



Need Satisfaction and Optimal Functioning at Leisure and Work: A Longitudinal Validation Study of the DRAMMA Model

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Abstract

In recent years, there has been an increasing interest in psychological need satisfaction and its role in promoting optimal functioning. The DRAMMA model integrates existing need and recovery models to explain why leisure is connected to optimal functioning (i.e., high well-being and low ill-being). It encompasses six psychological needs: detachment, relaxation, autonomy, mastery, meaning, and affiliation (DRAMMA). While the individual needs of the DRAMMA model have been previously shown to relate to different aspects of optimal functioning, a longitudinal study examining the entire model has not been conducted before. In this longitudinal field study covering leisure and work episodes, we tested the within-person reliability and (construct and criterion) validity of the operationalization of the DRAMMA model in a sample of 279 German employees. Participants filled out measures of DRAMMA need satisfaction and optimal functioning at five measurement times before, during, and after vacation periods in 2016 and 2017. The six-factor model showed good fit to the data. In the multilevel models, relaxation, detachment, autonomy, and mastery had the most consistent within-person effects on optimal functioning, while the relationships between optimal functioning, meaning, and affiliation were considerably weaker. In conclusion, DRAMMA need satisfaction can aid and nurture employees' optimal functioning.

Keywords Psychological needs · DRAMMA model · Well-being · Optimal functioning · Validation

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1 Introduction

Changes in modern working life have resulted in increasing work intensification and social acceleration, which may pose a threat to employees' well-being and health (Rosa 2013; Ulferts et al. 2013). As employees are expected to work longer hours and experience work-related stress, mental and physical exhaustion may build up, leading to higher need for recovery, depressive complaints (e.g., Theorell et al. 2015; Van Veldhoven and Broersen 2003) and even to coronary heart disease and stroke (Kivimäki et al. 2015).

Characterized by a relative absence of high job demands and pressure, leisure is the most important sphere of life where recovery from strain caused by work can take place (i.e., after work, during weekends and vacations). In a recent qualitative study eliciting descriptions of people's ideal future, 41% of the responses were related to leisure and participants indicated that they currently had less leisure than they would desire (Love-day et al. 2018a), demonstrating that leisure constitutes an important component of optimal functioning (conceptualized as both high well-being and low ill-being).

Besides having sufficient time for leisure, subjective experiences during leisure time are crucial for recovery from work stress (Bennett et al. 2018; Kono et al. 2017; Sonnentag et al. 2017). An important factor explaining differences in employees' optimal functioning in relation to increasing job pressures is psychological need satisfaction. If an employees' psychological needs are adequately satisfied at work, they may have more energy to cope with changing and demanding work situations and may also experience increasing job demands as less burdensome (e.g., Deci et al. 2001; Van den Broeck et al. 2016; Van Hooff and Geurts 2015). Satisfaction of psychological needs during leisure allows employees to rebuild and expand their physiological and psychological resources that were invested during the working day (Newman et al. 2014; Sirgy et al. 2017; Van Hooff and Geurts 2014). For example, a recent diary study showed that daily competence satisfaction at home compensated for lack of daily competence satisfaction at work (Hewett et al. 2017). Thus, need satisfaction at work and leisure can help employees achieve optimal functioning in both life domains.

This study is grounded on a recent model of need satisfaction during leisure, the DRAMMA model, which includes six psychological needs (detachment, relaxation, autonomy, mastery, meaning and affiliation) connecting leisure to better well-being (Newman et al. 2014). Together, these needs form the acronym "DRAMMA". In the next two chapters, we briefly describe the DRAMMA model and the existing research on the relationships between DRAMMA need satisfaction and optimal functioning.

In the present study, we first focus on assessing the reliability and (construct and criterion) validity of the operationalization of the DRAMMA model in a sample of 279 German employees. Second, we investigated within-person changes in DRAMMA need satisfaction and optimal functioning across a vacation period. Vacationing constitutes a "natural experiment" which enabled us to investigate co-occurring changes over time within the same employees. Using a within-person perspective, we examined individual variability (person-based effects) in need satisfaction and optimal functioning. The relationship between psychological need satisfaction and optimal functioning can be understood as a process occurring and possibly changing over time. Thus, studying intraindividual variation captures unique effects of the state-like qualities of need satisfaction that are easily overlooked in between-person designs (Bolger et al. 2003; Huta and Ryan 2010; Ilies et al. 2015; McCormick et al. 2018). For example, during weeks in which a person detaches from work, she may recover better from work than during weeks with

low detachment, regardless of whether she is generally high or low in detachment in relation to other employees.

Third, we studied the contribution of the satisfaction of each DRAMMA need both separately and conjointly in predicting optimal functioning. Importantly, the relative importance of individual DRAMMA needs for optimal functioning as well as potential reciprocal relationships between the DRAMMA needs and optimal functioning were also examined to obtain a clearer picture of their interrelations. Lastly, this study adds to the existing body of knowledge by examining whether balanced need satisfaction contributes to optimal functioning over and above satisfaction of single DRAMMA needs.

1.1 The DRAMMA Model: A Framework Connecting Leisure and Optimal Functioning

Despite the importance of psychological needs in the choice and conduct of leisure activities (Porter et al. 2010; Vogel et al. 2016), need theories have gained more attention in leisure research only in the 2010s. The first theory explicitly connecting leisure and psychological need satisfaction is the DRAMMA model (Newman et al. 2014). Based on a review of 363 research articles examining the links between leisure activities, needs, and well-being, Newman et al. (2014) posited that the satisfaction of psychological needs, namely detachment, relaxation (referred to as detachment-recovery in the original model), autonomy, mastery, meaning, and affiliation during leisure time is conducive to improved well-being.

Detachment from work refers to mental disengagement (e.g., “switching off”) from work-related thoughts and tasks during employees’ free time (see also Sonnentag and Bayer 2005). Relaxation refers to psychobiological unwinding in combination with low activation and high positive affect (Sonnentag and Fritz 2007). Recovery researchers have shown convincingly that detachment and relaxation are separate constructs that contribute to optimal functioning in unique ways (e.g., Bennett et al. 2016, 2018; Sonnentag and Fritz 2007). Detachment and relaxation are seen as passive recovery, allowing the mind and body of a fatigued employee to return to a homeostatic baseline (Bennett et al. 2018; Ten Brummelhuis and Trougakos 2014). Autonomy refers to a sense of being in control over one’s life, actions, and choices (see also Ryan and Deci 2008), and is an essential component of leisure (Newman et al. 2014). Mastery refers to experiencing proficiency and skillfulness in the tasks in which the person engages in Sonnentag and Fritz (2007). Meaning refers to experiencing a sense of purpose and significance in one’s life and activities (Steger et al. 2009), whereas affiliation refers to feeling closely related and emotionally connected to people (see also Baumeister and Leary 1995).

1.2 Relations Between DRAMMA Need Satisfaction and Optimal Functioning

In earlier studies, the DRAMMA needs have mainly been examined in work and organizational psychology, either in the context of self-determination theory (SDT) (Deci and Ryan 2000) or as recovery experiences (Sonnentag and Fritz 2007). In a meta-analytic review by Van den Broeck et al. (2016), the SDT’s three psychological needs for autonomy, competence (mastery), and relatedness (affiliation) at work were all related to aspects of well-being (such as job satisfaction and general well-being). The three needs, while still related to ill-being (e.g., negative affect and strain), explained about twice the variance in well-being outcomes. This suggests that satisfaction of psychological needs may be more

significant for well-being than for ill-being (Sheldon et al. 2001; Van den Broeck et al. 2016; Zika and Chamberlain 1992). Besides western studies, positive relations between autonomy, competence, relatedness, and well-being (such as vitality and life satisfaction) and negative relations to ill-being (such as anxiety) have also been found in Eastern European, Latin American and Asian samples, providing cultural validity for the SDT needs (Chen et al. 2015; Church et al. 2013; Deci et al. 2001; Rasskazova et al. 2016). Furthermore, besides absolute levels of the satisfaction of autonomy, competence and relatedness, their balanced satisfaction has also been shown to be positively related to well-being (Milyavskaya et al. 2009; Sheldon and Niemiec 2006).

Out of the four recovery experiences (Sonnentag and Fritz 2007), especially detachment from work and relaxation, and, less consistently, control (autonomy) and mastery have been related in numerous studies to optimal functioning (i.e., higher well-being and lower ill-being) (e.g., Bennett et al. 2018; Sonnentag et al. 2017; Wendsche and Lohmann-Haislah 2017). Psychological detachment following a stressful day at work seems to be particularly important, while little evidence has been reported in this regard for the other recovery experiences (Sonnentag et al. 2017; Wendsche and Lohmann-Haislah 2017). One of the first studies to compare conjoint profiles of recovery experiences found that people who experienced high levels of all four recovery experiences, as well as low problem-solving pondering (called the “leaving work behind” group), had the lowest levels of ill-being (i.e., emotional exhaustion and somatic complaints) in two different samples (Bennett et al. 2016).

Unlike the other DRAMMA needs, the need for meaning has been mainly examined in leisure sciences (see e.g., Iwasaki 2017 for a review). The need for meaning taps directly into people’s sense of needing to find something personally valuable and meaningful in life, a concept which is often missing among need theories. Meaningfulness is a pervasive theme in many accounts of what constitutes good leisure, especially in non-Western cultures (Iwasaki 2007). Already in the 1940s Viktor Frankl posited meaning as a fundamental human need (Frankl 1963). People unable to satisfy the need for meaning may feel distressed, empty or hopeless (Snyder 2002; Steger and Kashdan 2013). In the DRAMMA model, meaningful experiences during leisure time are seen as an important factor connecting leisure to subjective well-being (Newman et al. 2014, 2018; Zika and Chamberlain 1992).

