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Work Pressure and Recovery During a Cross-Atlantic Voyage: A Test of the Stressor-Detachment Model

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This study uses the stressor-detachment model to hypothesize that the recovery experiences of psychological detachment and relaxation are less likely after workdays with high work pressure and that individuals will therefore feel more exhausted and less engaged after such days. We also predict that daily recovery experiences weaken the daily work pressure–exhaustion relationship and strengthen the daily work pressure–work engagement relationship. We followed 78 naval cadets during a 30-day voyage on a sailing ship from Northern Europe to North America. The cadets filled out daily questionnaires for 30 days. Multilevel analyses revealed positive relationships between work pressure and both daily exhaustion and daily work engagement. A Monte Carlo test supported two of the four mediation effects. Previous-day work pressure was positively related to exhaustion and negatively related to work engagement, through reduced relaxation, but not through psychological detachment. Psychological detachment (but not relaxation) moderated the link between daily work pressure and exhaustion, while neither of the recovery experiences moderated the link between daily work pressure and work engagement. Daily work pressure was most strongly related to exhaustion among cadets who reported low psychological detachment between shifts. The implications of these findings for theory and practice are discussed.

Keywords: exhaustion, recovery, stressor-detachment model, work engagement, work pressure

Supplemental materials: https://doi.org/10.1037/str0000170.supp

Work intensification has made work pressure a real challenge for many employees. On days when employees experience high work pressure, job demands exceed employees' abilities with the result that they experience time pressure (Van Veldhoven, 2014). Especially on such days, employees may profit from recovery strategies aimed at replenishing their mental energy resources (Sonnentag & Fritz, 2007). Recovery is crucial to employee well-being, especially when organizations operate around the clock every day of the week, for example in order to make efficient use of machinery (Jansen et al., 2003), to meet time limits, or in maritime operations at sea (Miller et al., 2011).

In the present study, we investigate how naval cadets in a military operation at sea successfully meet their daily job demands and protect their well-being. As part of their leadership training, the cadets sail for 30 days across the North Sea and the Atlantic from Northern Europe to North America by sailing ship. During this voyage, the naval cadets are exposed to swift changes in daily work pressure (e.g., weather conditions, simulated pirate attacks), with limited opportunities for recovery. We use the stressor-detachment model (SDM; Sonnentag & Fritz, 2015) to test the role of two recovery strategies: psychological detachment and relaxation.

This study contributes to the recovery literature in three important ways. First, we expand the SDM by investigating the role of relaxation in addition to psychological detachment. Relaxation is a recovery strategy that is found to differ from psychological detachment but is equally able to replenish energy resources (Bennett et al., 2018). We will compare the effectiveness of both recovery strategies in dealing with work pressure. Second, we test the impact of daily work pressure on exhaustion as well as work engagement. By investigating the role of recovery in these relationships, we can test the novel prediction that recovery not only helps to buffer the unfavorable relationship between work pressure and exhaustion but also boosts the favorable relationship between work pressure and engagement. Third, we test the main propositions of the SDM in an operational setting in which employees work shifts. This context offers an opportunity to test the validity of the model under constrained conditions, where off-job time is spent in the work context and participants' job and off-job activities are similar.

Theoretical Background

According to Van Veldhoven (2014), quantitative job demands refer to the amount and speed of work that is to be performed, and the level of physical and/or psychological effort invested in order to

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The idea and preliminary findings from the study were presented at the 13th European Academy of Health Psychology conference (2018). The part of the data measuring daily work pressure has previously appeared in Bakker et al. (2020), while the control variable sleep quality was also included in Nordmo et al. (2019).

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do the work. Work pressure refers to situations in which such quantitative job demands have increased above normal levels. Work pressure is a job stressor. As such, it may increase exhaustion because, when confronted with stressors, employees have to invest extra effort and have to regulate their energy and emotions in order to meet the job demands (Zohar et al., 2003). The relationship between work pressure and exhaustion has been confirmed by longitudinal research (implying accumulation effects), but also by daily diary research (implying depletion; e.g., Demerouti et al., 2004, 2015). In parallel to the stressor–strain framework, LePine et al. (2005) introduced the challenge stressor–hindrance stressor framework, according to which work pressure can be considered a challenge stressor. As such, it costs considerable energy and is a strain, but at the same time may be inspiring and create interest. Challenge stressors like work pressure trigger positive emotions, increase work engagement and have a positive impact on performance (LePine et al., 2005). In contrast, hindrance stressors such as role conflicts and "red tape" are a strain, thwart the satisfaction of basic psychological needs and are therefore negatively related to work engagement and performance (De Gieter et al., 2018).

Crawford et al. (2010) have provided evidence of the challenge stressor–hindrance stressor framework. However, the vast majority of the studies included in their meta-analysis used a between-person approach, and thus examined differences in strain and work engagement between individuals exposed to low versus high levels of work pressure. In a daily diary study, the focus is on variations in work pressure within each person, from day to day. The question is whether a daily increase in work pressure coincides with a daily increase in strain (e.g., exhaustion) and work engagement—independently of the baseline work pressure. Although some recent within-person studies have confirmed that daily work pressure acts as a challenge stressor (De Gieter et al., 2018; Tadić et al., 2015), other studies have failed to find a relationship between daily work pressure and daily work engagement (e.g., Breevaart & Bakker, 2018). In the present study, we propose that daily work pressure will act as a challenge stressor. Such stressors cost considerable energy and thereby lead to exhaustion (Crawford et al., 2010; Pindek et al., 2018). However, the naval cadets are tested in a maritime operation in which they face novel and exciting challenges at sea, and can be expected to be eager to satisfy their need for competence and to reach their performance goals. Thus, higher levels of work pressure are expected to coincide with higher levels of work engagement as well.

Hypothesis 1: Daily work pressure is positively related to daily (a) exhaustion and (b) work engagement, after controlling for previous-day exhaustion and work engagement.

