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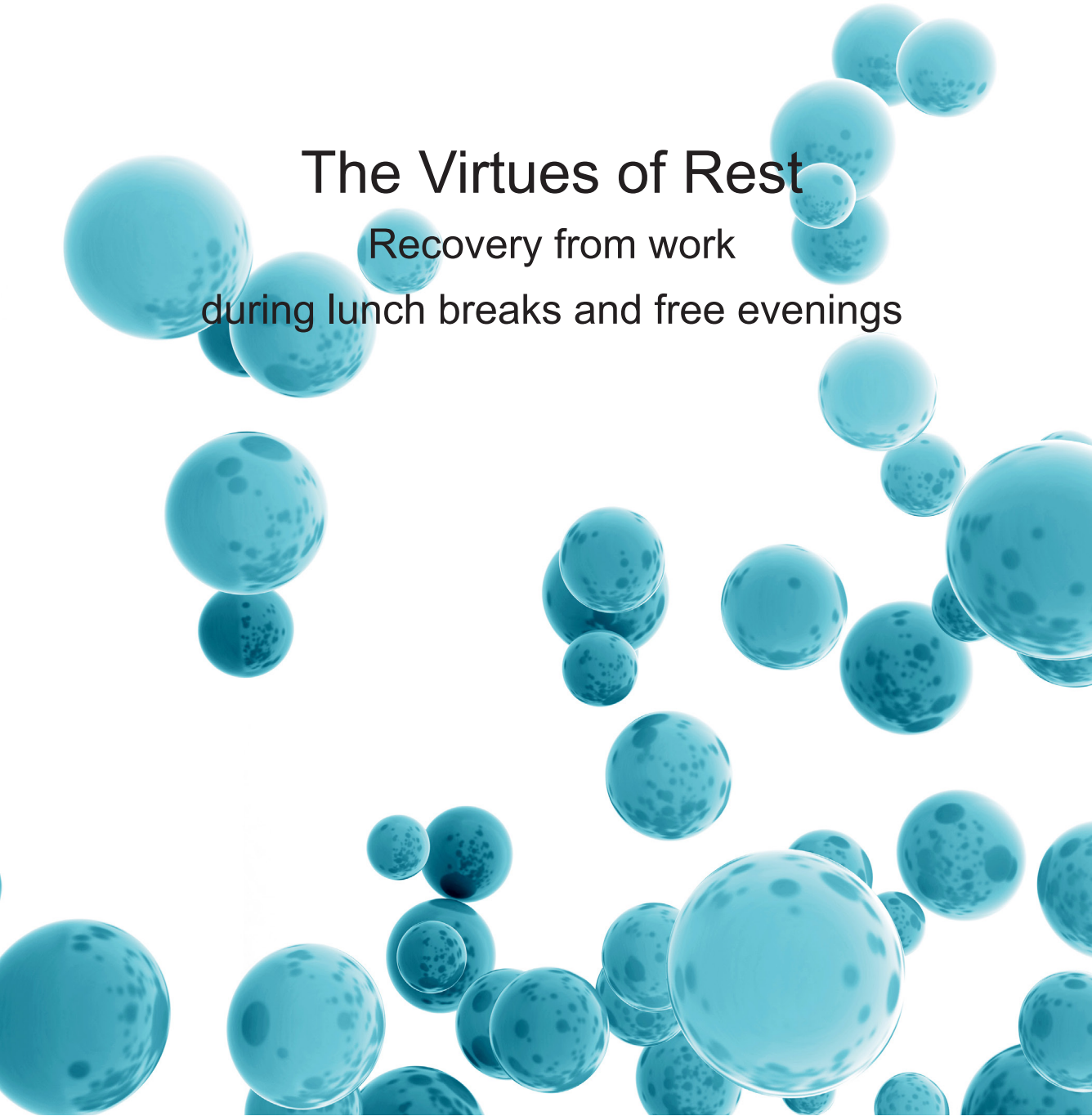
MARJAANA SIANOJA

The Virtues of Rest

Recovery from work during lunch breaks and free evenings



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ACADEMIC DISSERTATION
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UNIVERSITY OF TAMPERE

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Portland, Oregon, June 2018

Marjaana Sianoja

ABSTRACT

This dissertation focuses on recovery from work stress during lunch breaks and free evenings and investigates how recovery relates to psychological well-being on a daily level and over one year. Based on the effort-recovery model and the conservation of resources theory, lunch breaks that are free from job demands and offer opportunities to engage in resource recovering activities were expected to enhance recovery. Furthermore, in line with the stressor-detachment model, insufficient detachment (i.e. mental disengagement from work related thoughts) during free evenings was expected to predict increase in strain over time.

This dissertation consists of three original publications. In Study I, I examined which lunchtime recovery experiences and activities were related to lunchtime recovery cross-sectionally, and whether lunchtime recovery in turn predicted energy levels at work one year later. Study II explored the within-person effects of lunchtime intervention activities on employees' well-being at the end of the working day. The intervention activities examined were park walks and relaxation exercises. Additionally, lunchtime recovery experiences were tested as mediators between the intervention activities and well-being outcomes. Finally, in Study III, I investigated whether detachment during free evenings was related to intra-individual change in exhaustion or sleep difficulties over one year, and whether detachment attenuated the effects of workload on these strain outcomes.

The data used in this dissertation were collected as a part of a larger research project called "Recovery from work stress: Integrating perspectives of work and environmental psychology", which consisted of a longitudinal questionnaire study and an intervention study. Studies I (N = 841) and III (N = 1722) were based on the questionnaire study carried out in 12 Finnish organizations. Eleven organizations participated in 2013 and 2014, and one organization participated in 2014 and 2015. Study II (N = 97) was based on an intervention study carried out in seven Finnish organizations in 2014. Employees in both studies came from various fields and worked mainly in knowledge-intensive or emotionally demanding jobs (e.g. in education, public administration, media, IT, and engineering). In both studies the majority of the participants were women and they were on average 47 years old.

The results revealed, first, that taking lunch breaks regularly, taking longer lunch breaks, and spending breaks outside the office building were positively associated with lunchtime recovery. However, stronger associations were found between experiencing detachment and control during lunch breaks and lunchtime recovery. Lunchtime recovery was in turn related to less exhaustion and more vigor a year later, but the effects were small. Second, regarding the intervention activities, on days when employees engaged in park walks or relaxation exercises during lunch breaks, they experienced higher levels of well-being (higher concentration, less strain and fatigue) at the end of the working day compared to days without these exercises. Lunchtime enjoyment mediated the beneficial effects of park walks on well-being and lunchtime detachment mediated the effects of relaxation exercises on well-being. Finally, poor detachment during free evenings was related to an increase in exhaustion and sleep difficulties over one year. Detachment also attenuated the effects of workload on exhaustion cross-sectionally but not over time. All the results are based on models that controlled for relevant job characteristics. Autonomy was related to more lunchtime recovery, daily demands at work were related to higher levels of strain at the end of the working day, and workload was related to sleep difficulties cross-sectionally and to exhaustion over time.

Overall the results supported the ideas drawn from the effort-recovery model and the conservation of resources theory, i.e., lunch breaks that are free from demands and replenish resources enhance recovery. The results supported the long-term direct effects between detachment and strain as expected based on the stressor-detachment model, but the moderator hypotheses received only partial support. In practice, lunch breaks offer a significant recovery opportunity and engaging in recovering activities during lunch breaks is a promising way to enhance daily well-being at work. Recovering lunch break activities were also related to concentration at the end of the working day, suggesting that lunch breaks play a role in sustaining performance throughout the day. Organizations should pay attention to practices that allow employees to take workday breaks and detach during evenings after work in order to foster employee well-being in the long term.

TIIVISTELMÄ

Tämän väitöskirjatutkimuksen päätavoitteena oli tutkia työkuormituksesta palautumista lounastauoilla ja vapaa-aikana sekä selvittää, miten palautuminen on yhteydessä hyvinvointiin. Ponnistelujen ja palautumisen malliin sekä voimavarojen säilyttämisen teoriaan pohjautuen oletettiin, että lounastauot edistävät parhaiten palautumista silloin, kun ne ovat vapaita työn vaatimuksista ja kartuttavat työntekijän voimavaroja. Lisäksi työstressin ja irrottautumisen mallin mukaisesti riittämättömän työstä irrottautumisen vapaa-ajalla oletettiin lisäävän uupumusasteista väsymystä ja uniongelmia vuoden yli.

Väitöskirja koostuu kolmesta osajulkaisusta. Ensimmäisessä tutkimuksessa tarkasteltiin, miten erilaiset tavat viettää lounastaukoa ja lounastaukojen aikaiset palautumiskokemukset (työstä irrottautuminen ja kontrollin tunne) edistävät palautumista. Lisäksi tutkittiin, onko onnistunut palautuminen lounastauoilla yhteydessä koettuun uupumusasteiseen väsymykseen tai tarmokkuuteen työssä vuoden aikavälillä. Toisessa tutkimuksessa selvitettiin, onko lounastauon aikainen rentoutusharjoitus tai puistokävely yhteydessä työntekijöiden hyvinvointiin iltapäivällä ennen kotiinlähtöä. Tutkimuksessa oletettiin, että lisääntynyt työstä irrottautuminen ja mielihyvän kokeminen lounastauolla välittävät näiden harjoitusten hyötyjä iltapäivän kohentuneeseen hyvinvointiin. Kolmannessa tutkimuksessa tarkasteltiin, onko työstä irrottautuminen vapaa-ajalla yhteydessä uupumusasteiseen väsymykseen ja uniongelmiin vuoden aikavälillä. Työstä irrottautumisen oletettiin myös suojaavan työtekijöiden hyvinvointia työn aikapaineiden haitallisilta vaikutuksilta.

Aineisto kerättiin osana tutkimushanketta ”Työkuormituksesta palautuminen: Työ- ja ympäristöpsykologisten näkökulmien yhdistäminen”, joka koostui pitkittäis- ja interventiotutkimuksista. Pitkittäistutkimus toteutettiin yhdessätoista suomalaisessa organisaatiossa vuosina 2013 ja 2014 sekä yhdessä organisaatiossa vuotta myöhemmin (2014 ja 2015). Pitkittäistutkimuksessa kerättyä aineistoa hyödynnettiin ensimmäisessä (N = 841) ja kolmannessa (N = 1722) osajulkaisussa. Toinen osajulkaisu perustui (N = 97) interventiotutkimukseen, joka toteutettiin seitsemässä suomalaisessa organisaatiossa vuonna 2014. Mukana oli työntekijöitä, jotka työskentelivät tietointensiivisillä aloilla tai emotionaalisesti kuormittavissa

töissä. Tyypillisimmät alat olivat koulutus, julkinen hallinto, media ja informaatioteknologia. Osallistujista suurin osa oli naisia ja vastaajien keski-ikä oli 47 vuotta.

Tulokset osoittivat, että työstä irrottautuminen ja kontrollin tunne lounastaukojen aikana olivat yhteydessä onnistuneeseen palautumiseen lounastauoilla. Lisäksi palautumista edistivät lounastaukojen pitäminen useita kertoja viikossa, pidemmät lounastauot ja lounastaukojen viettäminen toimistorakennuksen ulkopuolella. Onnistunut palautuminen lounastauoilla puolestaan oli yhteydessä vähäisempään uupumusasteiseen väsymykseen ja lisääntyneeseen tarmokkuuteen vuoden aikavälillä, mutta yhteys oli suhteellisen heikko. Interventiotutkimuksessa havaittiin, että työntekijät kokivat hyvinvointinsa (parempi keskittymiskyky, vähemmän stressiä ja väsymystä) iltapäivällä paremmaksi niinä päivinä, kun he kävivät puistokävelyllä tai tekivät rentoutusharjoituksen lounastauolla verrattuna päiviin ilman tätä harjoitusta. Lisääntynyt mielihyvän kokemus lounastauoilla välitti puistokävelyn vaikutuksia iltapäivän hyvinvointiin. Työstä irrottautuminen puolestaan välitti rentoutusharjoituksen vaikutuksia iltapäivän hyvinvointiin. Kun tarkasteltiin työstä irrottautumista vapaa-aikana, havaittiin, että puutteellinen irrottautuminen ennusti lisääntynyttä uupumusasteista väsymystä ja uniongelmia vuoden yli. Irrottautuminen myös suojasi aikapaineiden uupumusasteista väsymystä lisääviltä vaikutuksilta, mutta tämä yhteys oli havaittavissa ainoastaan poikittaisasetelmassa. Kaikissa analyyseissa huomioitiin myös työn piirteiden merkitys palautumiseen ja hyvinvointiin. Autonomia työssä oli yhteydessä onnistuneeseen palautumiseen lounastauoilla ja työntekijät kokivat useammin olonsa stressaantuneeksi ja jännittyneeksi iltapäivällä niinä päivinä, kun työn vaatimukset olivat korkeat. Työn aikapaineet olivat yhteydessä lisääntyneisiin uniongelmiin ja uupumusasteiseen väsymykseen.

Kokonaisuudessaan tulokset tukivat ponnistelujen ja palautumisen mallin ja voimavarojen säilyttämisen teorian pohjalta asetettuja oletuksia: Lounastauot, jotka olivat työn vaatimuksista vapaita ja lounastaukojen viettäminen voimavaroja kartuttavalla tavalla edistivät työkuormituksesta palautumista. Myös työstressin ja irrottautumisen malli sai tukea, sillä puutteellinen työstä irrottautuminen vapaa-ajalla oli yhteydessä lisääntyneeseen uupumusasteiseen väsymykseen ja uniongelmiin vuotta myöhemmin. Mallin pohjalta asetettu hypoteesi irrottautumisen suojaavasta vaikutuksesta aikapaineiden haitallisia vaikutuksia vastaan sai vain osittaista tukea.

Lounastauot mahdollistavat palautumisen työkuormituksesta jo työpäivän aikana. Lisäksi rentoutusharjoitukset ja puistokävely lounastauolla olivat yhteydessä parempaan keskittymiskykyyn iltapäivällä, mikä antaa viitteitä siitä, että lounastauoilla saattaa olla myös työsuoritusta parantava vaikutus. Työhyvinvoinnin edistämiseksi

työnantajien tulisi kiinnittää huomiota käytöntöihin, jotka mahdollistavat säännölliset tauot työstä ja työstä irrottautumisen vapaa-ajalla.

