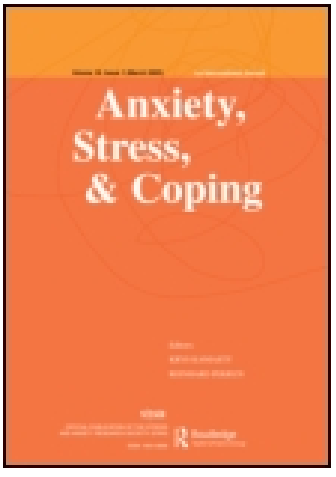

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Association between vigor and exhaustion during the workweek: a person-centered approach to daily assessments

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Association between vigor and exhaustion during the workweek: a person-centered approach to daily assessments

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The purpose of this quantitative diary study was to investigate daily vigor and exhaustion using a person-centered approach. The study also investigated whether and how experiences of vigor and exhaustion relate to a state of being recovered. A total of 256 Finnish employees filled in a diary questionnaire during five consecutive workdays. Vigor and exhaustion showed strong negative interdependence within and between days. However, by applying a person-centered analysis, we were able to differentiate three groups with meaningful variation in vigor and exhaustion. The groups were labeled as *Constantly vigorous* (n = 179), *Concurrently vigorous and exhausted* (n = 30) and *Constantly exhausted* (n = 43). The vigor-exhaustion groups were also characterized by their recovery experiences: The *Constantly vigorous* employees recovered well from work strain during the workweek whereas the *Constantly exhausted* group recovered poorly. Overall, while the results indicate that, typically, vigor and exhaustion are exclusive experiences, it is also possible for them to be experienced simultaneously from day to day at the moderate levels. Thus, positive and negative experiences may co-occur.

Keywords: vigor; exhaustion; recovery; diary study; person-centered approach

Thus far, no clear consensus exists on the relationship between positive and negative states of occupational well-being (see Bakker, Albrecht, & Leiter, 2011; Maslach, 2011; Schaufeli & Salanova, 2011). The current view posits that positive and negative occupational well-being states represent different phenomena that are usually conceptualized as polar opposites, but that could also be experienced simultaneously (Demerouti, Mostert, & Bakker, 2010; Folkman, 2008; Schaufeli, Salanova, González-Romá, & Bakker, 2002). Of the prevailing occupational well-being constructs, we focus in the present study on work-related vigor and exhaustion, which are regarded as key dimensions of work engagement and job burnout (see Maslach, Jackson, & Leiter, 1996; Shirom, 2010). Recent research has shown that, as enduring states, exhaustion and vigor are only weakly or moderately related; thus, they represent independent constructs that nevertheless could manifest themselves simultaneously (Demerouti et al., 2010; González-Romá, Schaufeli, Bakker, & Lloret, 2006; Mäkikangas, Feldt, Kinnunen, & Tolvanen, 2012). The research target of the present quantitative diary study is to clarify the association between

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exhaustion and vigor using a day-to-day and person-centered approach. We also investigate whether and how experiences of vigor and exhaustion relate to a state of being recovered, as adequate recovery on a daily basis is crucial for the maintenance of well-being and job performance (Demerouti & Cropanzano, 2010; Sonnentag, 2003).

Our study contributes to the existing research on burnout and work engagement in the following three ways. First, the association between exhaustion and vigor during one workweek is investigated utilizing a within-person approach, also known as a person-centered approach (Bergman, Magnusson, & El-Khouri, 2003; Laursen & Hoff, 2006; Magnusson, 1999). Thus far, how these two well-being indicators combine within individuals during a workday has not been determined: Does high vigor always go hand in hand with low exhaustion? Or can high vigor co-occur with high exhaustion? Thus, our aim was to identify latent groups based on different combinations of vigor and exhaustion and on daily variation in the intensity of the two states. The novel target of the present study was to offer a more complete picture of occupational well-being as, to the best of our knowledge, no previous studies have investigated the co-occurrence of daily vigor and exhaustion by applying a person-centered approach.

Second, the present study concentrates on the state level of exhaustion and vigor, and thus possible day-to-day fluctuations are investigated. Previous burnout and work engagement studies have mainly focused on investigating the enduring level (i.e. trait level) of these constructs, and consequently the state perspective, and possible day-to-day fluctuations, have largely been ignored. The existing diary studies have shown that a significant amount of the overall variance in burnout and work engagement (approximately 30-40%) can be attributed to day-level variation (see Sanz-Vergel, Demerouti, Moreno-Jiménez, & Mayo, 2010; Sonnentag, 2011; Xanthopoulou & Bakker, 2013), which indicates that in order to fully understand the experience of occupational well-being, it is essential to estimate its day-to-day fluctuation. This study investigates possible day-to-day fluctuation at the between-person level using a multilevel approach and at the intraindividual level using a person-oriented approach thereby enabling possible variation in vigor and exhaustion scores to be captured both at the whole data level and within individuals.

Third, recent research has shown that recovery experiences are important for work-related well-being (Kinnunen, Feldt, Siltaloppi, & Sonnentag, 2011; Sonnentag, Dormann, & Demerouti, 2010; Sonnentag, Mojza, Demerouti, & Bakker, 2012). Like occupational well-being, recovery also has been observed to vary from day to day (Demerouti, Bakker, Geurts, & Taris, 2009; Sonnentag, 2003). One novel aspect of this study, therefore, is to explain how experiences of recovery, operationalized as individuals' perceptions of the degree to which their off-job time activities help them to replenish their energy resources (Sonnentag & Fritz, 2007), associate with the intraindividual manifestations of vigor and exhaustion. This study investigates the role of recovery with simultaneously estimated vigor-exhaustion profiles for the first time, and thus offers more profound knowledge on their associations. In addition, the cross-lagged associations between well-being and recovery are investigated.

Exhaustion and vigor: definitions and mutual relation

Various conceptual and operational definitions have been proposed for both burnout and engagement. In this study, burnout is defined following Maslach and her colleagues

(Maslach et al., 1996). Accordingly, *burnout* represents a persistent, work-related state of ill-being characterized by the dimensions of exhaustion, cynicism and reduced professional efficacy. Exhaustion, which we focused on here, refers to the draining of emotional energy and feelings of chronic fatigue (Maslach et al., 1996; see also Mäkikangas, Hätinen, Kinnunen, & Pekkonen, 2011). *Work engagement* in turn, according to Schaufeli and his colleagues (Schaufeli et al., 2002), is a positive, fulfilling and consistent state of mind characterized by vigor, dedication and absorption. The focus of the present study is vigor, defined as an affective state characterized by feelings of high physical strength, emotional energy and cognitive liveliness (Shirom, 2004, 2011). Vigor also manifests as motivation to invest effort in work and the ability to withstand difficulties and persist despite obstacles (Schaufeli et al., 2002). We focused on vigor and exhaustion because these concepts characterize the energetic aspects of occupational well-being and are thus very likely fluctuate from day to day.

The relationship between vigor and exhaustion can be depicted from two theoretical perspectives, namely the bipolar (Maslach & Leiter, 1997) and bivariate (Schaufeli et al., 2002; Shirom, 2011; Shirom, Toker, Melamed, Berliner, & Shapira, 2013) perspective. According to the *bipolar view*, vigor items and emotional exhaustion items measure a single underlying bipolar dimension, and, consequently, they are scalable on a single underlying bipolar dimension labeled "energy" (Demerouti et al., 2010; González-Romá et al., 2006). In practice, the bipolar view suggests that vigor and exhaustion cannot be experienced simultaneously. The *bivariate approach*, however, suggests that vigor and exhaustion do not represent two poles of the same dimension but are obliquely related (Shirom, 2011; Shirom et al., 2013). Thus, on this view, vigor and exhaustion may co-occur, as they are two distinct and separable experiences (Shirom et al., 2013). This bivariate relation between vigor and exhaustion is also depicted in the circumplex model (Russell, 1980), which has been applied in the work context (Bakker & Oerlemans, 2011). In this theoretical framework, which distinguishes between positive and negative types of work-related well-being, vigor is positioned in the right-upper quadrant of the model as an active, positive state, whereas exhaustion is positioned in the left-lower quadrant as a passive, negative state.

Previous research has usually investigated the strength of the correlation between vigor and exhaustion scores, thus subscribing to the variable-oriented approach. Typically, a moderate negative correlation between vigor and exhaustion has been found. A meta-analysis based on more than 30 studies showed that the estimated population correlation was −0.37 (Halbesleben, 2010). Similar results were also reported in another meta-analysis (based on 37 studies; Cole, Walter, Bedeian, & O'Boyle, 2012), where a correlation of −0.43 was found. However, these correlations do not reveal the nature of the relation between vigor and exhaustion within individuals.