The Stressor-Detachment Model

Work can be engaging, but it is also strenuous and may cost considerable psychological and physical resources. It is, therefore, important to regularly recover and replenish the resources that are used up during work (Zijlstra & Sonnentag, 2006). Recovery refers to the process of strain reduction during which an individual's functioning returns to its prestressor level (Sonnentag & Fritz, 2007). Employees may engage in various activities—for example, sleep, sport and exercise, social activities, meditation—to reduce strain and restore a state of physiological and psychological performance readiness (Demerouti et al., 2013). The present study focuses on recovery *experiences* because "it is not a specific activity per se that helps [one] to recover from job stress but its underlying attributes" (Sonnentag & Fritz, 2007, p. 204). We selected two experiences: (a) psychological detachment, which implies refraining from job-related activities and not thinking about work during nonwork time, and (b) relaxation, which is characterized by low activation and increased positive affect (Stone et al., 1995), both of which have been found to be among the most effective means of reducing exhaustion (Demerouti, 2015). We excluded mastery and control as recovery experiences, since mastery seems to be more relevant to gaining new energy from learning something new, while control is more akin to a boundary condition.

A recent meta-analysis (Bennett et al., 2018) showed that psychological detachment and relaxation are important predictors of energy (i.e., reduced fatigue and increased vigor). Moreover, psychological detachment and relaxation during off-job time are important predictors of next-day work engagement (ten Brummelhuis & Bakker, 2012). Sonnentag and Fritz (2015) have proposed using the SDM as an integrative framework to understand the role of recovery experiences in the whole recovery process, whereby psychological detachment is both a mediator and moderator of the job stressor–strain relationship. The SDM proposes that, on days when job stressors like work pressure are relatively high, individuals continue working or continue talking or ruminating about their work during off-job time (Cropley & Millward Purvis, 2003). As a consequence, people do not detach from work and continue to experience job strain.

There is some preliminary evidence of this mediation process. Cross-sectional studies have confirmed that job demands (including work pressure) are related to higher fatigue Kinnunen et al. (2011), and stress and lower life satisfaction Safstrom and Hartig (2013) through difficulties detaching psychologically from work. Using a 6-month time lag, Von Thiele Schwarz (2011) found that a lack of withdrawal from work partially mediated the link between job demands, on the one hand, and a decreased sense of recovery and increased fatigue, on the other. Using a 10-day diary study, Germeys and De Gieter (2017) found that employees had more trouble detaching from their work on days when work pressure was high. Interestingly, the study showed that employees were also less satisfied with their marital relationship on these days. This suggests a negative work-to-family spillover effect and provides some support for the SDM.

We test the mediation hypothesis proposed by the SDM in an operational setting in which employees work shifts. In addition, we expand the SDM by integrating relaxation in the model. Since the naval cadets are on a 30-day voyage from Northern Europe to North America, they work and rest in the same environment, that is the sailing ship. This context offers an opportunity to test the validity of the SDM under constrained conditions. It is unclear how well the cadets will be able to detach from work while remaining in their work environment at all times. On board the ship, it may actually be easier to sit down and relax (engage in mindfulness, listen to music, watch TV, etc.) than to really distance from work and detach psychologically.

We propose that, on days the cadets experience higher work pressure, they will be less likely to detach psychologically from their work or to relax, which, in turn, will contribute to more exhaustion. In a similar vein, we predict that recovery experiences play a

mediating role in the relationship between daily work pressure and daily work engagement. The SDM proposes that daily job stressors lead to an increase in negative affective states such as anxiety and anger (e.g., Ilies et al., 2010). The high level of negative activation makes it more difficult to detach from work during off-job time and to relax because it stimulates recall of the stressful events that occurred during the workday (Bono et al., 2013). Previous research has demonstrated that psychological detachment and relaxation are positively related to work engagement (Siltaloppi et al., 2009; ten Brummelhuis & Bakker, 2012). This leads to the novel prediction (not in the SDM) that, on the days when individuals experience higher work pressure, they are less likely to detach psychologically from their work or to relax, and consequently experience *lower* work engagement. Since the direct relationship between work pressure and work engagement is hypothesized to be positive, this is a case of *inconsistent* mediation (MacKinnon et al., 2007).

Hypothesis 2: Previous-day work pressure is (a) positively related to exhaustion and (b) negatively related to work engagement, through reduced present-day psychological detachment.

Hypothesis 3: Previous-day work pressure is (a) positively related to exhaustion and (b) negatively related to work engagement, through reduced present-day relaxation.

Recovery Experiences as Moderators

The SDM proposes that psychological detachment from work during off-job time is not only a direct and indirect predictor of strain and (impaired) well-being, but may also alleviate or buffer the negative impact of job stressors. It is noteworthy that, in contrast to coping mechanisms that refer to how individuals deal with specific stressors, recovery activities can be seen as a kind of time-delayed coping that refers to the way individuals restore their resources when the stressor is no longer present (Sonnentag & Fritz, 2015). On the days when individuals do not detach from their work during off-job time, job stressors are constantly present and may continue to evoke strain reactions, including exhaustion. In contrast, on the days when individuals detach psychologically from their work, they forget about their job stressors, rebuild their psychological resources, and recover from the work-related effort (Sonnentag & Fritz, 2015). Thus, psychological detachment is proposed to attenuate the positive relationship between job stressors and strain.