To the best of our knowledge, the DRAMMA model’s needs (detachment, relaxation, autonomy, mastery, meaning and affiliation) have so far been studied together only in two cross-sectional quantitative studies. Virtanen et al. (2019) examined the DRAMMA model among 909 school teachers and principals. Relaxation, mastery, control and detachment related positively to vitality, and control, meaning, detachment and affiliation related positively to life satisfaction, suggesting that all DRAMMA needs play a role in well-being (Virtanen et al. 2019). Moreover, in an unpublished study on 704 college students (Twilley 2017), mastery, meaning, and affiliation correlated positively with subjective well-being (subjective happiness, global life satisfaction, and positive and negative emotions) and with leisure satisfaction, whereas autonomy was negatively related to leisure satisfaction (Twilley 2017). Besides these quantitative studies, Loveday et al. (2018a) examined the DRAMMA model qualitatively. The most frequently mentioned DRAMMA needs in 112 participants’ visions of their ideal future leisure were affiliation, followed by autonomy. Each of the DRAMMA needs accounted for at least 10% of the sentence-level responses (Loveday et al. 2018a).

To summarize, while the individual needs of the DRAMMA model have been shown in various studies to relate to optimal functioning and while people view the DRAMMA

needs as important qualities in their leisure, a longitudinal study examining the model as a whole is needed to examine if and how DRAMMA needs conjointly affect subjective well-being and ill-being over time and interact to create a within-person process for optimal functioning.

1.3 Hypotheses

In this study the six DRAMMA needs were examined together in a longitudinal design with five measurement points. We expected each individual DRAMMA need to show sufficient internal and test–retest reliability. Furthermore, to operationalize the full model for the first time in a quantitative data analysis, we expect that the DRAMMA needs load on six distinct factors and that the six-factor model provides a better fit to the within-person data than do alternative models (Hypothesis 1).

Satisfaction of individual DRAMMA needs has been consistently linked in earlier studies to higher subjective well-being (Newman et al. 2014; Van den Broeck et al. 2016). When people are able to satisfy their psychological needs, they feel better and are more able to take care of themselves physically and mentally, which benefits their well-being. Because of these fairly well-established links between well-being and the DRAMMA needs, we expect that satisfaction of each of the needs for detachment, relaxation, autonomy, mastery, meaning, and affiliation is positively related to better optimal functioning (i.e., subjective well-being: higher vitality, life satisfaction, and subjective health) (Hypothesis 2).

Conversely, when people have unsatisfied needs and the situation persists for an extended time, maladaptive behaviors, high negative emotions, and even helplessness may result (Sheldon 2011). Thus, lack of need satisfaction (need dissatisfaction) may exacerbate subjective ill-being. Research has shown that satisfaction of the different DRAMMA needs is negatively related to measures of ill-being, such as strain, psychological distress, anxiety, and negative affect, although these relationships have been weaker than the positive relationships between need satisfaction and well-being (Baard et al. 2004; Sheldon et al. 2001; Van den Broeck et al. 2016; Zika and Chamberlain 1992). Thus, need dissatisfaction (the reversed score of need satisfaction) has been related positively to ill-being, but the relationships have not been as strong as the positive relationships between need satisfaction and well-being. In line with past research, we expect that satisfaction of DRAMMA needs is negatively related to suboptimal functioning (i.e., subjective ill-being: more depressive complaints, need for recovery, tension and stress) (Hypothesis 3) but that the negative relations between DRAMMA needs and subjective ill-being are weaker than the positive relations between DRAMMA needs and subjective well-being (Hypothesis 4).

While there is an increasing body of research on the benefits of psychological needs satisfaction, studies rarely compare the relative strength of the effects of each satisfied need on outcomes. For example, when resources for increasing need satisfaction (e.g., time, money or recovery opportunities) are limited, is it enough to satisfy a single need (such as autonomy) to achieve distinctly higher levels of optimal functioning (Sheldon and Hoon 2007)? On the other hand, besides having a low level of overall need satisfaction, an imbalance in satisfaction levels between different psychological needs can also be detrimental to optimal functioning (Mack et al. 2011; Sheldon and Gunz 2009; Sheldon and Niemiec 2006). To make sense of the multitude of conceptualizations between the different determinants of optimal functioning, the relative importance of its predictors should be investigated more (Sheldon and Hoon 2007). Thus, to investigate need importance for each outcome,

we studied the order of relative importance of each DRAMMA need for each outcome. This means that we tested which DRAMMA needs' weekly satisfaction most consistently predicted weekly optimal functioning (i.e., higher well-being and lower ill-being). We proposed no hypotheses regarding the relative importance of DRAMMA needs: research on this topic is scarce and need theories seldom provide information on the relative importance of specific needs within their models.

2 Methods

2.1 Procedure and Sample

We conducted an online diary study across a period of 2 consecutive months during 2016 and 2017 in Germany. Participants filled out a baseline questionnaire (T1) 2 weeks prior to their vacations. The questionnaires at T2–T5 were filled on the participants' last day of work, during their vacation (average length of vacation = 17.60 days, $SD = 6.90$ days), in the evening after the first day back at work after the vacation, and 2 weeks after the vacation respectively. In our final data set ($N = 279$), participants completed an average of 3.38 surveys, resulting in 942 measurements. Although this response rate of 67.5% is less than desired, it is much better than the mean response rate of 35% usually found in online surveys (Cook et al. 2000; Rogelberg and Stanton 2007). To better understand the nature of the missing values and to ensure that missing data do not bias our results, we applied Little's MCAR test for the DRAMMA dimensions and the outcome variables at all measurement points. Little's MCAR test was not statistically significant ($\chi^2(1372) = 263.38$, $p = 0.98$), indicating that the missing data are missing at random.

The study was announced in several local newspapers, on television and by means of radio interviews with the research team members. Participants were directed to the study's homepage, which explained the purpose of the study in detail, gave assurances of confidentiality, confirmed voluntary participation, and stipulated that participants had to be at least 18 years old and employed to be eligible to participate in the study. The link to the first online survey was sent to employees who had provided an email address, thereby confirming their willingness to participate in the study. Participants were offered the opportunity to enter a lottery for 13 gift certificates ranging in value between 50 and 500 Euros. In total, 279 employees working in different branches (e.g., teaching, management, banking and saleswork) participated in the study. A total of 75.1% of the employees were female. Employees were between 19 and 66 years old ($M = 40.00$, $SD = 10.68$). The minimum duration of employment was less than 1 year; maximum 40 years ($M = 9.21$, $SD = 9.01$). Most employees had a permanent employment contract (84.0%) and worked full time (73.1%). One third (34.5%) had a managerial position.

2.2 Measures

All questionnaires were administered in German. If the scale was only available in English, two experts translated and back-translated the items to achieve the greatest possible correspondence. We calculated several multilevel reliability indicators at the intraindividual (level 1) and interindividual level (level 2), and these are available on request. All scales had acceptable to high internal consistency (multilevel alphas ranging from .78 to .98). Table 1 illustrates the study design and reference points of the respective response formats.

Table 1 Design of the study

Variables	T1 (2 weeks before vacation)	T2 (last day at work)	T3 (first half of vacation)	T4 (first day back at work)	T5 (2 weeks after vacation)
DRAMMA	Last 7 days during leisure time	Last week before vacation during leisure time	First half of vacation	During vacation	Last 7 days during leisure time
Vitality	Last 7 days	Last 7 days	First half of vacation	During today's work day	Last 7 days
Life satisfaction	Today	Today	Today	Today	Today
Subj. health	Today	Today	Today	Today	Today
Depressive complaints	Last 7 days	-	-	During vacation	Last 7 days
Need for recovery	Last 7 days during leisure time	Last 7 days during leisure time	-	Today during leisure time	Last 7 days during leisure time
Tension	Today	Today	Today	Today	Today
Stress	Today	Today	Today	Today	Today

Reference timepoint of response format

-, not assessed

2.2.1 DRAMMA Need Satisfaction

To assess the six DRAMMA needs, we used the same set of 18 items as De Bloom et al. (2017a), who found good psychometric properties and reported good fit indices of the six-factor model: Three items to measure *detachment* were adapted from the well-validated Recovery Experience Questionnaire (REQ; Sonnentag and Fritz 2007) and the cognitive irritation subscale of the Irritation Scale (Mohr et al. 2006). *Relaxation and mastery* were also measured with the REQ with three items each (Sonnentag and Fritz 2007). To measure *meaning*, three items from the Job Diagnostic Survey (Hackman and Oldham 1974) were reformulated to apply to leisure time. *Autonomy and affiliation* were each assessed with three items adapted from the Basic Needs Satisfaction in General Scale (Johnston and Finney 2010). Example items are: “During the last 7 days during leisure time”, “... I forgot about work” (detachment), “... I did relaxing things” (relaxation), “... I felt like I was free to decide for myself how to live my life” (autonomy), “... I did things that challenge me” (mastery), “... I did something that was important to me” (meaning) and “... I felt close to the people I was interacting with” (affiliation). Answers could range between 1 (totally disagree) and 5 (totally agree). The DRAMMA needs were assessed at each of the five measurement points, referring to the previous working week (T1, T2, T5) or the vacation period (T3, T4) respectively (Table 1). Multilevel alphas were 0.89 (level 1, within persons) and 0.89 (level 2, between persons) for detachment, 0.92 (level 1) and 0.93 (level 2) for relaxation, 0.85 (level 1) and 0.83 (level 2) for autonomy, 0.78 (level 1) and 0.94 (level 2) for mastery, 0.80 (level 1) and 0.92 (level 2) for meaning, and 0.82 (level 1) and 0.93 (level 2) for affiliation.

2.2.2 Optimal Functioning

For well-being indicators, *vitality* was measured with four items from the Profile of Mood States (McNair et al. 1971) at all five points in time, referring to the last 7 days (T1, T2, T5), vacation (T3) or first day at work (T4) (Table 1). An example item for vitality is: “During the last 7 days, I felt alive and vital”. Answers could range from 1 (not at all) to 7 (extremely). Multilevel alphas for vitality were 0.90 (level 1) and 0.98 (level 2). *Life satisfaction* was assessed with a single item (“How satisfied do you feel about this day?”) at all five points in time. Answers could range between 1 (not at all) and 10 (very much). *Subjective health* was assessed with a single item (“How healthy did you feel today?”) at all five points in time. Answers could range between 1 (not at all) and 10 (very healthy).