A recent person-oriented study provided evidence for the possibility to experience vigor and exhaustion concurrently at the within-person level (Mäkikangas et al., 2012), thus supporting the bivariate view. The results showed that, typically, vigor and exhaustion were mutually exclusive states (i.e. manifesting as a high-low combination at the individual level); however, based on the mean levels of vigor and exhaustion over the two-year follow-up, altogether 17 different intraindividual constellations were identified. In addition to the vigor-exhaustion link, the bivariate approach of negative and positive affective states has been supported in emotion research (Larsen & McGraw, 2011) and also in mental health research (Keyes, 2005).

In light of the bivariate view and the previous research evidence, it seems that coexistence of the energy dimension constructs is likely. Hence, the novel target of the present study is to extend existing knowledge on the relation between exhaustion and vigor by investigating their association and possible coexistence at the state (i.e. day) level. Although recent work engagement research has strongly focused on state-level experiences in various diary studies (see Bakker et al., 2011; Sonnentag, Binnewies, & Mojza, 2010; Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2009; Xanthopoulou, Bakker, Heuven, Demerouti, & Schaufeli, 2008), the relationship between exhaustion and vigor has not been investigated, as here, from a day-level person-centered perspective.

Recovery and its relation with exhaustion and vigor

Recovery from work has found to be essential for occupational well-being (Sonnentag, 2003). Successful recovery from work helps to prepare for new challenges at work, prevents detrimental accumulation of fatigue (Zijlstra & Sonnentag, 2006) and enhances overall psychological well-being (Sonnentag & Fritz, 2007). According to Meijman and Mulder (2001), recovery is a process during which the individual's functioning returns to its pre-stressor level. Recovery can be also seen from the perspective of supplementing energy resources, that is to recover from job stress, a person has to restore threatened or lost resources or gain new resources (Zijlstra & Sonnentag, 2006; see also Hobfoll, 1998). On this process-oriented definition, recovery is a very good construct for use in diary designs, which aim to unravel within- and between-day fluctuations. In the present study, recovery refers to positive mental and physical recreational experiences (Binnewies, Sonnentag, & Mojza, 2009). Our study aims at examining how the state of being recovered, measured before the workday, associates with exhaustion and vigor during the workday. Because recovery occurs mainly after the workday, in the evening and during sleep (Zijlstra & Sonnentag, 2006), we assessed recovery after sleep.

The relationship between the recovery and energy continua constructs, that is exhaustion and vigor, has inspired recent research. In particular, psychological detachment, defined as mental disengagement from work during off-job time (Sonnentag & Fritz, 2007), has been positively linked with low levels of exhaustion (Sonnentag, Binnewies, & Mojza, 2010; Sonnentag & Fritz, 2007; Sonnentag, Kuttler, & Fritz, 2010). In addition, successful recovery seems to associate positively with work engagement (Sonnentag, 2003; Sonnentag et al., 2012). It has also been shown that recovery during work (i.e. during breaks) promotes daily vigor (Sanz-Vergel et al., 2010). Also, the accumulation of recovery experiences over a period of several days has predicted subsequent vigor at work (Sonnentag & Niessen, 2008). A balance between work engagement and disengagement from work during non-work time has been found to be essential for positive affect and well-being (Sonnentag, Mojza, Binnewies, & Scholl, 2008). To summarize, recovery experiences seem to be essential for low levels of exhaustion and high levels of vigor. The novel aspect of the present study is the investigation of recovery with vigor and exhaustion estimated simultaneously on the within-person level. In addition, the causal relationships between recovery and well-being are tested; this is important, as it informs us about possible reciprocal relations between experiences built up at work and experiences built up at home.

The present study

The present diary study of five consecutive workdays conducted among Finnish health and social care and service sector employees (n = 256) had two major aims. *First*, we sought to identify classes of exhaustion and vigor during a single workweek. Thus, using a person-centered method of analysis, we searched for classes of employees among whom the level and changes in exhaustion and vigor – and the relation between these constructs – were as alike as possible during the working week. Based on the bivariate approach (Shirom, 2011; Shirom et al., 2013) and recent person-centered research findings (Mäkikangas et al., 2012), we hypothesized (H1) that exhaustion and vigor are relatively separate experiences at the individual level, and thus can co-occur within a person, producing different exhaustion-vigor patterns. In addition, as employees typically tend to report positive rather than negative occupational well-being states (Mäkikangas et al., 2012; Mäkikangas, Hyvönen, Leskinen, Kinnunen, & Feldt, 2011), we also predicted (H2) that the majority of the employees would report more vigor than exhaustion.

In addition, we were interested in whether different exhaustion-vigor groups also differ in recovery experiences. As shown by previous studies, recovery experiences associate with low levels of exhaustion and high levels of vigor (Sonnentag, 2003; Sonnentag, Binnewies, & Mojza, 2010; Sonnentag et al., 2012; Sonnentag & Fritz, 2007; Sonnentag, Kuttler, & Fritz, 2010; Sonnentag & Niessen, 2008). Recovery has been found to predict occupational well-being but not vice versa (Sonnentag, Binnewies, & Mojza, 2010; Sonnentag & Niessen, 2008), and recovery experiences tend also to vary from day to day (Sonnentag, 2003; Sonnentag, Dormann, & Demerouti, 2010). Consequently, we hypothesized (H3) that feelings of successful recovery before the working day would be more prominent among employees with high levels of vigor and low levels of exhaustion. In addition, we predicted that successful recovery before the workday would predict vigor and exhaustion during that workday (H4).

Method

Procedure and participants

The present diary study (n = 256) was conducted in Finland during April and May 2010 among members of two Finnish labor unions, the Union of Health and Social Care Professionals and Service Union United. This study was an extension of a larger research project titled "Work-family coping strategies and their role in the work-family interface and occupational well-being," funded by the Finnish Work Environment Fund. The participants of this larger research project (n = 2756) were asked in fall 2009 to indicate their possible interest in participating in a seven-day diary study during Spring 2010. Of this group, 815 responded positively. In March 2010, an email inviting their participation in the diary study was sent to these participants with a link to an electronic background questionnaire.

Of the initially interested 815 participants, 380 (45%) answered the background questionnaire, and paper and pencil diaries with instructions and return envelopes were sent to these participants in May 2010. This study is based on the 256 participants (67% of those answering the background questionnaire) who returned a completed diary for the weekdays Monday to Friday. The diary was instructed to be kept three times per day, that is, before going to work, immediately after the workday and before going to bed.

Of the 256 participants, 69% were members of the Union of Health and Social Care Professionals, representing health and social care workers, and 31% from the United Service Union, representing service workers. The study sample was female-dominated (90%), mean sample age was 42.91 (standard deviation [*SD*] = 10.8, range 21–63) and the majority (65%) had a higher vocational or polytechnic diploma. The participants worked on average 39.12 hours per week (*SD* = 11.2) with 54% working a regular day shift. Of the respondents, 83% had a partner relationship, of whom 75% were married or cohabiting and 89% of whose partners were also working. Of the participants, 75% had children, although 24% had children who no longer lived with the participant. The average number of children living at home was 1.49 (*SD* = 1.3).

It should be noted that, in Finland, the majority of employees (67.4%) belong to a labor union organized on the basis of their industry of employment (Ahtiainen, 2011), and thus labor union members are generally well representative of their occupational group. The level of unionization is even higher among health and social care workers (90%, Markkanen, 2009). Accordingly, the present participants were representative of Finnish health and social care and service workers in such background factors as gender and age (see Markkanen, 2009).

Measures

Vigor at work was assessed both at the trait and at the day level with three items from the Utrecht Work Engagement Scale (Schaufeli, Bakker, & Salanova, 2006; Schaufeli et al., 2002; see also Breevaart, Bakker, Demerouti, & Hetland, 2012) with the wording changed to correspond with this distinction (e.g. "At my job, I feel bursting with energy" [trait level], "Today at my job, I felt bursting with energy" [day level]). The seven-point response scale was the same for both the trait and the day level and ranged from 1 (totally disagree) to 7 (totally agree). Cronbach's alpha for trait-level vigor was 0.85 and for the day level, it ranged between 0.82 and 0.89. The multilevel alphas for vigor were 0.70 at the within-person level and 0.92 at the between-person level (see Geldhof, Preacher, & Zyphur, 2013).

Exhaustion was assessed both at the trait and at the day level with three items from the Maslach Burnout Inventory – General Survey (Maslach et al., 1996; see also Kalimo, Hakanen, & Toppinen-Tanner, 2006) with wording changed to correspond with this distinction (e.g. "I feel mentally exhausted because of my work" [trait level], "Today I felt mentally exhausted because of my work" [day level]). The seven-point response scale was the same for both the trait and the day level and ranged from 1 (totally disagree) to 7 (totally agree). Cronbach's alpha for trait-level job exhaustion was 0.84 and for the day level, it ranged between 0.76 and 0.82. The multilevel alphas were 0.64 (within-person level) and 0.90 (between-person level).