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Sianoja, M., Kinnunen, U., de Bloom, J., Korpela, K., & Geurts, S. (2016). Recovery during Lunch Breaks: Testing Long-Term Relations with Energy Levels at Work. *Scandinavian Journal of Work and Organizational Psychology, 1*(1): 7, 1–12, doi: 10.16993/sjwop.13

Study II

Sianoja, M., Syrek, C. J., de Bloom, J., Korpela, K., & Kinnunen, U. (2018). Enhancing Daily Well-Being at Work through Lunchtime Park Walks and Relaxation Exercises: Recovery Experiences as Mediators. *Journal of Occupational Health Psychology, 23*(3), 428–442. doi: 10.1037/ocp0000083

Study III

Sianoja, M., Kinnunen, U., Mäkikangas, A., Tolvanen, A. (2018, February 15). Testing the Direct and Moderator Effects of the Stressor-Detachment Model over One Year: A Latent Change Perspective. *Work & Stress*. Advance online publication. doi: 10.1080/02678373.2018.1437232

1 INTRODUCTION

1.1 Recovery from work in the context of contemporary working life

Western working life has changed dramatically in the last few decades. The recent changes, such as the rise in global competition, shifting labor markets, and the burgeoning use of information and communication technologies are reflected in employees' experiences of high workload, job insecurity, and blurred boundaries between work and free time. According to the report of the European Working Conditions Survey, work intensification in Europe increased slightly from 1991 to 2005, remaining at a high level in the 21st century (Eurofound & EU-OSHA, 2014). For example, in 2015, 21% of employees in Finland and 23% of employees in other European countries reported working at high speed either almost all the time or all the time (Eurofound, 2016). In addition, one third of European employees reported working during their free time several times a month, several times a week, or even every day. At the same time knowledge and service work have become more common and employees consequently also often face high cognitive and emotional demands at work. For example, emotional demands are especially common in the health sector and education, which are both growing sectors in Europe. While many developments, such as the introduction of the 40-hour working week, increased attention to accident prevention, and accessibility of education, have enhanced employees' rights and working conditions in European and other Western countries, high job demands challenge employees' psychological well-being and expose them to stress-related illnesses. Particularly high workload together with blurred boundaries, often coupled with high cognitive and emotional demands, raises the question how and when employees recover from work, and what kind of risks to employee health and well-being ensue from insufficient recovery.

This study focuses on recovery from work, which is defined as "psychophysiological unwinding after effort expenditure" (Geurts & Sonnentag, 2006, p. 485), and is seen as the opposite of physiological and psychological activation that occurs during a demanding work spell. Understanding how and when employees recover from work is important, as recovery has the potential to halt the

accumulation of strain reactions and to protect against the harmful effects of job demands on employee health and well-being (Geurts & Sonnentag, 2006). Additionally, employees' state of recovery may influence their behavior and performance at work (Sonnentag, 2003).

Whereas research on recovery during off-job time (e.g., during free evenings, weekends, and vacations) has received ample research attention during the last two decades, only few studies have addressed the recovery potential of workday breaks (for recent exceptions, see Bosch, Sonnentag, & Pinck, 2017; Hunter & Wu, 2015; Krajewski, Wieland, & Sauerland, 2010; Trougakos, Hideg, Cheng, & Beal, 2014; von Dreden & Binnewies, 2017). Even though the ergonomics literature has addressed questions of how the timing and length of workday breaks influence physical discomfort, safety, or job performance scientific knowledge on how different break activities or psychological experiences during workday breaks relate to recovery outcomes remains scarce. Workday breaks constitute an important recovery setting, as breaks can potentially prevent resource depletion early on, maintain productivity throughout the working day, and protect against high need for recovery at the end of a working day (Coffeng, van Sluijs, Hendriksen, van Mechelen, & Boot, 2015; Trougakos, Beal, Green, & Weiss, 2008). When employees feel more restored at the end of a working day, it is likely that they will find it easier to recover during free time as well (de Bloom, Kinnunen, & Korpela, 2015). Additionally, the recovery potential of workday breaks may be of particular interest to organizations, as employers can influence the recovery opportunities during workday breaks (e.g., by offering silent rooms for relaxation).

Another gap in the earlier recovery literature relates to examining the long-term outcomes of recovery. Whereas many recent studies have focused on daily recovery processes, for example examining how evening activities and experiences relate to fatigue at bedtime (Rook & Zijlstra, 2006) or the following morning (ten Brummelhuis & Trougakos, 2014), fewer studies have examined how recovery relates to health or well-being over several months or years. Examining recovery as a daily process is well justified, as recovery activities, experiences, and outcomes may – to some extent – vary from day to day. However, it is also important to investigate how recovery activities, experiences, or states that employees generally engage in or experience relate to long-term outcomes. Studying recovery outcomes over time makes it possible to assess whether insufficient recovery poses a significant long-term risk for impaired employee health and well-being.

To address the gaps identified above, this study investigated how people may recover from work during lunch breaks, how lunchtime recovery relates to well-

being, and how recovery during free evenings relates to long-term recovery outcomes. More specifically, I examined the following questions: 1) how to facilitate recovery during lunch breaks, 2) if lunchtime recovery relates to well-being over time and 3) whether lunch break intervention activities improve employee well-being. Relating to the long-term outcomes of evening recovery, I furthermore addressed the following two questions: 4) whether detachment (i.e., not thinking about work) during off-job time relates to strain over one year and 5) whether detachment attenuates the relationship between high job demands and strain. The focus of this study was on the psychological outcomes of recovery.

In the following parts of this introduction, I first present the key definitions and theories of recovery from work and propose definitions of the short- and long-term recovery outcomes measured in this study. Second, I discuss how job characteristics relate to recovery. Third, focusing mainly on workday breaks but also covering recovery during free evenings, I discuss different temporal and environmental settings, activities, and experiences that may influence recovery. Lunchtime interventions are introduced as a special case of recovery activities that also relate closely to recovery experiences. Fourth, the role of other important factors influencing recovery, such as working time arrangements, sleep quality, and demographic variables, is briefly discussed. Finally, I end the introduction by specifying the aims of this study in further detail.

1.2 Recovery from work stress: Conceptual and theoretical perspectives

Recovery from work stress is seen as a process of both psychological and physiological unwinding that occurs when job demands are no longer present (Geurts & Sonnentag, 2006). During a recovery period, both psychological and physiological systems return to and stabilize at a baseline level; for example, elevated heart rate, blood pressure, and cortisol levels return to normal, and feelings of strain and fatigue decrease. In this context, baseline level refers to the level that appears when no special demands are made on the individual, and the individual has recovered from any previous demands (Geurts & Sonnentag, 2006; Meijman & Mulder, 1998). Alternatively, recovery as an outcome refers to a psychological or physiological state that has been achieved after a certain recovery period, characterized by feeling restored and by readiness to meet new demands (Sonnentag,

Venz, & Casper, 2017). When referring to recovery as an outcome, phrases such as state of being recovered or feeling recovered are typically used.

This study draws mainly on two theories that have been popular in the recovery literature: the effort-recovery (E-R) model (Meijman & Mulder, 1998) and the conservation of resources (COR) theory (Hobfoll, 1989). The E-R model includes specific expectations regarding how recovery relates to employee health and well-being, whereas the COR theory is a general stress theory, which has nevertheless been widely used in recovery research. The E-R model and the COR theory forming the main theoretical background of this study are discussed next in more detail. Other theories and models applied in recovery research have also influenced the specific ideas tested in this study: the attention restoration theory (Kaplan, 1995) and the psycho-evolutionary theory (Ulrich, 1983) illustrating the role of restorative environments for recovery, the broaden-and-build theory (Fredrickson, Mancuso, Branigan, & Tugade, 2000) explaining how positive emotions can facilitate recovery, and the stressor-detachment model (Sonnentag & Fritz, 2015) describing the specific role of psychological detachment from work for recovery. These theories and models will be briefly introduced in the later parts of this introduction when the related recovery settings and experiences are discussed (i.e., restorative environments, positive affect, and psychological detachment).

The E-R model (Meijman & Mulder, 1998; see also Geurts & Sonnentag, 2006) states that to complete any work tasks, employees must expend effort, which results in acute load reactions. These short-term psychological and physiological reactions are normal and reversible. Therefore, when recovery is successful, all the functions will return to the baseline level and thus the employee starts the next work spell in a recovered state. However, failure to recover between two consecutive work spells (e.g., between two work shifts) causes employees to start the next spell (e.g., the next working day) in a suboptimal condition with incomplete resources, for example, still fatigued from the preceding working day. This means that employees must expend compensatory effort to perform adequately on the job. This increased effort expenditure leads to accumulating strain reactions, such as prolonged fatigue, chronic tension, or ill health (Geurts & Sonnentag, 2006). According to the E-R model, to recover from work, work demands should be absent and free time activities should not expend the same resources as those utilized during the working day. Thus recovery occurs through a temporary respite from job demands, sometimes classified as a passive recovery mechanism.

The COR theory (Hobfoll, 1989) offers a more active view on recovery. The core assumption of the COR theory is that people are motivated to protect existing and

gain new resources, which are defined broadly as valued objects (e.g., home), personal characteristics (e.g., high self-efficacy), conditions (e.g., secure job), or energies (e.g., time). These resources are either valuable in themselves or constitute instrumental value to achieve other desired assets. According to the COR theory, stress is caused by depletion of resources, experiencing a threat of losing resources, or not regaining resources after investing effort. To recover from job stress, employees must actively engage in activities that help to replenish the resources lost at work. Internal resources, such as energy and positive mood, are the most important resources in the context of recovery from work (Sonnentag & Fritz, 2007).

1.3 Outcomes of recovery

Recovery can be examined from the viewpoint of settings, processes, and outcomes (Sonnentag & Geurts, 2009), or by combining these perspectives. Examining recovery from the viewpoint of settings or processes addresses the questions of when, where, and how best to recover from work stress. Recovery settings and processes will be discussed in more detail later in this introduction. Recovery outcomes indicate how successful the recovery process is, which can be measured in two ways. First, the state of feeling recovered, or how restored employees feel, can be assessed directly using self-report measures. Second, different measures of health, well-being, or performance are typically examined as indicators of how well recovered the employees are. Both psychological and physiological outcomes, such as fatigue, affect, blood pressure and cortisol, can be measured. Recovery outcomes can also be divided into short- and long-term outcomes. For example, daily sleep quality can be measured as a short-term recovery outcome, and chronic sleep difficulties are typically assessed as a long-term recovery outcome.

In this study, I have focused on psychological recovery outcomes, from both short- and long-term perspectives. Particular emphasis was placed on outcomes intended to capture employees' energy levels. It is generally assumed that effort expenditure at work depletes energy resources and initiates strain reactions. Following this logic, recovery from work can be seen as a process of reducing fatigue and strain. Consequently, outcomes measuring energy levels, such as fatigue, exhaustion, or vigor, and outcomes reflecting employees' experience of psychological strain, can be considered as key outcomes of recovery.

Short-term recovery outcomes

To assess short-term outcomes of lunchtime recovery, I examined the state of feeling recovered after lunch breaks (henceforth lunchtime recovery) and well-being at the end of the working day. First, lunchtime recovery was conceptualized in terms of how well employees feel that they can recover from work and restore their resources during their lunch breaks. Second, to assess well-being at the end of the working day, concentration, strain, and fatigue were measured. Concentration can be defined as the ability to focus on the current task without attention shifting away (see Demerouti, Taris, & Bakker, 2007), and thus good concentration can benefit daily job performance. Situations where employees are exposed to high job demands or when they evaluate demands as threatening typically lead to psychological strain, which is characterized by high arousal and negative affect (Darr & Johns, 2008; Podsakoff, LePine, & LePine, 2007). Fatigue, in turn, refers to the subjective experience of feeling tiredness and low energy, and typically relates to low mood and to disinclination to engage in effortful activities (Hockey, 2013).

Long-term recovery outcomes

As long-term outcomes, I examined vigor as an outcome of lunchtime recovery, exhaustion as an outcome of both lunchtime and off-job time recovery, and sleep difficulties as an outcome of off-job time recovery. Exhaustion is considered as the core dimension of job burnout. It refers to "feelings of being overextended and depleted of one's emotional and physical resources" (Maslach, Schaufeli, & Leiter, 2001, p. 399). Exhaustion develops gradually over time, after a long-term exposure to high job demands and insufficient recovery. Thus, compared to fatigue, exhaustion is a more chronic strain reaction and usually less responsive to short periods of rest. Exhaustion has been linked to sickness absence (Toppinen-Tanner, Ojajärvi, Väänänen, Kalimo, & Jäppinen, 2005) and mental and physical illness, such as depression and cardiovascular diseases (Ahola, 2007).

To arrive at a more comprehensive picture of employees' energy levels, vigor is often measured as a positive antidote to exhaustion. As one of the components of work engagement, vigor refers to high activation, energy and mental resilience while working (Schaufeli, Salanova, González-romá, & Bakker, 2002). Vigor has been linked to positive outcomes at work, such as high motivation and performance (Bakker, Demerouti, & Sanz-Vergel, 2014). Absence of exhaustion does not automatically imply high levels of vigor, and thus it is important to measure both of

these outcomes (Demerouti, Mostert, & Bakker, 2010; Mäkikangas, Feldt, Kinnunen, & Tolvanen, 2012).

Insufficient recovery, and particularly low detachment in the evenings, can also lead over time to increased sleep difficulties. In the recovery literature, sleep may be addressed either as a recovery process conducive to recovery, or as a recovery outcome. For example, getting enough sleep and sleeping well can help employees to feel more recovered and energetic in the morning. At the same time, facing high job demands and thinking about work during off-job time may relate to increased physiological activation at bedtime, which may impair sleep quality on a daily basis (Clinton, Conway, & Sturges, 2017; Hülsheger et al., 2014). Over time poor recovery and low detachment may lead to increased sleep difficulties, which are characterized by difficulties in initiating and maintaining sleep, waking up too early, or experiencing nonrestorative sleep (Edinger et al., 2004). Sleep difficulties relate to many factors signaling poor life quality and ill health, such as burnout, depression, and increased alcohol consumption (Lindblom, Linton, Fedeli, & Bryngelsson, 2006; Stoller, 1994). In addition, sleep difficulties have been associated with increased sickness absence and lowered job performance (Stoller, 1994).