There is indeed some evidence of this interaction effect. In their 1-year follow-up study, Sonnentag et al. (2010) found that psychological detachment buffered the positive relationship between T1 job stressors and T2 psychosomatic complaints, as well as the negative relationship between T1 job stressors and T2 work engagement. Similarly, Sianoja et al. (2018) found that the relationship between workload and exhaustion (but not sleep difficulties) was moderated by psychological detachment. The workload was only positively related to exhaustion for employees who were low (vs. high) in detachment. Finally, using a daily diary design, Korunka et al. (2012) found that, when railway controllers were able to psychologically detach from their work in the hours before a night shift, the workload during the shift was unrelated to fatigue after 4 hr of shift work. In contrast, the workload was positively related to fatigue after 4 hr of shift work when the railway controllers could not detach from work. Importantly, however, this moderator effect of detachment disappeared after 8 and 12 hr of shift work. In the present study, we try to replicate and expand these findings. Specifically, in addition to psychological detachment, we propose and test relaxation as a recovery experience that buffers the relationship between work pressure and strain. Furthermore, we test the role of both recovery strategies in reducing exhaustion and protecting work engagement. Relaxation is an important recovery experience because it interrupts the high arousal state and high activation that translate job stressors into illness (Brosschot et al., 2005). Relaxation thus restores an individual's mental energy resources, so that these resources return to their prestressor state (Sonnentag & Fritz, 2007). Empirical evidence suggests that relaxation helps to reduce stress-related complaints in both the short and the long run (Stone et al., 1995; van der Klink et al., 2001). More specifically, Siltaloppi et al. (2009) demonstrated, using a sample of Finnish employees working in different occupational sectors, that relaxation protected against increased job exhaustion under high time demands.

Moreover, we argue that relaxation in the hours between shifts will help naval cadets to react with enthusiasm to work pressure. There is extensive literature showing that recovery helps individuals to stay engaged (e.g., Sonnentag et al., 2010; ten Brummelhuis & Bakker, 2012). The reason for this is that individuals who detach from work and relax can refill their energy reservoir, which has been depleted during work (because of the expenditure of effort). Once the energy reservoir has been replenished, people are more likely to feel energized at work and to be enthusiastically engaged in work. Moreover, individuals who have refilled their energy reservoir through detachment or relaxation will be better equipped to deal with the daily work pressure and will deal with it enthusiastically (i.e., engagement). After having recovered, the job stressor will be perceived as a challenge through which an individual can learn and grow (Cavanaugh et al., 2000). However, when individuals have not found opportunities to detach psychologically from work or to relax and reduce physiological arousal, work pressure is likely to lead to exhaustion and reduced work engagement.

Hypothesis 4: The positive relationship between work pressure and daily exhaustion is moderated by (a) previous-day psychological detachment and (b) previous-day relaxation. This relationship is weaker for cadets who report high (vs. low) levels of recovery experiences.

Hypothesis 5: The positive relationship between work pressure and daily work engagement is moderated by (a) previous-day psychological detachment, and (b) previous-day relaxation. This relationship is stronger for cadets who report high (vs. low) levels of recovery experiences.

Method

Participants and Procedure

A total of 78 Norwegian naval cadets from a Military University College participating in a cross-Atlantic voyage were invited to participate in our study. As part of their leadership training, the cadets were going to sail across the North Sea and the Atlantic from Northern Europe to North America by sailing ship during the storm season. All the invited participants were informed about the purpose of the study and gave their written consent to participate 2 days

before departure. However, one male cadet had to withdraw from the voyage and was granted leave of absence by the Military University College. The final sample therefore consisted of 77 cadets, yielding an overall participation rate of 98.7%. The written consent form and the questionnaires were registered and approved by the Norwegian Centre for Research Data prior to the data collection. In the written consent, it was clearly stated that participation was totally voluntary and that the cadets were free to withdraw from the study at any point in time without providing any reason.

During the voyage, the cadets were given different work tasks, such as planning and navigation, safety and fire drills, maintenance work, and sailing maneuvers that are essential for the performance of the sailing ship, in addition to academic studies. The participants received a booklet containing diary questionnaires for the first 30 days of their 75-day stay on the sailing ship. In order to ensure a good response rate, and to control for circadian rhythm effects, the cadets were instructed to fill out the questionnaire just before dinner at 5 p.m. each day, and they were promised individual monitoring reports on selected variables to enhance their personal development after the voyage. Moreover, leading officers reminded the cadets every day about the time they were to fill out the questionnaires. As a result, the daily mean response rate across the 30 days of the voyage was 91.12%. The sample consisted of 69 male participants (89.6%) and 8 female participants (10.4%). The mean age of the participants was 22.9 years ($SD = 2.2$). Of the 77 participants, 70 were from the naval branch and 7 from the army branch of the armed forces.

Measures

We used daily diaries to measure our study variables. All day-level questionnaires were adapted versions of existing scales. We adapted the time frame of the scales and reduced the number of items for most scales, so that the questions could be answered daily (cf., Ohly et al., 2010).

Day-level work pressure was measured using four items relating to quantitative and time pressure aspects of work. The items were based on a scale developed by van Veldhoven et al. (2002). The items followed a heading that read "To what extent ... ." The following are two examples: "did you have to work extra hard in order to complete something?," and "did you have to work fast?" (1 = *not at all*, 5 = *to a very large extent*). Reliability coefficients ranged from .80 to .95 across the 30 days, and the average Cronbach's α coefficient was .89.

Day-level exhaustion was measured using three items from the Maslach Burnout Inventory-General Survey (MBI-GS; Schaufeli et al., 1996). Two example items are: "Today, I felt emotionally drained from my work" and "Today, I felt used up at the end of the workday" (1 = *totally disagree*, 5 = *totally agree*). We refer to Xanthopoulou and Meier (2014) for a discussion of the differences between chronic burnout and daily burnout symptoms ("state burnout"). Reliability coefficients ranged from .82 to .96 across the 30 days. The average Cronbach's α was .89.

Day-level work engagement was measured using the state version (Breevaart et al., 2012) of the nine-item Utrecht Work Engagement Scale (UWES; Schaufeli et al., 2006). Here are three example items: "Today, I felt bursting with energy" (vigor), "Today, I was enthusiastic about my job" (dedication), and "Today, I was immersed in my work" (absorption). The statements could be answered on a 5-point scale (1 = *totally disagree*, 5 = *totally agree*). The reliability coefficients (Cronbach's α) had values ranging from .85 to .95 across the 30 days. The average Cronbach's α was .90.