For ill-being indicators, *depressive complaints* were assessed with eight items from the PHQ-8 (Kroenke et al. 2009) at three points in time (T1, T4, T5). The items referred to the last 7 days (T1, T5) or the vacation period (T4) (Table 1). The overall question was “Over the last 7 days/during your vacation, how often have you been bothered by any of the following problems?” An example item is: “Little interest or pleasure in doing things”. Answers could range between 0 (not at all) and 3 (nearly every day). Multilevel alphas were 0.82 (level 1) and 0.88 (level 2) for depressive complaints. *Need for recovery* was measured with four items from Van Veldhoven and Broersen (2003) at four points in time, referring to leisure time (time after work) during the last 7 days (T1, T2, T5) or leisure time after the first day back at work (T4) (Table 1). An example item is “When I got home from work, I needed to be left in peace for a while”. Answers could range between 1 (totally disagree) and 5 (totally agree). Multilevel alphas ranged from 0.87 (level 1) to 0.94 (level

2). *Tension* was assessed with a single item (“How tense did you feel today”) at all five points in time. Answers could range between 1 (not at all) and 10 (very much). *Stress* was assessed with a single item (“How stressed did you feel today?”) at all five points in time. Answers could range between 1 (not at all) and 10 (very much).

2.3 Statistical Analysis

We applied conventional item analysis techniques (Allen and Yen 2001; Waltz et al. 1991) to evaluate the psychometric properties of the items (frequencies, standard deviations, interitem correlations, item-total correlations, and alpha if item deleted). Items were considered good if they correlated moderately or highly with the other items within their subdimension and if the correlation with the items on other subdimensions was weak.

To test Hypothesis 1, we conducted a multilevel confirmatory factor analysis with Mplus (Muthén and Muthén 2006) due to the hierarchical structure of the data (i.e., weeks nested in persons). We first conducted several preliminary analyses (Grilli and Rampichini 2007; Heck and Thomas 2000) to assess whether a multilevel approach was warranted and to identify measurement structure problems. A multilevel confirmatory factor analysis (MCFA; Hox 2002; Muthén 1994) examines the model fit at the between-person and the within-person levels simultaneously and is used in the context of longitudinal and diary data (e.g., Merz and Roesch 2011; Stone et al. 2007). Similar to single-level CFA, factors in MCFA are defined a priori and competing models are compared statistically to determine the best fitting model. To test our first hypothesis, we first examined if the DRAMMA subscales represented distinct constructs at both the within- and the between-person level. Thus, to assess construct validity we analyzed a six-factor model with all items loading only on their intended need. We followed the recommendations of Schermelleh-Engel et al. (2003) and analyzed the following indices: Tucker Lewis index (TLI), confirmatory fit index (CFI), root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR). For the TLI and CFI values above 0.90 indicate acceptable fit values and for the RMSEA values under 0.05 indicate a good model fit and between 0.05 and 0.08 an acceptable model fit (Schermelleh-Engel et al. 2003). For the SRMR a value less than 0.08 is considered a good fit, less than 0.10 indicates an acceptable fit (Schermelleh-Engel et al. 2003).

To test Hypotheses 2–5, we accounted for the nonindependence of the data as well as for the systematic, chronological structure of the predictor (i.e., time) by following Bliese and Ployhart’s (2002) five-step approach for growth modeling using random coefficient models in R, using the NLME library written by Pinheiro and Bates (2000). In the first step, a simple model without any random effects serves as a baseline and is compared to a model with a random intercept term to examine whether the models allowing employees to randomly vary in terms of their initial outcome value fit the data better than do the models that fix the intercept constant across employees. Complexity is added with each step and log-likelihood ratios serve as a means of comparison between models. In the next steps, we determined the error structure by estimating whether we needed to account for autocorrelation (i.e., responses close in time are more strongly related than responses farther apart) and heteroscedasticity (i.e., responses may become less or more variable over the time period analyzed). In these steps, we estimated models that included an autoregressive structure and modeled heteroscedasticity by increasing or decreasing the within-person residual variance by a single estimated power function describing the nature of the variance change (see Bliese and Ployhart 2002 for more information). In the next step, we

tested for linear and quadratic, as well as for cubic time trends. First, we determined the fixed functions for time (linear-only model, adding a quadratic time trend, then including a cubic time trend), which allowed random intercepts but assumed that all employees follow the same growth trajectory, and then determined if we find variability in the growth parameters by model comparison. To scrutinize criterion-oriented validity we predicted weekly vitality, life satisfaction, and subjective health as indicators of well-being (Hypothesis 2), and weekly depressive complaints, need for recovery, tension and stress as indicators for ill-being (Hypothesis 3). For these outcome variables we included the DRAMMA needs as predictor variables in the last step of our model building.

Following Raudenbush and Bryk (2002), we centered the DRAMMA needs around the person mean (group-mean centering), depicting within-person variance and included aggregated person-level predictors (grand-mean centered, capturing the overall level of the predictor across the five measurement points), so that the effect is broken down into within- and between-person components and the between-person effect does not inherit the relationships within persons. In Tables 3 and 4 we provide the results for the within-person relationships. Our analyses consequently refer to deviations from the average level of each variable over multiple weeks for each person. We focused on the within-person effects to capture the individual, episodic effects of need satisfaction during the study period (Ilies et al. 2015; McCormick et al. 2018). For estimation, restricted maximum likelihood was used.

Furthermore, we examined whether the DRAMMA needs were a more important predictor for well-being than ill-being variables (Hypothesis 4) by comparing the average predicted variance and range of predicted variance in well-being and ill-being outcomes to one another. In order to examine the relative importance of each DRAMMA need, we followed Liu et al. (2014) to estimate the Pratt index (Pratt 1987; Thomas et al. 1998) in multilevel models. The Pratt index, due to its additive property, orthogonally partitions the R-square and sums to one, which provides a criterion of how much each DRAMMA need contributes to the explained variance in the respective outcome variable orthogonally (Liu et al. 2014). Comparing the Pratt indices of predictors differs from simply comparing coefficients such as standardized beta-weights in regression analyses in that the Pratt index takes account of the individual importance of the predictors regardless of correlation among them. Thus, the Pratt index provides a measure of relative importance that is robust to collinearity between predictors (Liu et al. 2014).

3 Results

3.1 Construct Validity: Multilevel Confirmatory Factor Analysis for the DRAMMA Model

Multilevel confirmatory factor analyses were conducted using the 18 DRAMMA items to evaluate the factor structure at the between- and within-person levels. The model fit statistics indicated a good fit at the within-person level and the between-person level [$\chi^2=443.97$, $df=205$, $p<0.001$, $RMSEA=0.035$, 90% CI (0.023; 0.045), $CFI=0.98$, $TLI=0.97$, $SRMR_{within}=0.046$, $SRMR_{between}=0.078$]. The fit of a model with two second-order factors (detachment and relaxation loading on one higher-order factor; autonomy, mastery, meaning and affiliation loading on the second higher-order factor) showed poorer fit indices [$\chi^2=627.98$, $df=221$, $p<0.001$, $RMSEA=0.044$, 90% CI (0.034; 0.053),

CFI=0.96, TLI=0.95, SRMR_{within}=0.058, SRMR_{between}=0.214]. Similarly, a five-factor model in which detachment and relaxation loaded on the same first-order factor did not show better model fit [$\chi^2=424.79$, $df=200$, $p<0.001$, RMSEA=0.035, 90% CI (0.023; 0.045), CFI=0.98, TLI=0.97, SRMR_{within}=0.058, SRMR_{between}=0.268]. The fit of a single-factor model was not acceptable [$\chi^2=3722.81$, $df=271$, $p<0.001$, RMSEA=0.116, 90% CI (0.110; 0.122), CFI=0.71, TLI=0.68, SRMR_{within}=0.122, SRMR_{between}=0.334]. Summing up, a six-factor model with all items loading on their intended DRAMMA need had a good model fit, supporting Hypothesis 1.

3.2 Preliminary Analyses: Change in DRAMMA Need Satisfaction Over Time

In the first step, we determined the strength of data non-independence and estimated a null model (Bryk and Raudenbush 1992). Intraclass correlation coefficient (ICC1) for all DRAMMA subscales was above 0.20 (Table 2), indicating that approximately a quarter of the variance in individual ratings of DRAMMA need satisfaction was due to inter-individual differences and that there was also substantial variance within persons across measurement points. Thus, a multilevel approach was warranted. The results showed that models with random intercepts fitted the data better, implying that individuals varied in terms of their overall level on the respective DRAMMA subscale.

Table 2 ICCs descriptive statistics and within-person inter-correlations between DRAMMA needs

Variable	ICC	M	SD	Det	Rel	Aut	Mas	Mea	Aff
Gendera		0.26	0.44	-.03	.02	-.02	-.03	-.08	-.09
Age		40.00	10.68	-.01	.05	-.02	.03	-.09	-.05
Dur. of employm. ^b		9.21	9.01	.12	.05	-.03	-.07	-.09	-.10
Full-time work ^c		0.74	0.44	-.14*	.00	.14*	.00	.02	-.04
Manager ^c		0.34	0.47	-.08	.05	.07	.04	.09	.01
Detachment	.20	3.10	0.78						
Relaxation	.21	3.00	0.79	.77**					
Autonomy	.21	3.36	0.69	.65**	.76**				
Mastery	.38	3.04	0.83	.31**	.37**	.44**			
Meaning	.34	3.22	0.86	.34**	.42**	.45**	.61**		
Affiliation	.34	4.03	0.56	.48**	.59**	.61**	.35**	.40**	
Vitality		4.32	1.24	.37**	.40**	.40**	.31**	.31**	.32**
Life satisfaction		6.79	1.91	.24**	.32**	.26**	.23**	.22**	.23**
Subj. health		6.65	2.23	.23**	.26**	.21**	.19**	.18**	.21**
Depr. complaints ^d		5.59	4.39	-.55**	-.59**	-.53**	-.41**	-.35**	-.39**
Need for recovery		2.92	0.98	-.52**	-.55**	-.44**	-.34**	-.32**	-.33**
Tension		5.28	2.28	-.42**	-.36**	-.31**	-.16**	-.15**	-.28**
Stress		5.01	2.31	-.46**	-.46**	-.39**	-.18**	-.19**	-.32**

$N=279$. * $p<0.05$; ** $p<0.001$

^aGender coded as 0=female. 1=male

^bDuration of employment

^cCoded as 0=no. 1=yes (full-time work/managerial position)

^dDepressive complaints reported as a sum score instead of mean. Potential range of DRAMMA: 1 (totally disagree) to 5 (totally agree)

Next, we assessed the error structure of the models. For detachment, autonomy, and mastery, models that did not include autocorrelation, but incorporated heterogeneity in the error structures, fitted best. For meaning a model including autocorrelation as well as heterogeneity in the error structure fitted best, while for relaxation and affiliation, models without autocorrelation and heterogeneity in the error structure fitted best.