1.4 Job characteristics and recovery

Before turning to recovery settings and processes, I will briefly discuss how job characteristics relate to recovery. In addition to influencing recovery needs, job characteristics relate directly to the same well-being outcomes that are often examined as outcomes of recovery. This results from the fact that the recovery process is the opposite of effort expenditure at work. For example, elevated blood pressure could be measured as an outcome of high workload and a fall in blood pressure as an outcome of the recovery process. Hence it is crucial to take job characteristics into account when measuring the relationship between recovery processes and well-being.

Particularly workload and job autonomy, identified as key job characteristics in the job demand-control model (Karasek, 1979), may influence recovery. Workload is characterized by a large work amount and pressure to work at high speed (van Veldhoven & Broersen, 2003), while autonomy is defined as having considerable decision latitude in terms of when, where, and how work tasks are accomplished (Semmer & Beehr, 2014). High workload implies that employees' resources are likely to be further depleted at work, resulting in greater demands on the recovery process

after work. In terms of internal recovery, high workload may lead to skipping lunch breaks and other workday breaks or taking shorter breaks, as employees feel that they are too busy to even stop working momentarily. Conversely, a high degree of autonomy may improve internal recovery, as it allows employees to adjust their break schedules or work tasks according to their current need for recovery (Geurts, Beckers, & Tucker, 2013). For example, when employees feel tired at work they may take a longer lunch break or switch to an easier task.

The link between job characteristics and well-being is explained in the job demands-resources (JD-R) model, which distinguishes between job demands and job resources as two broad categories of job characteristics (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001). In this model, job demands are defined as "physical, social, or organizational aspects of the job that require sustained physical or mental effort" (Demerouti et al., 2001, p. 501), while job resources refers to the physical, psychological, social, or organizational aspects of the job that stimulate personal growth, learning, and development. The JD-R model identifies excessive job demands as factors leading to a process of health impairment, which results in poor health and well-being, including burnout symptoms (exhaustion, cynicism, and inefficacy) and job resources as the central factor leading to motivation at work, including work engagement (vigor, dedication, and absorption).

In relation to the long-term outcomes examined in the present study, earlier longitudinal studies have found a relationship between high workload and exhaustion over one year (Schaufeli, Bakker, & Van Rhenen, 2009; Sonnentag, Binnewies, & Mojza, 2010; Taris, Kompier, Geurts, Houtman, & Van Den Heuvel, 2010). Additionally, systematic evidence has been reported of an association between high workload and increased sleep difficulties with time lags ranging from three months to five years (see Linton et al., 2015 for a review).

1.5 Recovery settings and processes – when, where, and how to recover from work

To answer when, where, and how employees can most successfully recover from work, various recovery settings and processes have been examined in relation to the recovery outcomes presented above. Settings can be theoretically divided into temporal and environmental recovery settings (Sonnentag et al., 2017), which I will next describe in more detail, followed by a discussion on recovery processes.

1.5.1 Temporal and environmental recovery settings

Temporal settings

Recovery can occur in various temporal settings. A general distinction is made between recovery that takes place during workday breaks, namely internal recovery, and recovery that occurs during off-job time, referred to as external recovery. As a temporal setting internal recovery includes short informal breaks, such as eating a snack or talking with colleagues about non-work-related subjects between work tasks, and formal breaks, such as scheduled coffee breaks or lunch breaks. External recovery includes free time between work shifts, typically free evenings and weekends, and longer breaks, such as vacations and sabbaticals. To be concise, in the following chapters I will use the phrase "recovery during (free) evenings" when referring to the off-job time period between two consecutive working days, although some employees may have their free time in the mornings or during the day. The expressions off-job and free time are used interchangeably when referring to time away from paid work, excluding workday breaks (even though lunch breaks could be also considered as "off-job time" or "free time").

As outlined earlier in the introduction, this study mainly focuses on internal recovery, and more specifically, on lunch breaks as a temporal recovery setting. Lunch breaks are typically the longest and most formalized of the workday breaks, and consequently offer the best recovery opportunity during the working day. In Finland, where this study was conducted, most employees who work more than six hours a day have a legal right to take a daily 30-minute rest break (Työaikalaki [Working Hours Act], 9.8.1996/605). This daily break does not constitute working time, thus employees are typically free to leave the work place during this time. Although earlier research has mainly focused on external recovery, some evidence exists that lunchtime recovery, i.e., feeling more recovered after lunch breaks, relates to less exhaustion and higher work engagement in the afternoon (Bosch et al., 2017), and that more resource recovery during workday breaks is associated with less of exhaustion at the end of the working week (Hunter & Wu, 2015). In addition to lunch breaks, free evenings as a temporal setting were also included in this study, representing another daily free-time period enabling recovery. Accordingly, the focus in the following chapters will be on introducing earlier studies examining recovery during lunch breaks, but relevant research on recovery during free evenings will also be discussed.

Related to the temporal setting, researchers have examined the length, frequency, and timing of workday breaks as predictors of successful recovery. In line with the E-R model and COR theory, breaks that are regular and long enough will likely facilitate recovery as they offer enough time to disengage from job demands and engage in resource recovering activities. An earlier review in the field of ergonomics by Tucker (2003) concluded that relatively frequent short rest breaks, and self-paced breaks taken when experiencing heightened fatigue, may be beneficial in terms of increasing productivity and decreasing fatigue, physiological strain, and discomfort. A more recent study examined the length, timing, and number of breaks in relation to post-break resources (Hunter & Wu, 2015). This experience sampling study conducted among 95 employees showed that break length was not directly associated with post-break resources. However, a significant interaction between break length, number of breaks, and resources after the last break of the day demonstrated that when employees took fewer breaks during the day, longer breaks were more strongly associated with resource recovery than were shorter breaks. In another recent diary study with lunch break length as a control variable (von Dreden & Binnewies, 2017), a significant positive within-person correlation was found between break length and lunchtime detachment, but the relationship was no longer significant in the final model including several other lunch break characteristics as predictors.

Environmental settings

The recovery potential of different environments has received limited attention in occupational health psychology, but in the field of environmental psychology there is a plethora of literature on the restorative effects of different environments, and natural environments in particular. As a concept closely related to recovery, environmental psychologists use the term restoration when referring to the renewal of psychological and physiological resources depleted by the demands of everyday life (Hartig, 2004; Korpela & Kinnunen, 2010).

According to the attention restoration theory (Kaplan, 1995), cognitive resources required to direct or sustain attention are replenished in environments that attract attention effortlessly. This effortless attention appears in environments that have fascinating stimuli evoking intrinsic interest. Additional experiences enhancing restoration identified by Kaplan (1995) include a sense of being away (i.e., psychological distance), compatibility (i.e., a fit between the environment and one's aims and desires), and extent of surroundings (i.e., sufficient scope to explore the surroundings). Natural environments have been claimed to have these qualities more

often, and have been shown to afford greater attention restoration than built or urban environments (Berman, Jonides, & Kaplan, 2008; Bowler, Buyung-Ali, Knight, & Pullin, 2010; Lee, Williams, Sargent, Williams, & Johnson, 2015). Other environments, such as monasteries (Ouellette, Kaplan, & Kaplan, 2005) and museums (Kaplan, Bardwell, & Slakter, 1993), have also been linked to these restorative experiences.

Furthermore, psychoevolutionary theory (Ulrich, 1983) proposes that people are well-adapted and respond positively to natural environments signaling chances of survival, and consequently spending time in natural environments is believed to reduce psychophysiological stress and evoke positive emotions. Overall, spending time in natural environments, having window views with natural elements, and seeing pictures or videos with natural scenery have been shown to promote restoration more than similar exposure to built environments without natural elements (Berto, 2014; Bowler et al., 2010; Hartig, Mitchell, De Vries, & Frumkin, 2014). Among employees, free time spent in interacting with nature has been associated with low need for recovery from work (Korpela & Kinnunen, 2010). Consequently, spending lunch breaks in natural environments, for example, in a park near the office building, may relate to higher levels of recovery than spending the breaks inside or in urban environments (for a more detailed discussion, see "Recovery activities during lunch breaks: Intervention studies" under Chapter 1.5.2.1)

In the experience sampling study by Hunter and Wu (2015), the researchers examined how break environment relates to resource recovery during workday breaks. Spending breaks outside the office (i.e., in the office building or outside the office building) had a significant positive within-person correlation with post-break resources. However, this relationship was no longer significant in the final model including several other break characteristics as predictors. Nevertheless, spending breaks outside the office may offer greater restoration, especially when the employees also exit the office building, as exiting the office building potentially increases the physical absence of work-related cues and provides greater change of scenery than staying in the same building. For example, spending the lunch break in a restaurant or café may provide experiences of being away and compatibility, and thus facilitate recovery compared to spending the break inside the office building.

As a summary of the temporal and environmental recovery settings, earlier research suggests that taking longer breaks, especially on days when employees took fewer breaks during the working day, and spending time in natural environments may be conducive to recovery. Additionally, spending breaks in any environment

that provides more restorative experiences, such as sense of being away, than staying inside the office building could benefit recovery. Next I will turn to recovery processes, and discuss which activities and experiences may best promote recovery.

1.5.2 Recovery processes

The following section presents empirical studies examining how recovery processes, that is, recovery activities and experiences, relate to recovery outcomes. I begin by briefly introducing studies examining different recovery activities in the context of free evenings, and continue by providing a more comprehensive review of the studies examining recovery activities during lunch breaks. I will also discuss intervention studies investigating the effects of different lunchtime activities on well-being. Recovery experiences will later be discussed first in the context of off-job time recovery and second in the context of lunch breaks. As mentioned at the beginning of this introduction, earlier studies addressing recovery during lunch breaks are notably scarce, whereas several studies have examined the role of recovery activities and experiences during free evenings.

1.5.2.1 Recovery activities

Recovery activities during free evenings

The recovery potential of engaging in different activities during off-job time, most often during free evenings, has been examined in multiple diary studies (see Sonnentag et al., 2017 for a review). Effortful activities, including work-related activities, household chores, and child care, have been suggested to hamper recovery, whereas low-effort (e.g., watching TV), social (e.g., meeting friends), and physical activities have been suggested to facilitate recovery. In fact, in most studies work-related activities have been associated with poor recovery outcomes, and social and physical activities with positive recovery outcomes, such as improved well-being, high vigor, or low need for recovery at bedtime or in the following morning (Bakker, Demerouti, Oerlemans, & Sonnentag, 2013; Sonnentag, 2001; Sonnentag & Zijlstra, 2006; ten Brummelhuis & Bakker, 2012; ten Brummelhuis & Trougakos, 2014). Additionally, one intervention study suggests that engaging in hour-long low-

intensity running sessions three times a week enhanced well-being in a group of fatigued employees (de Vries, van Hooff, Guerts, & Kompier, 2017).

Contrary to expectations, household activities have often been unrelated to recovery outcomes (e.g., Sonnentag, 2001; Sonnentag & Zijlstra, 2006; ten Brummelhuis & Bakker, 2012; ten Brummelhuis & Trougakos, 2014). The effects of household activities on recovery may depend on whether the employees choose to, or feel compelled to engage in these activities during their free time. For example, ten Brummelhuis and Trougakos (2014) found that more time spent on household and caregiving tasks was related to more exhaustion the following morning only when the tasks were extrinsically motivated. Regarding low-effort activities, some studies have found beneficial effects for recovery (e.g., Sonnentag, 2001; ten Brummelhuis & Bakker, 2012), but others have not (e.g., Sonnentag & Zijlstra, 2006; van Hooff, Geurts, Beckers, & Kompier, 2011).

Recovery activities during lunch breaks

Lunch breaks are much shorter and often take place in different environmental settings than typical off-job time recovery periods. Hence different recovery activities may be beneficial during lunch breaks than during free time. Nevertheless, only few earlier studies have explored how different lunch break activities relate to recovery outcomes. In one study conducted among summer camp cheerleading instructors, engaging in low-effort activities and socializing (labeled "respites") during 1-1.5 hour breaks was related to higher levels of positive emotions and lower levels of negative emotions during breaks than engaging in effortful activities (labeled "chores") (Trougakos et al., 2008). The employees who had engaged in respites during their breaks also exhibited higher levels of positive affective displays after the breaks than did the employees who had engaged in chores. In an experience sampling study conducted among university administrative employees by Trougakos et al. (2014), work-related activities were related to higher afternoon fatigue, unless lunchtime autonomy was particularly high (i.e., the employees felt that they could decide for themselves how to spend the break). In the same study, relaxing activities were related to less afternoon fatigue, and the combination of low lunchtime autonomy and low relaxation during lunch breaks was particularly harmful in terms of increased afternoon fatigue. Additionally, one cross-sectional study showed that physical activity during lunch breaks was associated with less need for recovery at the end of a working day (Coffeng et al., 2015).

The present study examined the relationship between social activities during lunch breaks and lunchtime recovery. Social activities during lunch breaks may not be as restorative as social activities during free time, as employees often spend breaks with colleagues and supervisors whose presence may require more emotion and impression management efforts than spending time with friends or family (see Trougakos et al., 2014). Nevertheless, it is possible that social activities during lunch breaks promote recovery through providing social support, relatedness, and opportunities to detach from work through engaging in discussions on private matters. Whereas one earlier study showed clear benefits of social activities during workday breaks associating them with lower turnover (Wendsche et al., 2014), the study by Trougakos et al. (2014) suggested that social activities during lunch breaks may in fact impede recovery. More specifically, when lunch break autonomy was moderate or low, social activities during lunch breaks were associated with increased fatigue at the end of a working day. Only when lunch break autonomy was particularly high were social activities associated with reduced fatigue.