Recovery was assessed only at the day level before work with a four-item scale developed by Binnewies, Sonnentag, and Mojza (2009) (e.g. "I feel well rested"; see also Sonnentag & Kruel, 2006). The seven-point response scale ranged from 1 (totally disagree) to 7 (totally agree). Cronbach's alphas ranged between 0.95 and 0.96. The multilevel alphas for recovery were 0.94 (within-person level) and 0.98 (between-person level).

Background factors. Gender (1 = male, 2 = female), age, children living at home, age of the youngest child living at home and weekly working hours were included in the analyses based on previous research results showing that these factors are relevant

correlates of vigor, exhaustion and recovery (e.g. Hakanen, 2009; Sanz-Vergel et al., 2010; Schaufeli & Enzmann, 1998; Sonnentag, 2003; Sonnentag, Binnewies, & Mojza, 2010; Sonnentag & Niessen, 2008).

Missing data

Inspection of the data showed that there were no missing data in the trait-level variables of vigor and exhaustion (i.e. in the background questionnaire). In day-level recovery, the proportion of missing data in the four items across five days was on average 4.23% (range 1.6–6.7%). For vigor and exhaustion, the respective proportions were 19.77% (range 16.3–22.2%) and 19.43 (range 16.3–21.4%). The higher rates of missing data for vigor and exhaustion are due to the fact that, among the participants in both unions several worked shifts and/or part-time. Thus, these participants were not at work every day from Monday to Friday and for this reason did not answer the questions on vigor and exhaustion every day.

Statistical analysis

The data analysis proceeded in four stages. In the *first* stage, the relationship between vigor and exhaustion was analyzed using Multilevel Confirmatory Factor Analysis (MCFA; Muthén & Muthén, 1998–2010). The correlated two-factor model for vigor and exhaustion was estimated using a two-level model in which the repeated measures were on the within-person level and individuals on the between-person level. In the model, the observed items for exhaustion and vigor loaded on their own latent factors. When evaluating the fit of the model to the data, the following results were assumed to indicate acceptable model fit: Non-significant χ^2-test value; comparative fit index (CFI) and Tucker–Lewis index (TLI) greater than 0.95; and root mean square error of approximation (RMSEA) lower than 0.06 (Muthén & Muthén, 1998–2010).

In the *second* stage, Growth Mixture Modeling (GMM) performed with the Mplus statistical package (version 7; Muthén & Muthén, 1998–2010) was used in five repeated measurements to identify classes of exhaustion and vigor during one workweek. The modeling was based on the idea that the observed data can represent latent classes, and that these classes can be identified and their parameters estimated (Muthén, 2001, 2006). More specifically, GMM treats longitudinal data by nesting the time observations within individuals and identifies unobserved classes by nesting the individuals within latent classes (Wang & Bodner, 2007). The parameters of the models were estimated using the maximum likelihood estimation with robust standard errors (MLR estimator; Muthén & Muthén, 1998–2010). The missing data method (i.e. the standard missing at random approach) was used, which allowed us to use all observations in the dataset to estimate the parameters in the models without imputing data.

The GMM analyses were carried out simultaneously for exhaustion and vigor in order to investigate their individual classes during the workweek. The analyses were based on growth curve models that consisted of a latent intercept component and a latent slope component (see Duncan, Duncan, Strycker, Li, & Alpert, 1999). These components were based on the same continuous observed composite variables measured in both study phases. Since the intercept is a constant for any given individual across time, the factor loadings of the observed composite variables were set to 1 at each of the five measurements

(see Duncan et al., 1999). The slope component describes individual differences in the constant rate of mean-level change across measurement points. The loadings for the slope components were set to be 0 on the first measurement day (Monday) and 1 on the last measurement day (Friday), all the other loadings being allowed to estimate freely. The analyses of the latent classes were based on differences in the means of the intercept and slope components of exhaustion and vigor. In the GMM analyses, the covariance structure and residual variances were set to be equal between the latent classes. Residual variances were fixed to be equal across weekdays.

Various criteria were used in determining the number of latent classes deemed adequate (Muthén, 2003; Nylund, Asparouhov, & Muthén, 2007): (i) the Akaike Information Criterion (AIC); (ii) the Bayesian Information Criterion (BIC); (iii) the Vuong-Lo-Mendel-Rubin (VLMR); (iv) the Lo-Mendell-Rubin (LMR); (v) the Bootstrap Likelihood Ratio Test (BLRT) and (vi) classification quality as determined by entropy (entropy values range from 0 to 1, where values close to 1 indicate a clear classification; Celeux & Soromenho, 1996). The class solution with the smallest AIC and BIC value was considered to be the best. The VLMR, LMR, and BLRT tests compare solutions with different numbers of latent classes. In all of these tests, a low p value ($p < .05$) indicates that the k model has to be rejected in favor of a model with at least $k + 1$ classes.

In the *third* stage, the General Linear Model (GLM) for repeated measures was used to test whether the exhaustion-vigor classes would differ in recovery. In the analysis, the exhaustion-vigor class solution was treated as a fixed factor and gender, age, children living at home and weekly working hours as covariates. The GLM analysis was calculated using IBM SPSS Statistics 19.

At the *fourth* and final stage, multilevel analyses using the prospective change model (Larson & Almeida, 1999) were performed to test the prospective impact of recovery after waking up on vigor and exhaustion later in the workday, and the day-to-day prospective impact of vigor and exhaustion on recovery the next day. The multilevel analysis of diary content specifies a statistical model with two levels: a within-person level (between days) and a between-person level (between persons) (Bolger, Davis, & Rafaeli, 2003). In order to build the model, values of successive days were arranged as separate variables. These analyses were performed by using Mplus (version 7; Muthén & Muthén, 1998–2010) and full information maximum likelihood with robust standard error and scale-corrected chi-square test value (MLR estimator; Muthén & Muthén, 1998–2010). Additionally, the intraclass correlations (ICC) were calculated for vigor, exhaustion and recovery to determine what proportions of the variance in the variables is due to the differences between individuals (between-person variation) and what is due to the differences experienced by each individual on different days (within-person variation). ICCs were calculated using a multilevel analysis in Mplus (version 7; Muthén & Muthén, 1998–2010).

Results

Descriptive statistics

Table 1 shows the means, standard deviations, Cronbach's alpha coefficients and inter-correlations for the study variables. Overall, the participants reported low levels of exhaustion (M = 2.57-2.68, SD = 1.40-1.55) and high levels of vigor (M = 4.64-4.84, SD = 1.31-1.45) during the workweek. Exhaustion and vigor correlated negatively with each other at both the trait level ($r = -0.60$) and day level ($r = -0.31$ to -0.61). The ICC

Table 1. Means, standard deviations, reliabilities (Cronbach's alphas in diagonal) and correlations.