Day-level recovery experiences in the form of psychological detachment and relaxation were measured using three items each from the Recovery Experience Questionnaire (Sonnentag & Fritz, 2007). The items followed a heading that read: "When not on duty (the last 24 hr) ... ". Example items for relaxation are: "I did relaxing things," and "I used the time to relax." Example items measuring psychological detachment are: "I distanced myself from my work," and "I have not been thinking about work at all." Participants could respond to these items on a 5-point scale, ranging from 1 (*totally disagree*) to 5 (*totally agree*). For psychological detachment, the Cronbach's α ranged from .45 to .86 across the 30 days (the average Cronbach's α was .75). Note that this scale produced inconsistent responses on one of the days, which will be considered in the discussion section. For relaxation, the Cronbach's α ranged from .75 to .94 across the 30 days (the average Cronbach's α was .90).

Control Variables

Sleep quality was measured using a single item asking the cadets to evaluate the previous night's sleep. Participants could respond to this item on a 6-point scale, ranging from 1 (*very bad*) to 6 (*very good*).

Analysis Strategy

In order to utilize the multilevel structure of the data, which means that the 30 daily measurements (Level 1) of the study constructs were nested within individuals (Level 2), we applied a two-level multilevel analysis with random intercepts using Mplus 7.4. Prior to conducting the multilevel analysis, the data were structured in a long format, where each row represents one measurement point per subject. In the analyses, we model both present-day (t) and previous-day ($t - 1$) predictions. Hence, in addition to the original present-day variables, we constructed a set of lagged variables representing our study constructs on the previous day ($t - 1$). Moreover, in the analyses, the day-level predictors were centered on the respective person mean and strictly defined as within-level variables, while the between-level predictors were modeled by using grand mean centered average scores of the variables. To test the hypothesized relationships, we modeled a prospective change model including a day-to-day dynamic moderator based on the analytical strategies recommended by Larson and Almeida (1999), including both present-day and previous-day variables at the within level of analysis. Figure S1, available as online supplement, presents the proposed research model. Because of the complexity of the hypothesized model, we used a model-building approach in the analysis to test the hypothesized main, mediational, and moderation effects one step at a time, building on the previous model. During the voyage, the cadets worked one of three shift rotas, where the first shift was on duty for 8 hr from 8.00 to 12.00 and from 20.00 to 24.00, the second shift from 12.00 to 16.00 and from 24.00 to 4.00, while the third shift worked from 16.00 to 20.00 and from 4.00 to 8.00. As the cadets were on the same shift during the whole voyage, shift type was not considered to be appropriate as a control variable for our daily outcomes in the analysis. Since the cadets who worked the least

favorable shifts during night time (from 24.00 to 4.00 and from 4.00 to 8.00) may occasionally have had more problems sleeping during the trip, we controlled for daily sleep quality. In order to model all theoretically relevant relationships between the study constructs, in addition to the hypothesized structural paths, we also included correlations between the predictors and between the two outcome variables at both the within level and between level. Moreover, at the between level, the general-level predictors were entered following the steps of the model-building approach. Model fit was determined using the following goodness of fit indices: chi-square, comparative fit index (CFI), Tucker–Lewis coefficient (TLI), root-mean-square error of approximation (RMSEA), and standardized root-mean-square residual (SRMR). The CFI and TLI were used to determine incremental fit, and RMSEA to determine the overall absolute fit (Hu & Bentler, 1999). In addition, SRMR provides information about the absolute fit of the model on the between and within levels, respectively. Conventionally, a value close to .95 for CFI and TLI, a value close to .05 for RMSEA, and a value close to .08 for SRMR, are indicative of a relatively good fit between the hypothesized model and the observed data (Hu & Bentler, 1999). The significance of indirect effects was tested by estimating confidence intervals using a Monte Carlo method (Selig & Preacher, 2008). Moreover, simple slope tests for hierarchal linear models were used to examine whether the slopes in the potential day-level interactions were significantly different from zero (Preacher et al., 2006). The slopes were tested at ±1 *SD* for the predictor and moderators, and calculations were based on the asymptotic covariance matrix from the respective multilevel models using R version 3.4.3.

Results

Table 1 shows the means, standard deviations, and correlations between all study variables.

The estimation of intraclass correlations (ICCs) for our outcomes prior to the two-level multilevel analysis revealed coefficients of .49 for exhaustion and .25 for work engagement, indicating sufficient remaining day-level variance in the respective dependent variables to proceed to models including day-level predictors. The estimated ICCs for the predictor variables were .32, .48, and .29, for work pressure, psychological detachment, and relaxation, respectively. In all tested models, we controlled both outcomes (exhaustion and work engagement) for their respective previous-day levels and sleep quality the previous night on the within-person level, and the average sleep quality across the 30 days on the between level.

In our first hypotheses (Hypotheses 1a and 1b), we postulate a positive relationship between daily work pressure and both exhaustion and work engagement within the same day. Using a model-building approach, we therefore first tested the main effect model estimating the main effects between daily work pressure and both daily exhaustion and work engagement on the same day at the within level. Correspondingly, the main effects of work pressure on both outcomes were modeled on the between level. The model showed an acceptable fit to the data ($\chi^2 = 42.7$, $df = 6$, $p < .001$, CFI = .97, TLI = .88, RMSEA = .051, $SRMR_{within} = .030$, $SRMR_{between} = .000$), and, in support of Hypotheses 1a and 1b, revealed significant positive relationships between daily work pressure and both present-day exhaustion ($\beta = .18$, $p < .01$) and work engagement ($\beta = .17$, $p < .01$). At the between level, a significant positive relationship was found between work pressure and exhaustion ($\beta = .42$, $p < .01$), while work pressure was unrelated to work engagement ($\beta = .01$, *n.s.*).

