chronotypes. To obtain the difference in procrastination between groups (night shift vs. day shift) at conditional values of chronotype, we followed recommendations by Preacher *et al.* (2006) and examined simple slopes for the regression of procrastination on night shift (now treated as a predictor) as a function of chronotype (now treated as a moderator). For earlier chronotypes (−1 SD), the difference

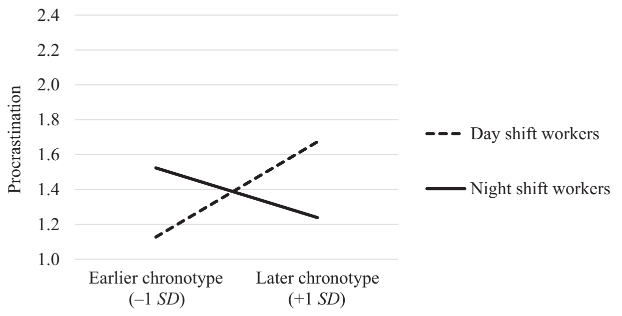

Figure 2. Person-level (Level-2) interaction of chronotype with work times (shift) on procrastination at work.

in procrastination between night shift and day shift was significant (simple slope = 0.39, *SE* = .17, $t = 2.31$, $p < .05$; value of procrastination in day shift = 1.12; value of procrastination in night shift = 1.52). For the average chronotype (*M*), the difference in procrastination between night shift and day shift was not significant (simple slope = −0.01, *SE* = .12, $t = -0.14$, $p = .881$; value of procrastination in day shift = 1.40; value of procrastination in night shift = 1.38). For later chronotypes (+1 *SD*), the difference in procrastination between night shift and day shift was significant (simple slope = −0.43, *SE* = .17, $t = -2.52$, $p < .05$; value of procrastination in day shift = 1.67, value of procrastination in night shift =1.23). Taken together, employees experiencing circadian misalignment (earlier chronotypes in night shift, later chronotypes in day shift) displayed more procrastination than employees experiencing less circadian misalignment (earlier chronotypes in day shift, later chronotypes in night shift).[3] Thus, Hypothesis 3 was supported.

Models 6 and 7 tested whether having energy and willpower available after sleep should be especially relevant to the prevention of procrastination for employees experiencing circadian misalignment (Hypothesis 4). Model 6 showed that night shift was a significant predictor of the slope of availability of energy and willpower after sleep predicting procrastination (Estimate = −0.29, *SE* = .09, $t = -3.15$, $p < .01$). Contrary to our expectations, Model 7 showed that the interaction term between chronotype and shift was not a significant predictor of the slope of availability of energy and willpower after sleep predicting procrastination (Estimate = −0.14, *SE* = .08, $t = -1.71$, $p = .091$). Thus, Hypothesis 4 was not supported.

[3] *We conducted another set of analyses in which we used an alternative coding of shift (1 =* working morning shift, *0 =* working evening or night shift*). The interaction term Chronotype × Morning shift was a significant predictor of procrastination (Estimate = 0.41,* SE *= .11,* t *= 3.51,* p *< .001), and the model fits the data better than the previous model without the interaction term (Δ −2 × log likelihood = 10.30, df = 1,* p *< .01). The interaction pattern showed the reverse picture to the interaction pattern of Chronotype × Night shift shown in Figure 2. For employees working morning shifts, the slope between chronotype and procrastination was positive and significant (simple slope = 0.28,* SE *= .09,* t *= 3.03,* p *< .01). That is, earlier chronotypes among employees working morning shifts procrastinated less compared to later chronotypes. For employees working evening or night shifts, the slope between chronotype and procrastination was not significant (simple slope = −0.12,* SE *= .07,* t *= −1.64,* p *= .106).*

Additional analyses

We performed simple slope tests with the computational tool by Preacher *et al.* (2006) to further explore the unexpected, significant cross-level interaction of night shift on the slope of availability of energy and willpower after sleep predicting procrastination (Model 6). For employees working night shifts, the slope between availability of energy and willpower after sleep and procrastination was negative and significant (simple slope = −0.31, $SE = .07$, $t = -4.07$, $p < .001$). For employees working day shifts, the slope between availability of energy and willpower after sleep and procrastination was not significant (simple slope = −0.01, $SE = .05$, $t = -0.31$, $p = .755$). Thus, results showed that the benefits of having energy and willpower available after sleep for preventing procrastination were found for employees working night shifts but not for employees working day shifts.

Discussion

This daily diary study contributes to current research revealing the benefits of sleep for effective self-regulation at work and thus helps to fill the gap in the literature on sleep and work that was identified by Litwiller, Snyder, Taylor, and Steele (2016). Our study shows that transitory sleep characteristics (sleep quality and sleep duration) as well as chronic sleep characteristics (circadian misalignment) are relevant for procrastination at work. On days when employees slept better and longer—compared to days when they slept worse and shorter—they had more energy and willpower available after sleep and subsequently were less prone to procrastination at work. Moreover, results of our study extend laboratory findings on synchrony effects (Schmidt *et al.*, 2007) to real-life settings, showing that whether work times were aligned with employees' sleep–wake preferences mattered for employees' general inclination to procrastinate at work. In the case of misalignment, higher levels of procrastination were found: Earlier chronotypes tended to procrastinate more when working night shifts, whereas the opposite pattern emerged for the day shift, that is, later chronotypes procrastinated more when working day shifts.