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Gender[a]	1.10	0.30																						
2. Age	43.09	10.70	−0.11																					
3. Children living at home	1.50	1.26	0.10	−0.42																				
4. Age of child[b]	11.95	6.53	−0.14	0.74	−0.46																			
5. Working hours/week	38.40	8.64	0.13	0.03	−0.06	0.12																		
6. VI[c]	4.81	0.89	−0.15	0.23	0.01	−0.06	0.07	0.85																
7. EX[c]	3.33	1.13	0.05	−0.05	0.01	0.10	−0.04	−0.60	0.84															
8. VI mo	4.64	1.38	−0.09	0.15	0.16	0.10	0.15	0.62	−0.50	0.82														
9. VI tu	4.84	1.35	−0.19	0.23	−0.18	0.17	0.06	0.60	−0.50	0.64	0.85													
10. VI we	4.70	1.45	−0.11	0.30	−0.07	0.18	0.04	0.62	−0.45	0.70	0.72	0.88												
11. VI thu	4.84	1.31	−0.19	0.17	0.11	0.08	0.00	0.60	−0.44	0.64	0.64	0.66	0.82											
12. VI fri	4.79	1.37	−0.10	0.16	−0.03	0.03	0.00	0.57	−0.46	0.60	0.59	0.63	0.68	0.89										
13. EX mo	2.66	1.43	0.16	−0.05	0.02	−0.05	0.06	−0.45	0.63	−0.59	−0.46	−0.48	−0.42	−0.36	0.79									
14. EX tu	2.62	1.40	0.16	−0.11	0.12	−0.13	0.01	−0.44	0.52	−0.45	−0.60	−0.52	−0.47	−0.33	0.60	0.79								
15. EX we	2.65	1.55	0.09	−0.10	0.03	−0.18	0.04	−0.29	0.44	−0.48	−0.49	−0.61	−0.48	−0.37	0.62	0.64	0.82							
16. EX thu	2.68	1.48	0.26	−0.03	−0.04	−0.08	0.13	−0.34	0.48	−0.41	−0.37	−0.33	−0.55	−0.37	0.59	0.55	0.58	0.76						
17. EX fri	2.57	1.42	0.14	−0.06	0.10	−0.09	0.11	−0.37	0.53	−0.33	−0.33	−0.31	−0.39	−0.55	0.53	0.49	0.50	0.58	0.79					
18. RE mo	4.27	1.66	−0.07	0.15	0.04	0.07	0.09	0.50	−0.38	0.71	0.51	0.53	0.37	0.39	−0.45	−0.37	−0.36	−0.28	−0.19	0.95				
19. RE tu	4.34	1.61	−0.19	0.17	−0.09	0.05	0.01	0.36	−0.33	0.39	0.53	0.43	0.34	0.39	−0.36	−0.28	−0.21	−0.16	−0.22	0.47	0.95			
20. RE we	4.43	1.61	−0.09	0.21	−0.15	0.09	0.05	0.45	−0.29	0.42	0.49	0.62	0.41	0.38	−0.30	−0.30	−0.33	−0.18	−0.18	0.43	0.44	0.96		
21. RE thu	4.46	1.68	−0.06	0.21	−0.15	0.08	−0.01	0.35	−0.18	0.35	0.42	0.47	0.44	0.40	−0.24	−0.25	−0.32	−0.25	−0.19	0.35	0.31	0.48	0.96	
22. RE fri	4.30	1.76	−0.14	0.22	−0.05	0.08	−0.08	0.37	−0.33	0.37	0.36	0.48	0.44	0.64	−0.27	−0.21	−0.31	−0.25	−0.40	0.30	0.39	0.41	0.49	0.96

Note: VI = vigor, EX = exhaustion, RE = recovery experiences.
[a]1 = women, 2 = men, [b]age of the youngest child living at home, [c]background questionnaire.
$r \geq |0.13|$: $p < .05$; $r \geq |0.17|$: $p < .01$; $r \geq |0.21|$: $p < .001$.

were, for vigor 0.40; for exhaustion 0.46 and for recovery 0.61. Hence, 39-60% of the variance was caused by the variation between the days. All ICC were statistically significant at the $p < .001$ level.

Construct validity testing for exhaustion and vigor

The MCFA results showed a good fit for the correlating two-factor model of exhaustion and vigor, $\chi^2(20) = 422.60$, $p < .001$, RMSEA = 0.05, CFI = 0.97, TLI = 0.96. No estimation of cross-loadings or error covariances between items from different scales was needed. The standardized factor loadings varied from 0.47 to 0.79 at the within level and from 0.67 to 0.99 at the between level. The vigor and exhaustion factors correlated −0.63 at the within level and −0.71 at the between level. These results indicate that although the association between exhaustion and vigor was relatively high, the two constructs represent two relatively independent occupational well-being indicators.

Exhaustion-vigor classes

Table 2 reports the tested latent class solutions for exhaustion and vigor included simultaneously in the GMM analysis. The results revealed that a three-class solution fitted the data best in comparison to the other group-solutions when the fit indices, estimation procedure and content of the classes were considered as a whole. First and most importantly, the three-class solution had the lowest BIC value (Nylund et al., 2007). The three-class solution was also replicated, indicating that the solution was global instead of local (see e.g. Jung & Wickrama, 2008). Furthermore, the average latent class probabilities for the three-class solution reflected rather high classification accuracy. The best likelihood value of the two-class solution, suggested by the VLMR and LMR tests, was not, however, replicated as many times as in the three-class solution. The comparison of the two-class solution with the three-class solution revealed that the three-class solution comprised an additional and interesting class, in the practical sense, of participants who reported more exhaustion than vigor.

Table 3 shows the results for the three-class solution in more detail. The largest, and thus the most typical, exhaustion-vigor class contained 71% of the respondents ($n = 179$). The profile of these respondents showed relatively high levels of vigor and low levels of exhaustion that both remained stable over the workweek (see Figure 1). Hence, this class was labeled "*Constantly vigorous*." The estimated mean correlation between the daily

Table 2. Fit indices for GMMs of exhaustion-vigor relation with different numbers of latent classes ($n = 252$, five consecutive workdays).

No. of classes	AIC	BIC	No. of free parameters	VLMR p value	LMR p value	BLRT p value	Entropy	Latent class proportions (%)
1	6251.29	6328.94	22	–	–	–	–	100
2	6192.44	6308.91	33	.000	.000	.000	0.88	90/10
3	6148.25	6303.54	44	.121	.125	.000	0.80	12/17/71
4	6109.12	6303.88	55	.240	.251	.000	0.70	64/13/12/11

Note: AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; VLMR = Vuong-Lo-Mendell-Rubin test; LMR = Lo-Mendell-Rubin test; BLRT = Bootstrap-Likelihood-Ratio Test.

Table 3. Estimated mean profiles for the latent growth curve models of different exhaustion-vigor classes (n = 252, five consecutive workdays).

Growth mixture models	Class 1. Constantly vigorous (n = 179)			Class 2. Concurrently vigorous and exhausted (n = 30)			Class 3. Constantly exhausted (n = 43)		
	Estimate	SE	p value	Estimate	SE	p value	Estimate	SE	p value
Vigor									
Intercept	4.83	0.45	.000	4.25	0.41	.000	3.36	0.29	.000
Slope	0.18	0.14	.187	0.06	0.27	.819	−0.04	0.26	.872
Exhaustion									
Intercept	2.49	0.26	.000	3.62	0.71	.000	5.16	0.80	.000
Slope	−0.05	0.19	.787	−0.68	0.29	.019	0.34	0.33	.293

vigor and exhaustion scores among the participants in this class was 0.52. In the second latent class, the participants reported moderate levels of both exhaustion and vigor. Twelve percent of all the respondents (n = 30) were included in this class, which we labeled "*Concurrently vigorous and exhausted*." In this class, while the levels of vigor remained stable over time, the mean level of exhaustion slightly decreased at the end of the week (see Figure 2 and Table 3). The estimated mean correlation between vigor and exhaustion in this class was 0.39. The third class, with the remaining 17% of the respondents (n = 43), was characterized by relatively high levels of exhaustion and low levels of vigor that remained unchanged during the workweek. This class was labeled "*Constantly exhausted*" (see Figure 3). The estimated mean level correlation between vigor and exhaustion in this class was 0.25.

The χ^2/F-tests resulted in significant differences in age across the exhaustion-vigor classes, $F(2, 249) = 2.98$, $p < .05$. The participants in the "*Constantly vigorous*" class

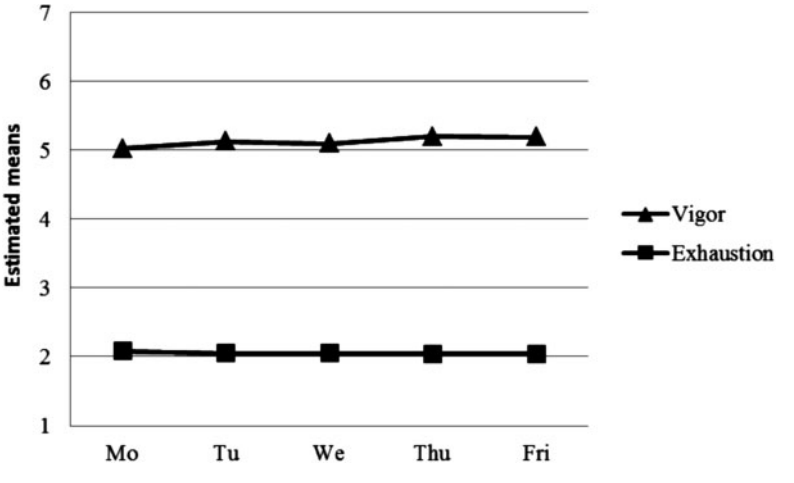

Figure 1. Estimated means for exhaustion and vigor for the latent class "Constantly vigorous" (n = 179).