In the next step, we tested for linear and quadratic, as well as for cubic time trends to examine the growth trajectory of the DRAMMA needs. For all DRAMMA needs, the linear as well as the quadratic slopes for time were significant, indicating that DRAMMA need satisfaction increased over the five measurement points and followed a u-shaped trend over time (Fig. 1, “Appendix”). In a subsequent step, we determined variability in the growth parameters to assess if employees follow different growth trajectories. Our results showed no significant slope variance for the linear and quadratic time slopes for detachment, relaxation, mastery, and affiliation. Thus, models that allowed random intercepts (i.e., random initial levels of these DRAMMA needs) and assumed that all employees follow the same growth trajectory fitted the data best. For autonomy, the model including a random linear time slope fitted the data better ($\Delta\chi^2(2) = 7.27, p < 0.05$), similarly for meaning ($\Delta\chi^2(2) = 6.22, p < 0.05$), indicating that the linear time trend varied between employees.

3.3 Criterion Validity: DRAMMA Needs Predicting Optimal Functioning

As in our preceding analyses focusing on the DRAMMA needs, we followed a model building approach and tested first the degree of nonindependence for the indicators of

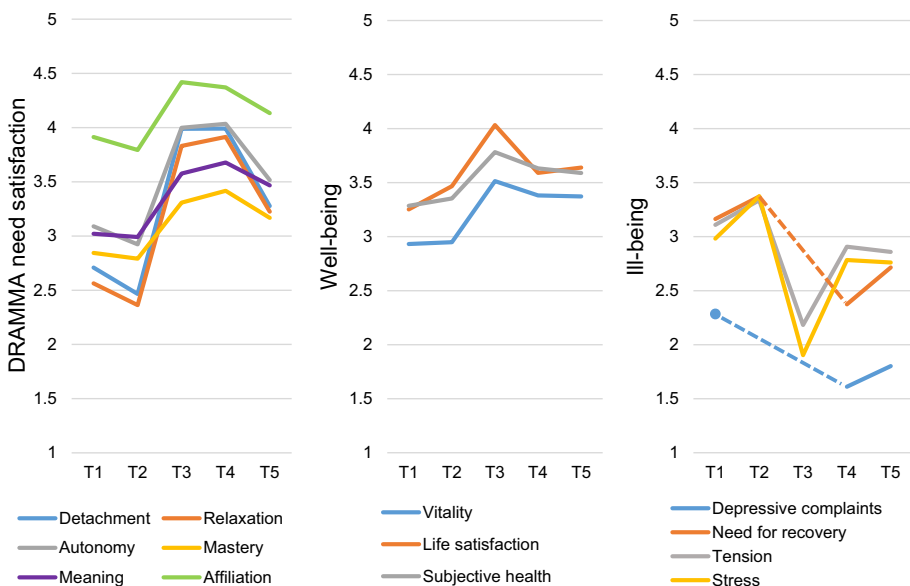


Fig. 1 Time trends of DRAMMA need satisfaction, well-being and ill-being across the study period. Values for all scales for well-being and ill-being (except need for recovery) transformed to a 1–5 Likert scale. T1 = 2 weeks before vacation, T2 = the last working day before vacation, T3 = in the middle of the vacation, T4 = the first working day after vacation, T5 = 2 weeks after vacation

well-being and ill-being. We then determined the error structure and examined if the model fit could be improved by including estimates of autocorrelation and heteroscedasticity in the within-group errors. In a subsequent step, we examined linear, quadratic, and cubic time trends and tested for significant slope variance. The steps so far allowed us to conclude (a) if there was sufficient variability between employees, (b) if the error structures were adequately addressed, (c) if there was a linear or quadratic trend in the indicators of well-being and ill-being over time, (d) if employees differed in terms of their initial levels, and (e) if the individual growth patterns varied among individuals. The results of these first steps are presented in Tables 3 and 4. To test Hypotheses 2–5, we then examined the extent to which satisfaction of DRAMMA needs predicted optimal functioning within persons (i.e., indicators of well-being and ill-being, Tables 3 and 4), comparing their contribution to predicting optimal functioning conjointly.

The results showed that weekly vitality depended mainly on weekly mastery (Table 3), and marginally on weekly detachment and autonomy. This finding implies that participants experienced greater vitality if they experienced more mastery and by trend more detachment from work and autonomy in a given week than in other weeks. For weekly life satisfaction, results indicated that weekly relaxation and mastery were particularly important. With regard to weekly subjective health, we found that weekly relaxation was particularly important. Thus, Hypothesis 2 was partially supported. Detachment, relaxation, autonomy and mastery all predicted one or two of our three well-being outcomes, while meaning and affiliation did not significantly predict well-being (Table 3), when jointly regressed with other DRAMMA needs.

For weekly depressive complaints, relaxation and mastery were of particular importance (Table 4). This finding implies that participants experienced a lower level of depressive complaints if they experienced more relaxation and mastery in a certain week than in other weeks. These findings were similar for need for recovery except that for need for recovery weekly detachment also played a significant role. For weekly tension, weekly detachment and affiliation served as significant predictors. For weekly stress, the most important DRAMMA needs were weekly detachment, relaxation and marginally affiliation. Thus, Hypothesis 3 was partially supported. When conjointly assessed with other DRAMMA needs, detachment, relaxation, mastery, and marginally affiliation predicted at least two of our four ill-being outcomes, while autonomy and meaning did not significantly predict ill-being (Table 4).

The focus of this study was on within-person effects. For transparency and clarity, in the following paragraph we report the results at the between-person level: Detachment from work positively predicted all well-being outcomes and negatively predicted all ill-being outcomes at the between-person level. Thus, the persons who on average experienced more detachment across all time points, experienced also higher well-being and lower ill-being across all time points. Relaxation was positively related to life satisfaction and negatively to depressive complaints, tension and stress. Autonomy was positively related to vitality and negatively to need for recovery. Mastery and meaning were not significantly related to the outcomes. Affiliation was positively related to all well-being outcomes, and negatively to depressive complaints. To summarize, the between-person level results were largely similar to the results at the within-person level with three exceptions. Mastery only showed relationships to optimal functioning at the within-person level, whereas affiliation showed relationships mostly at the between-person level. Detachment from work had even stronger relationships to optimal functioning at the between-person than at the within-person level.

To examine whether the DRAMMA needs were more important predictors for well-being rather than ill-being, we compared predicted variance in well-being outcomes

Table 3 Multilevel estimates for models predicting well-being

	Vitality (Obs = 928, n = 274)				Life satisfaction (Obs = 928, n = 274)				Subjective Health (Obs = 929, n = 275)						
	Est	SE	t	p	Pratt	Est	SE	t	p	Pratt	Est	SE	t	p	Pratt
Intercept	3.89	.15	26.44	<0.01		5.43	.26	20.68	<0.01		5.98	.30	20.26	0.01	
Time linear	.17	.11	1.49	0.14		.94	.20	4.70	<0.01		.36	.22	1.65	0.10	
Time quadratic	-.02	.02	-1.01	0.31		-.15	.03	-4.68	<0.01		-.06	.04	-1.62	0.11	
Detachment	.11	.06	1.90	0.06	.20	-.16	.10	-1.62	0.11	-.11	.09	.11	0.83	0.41	.17
Relaxation	.08	.07	1.22	0.22	.19	.46	.12	3.92	<0.01	.84	.29	.13	2.24	0.03	.44
Autonomy	.13	.07	1.89	0.06	.24	-.03	.12	-0.22	0.83	-.05	-.14	.14	-0.99	0.32	-.07
Mastery	.14	.06	2.60	0.01	.18	.19	.10	1.94	0.05	.18	.16	.11	1.48	0.14	.19
Meaning	.08	.06	1.40	0.16	.11	.07	.10	0.65	0.51	.05	.06	.11	.55	0.58	.07
Affiliation	.09	.08	1.21	0.23	.08	.07	.13	0.55	0.58	.09	.22	.15	1.47	0.14	.19
Level-1 intercept variance (SE)	.55	.74				2.26	1.50				2.57	1.60			
Level-1 Delta R ²	.42					.27					.22				
AIC	2739.75					3617.86					3906.39				
BIC	2826.49					3699.69					3997.95				

Obs the number of observations for each model

For the calculation of Delta Pseudo R² we used the formulas of Snijders and Bosker (1994) to estimate the amount of variance explained compared to each null model. The model for vitality included heteroscedasticity, the time slope for subjective health was random. Relationships between the DRAMMA needs and outcome variables were estimated at the within-person level as well as the between-person level, for reasons of parsimony only relationships at the within-person level are displayed