Notably, in this study, both sleep quality and sleep duration independently contributed to effective functioning at work. Although shift workers reported that they had slept better on days on which they had slept longer ($r_{\text{within-person}} = .35, p < .001$), duration and quality of sleep incrementally predicted procrastination. Thus, sleep of good quality as well as sleep of sufficient duration seem to be specific prerequisites for employees to exert willpower at work. Examining the relationship between sleep and procrastination in a non-shift worker sample, Kühnel *et al.* (2016) did not find a relationship between sleep duration and procrastination. They speculated that although employees' naturally occurring sleep duration varied across days, even on days with shorter sleep, employees were still able to meet their individual sleep need (in contrast to participants taking part in sleep restriction studies in which sleep duration is experimentally manipulated). In their study, employees slept on average 7 hr and 9 min ($SD = 1.13$ hr). The present study's findings on naturally occurring sleep in shift workers indicate that shift workers do not seem to be able to meet their individual sleep need on all days. On average, the present study's participants slept 6 hr and 24 min ($SD = 1.69$ hr), an amount of sleep that lies outside the range recommended by sleep experts of 7–9 hr (Hirshkowitz *et al.*, 2015). However, given that individual differences exist in the sleep duration required for optimal functioning (Van Dongen, Baynard, Maislin, & Dinges, 2004), future research might take into account not only sleep duration but might also assess whether individuals are able to meet their individual sleep need with the daily sleep they obtain.

This study also showed that the *alignment* of biological sleep–wake preferences (chronotype) and work times matters for procrastination. There was no significant main effect of chronotype on procrastination (r = .02). Previous cross-sectional research on academic procrastination (e.g., Digdon & Howell, 2008; Ferrari, Harriott, Evans, Lecik-Michna, & Wenger, 1997) and general procrastination (Díaz-Morales, Ferrari, & Cohen, 2008) has linked chronotype to procrastination, showing that later chronotypes (i.e., people with an evening preference) reported more procrastination compared to earlier chronotypes (i.e., people with a morning preference). We assume that the reason for this positive correlation is that later chronotypes are more likely to be misaligned with school and non-shift work schedules compared to earlier chronotypes (Roenneberg, Kühnle, *et al.*, 2007; Wittmann *et al.*, 2006). Thus, we conclude that being a late chronotype does not per se make someone prone to procrastination, but that the combination of chronotype and work/school schedule matters.

Contrary to expectations, we found no evidence that shift workers who experience more pronounced circadian misalignment are more dependent on the availability of energy and willpower to prevent day-specific procrastination than are shift workers who experience less circadian misalignment. Rather, we found that all employees working permanent night shifts (independently of their chronotypes) were especially vulnerable to impairments in the availability of energy and willpower resulting from impaired and/or insufficient sleep. Thus, we conclude that although being a late chronotype yields advantages for employees' ability to exert willpower during the night shift, it does not protect them entirely from the particularly high demands on self-regulation that working night shifts places on them.

Our research contributes to and is in line with the self-regulatory depletion model (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister *et al.*, 2000) and the dual process model of Barber and Budnick (2016), both of which postulate that sleep is an important predictor of effective self-regulation at work. Results of our study underpin the assumption that sleep is a crucial phase for the restoration of resources that are needed to avoid self-regulatory failure. Barber and Budnick (2016) suggested that future research should determine whether chronotype, time of day, and their interaction influence how sleep affects an individual's self-regulation. Results of our study did not support this idea directly but yield support for the idea that time of day (that is, night shift vs. day shift) is a moderator that qualifies the relationship between availability of energy and willpower due to good and sufficient sleep and self-regulatory failure.

Inzlicht and Schmeichel (2016) emphasized that outcomes associated with depleted willpower might be due to changes in priorities and motivation (that is, preferences for and willingness to exert willpower) rather than being the product of an exhaustible and finite resource (for further criticism of the limited resource approach, see Carter, Kofler, Forster, & McCullough, 2015). Although we argued in terms of depletable and renewable energetic and self-regulatory resources necessary to initiate action at work, our results are also in line with the idea that initiation of action depends on employee's current priorities and motivation and that priorities may change and motivation may vary throughout the day as a function of biological rhythms. Our study was not designed to answer the question of whether shift workers were either physiologically less able or psychologically less motivated to exert willpower during specific times of the day. However, we would like to challenge the notion that this is a question of either/or, because physiological and psychological processes are closely intertwined and often parallel processes (Segerstrom, Boggero, & Evans, 2016).

Relatedly, recent research has shown that implicit theories about willpower (an individual's belief about whether willpower is a limited resource, Job, Dweck, & Walton, 2010) affect whether demands on self-regulation at work result in a need to conserve and restore self-regulatory resources (Konze, Rivkin, & Schmidt, 2017). For employees holding the belief that willpower is a limited resource, demands at work were stronger positively related to the need to conserve and restore self-regulatory resources than for employees holding the belief that willpower is not a limited resource. An individual's belief about whether willpower is a limited resource may be the result of individual's past experiences. Thus, it would be interesting to explore whether an individual's belief about whether willpower is a limited resource is related to circadian misalignment. One might speculate that especially individuals who experience circadian misalignment might develop the belief that their willpower is a limited resource.