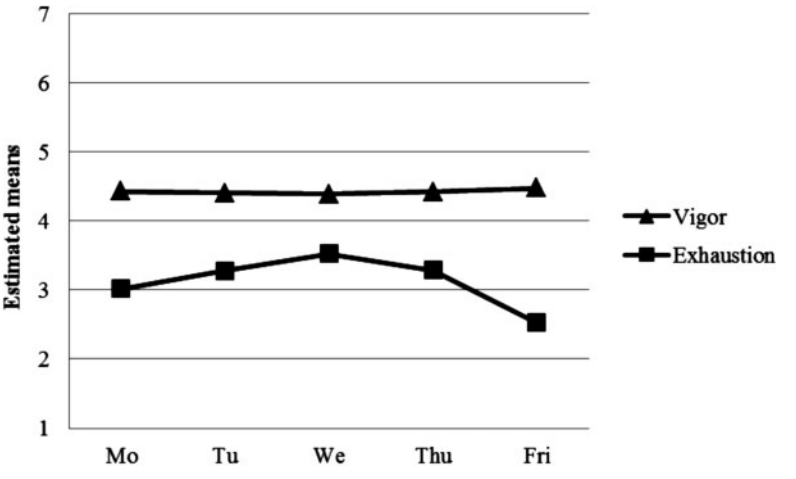

Figure 2. Estimated means for exhaustion and vigor for the latent class "Concurrently vigorous and exhausted" (n = 30).

were older (M = 43.66, SD = 10.75) than those in the class "*Concurrently vigorous and exhausted*" (M = 38.50, SD = 10.37). The mean age in the class "*Constantly exhausted*" was 42.88 (SD = 10.79). There were no statistically significant differences in the distribution of gender, $\chi^2(2, 252) = 2.02$, $p = .36$, working hours, $F(2, 249) = 0.82$, $p = .44$, children living at home, $\chi^2(2, 252) = 1.69$, $p = .43$, or in age of the youngest child living at home, $F(2, 128) = 1.67$, $p = .19$, across the exhaustion-vigor classes. Owing to the small sample sizes in the exhaustion-vigor classes, significant differences in background variables were difficult to detect. However, the participants in the "*Constantly exhausted*" class showed a tendency to report more working hours per week (M = 40.93, SD = 12.96) than those in the other classes. The average working

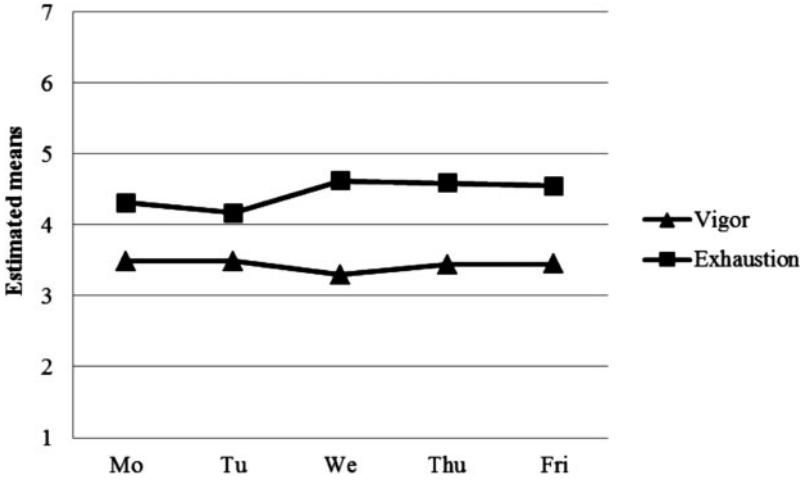

Figure 3. Estimated means for exhaustion and vigor for the latent class "Constantly exhausted" (n = 43).

hours per week of the "*Constantly vigorous*" class was 38.58 (*SD* = 11.54) and 39.77 (*SD* = 4.75) of the class "*Concurrently vigorous and exhausted*."

Exhaustion-vigor classes in relation to recovery

Differences in recovery states by the exhaustion-vigor classes were tested using GLM for repeated measures. In these analyses, gender, age, children living at home and weekly working hours were treated as covariates (see Table 1). The GLM results showed that the interaction effect between the exhaustion-vigor classes and time was not significant, $F(8, 217) = 1.32$, $p = .23$. However, there was a significant main effect showing that the exhaustion-vigor classes differed from each other significantly in recovery, $F(2, 217) = 17.47$, $p < .001$. The multiple Bonferroni comparisons showed that the participants in the "*Constantly vigorous*" class (average estimate for weekly recovery = 4.64) reported better recovery over the workweek compared to the "*Concurrently vigorous and exhausted*" (average estimate = 3.89; mean difference 0.76, $p < .01$) and "*Constantly exhausted*" (average estimate = 3.55; mean difference 1.08, $p < .001$) classes. The "*Concurrently vigorous and exhausted*" and "*Constantly exhausted*" classes did not differ statistically significantly from each other in recovery. Of the covariates, only age was significantly associated with recovery, $F(1, 217) = 12.59$, $p < .001$: Older employees reported better recovery than younger employees.

Prospective change models

Next, a multilevel model of prospective change regarding recovery on awakening after sleep and exhaustion and vigor during the workday was constructed. The fit of the model was perfect, as the model was saturated. The results presented in Figure 4 showed, first, that, at the between-person level (variability between persons), the better the recovery was across the five days measured, the less exhaustion and the more vigor employees reported at the overall level. Second, the results for the within-person level (variability between days) showed that the more employees felt recovered after waking up, the less exhausted and more vigorous they were later during the workday.

Next, a parallel model was constructed in order to investigate the association over time between occupational well-being the previous day and recovery the next day. In these analyses, the difference between recovery, the previous day and the overall level of recovery was taken into account by centering it and estimating it only at the within level. The results are presented in Figure 5. The between-person results showed that vigor was positively associated with recovery the next day at the overall level. The within-person level results showed that exhaustion was associated with recovery the next day: the lower the level of exhaustion, the more recovered employees felt during the next morning.

Discussion

The present study contributes to the literature on burnout and work engagement by applying a person-centered approach to the investigation of individual differences in experiences of exhaustion and vigor over one workweek. In addition, we compared the different exhaustion-vigor classes in recovery experiences and investigated the temporal associations between exhaustion, vigor and recovery during the workweek.

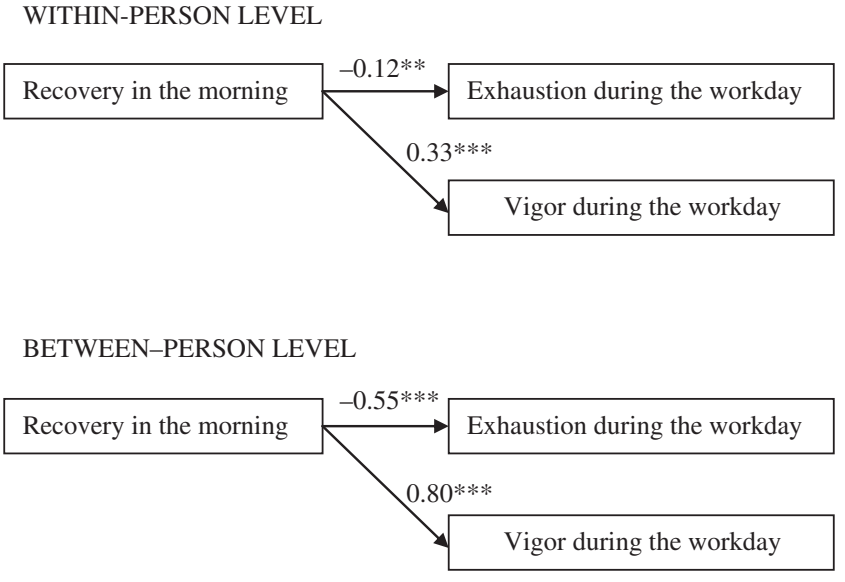

Figure 4. Multilevel prospective change model from recovery to exhaustion and vigor.

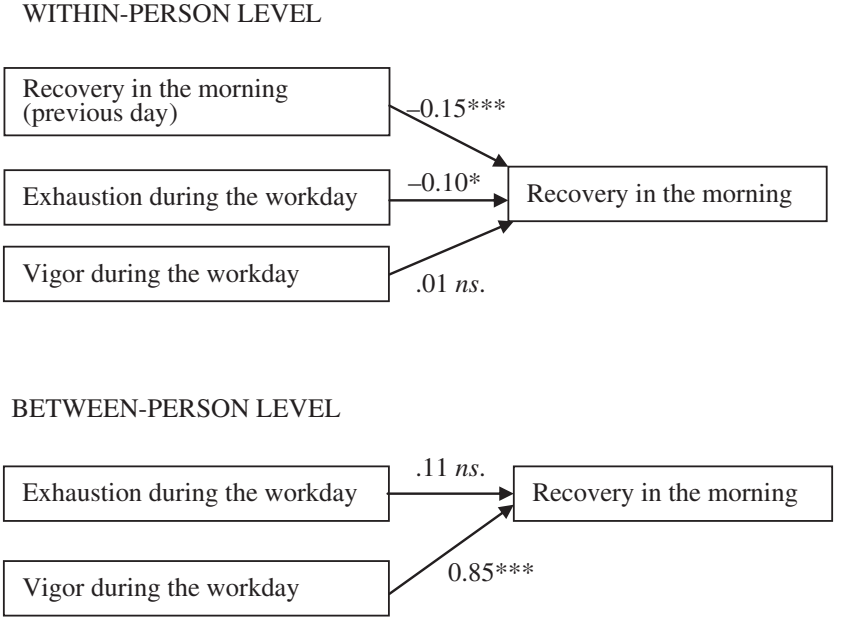

Figure 5. Multilevel prospective change model from exhaustion and vigor to recovery.