Table 4 Multilevel estimates for models predicting ill-being

	Depressive complaints (Obs = 552, n = 267)				Need for recovery (Obs = 755, n = 273)				Tension (Obs = 929, n = 275)				Stress (Obs = 929, n = 275)							
	Est	SE	t	p	Pratt	Est	SE	t	p	Pratt	Est	SE	t	p	Pratt	Est	SE	t	p	Pratt
Intercept	1.04	.09	11.09	<0.01		3.02	.12	25.74	<0.01		5.33	.34	15.86	<0.01		5.10	.33	15.26	<0.01	
Time linear	-.18	.09	-2.03	0.04		.06	.10	.59	0.55		-.03	.26	-.11	0.91		-.06	.25	-.25	0.80	
Time quadratic	.03	.01	1.69	0.09		-.02	.02	-1.29	0.20		.03	.04	.61	0.54		.03	.04	.84	0.40	
Detachment	-.04	.03	-1.22	0.22	.08	-.16	.05	-3.42	<0.01	.37	-.84	.13	-6.69	<0.01	.82	-.62	.12	-5.03	<0.01	.49
Relaxation	-.11	.04	-3.07	<0.01	.18	-.22	.06	-3.78	<0.01	.48	-.11	.15	-.70	0.48	.09	-.47	.15	-3.14	<0.01	.37
Autonomy	-.04	.04	-1.18	0.24	.06	.00	.06	.08	0.93	.00	.03	.16	.21	0.83	-.02	-.10	.15	-.63	0.53	.09
Mastery	-.09	.03	-2.93	<0.01	.12	-.13	.05	-2.86	<0.01	.14	-.08	.13	-.64	0.52	.02	-.06	.12	-.48	0.63	.01
Meaning	.00	.03	.11	0.91	-.02	-.01	.05	-.22	0.83	.01	.08	.13	.63	0.53	-.02	.09	.13	.68	0.50	-.03
Affiliation	-.02	.04	-.39	0.70	.03	.00	.06	.01	0.99	-.01	-.34	.17	-1.99	0.05	.11	-.30	.17	-1.75	0.08	.07
Level-1 intercept variance	.10	.34				.30	.55				3.88	1.97				3.67	1.91			
Level-1 Delta R ²	.34					.46					.25					.30				
AIC	745.30					1862.09					4065.45					4068.79				
BIC	822.48					1945.06					4147.37					4155.51				

Obs the number of observations for each model

For the calculation of Delta Pseudo R² we used the formulas of Snijders and Bosker (1994) to estimate the amount of variance explained compared to each null model. The model for need for recovery included heteroscedasticity, the models for depressive complaints and stress included an autoregressive structure. Relationships between the DRAMMA needs and outcome variables were estimated at the within-person level as well as the between-person level, for reasons of parsimony only relationships at the within-person level are displayed

(vitality, life satisfaction, subjective health) to predicted variance in ill-being outcomes (depressive complaints, need for recovery, tension, and stress). The total predictive variance of DRAMMA needs ranged from 0.09 to 0.21 for well-being (mean=0.14, mean $SE=0.03$) and from 0.19 to 0.39 for ill-being (mean=0.29, mean $SE=0.04$) (Tables 3 and 4). Thus, Hypothesis 4 was not supported. On average DRAMMA needs predicted almost twice as much variance for ill-being than for well-being outcomes.

3.4 Relative Importance of the DRAMMA Need Satisfaction Predicting Optimal Functioning

We estimated the relative importance of each DRAMMA need for optimal functioning using Pratt indices (Fig. 2). Concerning well-being indicators, vitality was best predicted by autonomy, closely followed by detachment, relaxation, and mastery. Relaxation showed the greatest relative importance for life satisfaction and subjective health. Regarding ill-being indicators, relaxation had the greatest relative importance for depressive complaints and need for recovery, while detachment had the greatest relative importance for stress and tension (Fig. 2). To summarize, relaxation was the strongest predictor for four of the seven relationships investigated between weekly DRAMMA needs and weekly optimal functioning (57% of all relationships studied), while detachment from work was the strongest predictor for two of the seven relationships (29% of all studied relationships) (Fig. 2).

3.4.1 Additional Analyses: Balanced Need Satisfaction

To explore whether balanced DRAMMA need satisfaction affects optimal functioning, we correlated balanced need satisfaction with optimal functioning for each measurement point (T1–T5). Balanced need satisfaction scores were created in line with Sheldon and Niemiec (2006), by computing absolute values for the differences (divergences) between each DRAMMA need pair (e.g., absolute value of detachment minus relaxation). A sum of those absolute values was then created for each time point to mark the divergence in DRAMMA needs. Finally, the divergence scores were reversed by subtracting each participant's score from our highest observed divergence score of 33.33 to create scores for balanced need satisfaction for each time point (Sheldon and Niemiec 2006).

Overall, the correlations between balanced need satisfaction and optimal functioning were modest (average r 's ranging from -0.13 to 0.09). Next, we conducted hierarchical linear regressions for each well-being and ill-being outcome with aggregated mean scores, where satisfaction of all the six DRAMMA needs were entered at step 1 as predictors and balanced need satisfaction was entered at step 2. For subjective health, balanced need

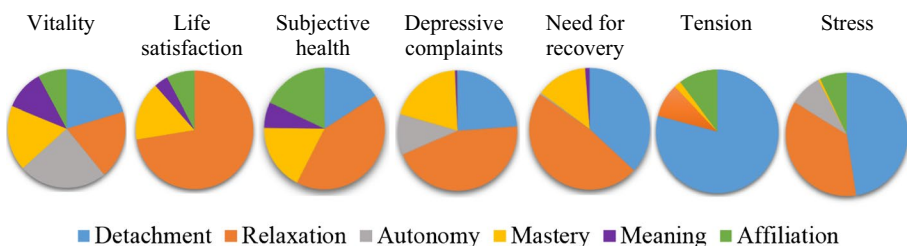


Fig. 2 Pratt indices of the weekly DRAMMA needs predicting weekly optimal functioning

satisfaction was a significant positive predictor beyond all individual DRAMMA needs ($\Delta R^2=0.009$), $F(1, 268)=4.11$, $p=0.044$). For stress, balanced need satisfaction as a negative predictor was marginally significant beyond the influence of individual DRAMMA needs ($\Delta R^2=0.009$), $F(1, 268)=3.70$, $p=0.056$). For all other optimal functioning outcomes, balanced need satisfaction did not explain significant variance beyond the individual DRAMMA needs. Thus, for subjective health and marginally for stress, balanced need satisfaction predicted variance beyond the influence of individual DRAMMA needs, suggesting that balanced need satisfaction also plays a role in optimal functioning.

4 Discussion

This study examined the reliability and validity of the operationalization of the DRAMMA model (Newman et al. 2014) in explaining optimal functioning over time. We conducted a longitudinal study over a period of 2 months, covering both leisure and work periods. We focused on within-person changes in investigating the relationship between satisfaction of DRAMMA needs and optimal functioning (i.e., high well-being and low ill-being). Rather than comparing people who are generally high on need satisfaction to those who are not, our results focused on whether people feel better off in terms of optimal functioning in weeks when they experienced more need satisfaction, compared to weeks when their need satisfaction is low. Thus, we were able to examine within-individual variability and weekly state-like effects in need satisfaction and optimal functioning.

The six-factor model, consisting of experienced satisfaction of psychological needs for detachment, relaxation, autonomy, mastery, meaning, and affiliation, showed a good fit in our sample of 279 German employees. The needs defined in the DRAMMA model were found to be separate constructs, which were related positively and consistently to one another. Thus, Hypothesis 1 was supported. The results provide support for the proposed six-factor structure of the DRAMMA model, suggesting that the six needs could also be reliably investigated conjointly in future studies with relatively brief questionnaires (three items per need).

Analyses of the longitudinal data showed that DRAMMA needs and optimal functioning co-developed across time (i.e., leisure and work). That is, the DRAMMA needs were more likely to be satisfied during the vacation than before or after it. Optimal functioning followed the same time-trend. Optimal functioning was highest during the vacation and lower before and after the vacation, which is substantiated by findings from vacation research (e.g., De Bloom et al. 2010). Using within-person correlations, we could demonstrate that all the DRAMMA needs were significantly related to optimal functioning (positively related to well-being and negatively related to ill-being).

However, when all needs predicted the outcomes conjointly, the stronger predictive power of certain DRAMMA needs caused many of the previously significant relationships to weaken or disappear. For vitality, mastery and marginally detachment from work and autonomy showed positive effects, whereas relaxation and mastery were significant predictors of life satisfaction. For weekly subjective health, only relaxation showed significant relations. Relaxation is commonly seen as an important component in interventions intended to prevent physical and mental health problems (Richardson and Rothstein 2008; Verbeek et al. 2019). Relaxation is a psychological need which,

when satisfied, helps people to recover from bodily strain and can have prolonged effects for well-being and health (Kleiber 2000; Krajewski et al. 2011; Ohtsu et al. 2012). Perhaps relaxation, containing a psychological as well as a biological component, can act as a mediator that connects the satisfaction of other psychological needs to psychobiological well-being and health benefits.

To summarize, all DRAMMA needs except meaning and affiliation were related to at least one of the three well-being variables in the multilevel analyses in our study. On a weekly level, it seems that specific needs (e.g., relaxation) can explain a greater share of variance in well-being outcomes (e.g., life satisfaction) than other needs (e.g., meaning). Thus, Hypothesis 2 received only partial support. Relaxation especially explained variance in subjective health, and together with mastery in life satisfaction, whereas for vitality all DRAMMA needs, especially mastery, detachment and autonomy were relatively equal predictors.