Our study departed from the prevailing view of procrastination as a relatively stable behavioural tendency by showing that procrastination shows meaningful variation both between and within persons that can be explained by day-specific sleep characteristics and circadian misalignment. A complementary approach explaining variation in procrastination would be to investigate characteristics of daily tasks that make it more or less likely that these tasks are going to be postponed or delayed (see Harris & Sutton, 1983). To capture characteristics of tasks that put demands on self-regulation, future research might want to take into account the concept of self-control demands (Diestel & Schmidt, 2012). Self-control demands capture whether employees have to deal with tasks that oblige them to control their impulses, to overcome inner resistances, and to ignore and resist distractions evoked by task-irrelevant stimuli, which would otherwise interfere with successful task completion. Furthermore, future research on self-control demands may want to consider that the extent to which an employee perceives a task as demanding may not be only a characteristic of the task but also a consequence of the employee's current state.

Strengths and limitations

A limitation of our study is that study participants were recruited from one company. Generalizability of our findings might thus be limited. However, our sampling approach had advantages as well, for example, it allowed us to tailor the method of collecting data to the specific job conditions and to personally distribute and collect the study material. Related to our sampling approach is the fact that we obtained an interesting, but not very large sample, what may have affected our power to detect hypothesized effects. Mathieu, Aguinis, Culpepper, and Chen (2012) identified average sample size at both Level 1 and Level 2, the magnitude of the direct cross-level effect, and the standard deviation of the Level-1 slope coefficients as factors affecting statistical power to detect cross-level effects. Thus, we aimed to maximize sample size at both levels of analysis, within the given limits of what was both feasible and accepted by the co-operation partner who allowed us to collect the data. Despite our efforts, the number of Level-1 (days) and Level-2 units (employees) might have constrained the statistical power to detect the hypothesized cross-level relationship.

We used a single item of the Pittsburgh Sleep Quality Index (Buysse *et al.*, 1989) to assess sleep quality. This item is considered to be a core subjective sleep quality indicator (Krystal & Edinger, 2008) and has been successfully used in similar diary studies (e.g., Hülsheger *et al.*, 2014; Kühnel *et al.*, 2016). Moreover, previous research (Hahn, Binnewies, Sonnentag, & Mojza, 2011, p. 208) has found a high item-total correlation of the single item with all other components of the Pittsburgh Sleep Quality Index ($r = .73$; $p < .001$), suggesting that sleep quality can be reliably assessed with this single item. Nevertheless, future field studies might want to use wrist actimetry to obtain objective indicators of sleep quality, such as sleep efficiency or number of awakenings (see, for example, Pereira & Elfering, 2014).

We also like to note that we obtained self-report data. To alleviate concerns about single-source bias, we separated the measurement of our independent variables and the dependent variable in time. Moreover, shift workers' indication of sleep and wake times and work times were not obtained with the help of rating scales. Thus, it is unlikely that shift workers' reports of day-specific procrastination and their report of sleep and wake times and work times are biased in a way such that results only occurred because they stem from the same source. Finally, Siemsen, Roth, and Oliveira (2010) demonstrated that interaction effects cannot be artefacts of common method variance. Similarly, Lai, Li, and Leung (2013) showed that it is extremely unlikely that common method variance generates significant cross-level interactions in the absence of true effects.

A strength of our study is that we studied the influence of chronotype on effective functioning at work and treated the continuum of chronotypes—ranging from early 'larks' to late 'owls'—as a continuous variable. Thus, results of this study do not suffer the limitations of the majority of previous studies, in which chronotype was categorized and/or groups of extreme chronotypes (extreme early vs. extreme late chronotypes) were compared.

Practical implications

Our findings suggest several starting points to prevent procrastination at work, namely promoting shift workers' day-specific sleep quality and duration—especially before days when procrastination would be especially harmful—and aligning shift work times with employees' chronotypes. The UCLA Sleep Disorders Center (n.d.) recommends several strategies to improve shift workers' sleep: Adjusting the bedroom environment (e.g., to darken and to sound-proof the bedroom), reinforcing proper sleep hygiene (see, for example, Mastin, Bryson, & Corwyn, 2006), and educating family and friends on the need for uninterrupted sleep of the shift worker. Most importantly, natural bright light at the wrong time should be avoided (which can be achieved by wearing dark sunglasses or special goggles on the way home after a night shift), and exposure to artificial bright light at specific times can be used to shift circadian rhythms to align with night work and day sleep schedules (Crowley, Lee, Tseng, Fogg, & Eastman, 2003; Eastman & Martin, 1999). However, complete circadian adaptation to night shift work and day sleep is not always the goal because of resulting misalignment on days off, difficulties in meeting family obligations, and restricted opportunities to participate in social life.