Energy dimension stronger than expected

The results indicated meaningful heterogeneity in employees' vigor and exhaustion levels when these experiences were estimated simultaneously. This heterogeneity was characterized by the three classes of exhaustion and vigor identified over one workweek. The large majority of the participants (71%) belonged to the class "*Constantly vigorous*," which was characterized by high stable levels of vigor and low stable levels of exhaustion on each of the five workdays. It is possible that the participants in this class are either high on job resources and/or high on personal resources, that is, the factors that are known to associate with high levels of work engagement (Crawford, LePine, & Rich, 2010; Mauno, Kinnunen, Mäkikangas, & Feldt, 2010; Mäkikangas, Feldt, Mauno, & Kinnunen, 2013). This finding is consistent with the bipolar view, suggesting that vigor and exhaustion are mutually exclusive experiences and cannot be experienced simultaneously (Maslach & Leiter, 1997). In addition, this finding also replicates the earlier person-centered findings of Mäkikangas, Feldt, Kinnunen, and Tolvanen (2012), according to which, in a two-year follow-up, around 60% of the participants belonged simultaneously to the classes of "Low exhaustion" and "High vigor" or "Moderate exhaustion" and "High vigor." Altogether, these person-centered findings are in line with the recent positive psychology debate that the majority of the employees feel relatively well in their work (see e.g. Mäkikangas, Hyvönen, et al., 2011).

We also found two other classes, which supports the bivariate view of the exhaustion-vigor relationship (Shirom, 2011; Shirom et al., 2013). First, we found a relatively small (17%) exhaustion-vigor class, which we labeled "*Constantly exhausted*," in which the levels of exhaustion were higher than the levels of vigor throughout the workweek. Second, we found a small (12%) class, which we labeled "*Concurrently vigorous and exhausted."* These participants reported moderate levels of both vigor and exhaustion but, in contrast to the "*Constantly exhausted*" class, feelings of vigor predominated. Altogether, these findings support our hypothesis, according to which vigor and exhaustion can co-occur within a person.

This study adds to previous knowledge on the energy dimension of burnout and work engagement. A previous longitudinal two-year follow-up study on the trait levels of exhaustion and vigor showed that 63% of the employees studied belonged to the most typically reported classes, that is, those for whom the levels and changes in exhaustion and vigor were the opposite of each other (Mäkikangas et al., 2012). In the present diary study, the typical exhaustion-vigor class accounted for 71% of the sample, indicating that it is likely that exhaustion and vigor are mutually exclusive states when measured on the day level. Hence, the findings of this study suggest that exhaustion and vigor are in a stronger inverse relationship than earlier trait-level studies have indicated (Demerouti et al., 2010; González-Romá et al., 2006, Mäkikangas et al., 2012). It could be that, when studied retrospectively, exhausted employees also report many vigorous workdays and employees who are generally vigorous sometimes also report feeling exhausted. However, on the day level, these well-being states rarely co-occur.

One important observation, based on the present results, is that the strength of the inter-relationship was determined by the mean levels of vigor and exhaustion. Whereas the employees in the classes "*Concurrently vigorous and exhausted*" and "*Constantly exhausted*" reported mild or average levels of both exhaustion and vigor compared with the Finnish intensity-based cut-off points (see Hakanen, 2009; Kalimo et al., 2006), the employees in the class "*Constantly vigorous*" reported levels that indicated high vigor

and no symptoms of exhaustion. These clear differences in cut-off points partially validate the exhaustion-vigor class solution found here, as well as illustrate the importance of estimating the mean level of constructs together with their inter-relationships, as is done in person-centered studies.

Successful recovery is key to high energy at work

The exhaustion-vigor classes differed in their recovery experiences during the workweek, as predicted. Those in the class "*Constantly exhausted*" reported poorer recovery than those in the classes "*Constantly vigorous*" or "*Concurrently vigorous and exhausted*." The "*Constantly vigorous*" class, in particular, reported feeling recovered before every workday throughout the workweek. These results are in line both with the previous theoretical debate and with studies reporting that recovery contributes to occupational well-being (Sanz-Vergel et al., 2010; Sonnentag, 2003; Sonnentag et al., 2012; Sonnentag, Kuttler, & Fritz, 2010; Sonnentag & Niessen, 2008). Overall, successful recovery measured in terms of high levels of restored energy resources in the morning seems to maintain high levels of vigor and low levels of exhaustion during the workweek.

We further examined the temporal relations between well-being and recovery, and found much stronger evidence that it is recovery, in particular, that predicts subsequent levels of vigor, and not the other way around. This finding is consistent with our assumptions as well as previous findings (Sonnentag & Niessen, 2008). Recovery and exhaustion were reciprocally related. The strength of the association from recovery to exhaustion was, however, slightly stronger than vice versa. The prospective change model analyses additionally showed that the linkages between recovery and vigor were stronger on both the between and within levels than the linkages between recovery and exhaustion. Thus, in order to experience vigor at work, recovery is essential.

Exhaustion-vigor classes and background factors

The exhaustion-vigor classes also differed in certain background factors. First, the employees in the "*Constantly exhausted*" class worked approximately three hours more per week than those in the "*Constantly vigorous*" class. Thus, it can be tentatively suggested that increased working hours can act as a risk factor of both recovery and occupational well-being (see also Van der Hulst & Geurts, 2001). This also implies that being highly vigorous at work does not necessary mean long hours – quite the opposite.

In this study, age was also associated with recovery: Older employees reported the best recovery. Winwood, Winefield, and Lushington (2006) also reported that, among nurses, young age was associated with reduced recovery from work. These findings may relate to the combination of inexperience and work demands and the fact that young nurses usually do more demanding shift work compared with their older colleagues (see Winwood, Winefield, & Lushington 2006). It is also possible that recovery strategies to deal with work-related strain may develop with increasing age. Overall, developmental psychology suggests that adaptation and life stress management improves with aging (Aldwin, 1991; Baltes & Baltes, 1990), and this may well apply to recovery experiences as well.

Limitations and strengths

Several limitations should be taken into account when interpreting our results. First, the sample was strongly female-dominated, which limits the generalizability of the results. Therefore, we need future studies among employees in other type of occupations and organizations to set against these results. It might be that the full heterogeneity of the exhaustion-vigor relationship did not emerge due to the female-dominated sample. Second, the present sample was formed on a voluntary basis, and therefore the results may suffer from self-selection bias. For instance, employees with high occupational well-being might have been more willing to participate in this study. Third, although the use of extensive diary data is one of the major strengths of this study, the impact of answering repeated questions on the phenomena of interest are not known (Bolger et al., 2003). However, the use of diary data has the advantage that enables exhaustion and vigor to be studied as transient states, and therefore to gain understanding of these experiences at the time and level at which they occur. Collecting the data, for example via smartphones, would have yielded information about the specific time of answering, and may, by reducing possible retrospective bias, also have increased the within-variability of the studied variables. In addition, several measurements within the same workday would have given more information about the fluctuation in well-being processes as well as on the links between well-being and recovery. Fourth, investigation of the other dimensions of burnout and work engagement during the workweek would have been valuable. Finally, we studied only one workweek, which leaves open the possibility that other time intervals (e.g. several measures during the workday, a month) or other season of the year would produce different findings, depending also on the extent to which work is experienced as demanding and rewarding during the measurement period.

Despite these limitations, the major strengths of this study are both theoretical and methodological. First, the study utilized extensive diary data with five consecutive workdays, enabling detailed day-level investigation of the relation between exhaustion and vigor, and thus offers novel information about their associations. Second, the statistical methods applied here for the first time to diary data accurately captured the same time-estimated exhaustion and vigor in subgroups. In addition, the role of recovery experiences in relation to the exhaustion-vigor classes was included in the same study.

Conclusions

In light of the present study, it can be concluded that negative and positive states of occupational well-being are often but not always polar opposites. Measured at the day level, exhaustion and vigor were more mutually exclusive than found in a previous two-year longitudinal study utilizing similar person-centered analyzing methods (Mäkikangas et al., 2012). In addition, an interesting observation emerging from this study is that although the three classes identified showed that meaningful variation exists in experiences of exhaustion and vigor during the workweek, these experiences were rather stable within each class. Thus, this observation supports the theoretical definition of these constructs according to which these well-being states are relatively stable across time (Maslach et al., 1996; Schaufeli et al., 2002). In the practical sense, the findings of this study indicate that recovery experiences were strongly associated with a low level of exhaustion and a high level of vigor, implying that stress management interventions should aim at improving employees' possibilities for off-job recovery. Hence, managers should

encourage their employees to spend their leisure time in a way that ensures adequate recovery and psychological detachment from work (see Sonnentag, 2003).