In a recent diary study, von Dreden and Binnewies (2017) examined the role of social activities during lunch breaks in greater detail. They investigated how lunch break companionship, conversation content, psychological detachment (i.e., not thinking about work, see Chapter 1.5.2.2.), and vigor were related. Companionship of colleagues and supervisor, and work-related conversation predicted poor detachment during lunch break. However, spending the break with colleagues did not hamper detachment when employees engaged in private conversations. Psychological detachment in turn was related to more vigor after the break and discussing work- related topics was related to less vigor at the end of a working day.

To summarize the results regarding social activities during lunch breaks, it seems that depending on multiple other factors social activities may either help or hinder lunchtime recovery. Social activities may benefit lunchtime recovery when employees experience a high level of autonomy in choosing the break activity, engage in non-work-related conversations, and experience detachment from work during the break.

Recovery activities during lunch breaks: Intervention studies

In addition to investigating which typical lunchtime activities are related to recovery outcomes, intervention studies have been conducted to purposefully manipulate lunch break activities. Intervention studies allow researchers to examine whether engaging in certain restorative activities during lunch breaks brings even greater

restorative benefits than the typical lunchtime activities that the employees usually engage in. Intervention studies also provide stronger evidence of causality than questionnaire or daily diary studies. In the present study, I examined the effects of two intervention activities on employee well-being: lunchtime park walks and relaxation exercises. Earlier intervention studies examining various lunch break activities are scarce, but some earlier intervention studies have indeed investigated the effects of exposure to natural surroundings, taking walks outside, or engaging in relaxation or mindfulness exercises on lunchtime recovery.

Taking park walks ensures the physical absence of work demands and thus enables participants to recover from work demands during the lunch break (Meijman & Mulder, 1998). Additionally, spending time in natural surroundings has specific restorative effects as discussed earlier in this introduction. Furthermore, park walks may facilitate recovery through engagement in light physical activity during the breaks. One earlier intervention study compared lunchtime walks in natural or urban environments with regular lunch break activities among 73 office workers (Brown, Barton, Pretty, & Gladwell, 2014). Self-reported mental health improved in the nature walking group but no changes occurred in several other health parameters measured. As the authors pointed out, the exposure may have been insufficient to yield greater benefits, as the participants were only instructed to walk twice a week and adherence to this regime was poor.

Relaxation exercises are typically designed to change bodily experiences associated with stress reaction (e.g., quick and shallow breathing, tense muscles) to a more relaxed state to induce both psychological and physiological relaxation. A more detailed description of common relaxation techniques, including progressive muscle relaxation (PMR), deep breathing, and mindfulness can be found in the original publication. Using relaxation exercises as stress management programs at workplaces has been widely assessed and found useful in reducing strain and improving mental health (Richardson & Rothstein, 2008).

One earlier intervention study examined the effects of lunchtime relaxation exercises on strain and sleepiness among 14 call center employees (Krajewski, Sauerland, & Wieland, 2011; Krajewski et al., 2010; Schnieder et al., 2013). Seven employees were instructed to complete a 20-minute PMR exercise every day during lunch breaks for over six months, and the other seven employees randomized to the control group were asked to engage in smalltalk with colleagues. The PRM group participants experienced less mental, motivational, and emotional strain after the lunch break and in the afternoon (Krajewski et al., 2010), and less afternoon sleepiness (Schnieder et al., 2013) than the control group. The PMR group also

showed reduced cortisol levels after the lunch break and at bedtime, and reduced cortisol awakening response after continuing the exercise for several months, thus demonstrating the effectiveness of lunchtime PMR in reducing physiological stress response (Krajewski et al., 2011).

One recently published intervention study examined the well-being effects of engaging in so called savoring nature exercises and PMR exercises during lunch breaks over ten working days among 82 administrative employees (Steidle, Gonzalez-Morales, Hoppe, Michel, & O'shea, 2017). Both exercises were completed at the employees' work desks and lasted about ten minutes. The savoring nature exercise combined auditory stimuli of a natural environment with a guided imagination technique. Treating both groups as one intervention condition, the researchers found that participants in the intervention group experienced higher levels of afternoon vigor and lower levels of evening fatigue during the intervention than the employees in the wait list control group.

1.5.2.2 Recovery experiences

Recovery experiences during free evenings

To ascertain why specific activities promote recovery, researchers have aimed to identify underlying psychological recovery experiences (Sonnentag & Fritz, 2007). It is likely that individuals differ to some extent in terms of which activities help them to recover most effectively, but the benefits of recovery experiences are believed to be relatively uniform across individuals. For example, some people may experience household tasks as relaxing whereas others may experience them as strenuous, but quite likely everyone benefits from experiencing relaxation. Sonnentag and Fritz (2007) identified four such uniform recovery experiences: psychological detachment from work, relaxation, mastery, and control.

Psychological detachment from work (henceforth detachment) was first introduced by Etzion, Eden, and Lapidot (1998, p. 579), conceptualized as a "sense of being away from the work situation". When defining detachment, Sonnentag and Fritz (2007) further emphasized the importance of mental disengagement, that is, in addition to not engaging in work-related activities, detachment entails the absence of any work-related thoughts during off-job time. Relaxation is characterized by low activation and high positive affect. It can occur during exercises designed to induce relaxation (e.g., progressive muscle relaxation exercise) or less deliberately when

engaging in relaxing activities, such as listening to music or reading a novel. The benefits of detachment and relaxation to recovery can be linked to the E-R model, as both of these experiences indicate the absence of work-related demands.

Mastery refers to the experience of competence or proficiency arising from challenging experiences or learning opportunities outside the work domain. Engaging in activities that create mastery experiences typically requires some effort. Nevertheless, mastery experiences are believed to promote recovery, as they help to create new resources, such as self-efficacy, and potentially increase positive affect. Control can be described as the degree to which people can decide for themselves how to spend their free time. The favorable effects of mastery and control can be attributed to regaining internal resources that were depleted at work, which advances recovery based on the COR theory.

In addition to these four recovery experiences, other recovery enhancing experiences have also been suggested, such as pleasure or enjoyment (Sonnentag & Geurts, 2009). According to the broaden-and-build theory (Fredrickson et al., 2000) positive emotions broaden people's awareness leading to novel thoughts and actions. Positive emotions are also believed to undo the effects of negative affect, thus reducing strain and facilitating recovery.

Cross-sectional studies focusing on external recovery have found positive effects for all four recovery experiences introduced by Sonnentag and Fritz (2007). For example, cross-sectional correlations suggest that detachment, relaxation, mastery, and control during off-job time are related to less psychological distress (Shimazu, Sonnentag, Kubota, & Kawakami, 2012), less exhaustion, less need for recovery, and all but mastery to fewer sleep problems (Sonnentag & Fritz, 2007). Studies examining all these four experiences in the same models (i.e., entering detachment, relaxation, mastery, and control as predictors at once) have found that detachment and mastery are related to less need for recovery, less exhaustion, and more vigor (Kinnunen, Mauno, & Siltaloppi, 2010; Siltaloppi, Kinnunen, & Feldt, 2009), relaxation is related to less need for recovery, less exhaustion (Kinnunen et al., 2010), better self-related health, and more vigor (de Bloom et al., 2015), and control to less need for recovery (Kinnunen et al., 2010; Siltaloppi et al., 2009), and better self-rated health (de Bloom et al., 2015). Diary studies examining within-person effects have mainly focused on detachment (see Sonnentag et al., 2017 for a review). These studies have shown, for example, that following evenings when employees experience high levels of detachment, they experience better sleep quality at night (Hülsheger et al., 2014), and more vigor (ten Brummelhuis & Bakker, 2012) and less fatigue in the morning (Sonnentag, Binnewies, & Mojza, 2008).

Researchers have suggested that detachment is the most powerful recovery experience, as it has shown the strongest associations with well-being (Siltaloppi et al., 2009; Sonnentag & Fritz, 2007; see also Sonnentag & Fritz, 2015). Based on this idea Sonnentag and Fritz (2015) introduced the stressor-detachment model, which identifies detachment as a key variable influencing strain in addition to job stressors. This model also suggests that detachment attenuates the stressor-strain relationship. Theoretically the importance of detachment for recovery can be explained by the fact that psychological detachment from work ensures the full absence of any work-related demands (Meijman & Mulder, 1998). Physically exiting the workplace or refraining from job-related activities is not always enough to ensure recovery, as merely thinking about work during free time may lead to prolonged physiological activation, even when the stressor is no longer present (Brosschot, Pieper, & Thayer, 2005; Ottaviani et al., 2016).

As discussed above, multiple studies have demonstrated the beneficial effects of detachment on employee well-being in the short term. However, the findings regarding the long-term effects of detachment on more chronic strain outcomes remain inconclusive. Focusing on the long-term effects of detachment, Sonnentag et al. (2010) found that low levels of detachment were related to higher levels of exhaustion one year later. Some studies found no evidence for detachment predicting exhaustion in the long-term: In the study by Kinnunen and Feldt (2013) detachment was not related to fatigue (including exhaustion) one year later, and Sonnentag, Arbeus, Mahn, and Fritz (2014) reported a reversed relationship. They found that higher levels of exhaustion predicted less detachment four weeks later, but not vice versa. Additionally, person-oriented studies have shown that people who experience high levels of psychological detachment combined with low levels of rumination over two years (Kinnunen, Feldt, Sianoja, et al., 2017), or high levels of all four recovery experiences over one year (Siltaloppi, Kinnunen, Feldt, & Tolvanen, 2011), had fewer sleep difficulties than other employees over the same time period.

To summarize, studies focusing on external recovery have examined how detachment, relaxation, mastery, and control during free evenings relate to employee well-being. All these experiences have been linked to beneficial outcomes, but the findings have been most consistent for detachment and relaxation (Sonnentag et al., 2017). Detachment, in particular, has been identified as a powerful recovery experience as it ensures the total absence of job-related demands and thus enables recovery from work. However, the empirical evidence of the long-term effects of detachment on strain remains inconclusive.

Recovery experiences during lunch breaks

Earlier studies have mainly examined the role of recovery experiences during off-job time, and it is unclear whether the same recovery experiences are equally beneficial when occurring during workday breaks. As workday breaks are much shorter, often spent in the physical proximity of the workplace, and as employees must quickly reattach to work after the break, some recovery experiences are not necessarily as beneficial during workday breaks as they are during off-job time. For example, whereas detachment during off-job time has been found in numerous studies to benefit recovery, experiencing detachment during lunch breaks could be less beneficial, as employees have to return to work quickly after the break.

In this study I examined the role of detachment, control, and enjoyment in lunchtime recovery. Detachment was chosen as it has been suggested to be one of the most powerful recovery experiences in the context of external recovery (Siltaloppi et al., 2009; Sonnentag & Fritz, 2007), but as mentioned above, it is not clear whether experiencing detachment during lunch breaks is feasible or beneficial. Control was believed to be important for lunchtime recovery based on the earlier study by Trougakos et al. (2014). They found that lunchtime recovery activities were related to less fatigue in the afternoon if employees experienced high levels of lunchtime control. Finally, lunchtime enjoyment was of interest in the intervention study because positive affect has been suggested to underlie the benefits of relaxation exercises (Jain et al., 2007) and exposure to natural surroundings (Ulrich, 1983).

More studies focusing on lunchtime recovery experiences have been published very recently. In two of these detachment during lunch breaks was positively associated with recovery outcomes. In a diary study by von Dreden and Binnewies (2017), lunchtime detachment was associated with increased vigor immediately after lunch breaks, but not at the end of the working day. Additionally, in a cross-sectional questionnaire study, detachment during lunch breaks was related to less need for recovery at the end of a working day (Coffeng et al., 2015).

Another diary study among 109 employees showed that within-persons lunchtime control and relaxation, but not detachment, were positively related to state of feeling recovered immediately after the lunch break (Bosch et al., 2017). Additionally, a state of being recovered mediated the effects of lunchtime control and relaxation on exhaustion and work engagement in the afternoon. Although detachment was not related to feeling recovered after a lunch break in the final model where all lunchtime recovery experiences were included at once, the day-level correlation between lunchtime detachment and feeling recovered after lunch break

was significant. Finally, one earlier a study showed that preferred activities during workday breaks were related to more resource recovery during the break (Hunter & Wu, 2015). As preferred activities are typically those that people most enjoy, this finding could support the idea that enjoyment during breaks benefits recovery.

1.5.2.3 Recovery experiences as mediators and moderators

In this study I examined recovery experiences as mediators between lunchtime recovery activities and well-being. It has been suggested that recovery experiences are psychological experiences that underlie the recovery process. Thus they may mediate the effects of recovery activities on well-being. Additionally, I investigated whether detachment moderates the effect between job demands and strain. Successful recovery is believed to alleviate the effects of job stressors on strain, and thus it is meaningful to examine whether recovery experiences can buffer against the harmful effects of job stressors on strain.

To test recovery experiences as mediators between recovery activities and well-being, I examined whether lunchtime detachment and enjoyment mediated the effects of the intervention activities (park walks and relaxation exercises) on afternoon well-being. Both park walks and relaxation exercises were hypothesized to increase lunchtime detachment and enjoyment. During the park walks employees were asked to direct their focus toward natural environments. Additionally, according to the attention restoration theory (Kaplan, 1995), natural environments can attract attention effortlessly. It was therefore expected that walking in a natural environment would shift attention towards natural surroundings, and consequently employees could easily detach from work-related thoughts during park walks. Engaging in physical activity may also increase detachment (Feuerhahn, Sonnentag, & Woll, 2014; ten Brummelhuis & Bakker, 2012). As a part of the relaxation exercises, employees were instructed to practice acceptance of thoughts and feelings. Accepting thoughts, rather than trying to control them, makes it easier to let go of disturbing thoughts (Hayes, 2004). The acceptance of thoughts, and directing the focus towards breathing or bodily sensations, was believed to increase detachment from work related thoughts during the relaxation exercise.

Furthermore, based on the psycho-evolutionary theory (Ulrich, 1983) people are well adapted to natural environments, and consequently spending time in natural surroundings incudes positive affect. In line with this theoretical idea, walking in natural environments compared to urban environments has been found in earlier studies to increase positive affect (McMahan & Estes, 2015; Tyrväinen et al., 2014).