When scheduling shift work, circadian principles should be taken into account (see, for example, Czeisler, Moore-Ede, & Coleman, 1982) and work times should be aligned with workers' chronotypes. Vetter *et al.* (2015) implemented an intervention study in a real-life industrial setting that adjusted shifts to individuals' chronotypes and found that not only shift workers' sleep duration and sleep quality improved but also their well-being and satisfaction with leisure time. Thus, employers might want to consider abolishing the most strenuous shifts for specific chronotypes (that is, night shifts for early chronotypes and morning shifts for late chronotypes). Most importantly, both employers and employees should be educated on circadian rhythms and potential consequences of circadian misalignment and chronic sleep restriction.

Convincing evidence from epidemiological and laboratory studies has shown that chronic sleep restriction—by which especially night and shift workers are affected—is related to alterations in the endocrine, immune, and inflammatory systems, with potential negative clinical consequences (Faraut, Boudjeltia, Vanhamme, & Kerkhofs, 2012). Thus, benefits of measures to promote sleep would not only be apparent for workers' effective functioning at work but also for public health (Knutsson & Kempe, 2014; Masri, Kinouchi, & Sassone-Corsi, 2015).

References

Aguinis, H., Gottfredson, R. K., & Culpepper, S. A. (2013). Best-practice recommendations for estimating cross-level interaction effects using multilevel modeling. *Journal of Management*, *39*, 1490–1528. https://doi.org/10.1177/0149206313478188

Åkerstedt, T. (2003). Shift work and disturbed sleep/wakefulness. *Occupational Medicine*, *53*, 89–94. https://doi.org/10.1093/occmed/kqg046

Åkerstedt, T., Hume, K., Minors, D., & Waterhouse, J. (1994). The meaning of good sleep: A longitudinal study of polysomnography and subjective sleep quality. *Journal of Sleep Research*, *3*, 152–158. https://doi.org/10.1111/j.1365-2869.1994.tb00122.x

Åkerstedt, T., Hume, K., Minors, D., & Waterhouse, J. (1997). Good sleep - its timing and physiological sleep characteristics. *Journal of Sleep Research*, *6*, 221–229. https://doi.org/10.1111/j.1365-2869.1997.00221.x

Åkerstedt, T., Nilsson, P. M., & Kecklund, G. (2009). Sleep and recovery. In S. Sonnentag, P. L. Perrewé & D. C. Ganster (Eds.), *Current perspectives on job-stress recovery: Research in occupational stress and well being*, Vol. 7 (pp. 205–247). Bingley, UK: JAI Press.

Åkerstedt, T., & Wright, K. P. (2009). Sleep loss and fatigue in shift work and shift work disorder. *Sleep Medicine Clinics*, *4*, 257–271. https://doi.org/10.1016/j.jsmc.2009.03.001

Amabile, T. M., & Kramer, S. J. (2011). The power of small wins. *Harvard Business Review*, *89*, 70–80.

Ariely, D., & Wertenbroch, K. (2002). Procrastination, deadlines, and performance: Self-control by precommitment. *Psychological Science*, *13*, 219–224. https://doi.org/10.1111/1467-9280.00441

Barber, L. K., & Budnick, C. J. (2016). Sleep and unethical behavior. In J. Barling, C. M. Barnes, E. L. Carleton & D. T. Wagner (Eds.), *Work and sleep: Research insights for the workplace* (pp. 125–146). New York, NY: Oxford University Press.

Barnes, C. M. (2012). Working in our sleep: Sleep and self-regulation in organizations. *Organizational Psychology Review*, *2*, 234–257. https://doi.org/10.1177/2041386612450181

Barnes, C. M., Lucianetti, L., Bhave, D., & Christian, M. (2015). "You wouldn't like me when I'm sleepy": Leaders' sleep, daily abusive supervision, and work unit engagement. *Academy of Management Journal*, *58*, 1419–1437. https://doi.org/10.5465/amj.2013.1063

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality & Social Psychology*, *74*, 1252–1265. https://doi.org/10.1037/0022-3514.74.5.1252

Baumeister, R. F., Muraven, M., & Tice, D. M. (2000). Ego depletion: A resource model of volition, self-regulation, and controlled processing. *Social Cognition*, *18*, 130–150. https://doi.org/10.1521/soco.2000.18.2.130

Beal, D. J., Weiss, H. M., Barros, E., & MacDermid, S. M. (2005). An episodic process model of affective influences on performance. *Journal of Applied Psychology*, *90*, 1054–1068. https://doi.org/10.1037/0021-9010.90.6.1054

Beswick, G., & Mann, L. (1994). State orientation and procrastination. In J. Kuhl & J. Beckmann (Eds.), *Volition and personality: Action versus state orientation* (pp. 391–396). Göttingen, Germany: Hogrefe & Huber.