Poor detachment from work predicted ill-being (need for recovery, tension, and stress) in the multilevel analyses, with the exception of depressive complaints. Relaxation and mastery were negatively related to depressive complaints and need for recovery, but not to tension. Relaxation was also negatively related to stress. Affiliation was negatively related to tension and marginally to stress, but not to depressive complaints or need for recovery. Need for recovery, tension and stress can be seen as a reaction to mental or physiological overload such as that caused by heavy job demands (Sonnentag et al. 2010). Psychological detachment creates mental distance from experienced strain, helping people to recover better in the evening and to better satisfy their needs to overcome strain and fatigue. Consistent with our results, in their meta-analysis, Wendsche and Lohmann-Haislah (2017) found that psychological detachment was related to better sleep quality and less physical discomfort. The effects of relaxation are also compatible with those reported in intervention studies, where relaxation interventions such as relaxation therapy and deep-breathing have been used for alleviating people's stress, fatigue and anxiety (De Bloom et al. 2017b; Richardson and Rothstein 2008; Thiar et al. 2015). Moreover, our results suggest that, besides detachment and relaxation, mastery may also be important in alleviating employees' depressive complaints and need for recovery. Satisfying the need to feel proficient and skillful may help a person to experience less negative affect and strain by building up positive personal resources and self-esteem (e.g., Iwasaki 2007). In summary, Hypothesis 3 received partial support. That is, detachment from work, relaxation, and mastery negatively predicted several outcomes of ill-being.

Earlier research has shown the DRAMMA needs to be more consistently related to well-being rather than ill-being (Sheldon et al. 2001; Van den Broeck et al. 2016; Zika and Chamberlain 1992). However, contrary to Hypothesis 4, the DRAMMA needs explained around twice as much variance for ill-being compared to the predicted variance for well-being. Earlier research has often used direct measures of positive and negative affect as the main variables for measuring subjective well- and ill-being. Perhaps the benefits of DRAMMA need satisfaction for well-being are especially prominent regarding the affective side of well-being rather than for more cognitive measures such as life satisfaction and subjective health. Nevertheless, our results suggest that besides impacting subjective well-being, the DRAMMA needs may also be of great importance in relation to ill-being (such as depressive complaints and need for recovery). A lack of psychological need satisfaction

can exacerbate ill-being and over time may even lead to increased negative affectivity and helplessness (Sheldon 2011). Indeed, DRAMMA need satisfaction may act as an important psychological buffer mechanism, protecting people from depression, various stress symptoms, and fatigue. Our results suggest that the relative importance of psychological need satisfaction for well-being and ill-being should be further examined in future studies, to ascertain if, when analyzed conjointly, psychological needs do indeed explain more variance in ill-being rather than in well-being outcomes.

According to our results, it seems that, of all the DRAMMA needs, relaxation and detachment from work are most consistently related to optimal functioning. Based on Pratt indices, which prevent problems of multicollinearity, relaxation was the strongest predictor for four relationships between weekly DRAMMA need satisfaction and weekly optimal functioning (57% of all relationships studied), while detachment was the strongest predictor for two relationships (29% of all relationships studied). This is in line with the review of recovery experiences by Sonnentag et al. (2017), who found most consistent links between detachment from work, relaxation, well-being, and ill-being outcomes. In a modern working society, work intensification and social acceleration pose a serious challenge to employees' optimal functioning (Rosa 2013; Ulferts et al. 2013). Detachment and relaxation, while sometimes labeled "passive recovery", can be very important mechanisms in counteracting effects of job strain and emotional exhaustion (Bennett et al. 2018; Sonnentag et al. 2017; Wendsche and Lohmann-Haislah 2017).

Besides high levels of certain satisfied DRAMMA needs (especially relaxation and detachment), balanced DRAMMA need satisfaction was also important for subjective health (and marginally for stress). This suggests that satisfying one or two needs may not suffice for a consistent experience of feeling healthy, whereas having an even level of satisfaction between the DRAMMA needs seems to play a less important role for other variables. To summarize, detachment from work and relaxation seem to be especially important needs for consistent optimal functioning, while for subjective health the overall balance between the DRAMMA needs also plays a role.

Although all DRAMMA needs (including meaning and affiliation) were positively related to well-being and negatively related to ill-being, when all needs were examined conjointly only detachment, relaxation, autonomy, mastery and to a small degree affiliation were related to optimal functioning. Four of the needs are identified as recovery experiences in the framework by Sonnentag and Fritz (2007). Thus, the four recovery experiences included in the DRAMMA model explained most of the variance in optimal functioning, while affiliation was only weakly related and meaning was not significantly related to optimal functioning in the conjoint model.

Other recovery experiences, such as problem-solving pondering, have also been recently examined together with detachment, relaxation, control, and mastery (Bennett et al. 2016). Besides being examined as psychological needs, meaning and affiliation could also be seen as experiences helping people to better recover from work through experiencing leisure as meaningful and feeling connected to people outside work. According to our results, the addition of meaning and affiliation to the original four recovery experiences might not bring much incremental value in explaining additional variance in optimal functioning. However, the role of meaning and affiliation should not be ignored. Recent qualitative research using a best possible selves paradigm (Loveday et al. 2018b) showed that affiliation was considered the most important ingredient participants described when envisioning their ideal future and that meaning also played a role in living a good life (Loveday et al.

2018a). Similarly, Virtanen et al. (2019) found that meaning and affiliation were positively related to life satisfaction among schoolteachers and principals.

Moreover, our design studying the DRAMMA needs conjointly did not allow us to examine hierarchical relationships among the DRAMMA needs. For example, to replenish resources lost due to job strain, detachment from work and relaxation may need faster satisfaction during leisure time than other DRAMMA needs and be therefore more salient early on in the need satisfaction process than autonomy, mastery, meaning, and affiliation. The DRAMMA model does not specify hierarchical temporal relationships within DRAMMA needs, which is why we did not examine these possible relationships. Future need research should investigate if some needs require the satisfaction of other needs as preconditions.

Concerning measurement, it may be that the outcomes we measured lean more towards the hedonic rather than the eudaimonic side of well-being. Future research may include eudaimonic outcomes (e.g., personal growth, beneficence, transcendence) to reassess the value of meaning and affiliation. Moreover, the scales we used to measure meaning and affiliation may not be optimal for capturing the richness of these constructs. We developed the scales and adapted them from the Job Diagnostic Survey (Hackman and Oldham 1974; Johnston and Finney 2010). Although the scales had good internal reliabilities, their validity may not be optimal. Especially the affiliation item “I really liked the people I interacted with” may have confounded social preferences with experiences of affiliation and relatedness. Future studies may benefit from measuring affiliation with items involving more closely the innate experience of closeness and relatedness. For meaning, it may be useful to attempt to distinguish between presence of meaning and searching for meaning (e.g., Newman et al. 2018).

Our results suggest that the interrelations between different need and recovery models (e.g., DRAMMA, SDT, and recovery experiences) should be more thoroughly investigated. For instance, although, like psychological need satisfaction, recovery experiences are also seen as “internal resources”, recovery experiences differ from SDT needs in that recovery experiences are not seen as universal, organismic, or always fundamentally innate (Sonnentag and Fritz 2007; Vansteenkiste et al. 2010). Affiliation (relatedness), an established SDT need that is important for leisure and work well-being (Loveday et al. 2018a; Newman et al. 2014; Sirgy et al. 2017; Van den Broeck et al. 2016), explained very little additional variance in our within-person outcomes compared to detachment from work, relaxation, autonomy, and mastery. Perhaps in the context of leisure well-being, recovery experiences are the definitive factors contributing to optimal functioning. The null results for meaning are also interesting. Meaning has more often been examined as an outcome of autonomy, competence, and relatedness (affiliation) than as a psychological need (e.g., Martela et al. 2018). The role of meaning in tying together the process of need satisfaction and improved optimal functioning should be investigated more thoroughly in the future, also in the context of leisure.

4.1 Strengths and Limitations

Our study has four key strengths. First, this study was the first to examine all DRAMMA needs conjointly in a longitudinal model, providing validity information on the direction and stability of the model and its effects. Second, studying the interrelationships,

similarities and dissimilarities of self-determination theory needs and recovery experiences helps to disentangle the fields of psychological need satisfaction at work and leisure and recovery from work during leisure time. Third, the five measurement points enabled us to examine the DRAMMA needs and outcomes both during leisure (vacation) and during work episodes (in the evening after work), investigating both domains in a single study. Fourth, we compared the importance of all predictor needs for outcomes, which allowed not only to conventionally test significances but to also examine the relative strengths and relative importance of each DRAMMA need using the Pratt index (Pratt 1987; Thomas et al. 1998).

This study is not without limitations. Although our participants had various different professions, our sample was not random and thus could potentially suffer from some degree of selection bias. Three out of four of the participants were female, so the generalizability of our findings to more male-dominated professions may be limited. Moreover, since there was only a single measurement point during the employees' vacation, we were not able to compare the importance of DRAMMA needs for optimal functioning between domains (i.e., work and leisure). Finally, in order to reduce participant burden over the study's five measurement times, many of our measures for optimal functioning were single-item measures. Thus, we could not examine reliability coefficients for those measures.

4.2 Suggestions for Future Research

Future studies could extend our results in several ways. First, although there is accumulating evidence on the importance of psychological need satisfaction for optimal functioning, how different combinations of needs might contribute to optimal functioning over time has not received much attention. Building on our results, one might study whether different profiles of the DRAMMA needs, such as high psychological detachment combined with high relaxation versus high satisfaction of other DRAMMA needs yield differing benefits, or whether specific combinations of dissatisfied DRAMMA needs are more detrimental to optimal functioning than others. Latent Profile Analysis could be applied to investigate this issue in more detail.

Second, the great importance of psychological detachment and relaxation for optimal functioning compared to other DRAMMA needs could be investigated further. Detachment from work and relaxation were likewise more consistently related to higher well-being and lower ill-being than mastery and control in a systematic review of recovery experiences by Sonnentag et al. (2017). Reminding employees of the importance of psychological detachment and relaxation for optimal functioning could be of great economic and clinical value in this age where active, difficult, and energy-consuming leisure pursuits are often valued over simple, more "leisurely" ways of spending one's leisure time such as reflection and rest (Kleiber 2000).

Third, although the relationships between balanced need satisfaction and optimal functioning were rather weak in general, balanced need satisfaction predicted subjective health (and marginally stress) beyond the influence of overall levels of DRAMMA need satisfaction. Balance of the DRAMMA needs could be an interesting topic for a more thorough examination. Perhaps the potential positive effects of a life with balanced DRAMMA need satisfaction are more protective than instant satisfaction of single needs, safeguarding the

self from harm caused by conflicts in need satisfaction to long-term future well-being (Sheldon and Niemiec 2006). Consistent with this idea, in our results balanced need satisfaction was slightly more strongly linked to ill-being than to well-being.