Similarly, relaxation induces positive affect, and completing relaxation exercises has previously been linked to increased pleasure (Jain et al., 2007). Lunchtime detachment and enjoyment, in turn, can relate to positive well-being outcomes as noted earlier in this introduction.

To examine detachment as a moderator between job stressors and strain, I examined whether evening detachment attenuates the effects of workload on strain in line with the stressor-detachment model (Sonnentag & Fritz, 2015). When employees experience high levels of detachment in the evening after work, the energy depletion caused by job demands ceases, and employees can restore their energy resources. Despite a high workload, if employees can detach from work-related thoughts in the evening before going to bed, they will likely also feel calmer and more relaxed at bedtime. Thus I examined whether detachment buffers against the effects of high workload on exhaustion and sleep difficulties cross-sectionally and over time.

Surprisingly few earlier studies have examined the moderating role of detachment between workload and exhaustion or sleep difficulties (for exceptions see Korunka, Kubicek, Prem, & Cvitan, 2012; Siltaloppi et al., 2009; Sonnentag et al., 2010), and earlier studies have mainly reported non-significant findings. For example, Korunka et al. (2012) found that detachment moderated the effects of workload on fatigue four hours after starting a night shift, but not eight or 12 hours after, and not during day shifts. In the study by Sonnentag et al. (2010) detachment did not moderate the effect between workload and exhaustion over one year. Despite the scarce evidence, based on the stressor-detachment model detachment was expected to attenuate the effects of workload on strain.

1.6 Other factors influencing recovery

Finally, in addition to the job characteristics, recovery settings, and recovery processes discussed above, it is important to acknowledge other factors that may influence recovery and well-being outcomes in order to account for any confounding variables in recovery studies. First, long and irregular working hours, such as shift work, are known to influence both recovery and well-being negatively (Geurts et al., 2013). Shift work may be particularly harmful in terms of sleep quality and increased sleep difficulties (Åkerstedt, Nordin, Alfredsson, Westerholm, & Kecklund, 2012; Härmä, Tenkanen, Sjöblom, Alikoski, & Heinsalmi, 1998). Second, as mentioned earlier, sleep quality can be measured as a recovery outcome, but it can also be viewed

as a recovery process influencing daily recovery. For example, when employees sleep poorly, they may feel more tired throughout the working day and feel less inclined to engage in recovering activities during workday breaks or during free time after work. Lastly, regarding demographic factors, age and gender are often included as control variables in recovery studies. It is generally assumed that older workers may have more trouble recovering successfully (Mohren, Jansen, & Kant, 2010) and may experience a higher level of sleep difficulties (Åkerstedt et al., 2012) than younger workers. Gender in turn is important in terms of exhaustion, a key outcome in many recovery studies, as women generally report experiencing higher levels of exhaustion than men (Maslach et al., 2001).

1.7 Study aims

This study consists of three original publications. The overall aim of this study was to gain a more profound understanding of recovery during lunch breaks. Additionally, the long-term outcomes of external recovery were examined. The exact hypotheses can be found in the results section (see Table 3). Figure 1 provides an overview of the relationships tested in this study.

In Study I I aimed to identify which factors are associated with successful lunchtime recovery and how lunchtime recovery in turn relates to employee well-being over time. The research questions were:

(1) Are lunchtime settings (break regularity, length, and location), activities (social activities), and recovery experiences (detachment and control) associated with successful lunchtime recovery cross-sectionally?

(2) Is lunchtime recovery related to energy levels at work (vigor and exhaustion) over one year?

Study II was based on an intervention study examining how to enhance recovery during lunch breaks. Park walks and relaxation exercises were included as intervention activities. The research questions were:

(3) On days when employees complete a park walk or relaxation exercise, do they experience higher levels of concentration and less strain and fatigue at the end of a working day compared to days without these activities?

(4) Are the effects of lunchtime park walks and relaxation exercises on afternoon well-being mediated via lunchtime detachment and enjoyment?

Study III shifted the focus from internal to external recovery, and more specifically focused on detachment during evening hours. The research questions were:

(5) *Does either the baseline level or change in workload relate to change in exhaustion or sleep difficulties over one year?*

(6) *Does either the baseline level or change in detachment relate to change in exhaustion or sleep difficulties over one year?*

(7) *Does either the baseline level or change in detachment moderate the relationship between the baseline level or change in workload and exhaustion or sleep difficulties?*

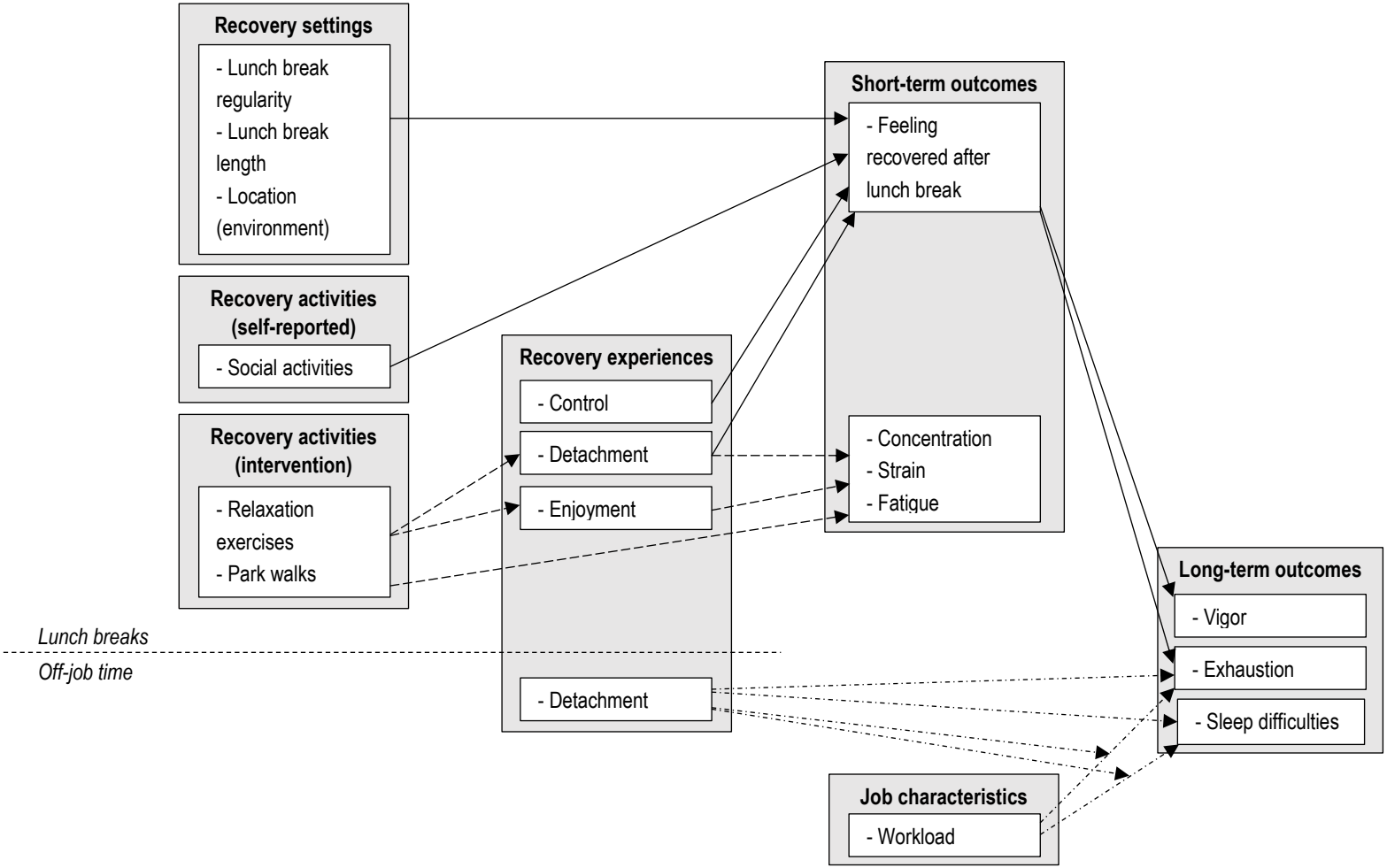

Figure 1. The general framework of the study. The hypothesized associations of Study I are shown with solid arrows, of Study II with long dashed arrows, and of Study III with dotted arrows.

2 METHODS

2.1 Participants and procedure

This study was part of a larger research project entitled "Recovery from Work Stress: Integrating Perspectives of Work and Environmental Psychology", which consisted of two separate studies: 1) a longitudinal questionnaire study and 2) an intervention study (de Bloom, Kinnunen, & Korpela, 2014; Kinnunen, Feldt, de Bloom, et al., 2017). Participants were Finnish employees from various fields working mainly in knowledge-intensive or emotionally demanding jobs. Twelve organizations participated in the longitudinal questionnaire study, and seven organizations in the intervention study. In the questionnaire study, 11 organizations participated in the spring of 2013 (Time 1) and 2014 (Time 2), and one new organization participated in 2014 (Time 1) and 2015 (Time 2). The intervention study was carried out in spring and fall 2014. The sample characteristics for Studies I, II, and III are presented in Table 1.

Longitudinal questionnaire study

In 2013 an electronic questionnaire was sent to 3,593 employees via email directly by the researchers in seven organizations, and via a contact person in four organizations. Of these, 1,347 people responded, resulting in a response rate of 37.5%. In 2014, those employees who had responded at T1 and were still employed by the same organizations were invited to complete the follow-up questionnaire (N = 1,192). At T2, 922 employees returned the questionnaire (response rate = 77.3%; 25.7% of the employees contacted at T1). In the organization that entered the study

Table 1. Sample characteristics.

Background factors	Longitudinal sample (Study I) (*N* = 841)		Intervention study sample (Study II) (*N* = 97)		Longitudinal, full data (Study III) (*N* = 1,722)	
Categorical variables	*N*	*%*	*N*	*%*	*N*	*%*
Organizations	11		7		12	
Gender						
Women	479	58,6	89	91,8	1000	63,2
Men	338	41,4	8	8,2	582	36,8
Education[1]						
Lower	287	35,2	31	32,3	552	35,0
Higher	529	64,8	65	67,7	1026	65,0
Employment contract						
Permanent	726	89,0	87	90,6	1342	86,0
Temporary	90	11,0	9	9,4	218	14,0
Working full time						
Full time	790	96,8	92	95,8	1489	95,5
Part time	26	3,2	4	4,2	70	4,5
Working time arrangement[2]						
Day shift	730	89,7	-	-	1398	90,4
Shift work	54	6,6	-	-	98	6,3
Other	30	3,7	-	-	51	3,3
Regular lunch breaks[3]						
Yes	699	83,1	91	93,8	1342	83,7
No	142	16,9	6	6,2	261	16,3
Living with a partner						
Yes	623	76,4	76	83,5	1200	77,2
No	192	23,6	15	16,5	355	22,8
Children living at home						
Yes	372	45,6	53	58,2	745	47,9
No	443	54,4	38	41,8	810	52,1
Field						
Education	451	53,6	29	29,9	721	41,9
Public administration	-	-	44	45,4	375	21,8
Media	143	17,0	6	6,2	235	13,6
IT or engineering	216	25,7	7	7,2	294	17,1

Other	31	3,7	11	11,3	97	5,6

Continuous variables	*M*	*SD*	*M*	*SD*	*M*	*SD*
Age	47,13	10,02	46,84	9,57	46,72	10,32
Working hours	39,09	5,94	38,39	3,50	35,62	7,94
Lunch break length (in minutes)	28,51	7,66	27,63	7,50	27,63	7,96

Note. [1]Education: Higher = bachelor's or polytechnic degree or higher; Lower = Vocational school qualification or less. [2]Only employees working a regular day shift were included in the intervention study. [3]Regular lunch breaks: Yes = Taking lunch breaks 4-5 times a week; No = Taking lunch breaks 3 times a week or less.

in 2014, the link to the electronic questionnaire was sent directly to 603 employees. Of these employees, 375 replied resulting in a response rate of 62.2%. At T2, 341 employees were invited to participate and 260 of them replied (response rate = 76.2%; 43.1% of the employees contacted at T1).

In Study I, I used cross-sectional data from T2, and two-wave data from T1 and T2 collected from the 11 organizations that participated in 2013 and 2014. The cross-sectional data were from T2 because some variables used in the cross-sectional part were not measured at T1. In this sample only those employees who had responded to at least half of the questions both at T1 and T2 were included. Thus the final sample for Study I consisted of 841 employees (23.4% of the employees contacted at T1). In Study III, I used the two-wave data from T1 and T2 combining responses from all 12 organizations (N = 1,722 at T1, response rate = 41.0%; N = 1,182 at T2, response rate = 77.1%). In this sample, all participants were included even if they only responded at T1 or only completed a small part of the questionnaire. Thus the sample used in Study III consisted of 1,722 employees.

In analyzing sample attrition, I compared the respondents of the longitudinal sample (N = 841 in Study I, and N = 1,182 in Study III) with the non-respondents at T2. In both samples the respondents did not differ from the non-respondents in terms of age, gender, having a partner, number of children, level of education, or the key study variables. However, the respondents had more often on a permanent employment contract (Study I: 89% vs. 79%, $p < .001$; Study III: 88.5% vs. 80.2%, $p < .001$), worked more hours per week (Study I: 39.1 vs. 37.9 hours, $p < .01$; Study III: 35.9 vs. 35.0, $p < .05$), and more often on regular day shifts (Study I: 90% vs. 83%; $p < .01$; Study III: 94.5% vs. 91.8%, $p < .05$) than did the non-respondents.

Intervention study

Invitations to participate in the intervention study were sent out via email to 2,226 employees. Initially 276 employees volunteered to participate in the study (response rate of 12.5%). After 54 participants were excluded and 72 employees dropped out or did not complete the intervention, 153 employees completed the study (see the original publication Study II for details). The participants were randomly assigned within each organization to one of the three intervention groups: 1) park walk group, 2) relaxation group, and 3) control group (spending the lunch break as usual). When analyzing sample attrition we found that drop-outs experienced more exhaustion than participants (M = 2.57 versus M = 2.03, $p < .05$). In this study, I examined within-person effects of the intervention and for this reason the control group (N =

56) was excluded. Thus the final sample consisted of 97 employees, of whom 51 belonged to the park walk group and 46 to the relaxation group.