References

Ahtiainen, L. (2011). Palkansaajien järjestäytyminen Suomessa vuonna 2009 [Employee union-isation in Finland in 2009]. Työ ja yrittäjyys [Work and Entrepreneurship], 27/2011. Finnish report. Ministry of Employment and the Economy.

Aldwin, C. M. (1991). Does age affect the stress and coping process? Implications of age differences in perceived control. *Journal of Gerontology: Psychological Sciences*, *46*, 174–180. doi:10.1093/geronj/46.4.P174

Bakker, A. B., Albrecht, S., & Leiter, M. P. (2011). Key questions regarding work engagement. *European Journal of Work and Organizational Psychology*, *20*, 4–28. doi:10.1080/1359432X.2010.485352

Bakker, A. B., & Oerlemans, W. (2011). Subjective well-being in organization. In K. S. Cameron & G. M. Spreitzer (Eds.), *The Oxford Handbook of Positive Organizational Scholarship* (pp. 178–189). New York: Oxford University Press. doi:10.1093/oxfordhb/9780199734610.013.0014

Baltes, P. B., & Baltes, M. M. (1990). *Successful aging. Perspectives from the behavioral sciences*. New York: Cambridge University Press.

Bergman, L. R., Magnusson, D., & El-Khouri, B. M. (2003). *Studying individual development in an interindividual context: A person-oriented approach*. Mahwah, NJ: Lawrence Erlbaum.

Binnewies, C., Sonnentag, S., & Mojza, E. (2009). Feeling recovered and thinking about the good sides of one's work. *Journal of Occupational Health Psychology*, *14*, 243–256. doi:10.1037/a0014933

Bolger, N., Davis, A., & Rafaeli, E. (2003). Diary methods: Capturing life as it is lived. *Annual Review of Psychology*, *54*, 579–616. doi:10.1146/annurev.psych.54.101601.145030

Breevaart, K., Bakker, A. B., Demerouti, E., & Hetland, J. (2012). The measurement of state work engagement: A multilevel factor analytic study. *European Journal of Psychological Assessment*, *28*, 305–312. doi:10.1027/1015-5759/a000111

Celeux, G., & Soromenho, G. (1996). An entropy criterion for assessing the number of clusters in a mixture model. *Journal of Classification*, *13*, 195–212. doi:10.1007/BF01246098

Cole, M. S., Walter, F., Bedeian, A. G., & O'Boyle, E. H. (2012). Job burnout and employee engagement: A meta-analytic examination of construct proliferation. *Journal of Management*, *38*, 1550–1581. doi:10.1177/0149206311415252

Crawford, E. R., LePine, J. A., & Rich, B. L. (2010). Linking job demands and resources to employee engagement and burnout: A theoretical extension and meta-analytic test. *Journal of Applied Psychology*, *95*, 834–848. doi:10.1037/a0019364

Demerouti, E., Bakker, A. B., Geurts, S. A. E., & Taris, T. W. (2009). Daily recovery from work-related effort during non-work time. In S. Sonnentag, P. L. Perrewé, & D. C. Ganster (Eds.), *Current perspectives on job-stress recovery: Research in occupational stress and wellbeing* (Vol. 7, pp. 85–123). Bingley: JAI Press. doi:10.1108/S1479-3555(2009)0000007006

Demerouti, E., & Cropanzano, R. (2010). From thought to action: Employee work engagement and job performance. In A. B. Bakker & M. P. Leiter (Eds.), *Work engagement: A handbook of essential theory and research* (pp. 147–163). Hove: Psychology Press.

Demerouti, E., Mostert, K., & Bakker, A. B. (2010). Burnout and work engagement: A thorough investigation of the independency of both constructs. *Journal of Occupational Health Psychology*, *15*, 209–222. doi:10.1037/a0019408

Duncan, T. E., Duncan, S. S., Strycker, L. A., Li, F., & Alpert, A. (1999). *An introduction to latent variable growth curve modeling: Concepts, issues, and applications*. Mahwah, NJ: Lawrence Erlbaum.

Folkman, S. (2008). The case for positive emotions in the stress process. *Anxiety, Stress and Coping*, *21*, 3–14. doi:10.1080/10615800701740457

Geldhof, G. J., Preacher, K. J., & Zyphur, M. J. (2013). Reliability estimation in a multilevel confirmatory factor analysis framework. *Psychological Methods*. Advance online publication. doi:10.1037/a0032138

González-Romá, V., Schaufeli, W. B., Bakker, A. B., & Lloret, S. (2006). Burnout and work engagement: Independent factors or opposite poles? *Journal of Vocational Behavior*, *62*, 165–174. doi:10.1016/j.jvb.2005.01.003

Hakanen, J. (2009). *Työn imun arviointimenetelmä* [Utrecht Work Engagement Scale]. Helsinki: Työterveyslaitos.

Halbesleben, J. R. B. (2010). A meta-analysis of work engagement: Relationships with burnout, demands, resources and consequences. In A. B. Bakker & M. P. Leiter (Eds.), *Work engagement: The handbook of essential theory and research* (pp. 102–117). New York: Psychology Press.

Hobfoll, S. E. (1998). *Stress, culture, and community: The psychology and physiology of stress*. New York: Plenum Press.

Jung, T., & Wickrama, K. A. S. (2008). An introduction to latent class growth analysis and growth mixture modeling. *Social and Personality Psychology Compass*, *2*(1), 302–317. doi:10.1111/j.1751-9004.2007.00054.x

Kalimo, R., Hakanen, J., & Toppinen-Tanner, S. (2006). *Maslachin yleinen työuupumuksen* arviointimenetelmä *MBI-GS* [The Finnish version of Maslach's Burnout Inventory–*General Survey*]. Helsinki: Työterveyslaitos.

Keyes, C. L. M. (2005). Mental illness and/or mental health? Investigating axioms of the complete state model of health. *Journal of Consulting and Clinical Psychology*, *73*, 539–548. doi:10.1037/0022-006X.73.3.539

Kinnunen, U., Feldt, T., Siltaloppi, M., & Sonnentag, S. (2011). Job demands-resources model in the context of recovery: Testing recovery experiences as mediators. *European Journal of Work and Organizational Psychology*, *20*, 805–832. doi:10.1080/1359432X.2010.524411

Larsen, J. T., & McGraw, A. P. (2011). Further evidence for mixed emotions. *Journal of Personality and Social Psychology*, *100*, 1095–1110. doi:10.1037/a0021846

Larson, R. W., & Almeida, D. M. (1999). Emotional transmission in the daily lives of families: A new paradigm for studying family process. *Journal of Marriage and the Family*, *61*, 5–20. doi:10.2307/353879

Laursen, B., & Hoff, E. (2006). Person-centered and variable-centered approaches to longitudinal data. *Merrill-Palmer Quarterly*, *52*, 377–389. doi:10.1353/mpq.2006.0029

Magnusson, D. (1999). On the individual: A person-oriented approach to developmental research. *European Psychologist*, *4*(4), 205–218. doi:10.1027//1016-9040.4.4.205

Mäkikangas, A., Feldt, T., Kinnunen, U., & Tolvanen, A. (2012). Do low burnout and high work engagement always go hand in hand? Investigation of the energy and identification dimensions in longitudinal data. *Anxiety, Stress & Coping*, *25*, 93–116. doi:10.1080/10615806.2011.565411

Mäkikangas, A., Feldt, T., Mauno, S., & Kinnunen, U. (2013). Does personality matter? A review of individual differences in occupational well-being. In A. Bakker (Ed.), *Advances in positive organizational psychology* (Vol. 1, pp. 107–143). Bingley: Emerald. doi:10.1108/S2046-410X(2013)0000001008

Mäkikangas, A., Hyvönen, K., Leskinen, E., Kinnunen, U., & Feldt, T. (2011). A person- centered approach to investigating the development trajectories of job-related affective well-being: A 10-year follow-up. *Journal of Occupational and Organizational Psychology*, *84*, 327–346. doi:10.1111/j.2044-8325.2011.02025.x

Mäkikangas, A., Hätinen, M., Kinnunen, U., & Pekkonen, M. (2011). Longitudinal factorial invariance of the Maslach Burnout Inventory-General Survey (MBI-GS) among employees with job-related psychological health problems. *Stress and Health*, *27*, 347–352. doi:10.1002/smi.1381

Markkanen, K. (2009). *Tehy tilastoina* 2009 [Tehy in statistics 2009]. Helsinki: Multiprint Oy.