Binnewies, C., Sonnentag, S., & Mojza, E. J. (2009). Daily performance at work: Feeling recovered in the morning as a predictor of day-level job performance. *Journal of Organizational Behavior*, *30*, 67–93. https://doi.org/10.1002/job.541

Bodenhausen, G. V. (1990). Stereotypes as judgmental heuristics: Evidence of circadian variations in discrimination. *Psychological Science*, *1*, 319–322. https://doi.org/10.1111/j.1467-9280.1990.tb00226.x

ten Brummelhuis, L. L., & Bakker, A. B. (2012). A resource perspective on the work–home interface: The work–home resources model. *American Psychologist*, *67*, 545–556. https://doi.org/10.1037/a0027974

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research*, *28*, 193–213. https://doi.org/10.1016/0165-1781(89)90047-4

Carrier, J., & Monk, T. H. (2000). Circadian rhythms of performance: New trends. *Chronobiology International*, *17*, 719–732. https://doi.org/10.1081/CBI-100102108

Carter, E. C., Kofler, L. M., Forster, D. E., & McCullough, M. E. (2015). A series of meta-analytic tests of the depletion effect: Self-control does not seem to rely on a limited resource. *Journal of Experimental Psychology: General*, *144*, 796–815. https://doi.org/10.1037/xge0000083

Claessens, B. J., Van Eerde, W., Rutte, C. G., & Roe, R. A. (2010). Things to do today..: A daily diary study on task completion at work. *Applied Psychology: An International Review*, *59*, 273–295. https://doi.org/10.1111/j.1464-0597.2009.00390.x

Clinton, M. E., Conway, N., & Sturges, J. (2016). “It’s tough hanging-up a call”: The relationships between calling and work hours, psychological detachment, sleep quality, and morning vigor. *Journal of Occupational Health Psychology*, https://doi.org/10.1037/ocp0000025

Crowley, S. J., Lee, C., Tseng, C. Y., Fogg, L. F., & Eastman, C. I. (2003). Combinations of bright light, scheduled dark, sunglasses, and melatonin to facilitate circadian entrainment to night shift work. *Journal of Biological Rhythms*, *18*, 513–523. https://doi.org/10.1177/0748730403258422

Curtis, J., Burkley, E., & Burkley, M. (2014). The rhythm is gonna get you: The influence of circadian rhythm synchrony on self-control outcomes. *Social and Personality Psychology Compass*, *8*, 609–625. https://doi.org/10.1111/spc3.12136

Czeisler, C. A., & Gooley, J. J. (2007). *Sleep and circadian rhythms in humans, cold spring harbor symposia on quantitative biology*, Vol. *72* (pp. 579–597). New York, NY: Cold Spring Harbor Laboratory Press.

Czeisler, C. A., Moore-Ede, M. C., & Coleman, R. (1982). Rotating shift work schedules that disrupt sleep are improved by applying circadian principles. *Science*, *217*, 460–463. https://doi.org/10.1126/science.7089576

Deci, E. L., & Ryan, R. M. (2000). The” what” and” why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*, 227–268. https://doi.org/10.1207/S15327965PLI1104_01

Díaz-Morales, J. F., Ferrari, J. R., & Cohen, J. R. (2008). Indecision and avoidant procrastination: The role of morningness-eveningness and time perspective in chronic delay lifestyles. *The Journal of General Psychology*, *135*, 228–240. https://doi.org/10.3200/GENP.135.3.228-240

Diestel, S., & Schmidt, K. H. (2012). Lagged mediator effects of self-control demands on psychological strain and absenteeism. *Journal of Occupational and Organizational Psychology*, *85*, 556–578. https://doi.org/10.1111/j.2044-8325.2012.02058.x

Digdon, N. L., & Howell, A. J. (2008). College students who have an eveningness preference report lower self-control and greater procrastination. *Chronobiology International*, *25*, 1029–1046. https://doi.org/10.1080/07420520802553671

Dijk, D.-J., & Lockley, S. W. (2002). Integration of human sleep-wake regulation and circadian rhythmicity. *Journal of Applied Physiology*, *92*, 852–862. https://doi.org/10.1152/japplphysiol.00924.2001

Eastman, C. I., & Martin, S. K. (1999). How to use light and dark to produce circadian adaptation to night shift work. *Annals of Medicine*, *31*, 87–98. https://doi.org/10.3109/07853899908998783

Engle-Friedman, M. (2014). The effects of sleep loss on capacity and effort. *Sleep Science*, *7*, 213–224. https://doi.org/10.1016/j.slsci.2014.11.001

Faraut, B., Boudjeltia, K. Z., Vanhamme, L., & Kerkhofs, M. (2012). Immune, inflammatory and cardiovascular consequences of sleep restriction and recovery. *Sleep Medicine Reviews*, *16*, 137–149. https://doi.org/10.1016/j.smrv.2011.05.001

Ferrari, J. R., Harriott, J. S., Evans, L., Lecik-Michna, D. M., & Wenger, J. M. (1997). Exploring the time preferences of procrastinators: Night or day, which is the one? *European Journal of Personality*, *11*, 187–196. https://doi.org/10.1002/(SICI)1099-0984(199709)11:3<187:AID-PER287>3.0.CO;2-6

Folkard, S. (2008). Do permanent night workers show circadian adjustment? A review based on the endogenous melatonin rhythm. *Chronobiology International*, *25*, 215–224. https://doi.org/10.1080/07420520802106835