5 Conclusion

In this study we validated the DRAMMA model with a longitudinal research design. Factorial structure of the six-need model was found to be robust, suggesting that the six DRAMMA needs could also be investigated conjointly in future studies on psychological need satisfaction. We focused on the within-person level to examine individual patterns in need satisfaction and optimal functioning across leisure and work. Among the DRAMMA needs, relaxation and detachment from work were found to be most strongly associated with optimal functioning. In modern working life, where work intensification and social acceleration are increasingly present, psychological need satisfaction during leisure and in the evening hours after work can aid and nurture employees' well-being, providing the necessary ingredients for optimal functioning.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval This study was approved by the ethics committee of the Leuphana University in Lüneburg, Germany (Reference No. 201606, EB-Antrag Lehr201606_holiday). The trial is also registered at the German Clinical Trial Register (DRKS00013650).

Informed Consent Participants provided their informed consent.

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Appendix

See Table 5.

Table 5 DRAMMA need satisfaction predicted by linear and quadratic time

DRAMMA	Estimate	SE	t value
<i>Detachment</i>			
(Intercept)	1.23	0.14	8.93***
Time linear	1.33	0.10	12.99***
Time quadratic	-0.18	0.02	-10.67***
Variance within	.98 (.56)		
<i>Relaxation</i>			
(Intercept)	1.30	0.12	10.13***
Time linear	1.15	0.10	11.58***
Time quadratic	-0.14	0.02	-8.70***
Variance within	.68 (.82)		
<i>Autonomy</i>			
(Intercept)	1.95	0.12	15.87***
Time linear	1.02	0.09	11.52***
Time quadratic	-0.14	0.01	-9.78***
Variance within	.95 (.97)		
<i>Mastery</i>			
(Intercept)	2.35	0.12	18.87***
Time linear	0.46	0.10	4.80***
Time quadratic	-0.06	0.02	-3.49***
Variance within	.65 (.80)		
<i>Meaning</i>			
(Intercept)	2.38	0.13	18.02***
Time linear	0.56	0.10	5.80**
Time quadratic	-0.07	0.02	-4.34***
Variance within	.85 (.92)		
<i>Affiliation</i>			
(Intercept)	3.39	0.08	38.87***
Time linear	0.45	0.07	6.67***
Time quadratic	-0.06	0.01	-5.25***
Variance within	.30 (.55)		

*** $p < .001$

References

- Allen, M. J., & Yen, W. M. (2001). *Introduction to measurement theory*. Long Grove: Waveland Press.
- Baard, P. P., Deci, E. L., & Ryan, R. M. (2004). Intrinsic need satisfaction: A motivational basis of performance and well-being in two work settings. *Journal of Applied Social Psychology*, 34(10), 2045–2068.
- Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, 117(3), 497–529.
- Bennett, A. A., Bakker, A. B., & Field, J. G. (2018). Recovery from work-related effort: A meta-analysis. *Journal of Organizational Behavior*, 39(3), 262–275.
- Bennett, A. A., Gabriel, A. S., Calderwood, C., Dahling, J. J., & Trougakos, J. P. (2016). Better together? Examining profiles of employee recovery experiences. *Journal of Applied Psychology*, 101(12), 1635–1654.
- Bliese, P. D., & Ployhart, R. E. (2002). Growth modeling using random coefficient models: Model building, testing, and illustrations. *Organizational Research Methods*, 5(4), 362–387.

- Bolger, N., Davis, A., & Rafaeli, E. (2003). Diary methods: Capturing life as it is lived. *Annual Review of Psychology*, *54*(1), 579–616.
- Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models for social and behavioral research: Applications and data analysis methods*. Newbury Park, CA: Sage.
- Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-Deeder, J., et al. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion*, *39*(2), 216–236.
- Church, A. T., Katigbak, M. S., Locke, K. D., Zhang, H., Shen, J., de Jesús Vargas-Flores, J., et al. (2013). Need satisfaction and well-being: Testing self-determination theory in eight cultures. *Journal of Cross-Cultural Psychology*, *44*(4), 507–534.
- Cook, C., Heath, F., & Thompson, R. L. (2000). A meta-analysis of response rates in web- or Internet-based surveys. *Educational and Psychological Measurement*, *60*(6), 821–836.
- De Bloom, J., Geurts, S., & Kompier, M. (2010). Vacation from work as prototypical recovery opportunity. *Gedrag & Organisatie*, *23*(4), 333–349.
- De Bloom, J., Sianoja, M., Korpela, K., Tuomisto, M., Lilja, A., Geurts, S., et al. (2017a). Effects of park walks and relaxation exercises during lunch breaks on recovery from job stress: Two randomized controlled trials. *Journal of Environmental Psychology*, *51*, 14–30.
- De Bloom, J., Syrek, C. J., Lamers, E., & Burkardt, S. (2017b). But the memories last forever... Vacation reminiscence and recovery from job stress: A psychological needs perspective. *Wirtschaftspsychologie*, *3*, 64–79.
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*(4), 227–268.
- Deci, E. L., Ryan, R. M., Gagné, M., Leone, D. R., Usunov, J., & Kornazheva, B. P. (2001). Need satisfaction, motivation, and well-being in the work organizations of a former eastern bloc country: A cross-cultural study of self-determination. *Personality and Social Psychology Bulletin*, *27*(8), 930–942.
- Frankl, V. E. (1963). *Man's search for meaning: An introduction to logotherapy* (Vol. 20). New York, NY: Washington Square. **(Originally published 1946).**
- Grilli, L., & Rampichini, C. (2007). Multilevel factor models for ordinal variables. *Structural Equation Modeling*, *14*(1), 1–25.
- Hackman, J. R., & Oldham, G. R. (1974). *The Job Diagnostic Survey: An instrument for the diagnosis of jobs and the evaluation of job redesign projects*. New Haven, CT: Yale University.
- Heck, R. H., & Thomas, S. L. (2000). *An introduction to multilevel modeling techniques*. Mahwah, NJ: Lawrence Erlbaum.
- Hewett, R., Haun, V. C., Demerouti, E., Rodríguez Sánchez, A. M., Skakon, J., & De Gieter, S. (2017). Compensating need satisfaction across life boundaries: A daily diary study. *Journal of Occupational and Organizational Psychology*, *90*(2), 270–279.
- Hox, J. J. (2002). *Multilevel analysis: Techniques and applications*. Mahwah, NJ: Lawrence Erlbaum.
- Huta, V., & Ryan, R. M. (2010). Pursuing pleasure or virtue: The differential and overlapping well-being benefits of hedonic and eudaimonic motives. *Journal of Happiness Studies*, *11*(6), 735–762.
- Ilies, R., Aw, S. S. Y., & Pluut, H. (2015). Intraindividual models of employee well-being: What have we learned and where do we go from here? *European Journal of Work and Organizational Psychology*, *24*(6), 827–838.
- Iwasaki, Y. (2007). Leisure and quality of life in an international and multicultural context: What are major pathways linking leisure to quality of life? *Social Indicators Research*, *82*(2), 233–264.
- Iwasaki, Y. (2017). Contributions of leisure to “meaning-making” and its implications for leisure studies and services. *Annals of Leisure Research*, *20*(4), 416–426.
- Johnston, M. M., & Finney, S. J. (2010). Measuring basic needs satisfaction: Evaluating previous research and conducting new psychometric evaluations of the Basic Needs Satisfaction in General Scale. *Contemporary Educational Psychology*, *35*(4), 280–296.
- Kivimäki, M., Jokela, M., Nyberg, S. T., Singh-Manoux, A., Fransson, E. I., Alfredsson, L., et al. (2015). Long working hours and risk of coronary heart disease and stroke: A systematic review and meta-analysis of published and unpublished data for 603,838 individuals. *The Lancet*, *386*, 1739–1746.
- Kleiber, D. A. (2000). The neglect of relaxation. *Journal of Leisure Research*, *32*(1), 82–86.
- Kono, S., Walker, G. J., Ito, E., & Hagi, Y. (2017). Theorizing leisure's roles in the pursuit of Ikigai (life worthiness): A mixed-methods approach. *Leisure Sciences*. <https://doi.org/10.1080/01490400.2017.1356255>.
- Krajewski, J., Sauerland, M., & Wieland, R. (2011). Relaxation-induced cortisol changes within lunch breaks—An experimental longitudinal worksite field study. *Journal of Occupational and Organizational Psychology*, *84*(2), 382–394.