Maslach, C. (2011). Engagement research: Some thoughts from a burnout perspective. *European Journal of Work and Organizational Psychology*, *20*, 47–52. doi:10.1080/1359432X.2010.537034

Maslach, C., Jackson, S., & Leiter, M. P. (1996). *MBI: Maslach burnout inventory manual* (3th ed.). Palo Alto, CA: Consulting Psychologists Press.

Maslach, C., & Leiter, M. P. (1997). *The truth about burnout*. San Francisco, CA: Jossey Bass.

Mauno, S., Kinnunen, U., Mäkikangas, A., & Feldt, T. (2010). Job demands and resources as antecedents of work engagement: A qualitative review and directions for future research. In S. Albrecht (Ed.), *The handbook of employee engagement: Perspectives, issues, research and practice* (pp. 111–128). Cheltenham: Edward Elgar.

Meijman, T. F., & Mulder, G. (2001). Psychological aspects of workload. In P. J. D. Drenth, H. Thierry & C. J. de Wolff (Eds.), *A handbook of work and organizational psychology: Work psychology* (2nd ed., pp. 5–34). Hove: Psychology Press.

Muthén, B. O. (2001). Latent variable mixture modeling. In G. A. Marcoulides & R. E. Schumacker (Eds.), *Advanced structural equation modeling: New developments and techniques* (pp. 1–33). Mahwah, NJ: Lawrence Erlbaum.

Muthén, B. O. (2003). Statistical and substantive checking in growth mixture modeling: Comment on Bauer and Curran. *Psychological Methods*, *8*, 369–377. doi:10.1037/1082-989X.8.3.369

Muthén, B. O. (2006). The potential of growth mixture modeling. *Infant and Child Development*, *15*, 623–625. doi:10.1002/icd.482

Muthén, L. K., & Muthén, B. O. (1998–2010). *Mplus User's Guide* (6th ed.) Los Angeles, CA: Muthén & Muthén.

Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling*, *14*, 535–569. doi:10.1080/10705510701575396

Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, *39*, 1161–1178. doi:10.1037/h0077714

Sanz-Vergel, A. I., Demerouti, E., Moreno-Jiménez, B., & Mayo, M. (2010). Work-family balance and energy: A day-level study on recovery conditions. *Journal of Vocational Behavior*, *76*, 118–130. doi:10.1016/j.jvb.2009.07.001

Schaufeli, W. B., Bakker, A. B., & Salanova, M. (2006). The measurement of work engagement with a short questionnaire. A cross-national study. *Educational and Psychological Measurement*, *66*, 701–716. doi:10.1177/0013164405282471

Schaufeli, W. B., & Enzmann, D. (1998). *The burnout companion to study and practice: A critical analysis*. London: Taylor & Francis.

Schaufeli, W. B., & Salanova, M. (2011). Work engagement: On how to better catch a slippery concept. *European Journal of Work and Organizational Psychology*, *20*, 39–46. doi:10.1080/1359432X.2010.515981

Schaufeli, W. B., Salanova, M., González-Romá, V., & Bakker, A. B. (2002). The measurement of engagement and burnout: A two sample confirmatory factor analytic approach. *Journal of Happiness Studies*, *3*, 71–92. doi:10.1023/A:1015630930326

Shirom, A. (2004). Feeling vigorous at work? The construct of vigor and the study of positive affect in organizations. In D. Ganster & P. L. Perrewe (Eds.), *Research in organizational stress and well-being* (Vol. 3, pp. 135–165). Greenwich, CN: JAI Press. doi:10.1016/S1479-3555(03)03004-X

Shirom, A. (2010). Feeling energetic at work: On vigor's antecedents. In A. B. Bakker & M. P. Leiter (Eds.), *Work engagement – A handbook of essential theory and research* (pp. 69–84). New York: Psychology Press.

Shirom, A. (2011). Vigor as positive affect at work: Conceptualizing vigor, its relations with related constructs, and its antecedents and consequences. *Review of General Psychology*, *15*, 50–64. doi:10.1037/a0021853

Shirom, A., Toker, S., Melamed, S., Berliner, S., & Shapira, I. (2013). Burnout and vigor as predictors of the incidence of hyperlipidemia among healthy employees. *Applied Psychology: Health and* Well-Being, *5*, 79–98. doi:10.1111/j.1758-0854.2012.01071.x

Sonnentag, S. (2003). Recovery, work engagement, and proactive behavior: A new look at the interface between nonwork and work. *Journal of Applied Psychology*, *88*, 518–528. doi:10.1037/0021-9010.88.3.518

Sonnentag, S. (2011). Research on work engagement is well and alive. *European Journal of Work and Organizational Psychology*, *20*, 29–38. doi:10.1080/1359432X.2010.510639

Sonnentag, S., Binnewies, C., & Mojza, E. J. (2010). Staying well and engaged when demands are high: The role of psychological detachment. *Journal of Applied Psychology*, *95*,965–976. doi:10.1037/a0020032

Sonnentag, S., Dormann, C., & Demerouti, E. (2010). Not all days are created equal: The concept of state work engagement. In A. B. Bakker & M. P. Leiter (Eds.), *Work engagement – A handbook of essential theory and research* (pp. 25–38). New York: Psychology Press.

Sonnentag, S., & Fritz, C. (2007). The recovery experience questionnaire: Development and validation of a measure for assessing recuperation and unwinding from work. *Journal of Occupational Health Psychology*, *12*, 204–221. doi:10.1037/1076-8998.12.3.204

Sonnentag, S., & Kruel, U. (2006). Psychological detachment from work during off-time: The role of job stressors, job involvement, and recovery-related self-efficacy. *European Journal of Work and Organizational Psychology*, *15*, 197–217. doi:10.1080/13594320500513939

Sonnentag, S., Kuttler, I., & Fritz, C. (2010). Job stressors, emotional exhaustion, and need for recovery: A multi-source study on the benefits of psychological detachment. *Journal of Vocational Behavior*, *76*, 355–365. doi:10.1016/j.jvb.2009.06.005

Sonnentag, S., Mojza, E. J., Binnewies, C., & Scholl, A. (2008). Being engaged at work and detached at home: A week-level study on work engagement, psychological detachment, and affect. *Work and Stress*, *22*, 257–276. doi:10.1080/02678370802379440

Sonnentag, S., Mojza, E. J., Demerouti, E., & Bakker, A. B. (2012). Reciprocal relations between recovery and work engagement: The moderating role of job stressors. *Journal of Applied Psychology*, *97*, 842–853. doi:10.1037/a0028292

Sonnentag, S., & Niessen, C. (2008). Staying vigorous until work is over: The role of trait vigour, day-specific work experiences and recovery. *Journal of Occupational and Organizational Psychology*, *81*, 435–458. doi:10.1348/096317908X310256

Van der Hulst, M., & Geurts, S. A. E. (2001). Associations between overtime and psychological health in high and low reward jobs. *Work and Stress*, *15*, 227–240. doi:10.1080/026783701110.1080/02678370110066580

Wang, M., & Bodner, T. E. (2007). Growth mixture modeling. Identifying and prediction unobserved subpopulations with longitudinal data. *Organizational Research Methods*, *10*, 635–656. doi:10.1177/1094428106289397

Winwood, P. C., Winefield, A. H., & Lushington, K. (2006). Work-related fatigue and recovery: The contribution of age, domestic responsibilities and shiftwork. *Journal of Advanced Nursing*, *56*, 438–449. doi:10.1111/j.1365-2648.2006.04011.x

Xanthopoulou, D., & Bakker, A. B. (2013). State work engagement: The significance of within-person fluctuations. In A. B. Bakker & K. Daniels (Eds.), *A day in the life of a happy worker* (pp. 25–40). Hove Sussex: Psychology Press.

Xanthopoulou, D., Bakker, A. B., Demerouti, E., & Schaufeli, W. B. (2009). Work engagement and financial returns: A diary study on the role of job and personal resources. *Journal of Organizational and Occupational Psychology*, *82*, 183–200. doi:10.1348/096317908X285633

Xanthopoulou, D., Bakker, A. B., Heuven, E., Demerouti, E., & Schaufeli, W. B. (2008). Working in the sky: A diary study on work engagement among cabin attendants. *Journal of Occupational Health Psychology*, *13*, 345–356. doi:10.1037/1076-8998.13.4.345

Zijlstra, F. R. H., & Sonnentag, S. (2006). After work is done: Psychological perspectives on recovery from work. *European Journal of Work and Organizational Psychology*, *15*, 129–138. doi:10.1080/13594320500513855