Details of the data collection procedure and a figure illustrating this procedure are provided in the original publication (Study II). To summarize, the data were collected in two identical studies in spring (N = 51) and fall (N = 46) of 2014. Each study lasted six working weeks in total, and the intervention was carried out during two of these weeks (second and third weeks). During the two intervention weeks, participants completed the 15-minute intervention activity corresponding to their group every day during the lunch break. Before and after the study, participants filled out an online questionnaire eliciting general information. Daily measurements were completed twice a week on each Tuesday and Thursday one week before the intervention, during the two intervention weeks, and one and three weeks after the intervention. These daily measurements included a short SMS questionnaire that was sent to participants' cell phones about one hour before they left work, and a pencil-and-paper questionnaire to be filled out in the evening. To measure compliance with the intervention protocol, the participants were asked to indicate whether they completed the intervention exercise or not in a booklet daily from Monday to Friday during the two intervention weeks.

Before the study all participants were asked to attend a training session, where they were informed about the data collection procedure and provided with detailed instructions on how to complete the park walk or relaxation exercise. Participants in the park walk group were instructed to walk a pre-determined route in a nearby urban park. The participants were asked to walk at a slow pace and direct their focus towards the natural surroundings. They could walk alone or with their colleagues but they were asked to refrain from conversations in order to keep the exercise as constant as possible for all participants. Employees in the relaxation group were asked to find a quiet place inside the office and follow the protocol practiced during the training session. The relaxation exercise consisted of PMR, deep breathing, and acceptance of thoughts and feelings. During the intervention period, participants completed the exercise on average 8.6 times out of 10 in both intervention groups. The park walking group engaged in the exercise on average for 15 minutes (range: 8-20), and the relaxation group for 14 minutes (range: 8-20). The research plan was duly approved by the Ethics Committee of the Tampere Region (Statement 10/2014).

2.2 Measures

The following sections provide a brief summary of the measures used in this study. As this study was a part of a larger research project, multiple-item scales had to be shortened and some one-item measures were used to minimize participant burden and prevent drop-out. The Cronbach's alphas for the sum variables are presented in Table 2. All measures were presented to the participants in Finnish, and all variables used in the longitudinal analyses in Studies I and III were measured at both time points (T1 and T2).

Lunch breaks: settings, activities, and experiences

In Study I, of temporary settings, regularity of lunch breaks and length of the lunch break (in minutes) were measured. The answers regarding regularity of taking lunch breaks were coded as 0 = occasionally (1-3 times a week), and 1 = regularly (4-5 times a week). Participants who reported not taking lunch breaks were excluded from the analyses (N = 36 at T1 and N = 32 at T2). The environmental setting was measured by asking whether employees habitually spent their lunch breaks outside the office building with one item: "I spend my lunch break outside my company building (e.g., in a restaurant or in a café)", with answers coded as 0 = hardly ever or once a week, 1 = 2-5 times a week.

Regarding lunch break activities in Study I, we measured social activities with one item: "I spend my lunch break with others (e.g., with colleagues, acquaintances, friends or family members)". Again, the responses were coded as 0 = hardly ever or once a week, 1 = 2-5 times a week. In the intervention study (Study II), to measure whether the employees completed the park walk or relaxation exercise, participants responded to the questions "Did you go for a walk during your lunch break?" and "Did you engage in a relaxation exercise during your lunch break?" (0 = no, 1 = yes) in the evening pencil-and-paper questionnaire.

Of lunchtime recovery experiences, we measured lunchtime detachment and control in Study I, and lunchtime detachment and enjoyment in Study II using one item measures. In Study I, detachment was measured with the item "I distance myself mentally from my work during lunch breaks" and control was measured with the item "I decide myself how to spend my lunch breaks" (1 = very seldom or never, 5 = very often or always). The items were adapted from the Finnish version of the Recovery Experience Questionnaire (REQ) (Kinnunen, Feldt, Siltaloppi, &

Sonnentag, 2011; Sonnentag & Fritz, 2007). In Study II detachment was measured with the same item, but now adapted to day-level: "During my lunch break, I distanced myself from my work". Enjoyment was measured with the item "I enjoyed my lunch break" adapted from Trougakos et al. (2008). Both items were rated on a scale from 1 (= strongly disagree) to 5 (= strongly agree).

Detachment during off-job time

In Study III, Detachment during off-job time was measured with a three-item scale (e.g., "During time after work… I don't think about work at all") from the Finnish version of the REQ on a scale from 1 (= strongly disagree) to 5 (= strongly agree).

Short-term recovery outcomes.

In Study I, recovery during lunch breaks was measured with the item "I recuperate from work during my lunch break" from the Recovery after Breaks Scale (1 = very seldom or never, 5 = very often or always) (Demerouti, Bakker, Sonnentag, & Fullagar, 2012).

In the intervention study (Study II), afternoon concentration, strain, and fatigue were measured each with one item in the afternoon SMS questionnaire. To measure concentration the participants were asked to rate their ability to concentrate ("My ability to concentrate is…") on a scale from 1 (= very poor) to 7 (= very good) (cf. Hunter & Wu, 2016). Strain was measured with the item "I feel stressed and tense" (adapted from Elo, Leppänen, and Jahkola (2003)), and fatigue with the item "I feel fatigued" (adapted from van Hooff, Geurts, Kompier, and Taris (2007)) on a scale from 1 (= strongly disagree) to 7 (= strongly agree).

Long-term recovery outcomes

In Studies I and III, emotional exhaustion was measured with five items (e.g., "I feel emotionally drained from my work") from the Maslach Burnout Inventory (Kalimo, Hakanen, & Toppinen-Tanner, 2006; Maslach, Jackson, & Leiter, 1996) and in Study I, vigor was measured with three items (e.g., "At my work, I feel bursting with energy") from the Utrecht Work Engagement Scale (Schaufeli, Bakker, & Salanova, 2006). Both exhaustion and vigor were measured on a scale from 0 (=never) to 6 (=

every day). In Study III, sleep difficulties were assessed with four items adapted from the Karolinska Sleep Questionnaire (Keklund & Åkerstedt, 1997; Åkerstedt, Hume, Minors, & Waterhouse, 1994) on a scale from 1 (= very seldom or never) to 5 (= very often or always). Participants reported "How often have you perceived any of the following complaints during the last month?" with items including difficulty falling asleep, repeated awakenings, premature (final) awakening, and not feeling refreshed upon waking.

Job characteristics

Workload, which was included in Study I as a control variable and in Study III as an independent variable, was measured with three items (e.g., "How often does your job require you to work very fast?") from the Quantitative Workload Inventory (Spector & Jex, 1998). Autonomy, also included in Study I as a control variable, was measured with five items (e.g., "I can influence decisions that are important for my work") from the QPS Nordic-ADW (Dallner et al., 2000). Both workload and autonomy were measured on a scale from 1 (= very seldom or never) to 5 (= very often or always).

Control variables

I included age (in years) and gender (1 = female, 2 = male) as control variables in Studies I and III. In Study I, working hours were also included as a control variable, measured with "How many hours do you actually work per week? (Include paid and unpaid overtime, but not your commuting time)". In Study III I also controlled for shift work (1 = daytime job; 2 = shift work).

In Study II I included sleep quality, break length, and job demands as daily control variables. Sleep quality from the previous night was measured with one item "How well did you sleep last night?" (1 = very poorly, 5 = very well) in the morning. Job demands and length of the lunch break were both assessed with one item in the pencil-and-paper evening questionnaire respectively "Today at work, my work demands were…" (1 = very low, 5 = very high) and "How long was your lunch break in total?" (in minutes).

Finally, in Study II, I conducted additional analyses to test for potential cross-level moderators. As moderator variables I included age, exhaustion, workload, and autonomy, which were measured similarly as presented above. Furthermore, two

variables measuring compliance with the intervention protocol were included: number of completed exercises during the two intervention weeks and average duration of the exercise (in minutes).

2.3 Analyses

The data analyses are briefly introduced below and summarized in Table 2. A more comprehensive description of the analyses is provided in the original publications.

In Study I a multiple hierarchical regression analysis was carried out in IBM SPSS Statistics 24.0 to examine, first, the relationship between antecedents (lunch break characteristics and lunchtime recovery experiences) and lunchtime recovery cross-sectionally, and second, the relationship between lunchtime recovery and vigor and exhaustion at work over one year. In the longitudinal part of this study, each respective outcome at Time 1 was controlled for in the analyses.

In Study II, the intervention data were analyzed from a within-person perspective. The aim was to investigate whether employees experienced higher levels of well-being in the afternoon after completing a park walk or relaxation exercise than on days when they did not complete the exercise during lunch break. As day-level data were collected on 10 days from the same persons, multilevel modeling was used to account for the non-independence of the data. The analysis was carried out using the NLME library in R (Pinheiro & Bates, 2000), and following the five-step approach proposed by Bliese and Ployhart (2002). In addition to examining the direct effects between the intervention exercises and afternoon well-being, I examined whether lunchtime recovery experiences mediated these within-person relationships. R mediation package was used to estimate the indirect effects and the respective 95% quasi-Bayesian confidence intervals (Tingley, Yamamoto, Hirose, Keele, & Imai, 2014). Finally, to test for potential cross-level moderators, for any significant predictors I examined whether defining slope as random would improve the model fit over a fixed slope. When a random slope improved the model fit, the slope variance was predicted by the potential cross-level moderator variables.

In Study III I used a latent change score approach in the structural equation modeling framework to test both direct effects between the antecedents (workload and detachment) and the long-term outcomes (exhaustion and sleep difficulties) and the moderating effect of detachment between workload and the outcomes (Ferrer & McArdle, 2010; McArdle, 2009; McArdle & Hamagami, 2001). The analysis was carried out in the Mplus 7.3 program (Muthén & Muthén, 1998-2015). The latent

change score approach was chosen as it enables separating intra-individual change from the baseline level. As the goal was to predict intra-individual change in exhaustion and sleep difficulties over one year latent change score was preferred over the more often used cross-lagged panel model (Usami, Hayes, & McArdle, 2016). Separating intra-individual change from baseline level also makes it possible to use both the baseline level and concurrent change of predictors to predict change in the outcomes.

First, the measurement models and time invariance of factor loadings were examined. Second, final structural equation models were estimated separately for exhaustion and sleep difficulties. The final models were estimated with and without the interaction terms, as including latent continuous interaction terms in Mplus requires defining the type as random and incorporating integration (see Muthén & Muthén, 1998-2015, pp. 76-77). This implies that standardized estimates, model fit information and R-square values are not available for the models with latent continuous interaction terms. Thus in the results section I report the explained variance in the outcomes and the model fit information before the inclusion of the interaction terms, and report the unstandardized estimates for the final models.

Table 2. Summary of the studies.

Study	Data	Research aims	Variables (Cronbach's alpha)	Control variables (Cronbach's alpha)	Main data analysis
Study I: *Lunch breaks*	Cross-sectional from T2; Two-wave longitudinal[1] (*N* = 841)	To test which factors predict lunchtime recovery cross-sectionally and if lunchtime recovery predicts vigor and exhaustion over one year.	Lunchtime recovery Lunch break recovery settings, activities, and experiences Vigor (α = .89-.90) Exhaustion (α = .93)	Age Gender Working hours Workload (α = .88) Autonomy (α = .77)	Multiple hierarchical regression analysis
Study II: *Lunch breaks*	Intervention data excluding the control group (*N* = 97)	To examine whether employees' afternoon well-being improved on days when they completed the intervention exercise. Recovery experiences were tested as mediators.	Park walks and relaxation exercises Lunchtime recovery experiences Concentration Strain Fatigue	Sleep quality Job demands Length of the lunch break *Cross-level moderators:* Age Exhaustion (α = .91) Workload (α = .87) Autonomy (α = .81) Compliance with the intervention protocol	Multilevel models; multilevel mediation analysis
Study III: *Off-job time*	Two-wave longitudinal, full data[2] (*N* = 1,722)	To investigate whether workload and detachment predict change in strain (exhaustion or sleep difficulties) over one year. Detachment was tested as a moderator in the workload-strain relationship.	Detachment during off-job time (α = .86-.87) Workload (α = .87-.88) Exhaustion (α = .93) Sleep difficulties (α = .79-.80)	Age Gender Shift work	Latent change score models with latent interaction terms

Note. [1]Only those participants were included who came from the 11 organizations that entered the study in 2013 and who had responded at both time points and completed most of the questionnaire.
[2]All participants from the 12 organizations were included even if they only responded at T1 or filled out the questionnaire partially.

3 OVERVIEW OF THE RESULTS

3.1 Study I

The purpose of this study was to examine which lunchtime characteristics and recovery experiences are related to lunchtime recovery cross-sectionally, and whether lunchtime recovery predicts exhaustion and vigor over one year. The results are reported from models where age, gender, working hours, workload, autonomy, and the outcome at T1 (exhaustion or vigor) were first controlled for.

In the cross-sectional part of this study, I first expected that a) taking lunch breaks regularly (= 4-5 times per week), b) having longer lunch breaks, c) spending lunch breaks outside the office building, and d) spending lunch breaks with others would be positively associated with recovery during lunch breaks (Hypotheses 1 a-d). Second, lunchtime detachment and control were expected to relate positively to lunchtime recovery (Hypothesis 2). As expected, the cross-sectional results showed that taking lunch breaks regularly, having longer lunch breaks, and typically spending lunch breaks outside the office were positively related to lunchtime recovery. However, after entering lunchtime detachment and control as predictors into the model, the length of the lunch breaks and spending lunch breaks outside were no longer related to lunchtime recovery. Contrary to expectations, typically spending lunch breaks with others was not related to recovery. In the final model, taking lunch breaks regularly, and experiencing high levels of detachment and control during lunch breaks were related to successful lunchtime recovery (explanation rate 41%). Thus Hypothesis 1a was fully supported, 1b-c partially supported, and 1d was not supported, whereas Hypothesis 2 was fully supported. Of the control variables, age and gender were related to lunchtime recovery: older workers and those experiencing higher levels of autonomy at work experienced higher levels of lunchtime recovery.