In Hypotheses 2a and 2b, we predict that previous-day work pressure is positively related to exhaustion and negatively related to work engagement, through present-day reduced psychological detachment. Correspondingly, in Hypotheses 3a and 3b, we predict that the previous-day's level of work pressure will be positively related to exhaustion and negatively related to work engagement, through present-day reduced relaxation. Continuing our model-building approach, we therefore expand the model at the within level by also including daily work pressure of the previous day, and daily psychological detachment and relaxation of the present day, modeling both their direct and indirect relationships with daily exhaustion and work engagement. At the between level, the model was expanded by including the mean scores of psychological detachment and relaxation across the 30 days. The mediational model fit the data well ($\chi^2 = 23.02$, $df = 8$, $p < .01$, CFI = .99, TLI = .95, RMSEA = .029, $SRMR_{within} = .016$, $SRMR_{between} = .000$), but an examination of the structural paths in the model revealed that the direct effects of previous-day's work pressure on both exhaustion ($\beta = -.02$, *n.s.*) and work engagement ($\beta = -.02$, *n.s.*) were not significant. We, therefore, adjusted the model by omitting these direct paths from the model. The adjusted model fitted the data well ($\chi^2 = 25.27$, $df = 10$, $p < .001$, CFI = .99, TLI = .96, RMSEA = .026, $SRMR_{within} = .017$, $SRMR_{between} = .000$), and omitting the direct paths did not result in a significant deterioration of fit ($\Delta\chi^2 = 2.25$, $\Delta df = 2$, *n.s.*), which supports the validity of the adjusted model. In accordance with our hypothesized indirect effects, the adjusted model revealed significant negative predictions from previous-day work pressure to both psychological detachment ($\beta = -.08$, $p < .01$) and relaxation ($\beta = -.13$, $p < .01$) of the present day. As expected, relaxation was again negatively related to daily

Table 1
Means, Standard Deviations, and Correlations Between Study Variables

Variables	*M*	*SD*	1	2	3	4	5
1. Work pressure	2.42	.81	(.89)	.51**	−.05	−.27*	−.16
2. Exhaustion	2.36	.98	.22**	(.89)	−.40**	−.24*	−.38**
3. Work engagement	3.21	.66	.18**	−.27**	(.90)	.07	.07
4. Psychological detachment	2.71	.82	−.17**	−.16**	−.04	(.75)	.39**
5. Relaxation	2.84	1.01	−.24**	−.15**	.04	.34**	(.90)

Note. Correlations above the diagonal are person-level correlations ($n = 77$ respondents), and correlations below the diagonal are day-level correlations ($n = 2{,}310$ measurement occasions).
* $p < .05$. ** $p < .01$.

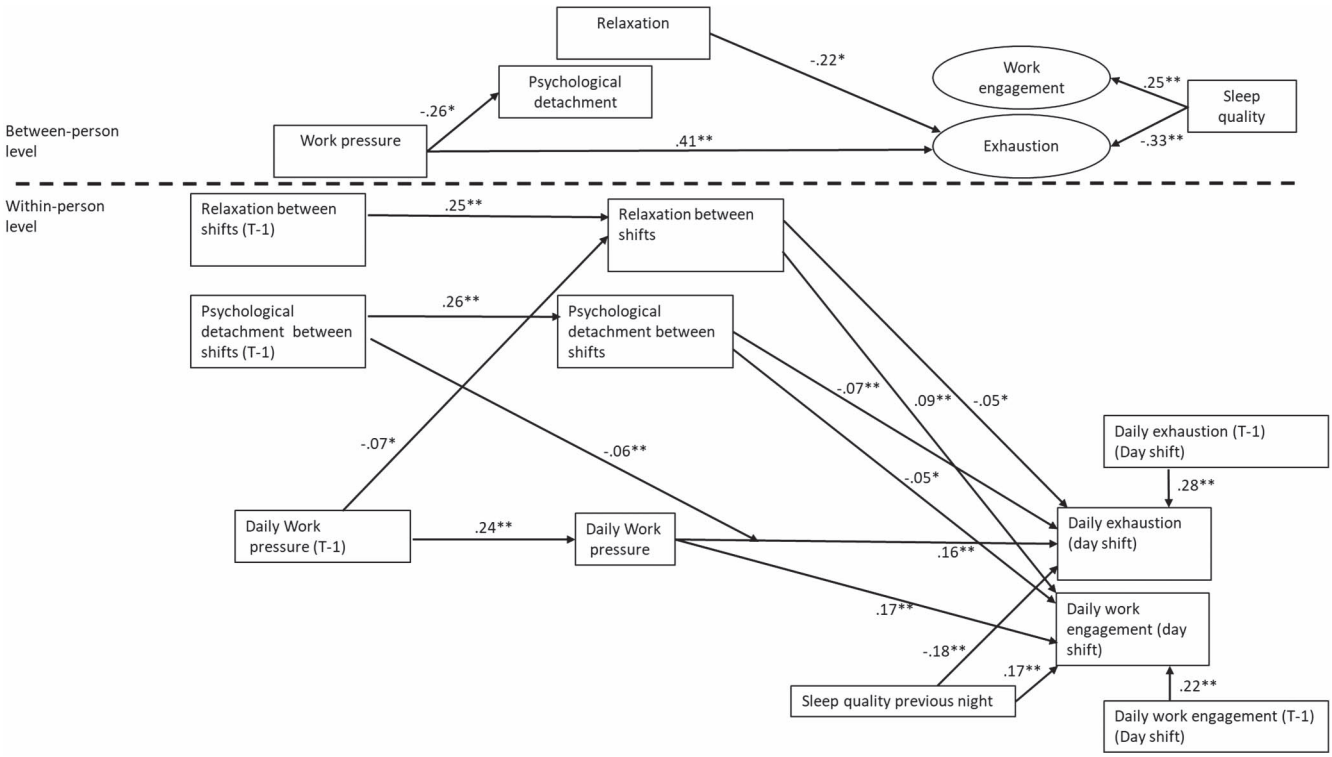
exhaustion ($\beta = -.05$, $p < .05$) and positively related to daily work engagement ($\beta = .09$, $p < .01$). In line with our hypothesized mediational effects, the model also revealed that psychological detachment was negatively related to daily exhaustion ($\beta = -.07$, $p < .01$), but, surprisingly and contrary to our hypothesis, the model also revealed a significant negative relationship between psychological detachment and work engagement ($\beta = -.05$, $p < .05$). At the between level, work pressure was negatively related to psychological detachment ($\beta = -.26$, $p < .05$), while the relationship between work pressure and relaxation was nonsignificant ($\beta = -.17$, *n.s.*). Moreover, the psychological detachment was not significantly related to either of the two outcome variables. In contrast, relaxation significantly explained between-level variance in exhaustion ($\beta = -.22$, $p < .05$) but was unrelated to work engagement ($\beta = -.01$, *n.s.*).