Gröpel, P., & Steel, P. (2008). A mega-trial investigation of goal setting, interest enhancement, and energy on procrastination. *Personality and Individual Differences*, *45*, 406–411. https://doi.org/10.1016/j.paid.2008.05.015

Gunia, B. C., Barnes, C. M., & Sah, S. (2014). The morality of larks and owls unethical behavior depends on chronotype as well as time of day. *Psychological Science*, *25*, 2272–2274. https://doi.org/10.1177/0956797614541989

Hahn, V. C., Binnewies, C., Sonnentag, S., & Mojza, E. J. (2011). Learning how to recover from job stress: Effects of a recovery training program on recovery, recovery-related self-efficacy, and well-being. *Journal of Occupational Health Psychology*, *16*, 202. https://doi.org/10.1037/a0022169

Halbesleben, J. R., Neveu, J.-P., Paustian-Underdahl, S. C., & Westman, M. (2014). Getting to the "COR" understanding the role of resources in conservation of resources theory. *Journal of Management*, *40*, 1334–1364. https://doi.org/10.1177/0149206314527130

Harriott, J., & Ferrari, J. R. (1996). Prevalence of procrastination among samples of adults. *Psychological Reports*, *78*, 611–616. https://doi.org/10.2466/pr0.1996.78.2.611

Harris, N. N., & Sutton, R. I. (1983). Task procrastination in organizations: A framework for research. *Human Relations*, *36*, 987–995. https://doi.org/10.1177/001872678303601102

Harrison, Y., & Horne, J. A. (2000). The impact of sleep deprivation on decision making: A review. *Journal of Experimental Psychology: Applied*, *6*, 236–249. https://doi.org/10.I037//1076-8O8X.6.3.236

Hirshkowitz, M., Whiton, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., . . . Kheirandish-Gozal, L. (2015). National Sleep Foundation's sleep time duration recommendations: Methodology and results summary. *Sleep Health*, *1*, 40–43. https://doi.org/10.1016/j.sleh.2014.12.010

Horne, J. A., & Østberg, O. (1976). A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. *International Journal of Chronobiology*, *4*, 97–110.

Howell, A. J., Watson, D. C., Powell, R. A., & Buro, K. (2006). Academic procrastination: The pattern and correlates of behavioural postponement. *Personality and Individual Differences*, *40*, 1519–1530. https://doi.org/10.1016/j.paid.2005.11.023

Hülsheger, U. R., Lang, J. W. B., Depenbrock, F., Fehrmann, C., Zijlstra, F. R. H., & Alberts, H. J. E. M. (2014). The power of presence: The role of min*df*ulness at work for daily levels and change trajectories of psychological detachment and sleep quality. *Journal of Applied Psychology*, *99*, 1113–1128. https://doi.org/10.1037/a0037702

Ingram, K. K., Ay, A., Kwon, S. B., Woods, K., Escobar, S., Gordon, M., . . . Jain, K. (2016). Molecular insights into chronotype and time-of-day effects on decision-making. *Scientific Reports*, *6*, 1–9. https://doi.org/10.1038/srep29392

Inzlicht, M., & Schmeichel, B. J. (2016). Beyond limited resources: Self-control failure as the product of shifting priorities. In K. Vohs & R. F. Baumeister (Eds.), *The handbook of self-regulation* (pp. 165–181). New York, NY: Guilford.

Job, V., Dweck, C. S., & Walton, G. M. (2010). Ego depletion—Is it all in your head? Implicit theories about willpower affect self-regulation. *Psychological Science*, *21*, 1686–1693. https://doi.org/10.1177/0956797610384745

Jones, K., & Harrison, Y. (2001). Frontal lobe function, sleep loss and fragmented sleep. *Sleep Medicine Reviews*, *5*, 463–475. https://doi.org/10.1053/smrv.2001.0203

Juda, M., Vetter, C., & Roenneberg, T. (2013). Chronotype modulates sleep duration, sleep quality, and social jet lag in shift-workers. *Journal of Biological Rhythms*, *28*, 141–151. https://doi.org/10.1177/0748730412475042

Juda, M., Vetter, C., & Roenneberg, T. (2013). The Munich ChronoType Questionnaire for shift-workers (MCTQShift). *Journal of Biological Rhythms*, *28*, 130–140. https://doi.org/10.1177/0748730412475041

Knutsson, A., & Kempe, A. (2014). Shift work and diabetes—A systematic review. *Chronobiology International*, *31*, 1146–1151. https://doi.org/10.3109/07420528.2014.95730

Konze, A.-K., Rivkin, W., & Schmidt, K.-H. (2017). Implicit theories about willpower as a moderator of the adverse effect of daily self-control demands on need for recovery. *Zeitschrift für Arbeitswissenschaft*, Advance online publication. https://doi.org/10.1007/s41449-017-0062-y

Krystal, A. D., & Edinger, J. D. (2008). Measuring sleep quality. *Sleep Medicine*, *9*, S10–S17. https://doi.org/10.1016/S1389-9457(08)70011-X

Kuhl, J., & Beckmann, J. (1994). *Volition and personality: Action versus state orientation*. Göttingen, Germany: Hogrefe & Huber.