- Kroenke, K., Strine, T. W., Spitzer, R. L., Williams, J. B. W., Berry, J. T., & Mokdad, A. H. (2009). The PHQ-8 as a measure of current depression in the general population. *Journal of Affective Disorders, 114*(1–3), 163–173.
- Liu, Y., Zumbo, B. D., & Wu, A. D. (2014). Relative importance of predictors in multilevel modeling. *Journal of Modern Applied Statistical Methods, 13*(1), 2–22.
- Loveday, P. M., Lovell, G. P., & Jones, C. M. (2018a). The importance of leisure and the psychological mechanisms involved in living a good life: A content analysis of best-possible-selves texts. *The Journal of Positive Psychology, 13*(1), 18–28.
- Loveday, P. M., Lovell, G. P., & Jones, C. M. (2018b). The Best Possible Selves intervention: A review of the literature to evaluate efficacy and guide future research. *Journal of Happiness Studies, 19*(2), 607–628.
- Mack, D. E., Wilson, P. M., Oster, K. G., Kowalski, K. C., Crocker, P. R. E., & Sylvester, B. D. (2011). Well-being in volleyball players: Examining the contributions of independent and balanced psychological need satisfaction. *Psychology of Sport and Exercise, 12*(5), 533–539.
- Martela, F., Ryan, R. M., & Steger, M. F. (2018). Meaningfulness as satisfaction of autonomy, competence, relatedness, and beneficence: Comparing the four satisfactions and positive affect as predictors of meaning in life. *Journal of Happiness Studies, 19*(5), 1261–1282.
- McCormick, B. W., Reeves, C. J., Downes, P. E., Li, N., & Ilies, R. (2018). Scientific contributions of within-person research in management: Making the juice worth the squeeze. *Journal of Management*. <https://doi.org/10.1177/0149206318788435>.
- McNair, D. M., Lorr, M., & Droppelman, L. F. (1971/1982/1992). *Manual for the profile of mood states*. San Diego, CA: Educational and Industrial Testing Service.
- Merz, E. L., & Roesch, S. C. (2011). Modeling trait and state variation using multilevel factor analysis with PANAS daily diary data. *Journal of Research in Personality, 45*(1), 2–9.
- Milyavskaya, M., Gingras, I., Mageau, G. A., Koestner, R., Gagnon, H., Fang, J., et al. (2009). Balance across contexts: Importance of balanced need satisfaction across various life domains. *Personality and Social Psychology Bulletin, 35*(8), 1031–1045.
- Mohr, G., Müller, A., Rigotti, T., Aycan, Z., & Tschan, F. (2006). The assessment of psychological strain in work contexts. *European Journal of Psychological Assessment, 22*(3), 198–206.
- Muthén, B. O. (1994). Multilevel covariance structure analysis. *Sociological Methods & Research, 22*(3), 376–398.
- Muthén, L. K., & Muthén, B. O. (2006). *Mplus user's guide*. Los Angeles, CA: Author.
- Newman, D. B., Nezelek, J. B., & Thrash, T. M. (2018). The dynamics of searching for meaning and presence of meaning in daily life. *Journal of Personality, 86*(3), 368–379.
- Newman, D. B., Tay, L., & Diener, E. (2014). Leisure and subjective well-being: A model of psychological mechanisms as mediating factors. *Journal of Happiness Studies, 15*(3), 555–578.
- Ohtsu, T., Kaneita, Y., Aritake, S., Mishima, K., Uchiyama, M., Akashiba, T., et al. (2012). Preferable forms of relaxation for health promotion, and the association between recreational activities and self-perceived health. *Acta Medica Okayama, 66*(1), 41–51.
- Pinheiro, J. C., & Bates, D. M. (2000). *Mixed-effects models in S and S-Plus*. Berlin: Springer.
- Porter, H., Iwasaki, Y., & Shank, J. (2010). Conceptualizing meaning-making through leisure experiences. *Loisir et Société, 33*(2), 167–194.
- Pratt, J. W. (1987). Dividing the indivisible: Using simple symmetry to partition variance explained. In T. Pukkila & S. Puntanen (Eds.), *Proceedings of the second international conference in statistics* (pp. 245–260). Tampere: University of Tampere.
- Rasskazova, E., Ivanova, T., & Sheldon, K. (2016). Comparing the effects of low-level and high-level worker need-satisfaction: A synthesis of the self-determination and Maslow need theories. *Motivation and Emotion, 40*(4), 541–555.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods*. Thousand Oaks, CA: Sage.
- Richardson, K. M., & Rothstein, H. R. (2008). Effects of occupational stress management intervention programs: A meta-analysis. *Journal of Occupational Health Psychology, 13*(1), 69–93.
- Rogelberg, S. G., & Stanton, J. M. (2007). Understanding and dealing with organizational survey nonresponse. *Organizational Research Methods, 10*(2), 195–209.
- Rosa, H. (2013). *Social acceleration: A new theory of modernity*. New York, NY: Columbia University Press.
- Ryan, R. M., & Deci, E. L. (2008). From ego depletion to vitality: Theory and findings concerning the facilitation of energy available to the self. *Social and Personality Psychology Compass, 2*(2), 702–717.

- Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online*, 8(2), 23–74.
- Sheldon, K. M. (2011). Integrating behavioral-motive and experiential-requirement perspectives on psychological needs: A two process model. *Psychological Review*, 118(4), 552–569.
- Sheldon, K. M., Elliot, A. J., Kim, Y., & Kasser, T. (2001). What is satisfying about satisfying events? Testing 10 candidate psychological needs. *Journal of Personality and Social Psychology*, 80(2), 325–339.
- Sheldon, K. M., & Gunz, A. (2009). Psychological needs as basic motives, not just experiential requirements. *Journal of Personality*, 77(5), 1467–1492.
- Sheldon, K. M., & Hoon, T. H. (2007). The multiple determination of well-being: Independent effects of positive traits, needs, goals, selves, social supports, and cultural contexts. *Journal of Happiness Studies*, 8(4), 565–592.
- Sheldon, K. M., & Niemiec, C. P. (2006). It's not just the amount that counts: Balanced need satisfaction also affects well-being. *Journal of Personality and Social Psychology*, 91(2), 331–341.
- Sirgy, M. J., Uysal, M., & Kruger, S. (2017). Towards a benefits theory of leisure well-being. *Applied Research in Quality of Life*, 12(1), 205–228.
- Snijders, T. A., & Bosker, R. J. (1994). Modeled variance in two-level models. *Sociological Methods & Research*, 22, 342–363.
- Snyder, C. R. (2002). Hope theory: Rainbows in the mind. *Psychological Inquiry*, 13(4), 249–275.
- Sonnentag, S., & Bayer, U.-V. (2005). Switching off mentally: Predictors and consequences of psychological detachment from work during off-job time. *Journal of Occupational Health Psychology*, 10(4), 393–414.
- 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(3), 204–221.
- 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(3), 355–365.
- Sonnentag, S., Venz, L., & Casper, A. (2017). Advances in recovery research: What have we learned? What should be done next? *Journal of Occupational Health Psychology*, 22(3), 365–380.
- Steger, M. F., & Kashdan, T. B. (2013). The unbearable lightness of meaning: Well-being and unstable meaning in life. *Journal of Positive Psychology*, 8(2), 103–115.
- Steger, M. A., Oishi, S., & Kashdan, T. B. (2009). Meaning in life across the life span: Levels and correlates of meaning in life from emerging adulthood to older adulthood. *Journal of Positive Psychology*, 4(1), 43–52.
- Stone, A., Shiffman, S., Atienza, A., & Nebeling, L. (2007). *The science of real-time data capture: Self-reports in health research*. Oxford: Oxford University Press.
- Ten Brummelhuis, L. L., & Trougakos, J. P. (2014). The recovery potential of intrinsically versus extrinsically motivated off-job activities. *Journal of Occupational and Organizational Psychology*, 87(1), 177–199.
- Theorell, T., Hammarström, A., Aronsson, G., Träskman Bendz, L., Grape, T., Hogstedt, C., et al. (2015). A systematic review including meta-analysis of work environment and depressive symptoms. *BMC Public Health*, 15(1), 1–14.
- Thiart, H., Lehr, D., Ebert, D., Berking, M., & Riper, H. (2015). Log in and breathe out: Internet-based recovery training for sleepless employees with work-related strain—results of a randomized controlled trial. *Scandinavian Journal of Work, Environment and Health*, 41(2), 164–174.
- Thomas, D. R., Hughes, E., & Zumbo, B. D. (1998). On variable importance in linear regression. *Social Indicators Research*, 45(1–3), 253–275.
- Twilley, D. L. (2017). *Quantitatively testing the DRAMMA model of leisure and subjective well-being on college students*. Unpublished doctoral dissertation, Ohio University, Athens.
- Ulferts, H., Korunka, C., & Kubicek, B. (2013). Acceleration in working life: An empirical test of a sociological framework. *Time & Society*, 22(2), 161–185.
- Van den Broeck, A., Ferris, D. L., Chang, C.-H., & Rosen, C. C. (2016). A review of self-determination theory's basic psychological needs at work. *Journal of Management*, 42(5), 1195–1229.
- Van Hooff, M. L. M., & Geurts, S. A. E. (2014). Need satisfaction during free evening hours: Examining its role in daily recovery. *Stress and Health*, 30(3), 198–208.
- Van Hooff, M. L. M., & Geurts, S. A. E. (2015). Need satisfaction and employees' recovery state at work: A daily diary study. *Journal of Occupational Health Psychology*, 20(3), 377–387.

- Van Veldhoven, M., & Broersen, S. (2003). Measurement quality and validity of the “need for recovery scale”. *Occupational and Environmental Medicine*, *60*, i3–i9.
- Vansteenkiste, M., Niemiec, C. P., & Soenens, B. (2010). The development of the five mini-theories of self-determination theory: An historical overview, emerging trends, and future directions. In T. Urdan & S. Karabenick (Eds.), *Advances in motivation and achievement. The decade ahead* (Vol. 16, pp. 105–165). Yorkshire: Emerald Publishing.
- Verbeek, J., Ruotsalainen, J., Laitinen, J., Korhakangas, E., Lusa, S., Mänttari, S., et al. (2019). Interventions to enhance recovery in healthy workers: A scoping review. *Occupational Medicine*, *69*(1), 54–63. <https://doi.org/10.1093/occmed/kqy141>.
- Virtanen, A., De Bloom, J., & Kinnunen, U. (2019). Relationships between recovery experiences and well-being among younger and older teachers. *International Archives of Occupational and Environmental Health*. <https://doi.org/10.1007/s00420-019-01475-8>.
- Vogel, R. M., Rodell, J. B., & Lynch, J. W. (2016). Engaged and productive misfits: How job crafting and leisure activity mitigate the negative effects of value incongruence. *Academy of Management Journal*, *59*(5), 1561–1584.
- Waltz, C. F., Strickland, O., & Lenz, E. R. (1991). *Measurement in nursing research*. Philadelphia, PA: FA Davis Company.
- Wendsche, J., & Lohmann-Haislah, A. (2017). A meta-analysis on antecedents and outcomes of detachment from work. *Frontiers in Psychology*. <https://doi.org/10.3389/fpsyg.2016.02072>.
- Zika, S., & Chamberlain, K. (1992). On the relation between meaning in life and psychological well-being. *British Journal of Psychology*, *83*, 133–145.

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