In Hypotheses 4a and 4b, we predict that previous-day psychological detachment and relaxation buffer the positive relationship between daily work pressure and exhaustion, while in Hypotheses 5a and 5b, we postulate that previous-day psychological detachment and relaxation will strengthen the positive relationship between daily work pressure and work engagement. In order to test the complete hypothesized model, we therefore further expanded the adjusted mediational model to also include previous-day psychological detachment and relaxation, modeling both their direct effects and interactional effects with present-day work pressure on both daily outcomes. In addition to these effects, the model is also expanded by including the autoregressive prediction from previous-day psychological detachment and relaxation to present-day detachment and relaxation, representing the day-to-day stability of these constructs. At the between level, the interactional effects between work pressure and two forms of recovery experiences were included. Estimating the complete hypothesized multilevel model revealed an acceptable fit ($\chi^2 = 160.01$, $df = 41$, $p < .001$, CFI = .96, TLI = .90, RMSEA = .035, $SRMR_{within} = .030$, $SRMR_{between} = .088$), which supports the overall validity of the model. Figure 1 presents the standardized between-level and within-level parameter estimates for the final multilevel model.

As can be seen in Figure 1, the significant positive prediction from daily work pressure to daily exhaustion ($\beta = .16$, $p < .01$), and work engagement ($\beta = .17$, $p < .01$) remains significant in the final model, providing support for both Hypotheses 1a and 1b. With regard to our mediational hypotheses, as expected, the final model revealed a significant negative relationship between previous-day work pressure and present-day relaxation between shifts ($\beta = -.07$, $p < .05$). However, the hypothesized negative link between previous-day work pressure and psychological detachment was no longer significant. Moreover, present-day relaxation between shifts was positively related to present-day engagement ($\beta = .09$, $p < .01$), and negatively related to present-day exhaustion ($\beta = -.05$, $p < .05$). In contrast, our analysis revealed a significant negative relationship between psychological detachment and exhaustion on the present day ($\beta = -.07$, $p < .01$), while the expected positive relationship between psychological detachment between shifts and present-day work engagement remained negative ($\beta = -.05$, $p < .05$) in the final model. Testing the specific indirect effects by obtaining Monte Carlo-estimated confidence intervals consistently

Figure 1

Between-Level and Within-Level Parameter Estimates (β Coefficients) for the Final Multilevel Model



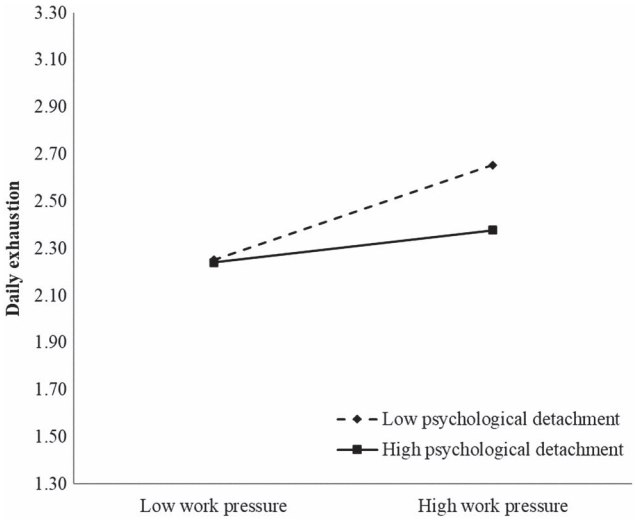
revealed that neither the effect from previous-day work pressure, through psychological detachment, on exhaustion, Estimate; Est = .002, 95% CI [−.001 to .006], nor work engagement, Est = .001, 95% CI [−.001 to .004], were significant in the final model. Hence, Hypotheses 2a and 2b were not supported. However, as predicted, we find a significant positive indirect effect between previous-day work pressure and present-day exhaustion through present-day relaxation, Est = .004, 95% CI [.001–.010], and a significant negative indirect effect between previous-day work pressure and present-day work engagement through reduced daily relaxation, Est = −.006, 95% CI [−.011 to −.002]. Hence, Hypotheses 3a and 3b were both supported in the final model.

Finally, as can been see in Figure 1, we find a significant negative interaction effect between daily work pressure and previous-day psychological detachment in the prediction of exhaustion (B = −.060, $p < .01$), while the other expected interaction effects were not significant in the final model. Hence, the results yielded support for Hypothesis 4a, while Hypotheses 4b, 5a, and 5b were not supported. At the between level, neither the interaction between work pressure and psychological detachment nor the interaction between work pressure and relaxation was significant.