Kühnel, J., Bledow, R., & Feuerhahn, N. (2016). When do you procrastinate? Sleep quality and social sleep lag jointly predict self-regulatory failure at work. *Journal of Organizational Behavior*, *37*, 983–1002. https://doi.org/10.1002/job.2084

Kühnel, J., Sonnentag, S., & Bledow, R. (2012). Resources and time pressure as day-level antecedents of work engagement. *Journal of Occupational and Organizational Psychology*, *85*, 181–198. https://doi.org/10.1111/j.2044-8325.2011.02022.x

Kühnle, T. (2006). *Quantitative analysis of human chronotype* (Doctoral thesis, Ludwig-Maximilian-University, Munich, Germany). Retrieved from: http://edoc.ub.uni-muenchen.de/5168/

Lai, X., Li, F., & Leung, K. (2013). A Monte Carlo study of the effects of common method variance on significance testing and parameter bias in hierarchical linear modeling. *Organizational Research Methods*, *16*, 243–269. https://doi.org/10.1177/1094428112469667

Lanaj, K., Johnson, R. E., & Barnes, C. M. (2014). Beginning the workday yet already depleted? Consequences of late-night smartphone use and sleep. *Organizational Behavior and Human Decision Processes*, *124*, 11–23. https://doi.org/10.1016/j.obhdp.2014.01.001

Lay, C. H. (1986). At last, my research article on procrastination. *Journal of Research in Personality*, *20*, 474–495. https://doi.org/10.1016/0092-6566(86)90127-3

Litwiller, B., Snyder, L. A., Taylor, W. D., & Steele, L. M. (2016). The relationship between sleep and work: A meta-analysis. *Journal of Applied Psychology*, https://doi.org/10.1037/apl0000169

Lord, R. G., Diefendorff, J. M., Schmidt, A. M., & Hall, R. J. (2010). Self-regulation at work. *Annual Review of Psychology*, *61*, 543–568. https://doi.org/10.1146/annurev.psych.093008.100314

Martin, S. K., & Eastman, C. I. (2002). Sleep logs of young adults with self-selected sleep times predict the dim light melatonin onset. *Chronobiology International*, *19*, 695–707. https://doi.org/10.1081/CBI-120006080

Masri, S., Kinouchi, K., & Sassone-Corsi, P. (2015). Circadian clocks, epigenetics, and cancer. *Current Opinion in Oncology*, *27*, 50–56. https://doi.org/10.1097/CCO.0000000000000153

Mastin, D. F., Bryson, J., & Corwyn, R. (2006). Assessment of sleep hygiene using the Sleep Hygiene Index. *Journal of Behavioral Medicine*, *29*, 223–227. https://doi.org/10.1007/s10865-006-9047-6

Mathieu, J. E., Aguinis, H., Culpepper, S. A., & Chen, G. (2012). Understanding and estimating the power to detect cross-level interaction effects in multilevel modeling. *Journal of Applied Psychology*, *97*, 951–966. https://doi.org/10.1037/a0028380

Muthén, L. K., & Muthén, B. O. (1998-2007). *Mplus user's guide* (5th ed.). Los Angeles, CA: Muthén & Muthén.

National Sleep Foundation (2013). *International bedroom poll*. Washington, DC: National Sleep Foundation.

National Sleep Foundation (2014). *Sleep health index*™. Washington, DC: National Sleep Foundation.

Pereira, D., & Elfering, A. (2014). Social stressors at work, sleep quality and psychosomatic health complaints—A longitudinal ambulatory field study. *Stress and Health*, *30*, 43–52. https://doi.org/10.1002/smi.2494

Pilcher, J. J., Lambert, B. J., & Huffcutt, A. I. (2000). Differential effects of permanent and rotating shifts on self-report sleep length: A meta-analytic review. *Sleep: Journal of Sleep Research & Sleep Medicine*, *23*, 155–163. https://doi.org/10.1093/sleep/23.2.1b

Preacher, K. J., Curran, P. J., & Bauer, D. J. (2006). Computational tools for probing interactions in multiple linear regression, multilevel modeling, and latent curve analysis. *Journal of Educational and Behavioral Statistics*, *31*, 437–448. https://doi.org/10.3102/10769986031004437

Preacher, K. J., Zhang, Z., & Zyphur, M. J. (2011). Alternative methods for assessing mediation in multilevel data: The advantages of multilevel SEM. *Structural Equation Modeling*, *18*, 161–182. https://doi.org/10.1080/10705511.2011.557329

Preacher, K. J., Zyphur, M. J., & Zhang, Z. (2010). A general multilevel SEM framework for assessing multilevel mediation. *Psychological Methods*, *15*, 209–233. https://doi.org/10.1037/a0020141

Raudenbush, S. W., Bryk, A. S., Cheong, Y. F., Congdon, R. T., & du Toit, M. (2011). *HLM 7*. Lincolnwood, IL: Scientific Software International.