Table 3. Summary of hypotheses and results.

Study	Hypothesis			Conclusion
I	H1a	a) Having lunch breaks regularly	…is positively associated with recovery during lunch breaks.	Supported
	H1b	b) Having longer lunch breaks		Partially supported[1]
	H1c	c) Spending lunch breaks outside the office building		Partially supported[1]
	H1d	d) Spending lunch breaks with others		Not supported
	H2	Lunchtime detachment and control are positively associated with recovery during lunch breaks.		Supported
	H3	Insufficient recovery during lunch breaks is related to high exhaustion over time.		Supported, but found effects were small
	H4	Successful recovery during lunch breaks is related to high vigor over time.		Supported, but found effects were small
II	H5a	Within persons, park walking during lunch breaks is associated with…	a) better concentration	Supported
	H5b		b) lower strain	Partially supported[1]
	H5c		c) lower fatigue.	Not supported (see the indirect effect, H6)
	H6a	Within persons, a relaxation exercise during lunch breaks is associated with…	a) better concentration	Supported
	H6b		b) lower strain	Supported
	H6c		c) lower fatigue.	Supported
	H7	The effect of park walking during lunch breaks on afternoon concentration, strain, and fatigue, is transmitted via lunchtime detachment and enjoyment.		Partially supported[2]
	H8	The effect of a relaxation exercise during lunch breaks on afternoon concentration, strain, and fatigue, is transmitted via lunchtime detachment and enjoyment.		Partially supported[3]
III	H9a	High levels of workload are related to…	a) high levels of exhaustion and sleep difficulties at baseline	Supported
	H9b		b) an increase in exhaustion and sleep difficulties.	Only supported for exhaustion
	H9c	c) An increase in workload is related to a simultaneous increase in exhaustion and sleep difficulties.		Only supported for exhaustion

H10a	Low levels of evening detachment are related to…	a) high levels of exhaustion and sleep difficulties at baseline	Supported
H10b		b) an increase in exhaustion and sleep difficulties.	Supported
H10c	c) A decrease in evening detachment is related to a simultaneous increase in exhaustion and sleep difficulties.		Supported
H11a	High levels of evening detachment attenuate the relationship between high levels of workload and…	a) high levels of exhaustion and sleep difficulties at baseline	Partially supported[4]
H11b		b) an increase in exhaustion and sleep difficulties.	Not supported
H11c	c) An increase in evening detachment attenuates the relationship between an increase in workload and an increase in exhaustion and sleep difficulties.		Not supported

Note. [1]The relationship was no longer significant after a number of other predictors were added into the model. [2]The indirect effects between park walks, enjoyment, concentration, and fatigue were significant. [3]The indirect effect between relaxation exercise, detachment, and concentration was significant. [4]Detachment moderated the relationship between workload and exhaustion at baseline.

In the longitudinal part of this study, I hypothesized that recovery during lunch breaks would be negatively related to exhaustion (Hypothesis 3) and positively related to vigor (Hypothesis 4) over one year. Of the control variables gender was related to exhaustion (women reported experiencing higher levels of exhaustion than men). Additionally, exhaustion at T1 strongly predicted exhaustion at T2 and vigor at T1 strongly predicted vigor at T2. Confirming hypotheses 3 and 4, it was found that high levels of lunchtime recovery at T1 predicted experiencing lower levels of exhaustion and higher levels of vigor one year later. However, entering lunchtime recovery as a predictor in the final step after the control variables increased the explained variance in exhaustion by only 0.3% and in vigor by only 1%. This suggests that lunchtime recovery plays a minor role in explaining change in these outcomes in the long term.

3.2 Study II

The first aim of Study II was to investigate whether employees experienced higher levels of a) concentration and b) less strain and c) fatigue at the end of a working day on days when they completed a 15-minute park walk (Hypothesis 5) or relaxation exercise (Hypothesis 6) during lunch break, compared to days without these activities. The second aim was to examine whether lunchtime detachment and enjoyment partially mediated the effect of park walks (Hypothesis 7) and relaxation exercises (Hypothesis 8) on afternoon well-being.

Both park walks and relaxation exercises were related to concentration: on days when employees engaged in one of these exercises during lunch break, they experienced higher levels of concentration in the afternoon. In a similar manner, both exercises were related to experiencing less strain in the afternoon. However, after entering mediators (lunchtime detachment and enjoyment) into the model, park walks were no longer related to less strain. Finally, only relaxation exercises were related to less fatigue in the afternoon. Thus hypothesis 5 concerning the benefits of park walks was supported for a) concentration, but not for b) strain, or c) fatigue. Hypothesis 6 concerning the benefits of relaxation exercises was supported for a) concentration, b) strain, and c) fatigue. Together these exercises increased the explained variance by 7% for concentration, by 5% for strain, and by 3% for fatigue. Of the control variables, high daily job demands were related to high levels of afternoon strain, and good sleep quality was related to less afternoon fatigue.

Hypothesis 7 was partially supported, an indirect effect of park walks via lunchtime enjoyment on concentration and fatigue was significant: on days when employees engaged in park walks they experienced higher levels of enjoyment during lunch breaks, which in turn related to more concentration and less fatigue in the afternoon. However, there was no indirect effect of park walks on strain via enjoyment, and no indirect effects on any of the three outcomes via lunchtime detachment. Hypothesis 8 was also partially supported as an indirect effect of relaxation exercises on afternoon concentration via lunchtime detachment was significant: on days when employees completed the relaxation exercise during lunch break they experienced higher levels of detachment from work during lunch breaks, which in turn was related to higher levels of concentration in the afternoon. No effect was found on strain or fatigue, and lunchtime enjoyment did not mediate the effects of relaxation exercises on afternoon well-being.

In the additional analyses concerning cross-level moderators, only one significant cross-level interaction was found: when lunchtime enjoyment increased, afternoon fatigue decreased more for those employees who generally experienced higher levels of exhaustion. It seems that as those employees who experience greater exhaustion at the beginning likely also report higher levels of afternoon fatigue, there will be more room for improvement in terms of fatigue for the more exhausted employees than for those who display low levels of exhaustion.

3.3 Study III

Finally in Study III my aim was to examine the long-term relationships between workload, detachment, exhaustion, and sleep difficulties from a latent change perspective. I expected that high levels of workload and low levels of detachment are related to high levels of exhaustion and sleep difficulties at baseline (hypothesis 9a for workload and 10a for detachment) and to an intra-individual increase in exhaustion and sleep difficulties over one year (hypotheses 9b and 10b). Furthermore, it was also hypothesized that employees experiencing an increase in workload or decrease in detachment over time would experience a simultaneous increase in exhaustion and sleep difficulties (hypotheses 9c and 10c). Corresponding hypotheses were also set for the moderator effects, where detachment was expected to attenuate the relationship between high workload and high exhaustion and sleep difficulties. Detachment at baseline was expected to moderate the relationship between high levels of workload at baseline and a) high levels of exhaustion and

sleep difficulties at baseline (hypothesis 11a) and b) an increase in exhaustion and sleep difficulties over one year (hypothesis 11b). Also, a change in detachment was expected to moderate the relationship between and increase in workload and increase in the strain outcomes over one year (hypothesis 11c).

For exhaustion, all direct relationships were confirmed as expected: high level of workload and low level of detachment at baseline predicted high level of exhaustion at baseline and an increase in exhaustion over one year. Furthermore, an increase in workload and a decrease in detachment predicted a simultaneous increase in exhaustion over one year. Thus hypotheses 9a-c and 10a-c were confirmed for exhaustion. The tested model explained 20% of the variance in exhaustion at baseline, and 27% of the variance in the change in exhaustion (of which baseline exhaustion accounted for 16%). Regarding sleep difficulties, it was found that low level of detachment at baseline predicted high level of sleep difficulties at baseline, an increase in sleep difficulties over time, and a decrease in detachment predicted a simultaneous increase in sleep difficulties over time. Thus hypotheses 10a-c were also confirmed for sleep difficulties. However, contradictory to expectations, high workload was only related to sleep difficulties at baseline, but not over time, confirming hypothesis 9a, but rejecting hypotheses 9b-c for sleep difficulties. The model explained 19% of the variance in sleep difficulties at baseline and 18% of the variance in the change in sleep difficulties over time (of which 11% was explained by sleep difficulties at baseline).

The moderating role of detachment in the workload-strain relationship received only weak support in this study. It was found that high levels of detachment attenuated the relationship between workload and exhaustion at baseline, so that the relationship between workload and exhaustion was weaker for those employees who experienced high levels of detachment than for those who experienced low levels of detachment. Thus hypothesis 11a was confirmed for exhaustion. No other interactions tested were significant, and thus hypotheses 11b-c for exhaustion and 11a-c for sleep difficulties were rejected. All hypotheses and results are summarized in Table 3.

4 DISCUSSION

4.1 Main findings

4.1.1 Summary of the main findings

In Study I, taking lunch breaks regularly (i.e., 4-5 times a week), taking longer lunch breaks and habitually spending breaks outside the office building contributed to successful lunchtime recovery. However, after lunchtime recovery experiences were taken into account, only taking lunch breaks regularly, lunchtime detachment, and lunchtime control were significant predictors of lunchtime recovery.

In the longitudinal part of Study I lunchtime recovery was associated with less exhaustion and more vigor one year later. However, the effects were notably small, as lunchtime recovery explained only a 0.3% decrease in exhaustion and a 1% increase in vigor. The small effect sizes clearly limit the practical importance of these findings. Nevertheless, large effects were not realistically expected, either, as lagged analyses were used and both exhaustion and vigor showed high stabilities over one year. Baseline exhaustion explained 47% of the variance in exhaustion at Time 2, and similarly baseline vigor explained 47% of the variance in vigor at Time 2.

The results from Study II showed that on days when employees engaged in lunchtime park walks or relaxation exercises their well-being in the afternoon improved compared to days when they engaged in typical lunch break activities. Specifically, park walks predicted better concentration and less fatigue through increased lunchtime enjoyment. Relaxation exercises predicted better concentration through lunchtime detachment, and less fatigue and strain directly.

The findings from Study III demonstrate that lack of detachment during off-job time predicts intra-individual increase in exhaustion and sleep difficulties over one year. Both low level of detachment at baseline and an intra-individual decrease in detachment over one year were associated with an increase in strain over the year. High levels of workload at baseline and an intra-individual increase in workload were related to an increase in exhaustion over time, but workload was not related to change in sleep difficulties. Additionally, detachment attenuated the effects of

workload on exhaustion at baseline, but not over time. The interaction between detachment and workload did not predict sleep difficulties at baseline or over time.

4.1.2 Recovery during lunch breaks

Temporal and environmental lunch break settings

Regarding temporal recovery settings, this study suggests that taking lunch breaks four to five times a week and taking longer lunch breaks are associated with successful lunchtime recovery. This concurs with the ideas drawn from the E-R model and the COR theory: Breaks that are regular and long enough so that employees can experience a temporary respite from job demands and engage in resource recovering activities enhance recovery. Somewhat contrary to these findings, an earlier review in the field of ergonomics showed that short breaks taken relatively frequently were beneficial in reducing fatigue (Tucker, 2003). In fact, it seems that whether or not longer workday breaks are beneficial depends on the frequency of breaks. When only few breaks are taken during the working day, longer breaks may be more beneficial than shorter breaks (Hunter & Wu, 2015). Nevertheless, the results from Study I and Study II, where lunch break length was included as a control variable, suggest that other lunch break characteristics are more important in enhancing lunchtime recovery than break length alone. Thus I suggest that taking regular and long enough lunch breaks should be viewed as a prerequisite that allows employees to engage in recovering activities during their lunch breaks. It should also be noted that the employees in these studies reported lunch breaks that lasted on average about 30 minutes (*SD* = 8 or 9 minutes), which is a typical lunch break length in Finland.

Regarding environmental recovery settings, based on the attention restoration theory and the psychoevolutionary theory, spending lunch breaks in natural environments was expected to promote recovery. Additionally, spending breaks outside the office building was expected to enhance recovery, as exiting the workplace can provide restorative experiences such as change of scenery and a sense of being away (Kaplan & Kaplan, 1989). The results showed accordingly that spending lunch breaks outside the office building was associated with greater lunchtime recovery. However, this effect was no longer significant when lunchtime detachment and control were taken into account.

As detachment was positively correlated with spending lunch breaks outside, it is possible that detachment mediates the effect of spending lunch breaks outside on lunchtime recovery. This would also be theoretically meaningful, because a sense of being away was expected to cause the restorative benefits of leaving the workplace behind and a sense of being away is conceptually similar to detachment. The cross-sectional study design did not allow testing mediation, but future studies should test detachment as a mediator between spending lunch breaks outside and lunchtime recovery. This finding was partly contradictory to an earlier result, where spending workday breaks outside the office (either in the office building or outside the office building) was not related to resource gain (Hunter & Wu, 2015). It seems likely that spending breaks outside the office but inside the office building provides less restorative effects than exiting the office building.

This study also supports the idea that spending lunch breaks in natural environments brings about restorative effects. Lunchtime park walks were related to increased enjoyment during lunch breaks, which in turn mediated the effects of park walks on better concentration and less fatigue in the afternoon. Since park walks were compared to typical lunch break activities, it is not possible to differentiate between the benefits of spending time in natural surroundings and engaging in light physical exercise. Furthermore, temporarily leaving the work place behind could explain why lunchtime park walks were restorative. If this is the case, spending lunch breaks anywhere outside the workplace, such as in a nearby restaurant or café, could have similar positive effects as lunchtime park walks. Nevertheless, earlier evidence from environmental psychology suggests that spending time or walking in natural surroundings relates to greater restorative benefits than spending time in urban environments (Berto, 2014; Hartig et al., 2014). Thus it seems likely that the benefits of lunchtime park walks result at least partially from spending time in natural environments.