Figure 2 presents the interactional effect of daily work pressure and previous-day psychological detachment on the prediction of daily exhaustion. In accordance with the expected buffering effect of psychological detachment in Hypothesis 4a, the positive relationship between daily work pressure and exhaustion was stronger in the group reporting low psychological detachment between shifts the previous day than in the group reporting high psychological detachment. Accordingly, simple slope tests show that the positive slope for those scoring low on psychological detachment is significant, Slope = 0.256 (0.053), $z = 4.860$, $p < .01$, while the slope for those scoring high on psychological detachment between shifts is not significant, Slope = 0.089 (0.054), $z = 1.666$, *n.s.,* at the conditional values of ±1 standard deviation.

Figure 2

Significant Interaction Effect Between Present Day Work Pressure and Previous Day Psychological Detachment on Daily Exhaustion (Controlled for Previous Day Work Exhaustion and Previous Night Sleep Quality)



Discussion

This study investigated how naval cadets on a military operation at sea succeed in meeting their daily job demands and protecting their well-being. We used the SDM (Sonnentag & Fritz, 2015) to test the role of two recovery strategies, that is psychological detachment and relaxation, in the stressor–strain relationship—from day to day. The results showed that previous-day work pressure was positively related to exhaustion and negatively related to engagement through reduced relaxation, but not through reduced psychological detachment, as suggested by the SDM. Consistent with the model, psychological detachment (but not relaxation) moderated the link between daily work pressure and exhaustion. The positive relationship between work pressure and daily exhaustion was stronger among cadets reporting low psychological detachment between shifts than among those reporting high detachment. However, the recovery experiences did not moderate the link between daily work pressure and work engagement. In the following, we discuss the most important theoretical contributions and practical implications.

Theoretical Contributions

The present within-person study contributes to the recovery literature in several ways. The first contribution is that we tested the propositions of the SDM in an unusual setting, that is naval cadets involved in an actual operation, exposed to certain risks and working shifts, and who could recover under constrained conditions, namely in the work context (on board the ship). The SDM postulates that, on days people experience high work pressure, they are more likely to use off-job time to finish work. On such days, individuals have more reasons to ruminate about work and may need more time to "switch off" and unwind from work-related activities (Sonnentag & Kruel, 2006). The results of the present study did not support the hypothesis that job stressors undermine subsequent psychological detachment and therefore indirectly lead to job strain, as hypothesized in the SDM. This is surprising since between-person studies (Kinnunen et al., 2011; Safstrom & Hartig, 2013; Von Thiele Schwarz, 2011) and a within-person diary study (Germeys & De Gieter, 2017) demonstrate that employees who are exposed to more job stressors are less likely to detach from their work and report higher levels of strain.

The nonsignificant relationship found in the present study between previous-day work pressure and psychological detachment is inconsistent with previous research that has suggested a negative relationship (Sonnentag & Fritz, 2015). It is conceivable that the specific and constrained conditions on board the ship make it difficult to detach from work—independently of the daily workload. For example, the difference between work time and nonwork time is less clear when cadets are constantly physically present in the work context, and the cadets' opportunity to psychologically detach is more dependent on the present-day context on board the ship than on previous-day work pressure. Indeed, a comparison of the mean score on daily psychological detachment found in the present study with findings in previous research carried out in Germany (e.g., Sonnentag et al., 2008) and the Netherlands (Bakker et al., 2015) indicates that the mean score on board the sailing ship is about

one standard deviation lower on average than in the other two studies. Thus, forgetting work and becoming fully immersed in other activities seems to be more difficult when recovery has to take place in the same context as the context in which one works. Another possible explanation is that the use of a prospective change model in the present study, which means that work pressure and detachment are measured at different points in time, is a much stricter test of the mediating mechanism of psychological detachment than is the case in the analytical approach used in Germeys and De Gieter (2017) diary study, where the constructs were modeled simultaneously.

The second central SDM hypothesis, that previous-day psychological detachment would buffer the link between work pressure and exhaustion, was confirmed. Our findings are consistent with previous studies that have demonstrated interactional effects between stressors and psychological detachment in relation to strain in more general work contexts (Korunka et al., 2012; Sianoja et al., 2018; Sonnentag et al., 2010). Despite the fact that the cadets experienced reduced opportunities to detach psychologically, detachment still had an important "buffering" effect on the relationship between work pressure and exhaustion within a day, as predicted by the SDM. Importantly, this finding demonstrates that psychological detachment is an important recovery strategy that helps to alleviate the impact of daily work pressure on individuals' energy resources. Note that we found evidence for the interaction effect despite the fact that psychological detachment showed a relatively low mean value of 2.71 on a 5-point scale, and despite the participants working under constrained conditions.

A second contribution of the present study is that we argued and showed that relaxation may play a role in the stressor–strain relationship that is similar to psychological detachment in the SDM. These findings expand the SDM and suggest that reduced relaxation is one of the mechanisms through which work pressure translates into impaired well-being. Relaxation experiences have the potential to reduce activation and to increase positive affect (Sonnentag & Fritz, 2007), and may be the result of meditation, listening to music, or playing board games. Following a day where work pressure is high, individuals are less able to relax because they experience prolonged activation during off-job time, which prevents them from truly restoring the energizing and cognitive resources needed to be vigorous and enthusiastic about work. Although relaxation plays an important mediating role in the work pressure and strain processes, it did not moderate the daily link between work pressure and the two outcomes as we had expected it to do when expanding the SDM framework. One explanation for this could be that under constrained conditions where the cadets' opportunities to withdraw from social interaction and to engage in individual relaxation activities are limited, the cadets profit more from their ability to detach from the activities of the specific day than from their ability to relax. In such a context, even some degree of relaxation helps everyone since the possibility to relax is constrained. Moreover, in the present study, we investigated how and whether previous-day relaxation moderated the stressor–well-being relationship when controlling for sleep quality the night before the shift. Relaxation and sleep are highly related, since both are states characterized by reduced activation. Thus, the potential stress-reducing effect of relaxation during off-time the previous day may act through the quality of sleep during night time. This possible mediated-moderation mechanism should be further examined in future studies.