Reynolds, B., & Schiffbauer, R. M. (2004). Impulsive choice and workplace safety: A new area of inquiry for research in occupational settings. *The Behavior Analyst*, *27*, 239–246. https://doi.org/10.1007/BF03393183

Roenneberg, T. (2012). What is chronotype? *Sleep and Biological Rhythms*, *10*, 75–76. https://doi.org/10.1111/j.1479-8425.2012.00541.x

Roenneberg, T., Allebrandt, K. V., Merrow, M., & Vetter, C. (2012). Social jetlag and obesity. *Current Biology*, *22*, 939–943. https://doi.org/10.1016/j.cub.2012.03.038

Roenneberg, T., Kühnle, T., Juda, M., Kantermann, T., Allebrandt, K., Gordijn, M., . . . Merrow, M. (2007). Epidemiology of the human circadian clock. *Sleep Medicine Reviews*, *11*, 429–438. https://doi.org/10.1016/j.smrv.2007.07.005

Roenneberg, T., Kumar, C. J., & Merrow, M. (2007). The human circadian clock entrains to sun time. *Current Biology*, *17*, R44–R45. https://doi.org/10.1016/j.cub.2006.12.011

Roenneberg, T., Wirz-Justice, A., & Merrow, M. (2003). Life between clocks: Daily temporal patterns of human chronotypes. *Journal of Biological Rhythms*, *18*, 80–90. https://doi.org/10.1177/0748730402239679

Schmidt, C., Collette, F., Cajochen, C., & Peigneux, P. (2007). A time to think: Circadian rhythms in human cognition. *Cognitive Neuropsychology*, *24*, 755–789. https://doi.org/10.1080/02643290701754158

Schmitt, A., Belschak, F. D., & Den Hartog, D. N. (2017). Feeling vital after a good night's sleep: The interplay of energetic resources and self-efficacy for daily proactivity. *Journal of Occupational Health Psychology*, *22*, 443–454. https://doi.org/10.1037/ocp0000041

Segerstrom, S. C., Boggero, I. A., & Evans, D. R. (2016). Pause and plan - The physiology of self-regulation. In K. D. Vohs & R. F. Baumeister (Eds.), *Handbook of self-regulation: Research, theory, and applications* (pp. 131–145). New York, NY: Guilford.

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

Sonnentag, S., Binnewies, C., & Mojza, E. J. (2008). "Did you have a nice evening?" A day-level study on recovery experiences, sleep, and affect. *Journal of Applied Psychology*, *93*, 674–684. https://doi.org/10.1037/0021-9010.93.3.674

Sonnentag, S., & Fritz, C. (2015). Recovery from job stress: The stressor-detachment model as an integrative framework. *Journal of Organizational Behavior*, *36*, S72–S103. https://doi.org/10.1002/job.1924

Steel, P. (2007). The nature of procrastination: A meta-analytic and theoretical review of quintessential self-regulatory failure. *Psychological Bulletin*, *133*, 65–94. https://doi.org/10.1037/0033-2909.133.1.65

Steel, P., Brothen, T., & Wambach, C. (2001). Procrastination and personality, performance, and mood. *Personality and Individual Differences*, *30*, 95–106. https://doi.org/10.1016/S0191-8869(00)00013-1

Tuckman, B. W. (1991). The development and concurrent validity of the procrastination scale. *Educational and Psychological Measurement*, *51*, 473–480. https://doi.org/10.1177/0013164491512022

UCLA Sleep Disorders Center. (n.d.). *Coping with shift work*. Retrieved from http://sleepcenter.ucla.edu/coping-with-shift-work.

Van Dongen, H. P. A., Baynard, M. D., Maislin, G., & Dinges, D. F. (2004). Systematic interindividual differences in neurobehavioral impairment from sleep loss: Evidence of trait-like differential vulnerability. *Sleep*, *27*, 423–433.

Van Eerde, W. (2003). A meta-analytically derived nomological network of procrastination. *Personality and Individual Differences*, *35*, 1401–1418. https://doi.org/10.1016/S0191-8869(02)00358-6

Vetter, C., Fischer, D., Matera, J. L., & Roenneberg, T. (2015). Aligning work and circadian time in shift workers improves sleep and reduces circadian disruption. *Current Biology*, *25*, 907–911. https://doi.org/10.1016/j.cub.2015.01.064

Vetter, C., Juda, M., & Roenneberg, T. (2012). The influence of internal time, time awake, and sleep duration on cognitive performance in shiftworkers. *Chronobiology International*, *29*, 1127–1138. https://doi.org/10.3109/07420528.2012.707999

Wagner, D. T., Barnes, C. M., Lim, V. K., & Ferris, D. (2012). Lost sleep and cyberloafing: Evidence from the laboratory and a daylight saving time quasi-experiment. *Journal of Applied Psychology*, *97*, 1068–1076. https://doi.org/10.1037/a0027557

Welsh, D. T., Ellis, A. P., Christian, M. S., & Mai, K. M. (2014). Building a self-regulatory model of sleep deprivation and deception: The role of caffeine and social influence. *Journal of Applied Psychology*, *99*, 1268–1277. https://doi.org/10.1037/a0036202

Wittmann, M., Dinich, J., Merrow, M., & Roenneberg, T. (2006). Social jetlag: Misalignment of biological and social time. *Chronobiology International*, *23*, 497–509. https://doi.org/10.1080/07420520500545979