A final contribution is that we tested work engagement as an outcome in the SDM (Sonnentag & Fritz, 2015). Our findings clearly showed that work pressure acted as a challenge job demand and was positively related to work engagement. Although neither previous-day psychological detachment nor relaxation facilitated this positive relationship between work pressure and work engagement, we find support for the hypothesized inconsistent mediation. Specifically, following days on which the naval cadets have to work at high speed and only have limited time in which to do their work well, they are less likely to relax between shifts and are consequently less engaged in their work. This within-person effect means that, on days when individuals can relax and lower their own arousal during off-job time, they can restore the energizing and cognitive resources they need to carry out their work tasks in an enthusiastic and engaged way. In addition, these findings expand the original SDM and previous research by showing that relaxation is an important mediator in the job stressor–strain relationship.

Strengths, Limitations, and Avenues for Future Research

A clear strength of the present study is its use of a reasonably large sample and the collection of data over a period as long as 30 days. Because modeling prospective changes using diary data requires high statistical power (Larson & Almeida, 1999), the present study provided a unique opportunity to test the SDM. Another strength is that, unlike most other field studies, the participants were located in and exposed to more or less the same conditions throughout the measurement period (i.e., on board a sailing ship). Hence, it is likely that the extent to which the cadets were exposed to various possible confounding variables, such as weather and opportunities to exercise, was the same for the whole group. During the voyage, the cadets did not have access to their personal mobile phones and were not allowed to play computer games. In addition, contact with family members was limited to one phone call. This rules out potential confounding variables that are often present when studying recovery processes in other work settings. It should be noted that these restrictions might also reduce the extent to which our findings can be generalized to more mundane workplaces, where such potential barriers to the recovery process may exist.

Although the findings were generally consistent with our theory-based predictions, one possible limitation is that the majority of the sample was male and quite young and that the work tasks were rather unique (e.g., climbing masts, dealing with fluctuating weather conditions, engaging in military operations). Thus, we do not know whether the findings are generalizable across genders, older employees, and other occupational groups. However, various occupational groups, including the navy, offshore drilling contractors, and container transport companies, carry out ocean crossings or large-scale operations at sea. Our findings are important to these occupational groups, and future research should test whether the findings can be generalized to more mundane jobs. Occupational settings in which individuals do not work shifts and have clear off-job time may even be better suited to showing the value of psychological detachment and relaxation as recovery strategies.

Another possible limitation of this study is that we used self-reported work pressure and strain, which may be subject to impression management motives or cognitive biases. The problem with self-report measures is that the same person provides all the information and that statistical relationships between constructs

may be inflated as a result of common source bias (Podsakoff et al., 2012). However, previous research has shown that self-ratings of work pressure are positively related to observer ratings of work pressure (Demerouti et al., 2001) and that objective workload measures in a hospital context (e.g., hospital service census, patient length of stay, daily admissions) are related to patient outcomes (e.g., intensive care unit transfers and patient deaths). However, new research may include impression management motives or use work pressure interventions in order to rule out alternative explanations.

Third, as in all field studies, we were unable to carry out a strict test of cause and effect while simultaneously having control of all potential third variables. However, we formally tested the hypothesized causal order of the mediational part of the SDM by applying a prospective change model, which is regarded as the most powerful test of causality when using diary data (Larson & Almeida, 1999). Moreover, we used the SDM to argue that work pressure influences employee strain and impaired well-being and that recovery experiences qualify this effect. Nevertheless, exhaustion may also lead to more work pressure, for example when tired individuals start to make mistakes that add to already high job demands. Future research could test causal and reversed causal effects by evaluating recovery interventions, and by following the participants during the weeks in which they implement the recovery strategies they have learned in intervention training (Hahn et al., 2011).

Finally, the reliability coefficient of the daily psychological detachment measure was relatively low on one of the days. This may be due to the fact that the experiences to be assessed may not be equally prevalent on each of the days—undermining the validity of the measure. This is a known problem in diary research, which is partly alleviated by the repeated measurements in the present study (30 days). Nevertheless, we urge methodologically interested scholars to investigate the impact of unreliability in daily measures.

Practical Implications

The practical implication of our findings is that leaders or supervisors should offer their employees sufficient opportunities to engage in recovery activities during off-job time. Whereas recovery activities usually take place in the home domain—a domain organizations should not try to influence—in some occupational contexts, recovery activities take place in the work context (e.g., on board a ship, on oil drilling platforms). In these situations, organizations may want to create conditions where employees are able to unwind and relax (e.g., quiet rooms), provide tablets, Wi-Fi, and headphones so that individuals can listen to music and watch movies, or offer a gym and swimming pool to relax and detach in.

Moreover, HR departments or consultancy firms may want to use the present insights to develop training programs in which employees learn how to use relaxation and psychological detachment as recovery strategies. In such training programs, employees could develop a personalized recovery plan in which they formulate specific and daily recovery activities (see, e.g., Hahn et al., 2011). The current findings indicate that psychological detachment activities, in particular, may be able to buffer the impact of work pressure on exhaustion. Since psychological detachment strategies in operational settings may be rather different from psychological detachment strategies in most other work contexts, it seems important to tailor the intervention to the population in which the intervention takes place.

Conclusion

The present study has shown that work pressure in an operational setting undermines relaxation and indirectly impairs employee well-being. In addition, we found that psychological detachment is a particularly important buffer of the impact of work pressure on exhaustion. Thus, our study suggests that organizations should invest in interventions that improve opportunities for psychological detachment and relaxation. Such interventions seem to be particularly important when individuals are confronted with peaks in their workload because psychological detachment and relaxation experiences replenish used-up psychological resources and seem to provide new resources that can be used to remain engaged during challenging assignments.

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