Recovery activities during lunch breaks

Contrary to the known benefits of social activities during free time, social activities during lunch breaks were not related to lunchtime recovery in the present study. It seems that spending breaks with others as such does not bring additional restorative benefits compared to spending lunch breaks alone. Based on earlier studies social lunchtime activities are conducive to recovery only when employees choose themselves how to spend their lunch breaks and when they avoid engaging in work-related conversations. One earlier study suggests that lunchtime social activities may

even hinder recovery unless employees experience particularly high levels of lunchtime autonomy (Trougakos et al., 2014). According to Trougakos et al. (2014) spending breaks with colleagues and supervisors may require more emotion and impression management efforts than social activities during free time (e.g., spending evenings with family members), which could explain why social activities during lunch breaks have different restorative value than social activities during free time. Additionally, in order to detach from work during lunch breaks, employees should engage in private conversations with colleagues and avoid work-related conversations (von Dreden & Binnewies, 2017). Thus in line with the E-R model, engaging in social activities during lunch breaks is not always beneficial to recovery, as work-related conversations prevent getting respite from job demands. Nevertheless, as the feasibility of collective workday breaks has also been associated with lower turnover (Wendsche et al., 2014), it is crucial to note that social break activities seem to have significant benefits that are not necessarily related to recovery. For example, spending lunch breaks with colleagues may promote social support, create a collegial culture at work, and thus potentially increase organizational commitment.

Based on the E-R model and the COR theory, lunchtime park walks and relaxation exercises were suggested to enhance lunchtime recovery and lead to improved well-being in the afternoon. First, both of these activities ensured a break free from job demands, as employees stopped working, refrained from work-related conversations, and directed their focus either towards the natural surroundings or towards breathing and bodily sensations. Second, both activities were conducive to restoring internal resources, such as attentional resources, energy levels, and positive mood.

Lending support to these theoretical ideas, on days when employees engaged in lunchtime park walks and relaxation exercises they reported higher levels of well-being in the afternoon than on days when they engaged in typical lunch break activities. The restorative effects of natural environments compared to urban environments are well established in the field of environmental psychology (e.g., Berto, 2014; Hartig et al., 2014). This study extended the existing findings to occupational context and showed that taking a 15-minute lunchtime walk in a nearby park is sufficient to improve employees' well-being at the end of the working day. To confirm that these benefits are contributable to spending time in natural environment rather than going for a walk outside the office, future studies should compare lunchtime park walks to lunchtime walks in an urban environment. Regarding the relaxation exercises, the findings were in line with one earlier

intervention study where PMR was related to less strain and sleepiness among seven call center agents (Krajewski et al., 2010; Schnieder et al., 2013). This study extended the earlier findings by demonstrating the benefits of lunchtime relaxation exercises in a larger and more diverse sample.

Recovery experiences during lunch breaks

Experiencing detachment, control, and enjoyment during lunch breaks was expected to enhance lunchtime recovery. Detachment signals a break free from job demands, control allows employees to spend breaks in preferred ways, and enjoyment restores positive affect. Both lunchtime detachment and control were related to successful lunchtime recovery cross-sectionally. Additionally, on days when employees experienced higher levels of detachment during lunch breaks, they experienced better concentration in the afternoon. In line with these findings, one earlier study supported the benefits of lunchtime detachment, as detachment was associated with increased vigor after the lunch break (von Dreden & Binnewies, 2017). In the study by Bosch et al. (2017), relaxation and control, but not detachment, were positively related to feeling recovered after the lunch break when all recovery experiences were included simultaneously as predictors. This study did, however, report a positive day-level correlation between lunchtime detachment and feeling recovered after the lunch break. As lunchtime detachment and relaxation were highly correlated, including both of them at once in the final model may have affected the results. Nevertheless, their findings suggest that relaxation may be a more important recovery experience during lunch breaks than detachment. Future studies should therefore measure both lunchtime relaxation and lunchtime detachment and continue examining whether experiencing relaxation is even more important during lunch breaks than detachment.

Furthermore, the findings from the present study suggest that enjoyment could be a particularly beneficial recovery experience during lunch breaks. The broaden-and-build theory (Fredrickson et al., 2000) states that positive emotions can undo the effects of negative affect, and thus positive emotions can facilitate recovery from work stress. Supporting this idea, on days when employees experienced more enjoyment during their lunch breaks they reported better concentration and less fatigue in the afternoon.

Lunchtime recovery experiences as mediators

Finally, according to the idea that recovery experiences are psychological experiences that underlie the recovery process (Sonnentag & Fritz, 2007), I examined whether lunchtime detachment and enjoyment mediate the effects of lunchtime recovery activities on afternoon well-being. Lunchtime detachment mediated the effects of lunchtime relaxation exercises on afternoon concentration: On days when employees completed the lunchtime relaxation exercise, they experienced higher levels of detachment during the lunch breaks, which in turn mediated the effects of relaxation exercises on better concentration in the afternoon. Enjoyment mediated the effects of lunchtime park walks. On days when employees completed the lunchtime park walk, they experienced higher levels of lunchtime enjoyment, which transmitted the effects of park walks on improved concentration and decreased fatigue in the afternoon.

The findings suggest that experiencing high levels of detachment during the lunchtime relaxation exercises partly explained their benefits for recovery, and that experiencing more enjoyment during the lunchtime park walks underlay the benefits of park walks. It has been noted that trying to control thoughts and feelings makes it even harder to forget about them than accepting and letting them go (Hayes, 2004). Thus the acceptance component of mindfulness, which was incorporated in the relaxation exercise in this study, could be particularly beneficial in promoting detachment from work related thoughts. Park walks were moreover hypothesized to increase detachment, but this idea was not supported. It is possible that slow-paced exercise is not particularly beneficial in fostering detachment, and the idea that strenuous physical exercise increases detachment more than slow-paced exercise has been supported in one earlier study (van Hooff & Geurts, 2016).

The finding that enjoyment underlies the effects of park walks is in line with previous evidence, suggesting that spending time in natural surroundings increases positive affect more than spending time in urban environments (McMahan & Estes, 2015). Additionally, leaving the workplace momentarily behind and having a change of scenery could explain why park walks induced more enjoyment than typical lunch breaks. It is also important to note that the weather was pleasant during the study period, which was likely an important factor in ensuring enjoyment during the park walks. Relaxation exercises may require high self-regulation at first when employees are not yet used to the routine, which could explain why enjoyment did not mediate the effects of relaxation exercises.

4.1.3 Recovery during off-job time

Detachment and long-term outcomes

The stressor-detachment model proposes that in addition to stressors, detachment is an important predictor of strain over days, weeks, or years (Sonnentag & Fritz, 2015). The results support the idea that poor detachment during off-job time predicts intra-individual increase in exhaustion and sleep difficulties over one year. This is in line with the study by Sonnentag et al. (2010) who also found that poor detachment predicted increase in exhaustion one year later.

The present study extended the previous knowledge of the long-term relationship between detachment and strain by demonstrating that detachment-strain effects may unfold over time in two distinct ways: Detachment had both lagged and synchronous effects on strain over one year. Synchronous effects refer to concurrent changes in detachment and strain, i.e., employees who experienced a decrease in detachment over one year experienced a simultaneous increase in strain. Lagged effects on the other hand refer to using a baseline level of the predictors to predict upcoming change in the outcomes. Thus lagged effects are often seen as a more rigorous proof of causality than synchronous effects (Ford et al., 2014). From a practical perspective both synchronous and lagged effects are meaningful. It is important to understand that employees who at baseline have more trouble than others in detaching, and employees who experience an intra-individual decrease in detachment over one year are at risk of experiencing increased exhaustion and sleep difficulties over one year.

Two earlier studies have reported contradictory results. In the study by Kinnunen and Feldt (2013) detachment was not related to fatigue one year later. The fact that the current study only included workload and detachment as predictors, and the study by Kinnunen and Feldt (2013) included all four recovery experiences (detachment, relaxation, mastery, and control), job demands, and job resources as predictors, could potentially explain the different results. As the lagged effects between detachment and strain were not very large in this study, which is often the case (cf. Ford et al., 2014), it seems likely that these relationships are harder to detect in models where multiple predictors of interest are included simultaneously. Using a shorter time lag, Sonnentag et al. (2014) also found that detachment was not related to exhaustion four weeks later. The authors concluded that finding a non-significant lagged relationship between detachment and exhaustion over four weeks was not surprising as exhaustion was fairly stable over this period. Thus for detecting lagged

relationships between detachment and exhaustion, longer time periods than four weeks (one year in our study) may be optimal as exhaustion is a fairly stable outcome.

Detachment as a moderator

Additionally, evening detachment was tested as a moderator between workload and strain. Based on the stressor-detachment model, detachment was expected to attenuate the effect of workload on strain cross-sectionally and over time. The results lend limited support to the moderator hypothesis of the stressor-detachment model. The relationship between workload and exhaustion was weaker at baseline among those employees who experienced high levels of detachment than among employees experiencing low levels of detachment. Thus this study partially supports the moderator hypothesis of the stressor-detachment model in a cross-sectional setting. However, detachment did not attenuate the effect of workload on sleep difficulties at baseline. Furthermore, none of the interactions tested were significant in predicting change in exhaustion or sleep difficulties over time. It would be important to examine longitudinal interaction effects using different time lags in the future to reveal potential long-term moderation effects between detachment and workload on strain. In this study the number of data collection rounds was limited due to the reality of collecting data in multiple organizations and respecting the organizations' wishes.

Overall, the findings regarding the role of detachment as a moderator between stressors and strain remain rather mixed. It seems that whether or not detachment protects against the harmful effects of stressors on strain depends on which stressors and which outcomes are examined. For example, in the study by Sonnentag et al. (2010) detachment at baseline did not moderate the relationship between workload and exhaustion longitudinally. They did, however, report a significant interaction between detachment and workload when predicting psychosomatic complaints and work engagement a year later. Future studies could select the constructs to be studied in line with the match principle, as the type of detachment that matches the specific demands and outcomes will be most effective (de Jonge, Spoor, Sonnentag, Dormann, & van den Tooren, 2012).

4.2 Methodological evaluation of the study

This study has certain limitations that should be considered when drawing theoretical and practical conclusions. In the following I will discuss issues related to causality, use of self-report measures, response rates and sample selection, and choosing appropriate time lags for longitudinal research.

Causality. To improve the understanding of how employees' well-being and health can be enhanced, studies in occupational health psychology should strive to establish causality among the constructs studied. Although only experimental studies can be used to establish causality in a strict sense, longitudinal studies can under certain conditions provide stronger evidence of predictive causality than cross-sectional studies. Study I is partly based on cross-sectional data. Thus the results should be interpreted as associations rather than directional effects, and the direction implied is based on the theoretical models (i.e., identified break characteristics and recovery experiences could improve lunchtime recovery in light of the theoretical understanding of the phenomena). Additionally, in the longitudinal part of Study I, the analyses do not account for change in the predictor, nor do the results exclude reversed relationships. Thus the longitudinal part of Study I should also be interpreted as an over-time association and not as a causal effect.

To overcome some of these limitations in Study III, which was also based on questionnaire data, I adopted a more advanced analytical method. Using a latent change score approach, I was able to account for change in the predictors and separate intra-individual change from the baseline levels of each variable. Modeling intra-individual change controls for stable differences across persons and thus rules out some third variables (e.g., negative affectivity). Additionally, based on the information criteria normal causality models were superior to reciprocal models. Finally, Study II was based on an intervention study, where the days when the relaxation exercises or park walks were completed were pre-determined. This study consequently provides somewhat stronger evidence of causality than questionnaire studies, although the analysis was conducted in a within-person manner and consequently did not compare the participants to a control group. Thus in Study III, too, it is not possible to rule out all possible alternative explanations.

Self-report measures. All variables in Studies I and III were obtained through self-reports. Thus part of the shared variance of the variables examined may be attributable to the self-report method and not to true effects. This is less problematic in Study III than in Study I, as the study was based on a longitudinal design and temporal separation of measurements reduces the concern about common method

variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Self-reports seem to be the most appropriate measures of recovery experiences and many well-being related outcomes (exhaustion, vigor, fatigue, psychological strain). These are internal experiences and may be hard to capture using outsider reports or objective measurements. Future studies may consider using objective measures of workload (e.g., observation by external raters) and sleep difficulties (e.g., actigraphs). Additionally, self-reported concentration was found appropriate in this study. Among knowledge workers, employees' own assessments of their ability to concentrate may be most important for their willingness or ability to engage and perform optimally at work. Studies intended to examine employees whose failure to concentrate may compromise safety (e.g., truck drivers) should measure concentration with objective vigilance tests.

Overlapping items across different measures was initially a concern in Study I, where I planned to measure lunchtime recovery with three items from the Recovery after Breaks Scale (Demerouti et al., 2012). Two of these items were eventually dropped as there was considerable conceptual overlap with the measure for vigor (e.g., "I am again full of energy after my lunch break" was dropped, as it was similar to the item "At my work, I feel bursting with energy"). Consequently, using one-item measure for lunchtime recovery became one of the limitations in Study I. However, earlier studies have demonstrated that single-item measures can often be valid replacements of multiple-item measures (Fisher, Matthews, & Gibbons, 2016; van Hooff et al., 2007). Additionally, in Study II one-item measures were used in order to minimize participant burden, as the participants were asked to fill out questionnaires multiple times a day on a total of ten days.

Response rates and sample selection. One limitation of this study is that the attributes of non-respondents at baseline are not known. It is consequently impossible to evaluate whether the baseline samples were biased. The response rates were relatively low: 37.5% at Time 1 and 23.4% at Time 2 relative to employees contacted at baseline in Study I, 41.0% at Time 1 and 28.2% at Time 2 in Study III, and an initial response rate of 12.5% in the intervention study. Although these response rates are low and raise concerns about selection bias, they are quite similar to other studies conducted in organizational settings (Baruch & Holtom, 2008).

There was more drop-out in the questionnaire study between Times 1 and 2 among employees on temporary job contracts, and among those working night shifts or shorter hours. It seems likely that employees on temporary contracts were more likely to change jobs before the follow-up questionnaire was sent out than employees on permanent contracts. Among the intervention study participants, those

experiencing high levels of exhaustion at baseline were more likely to drop out during the study. According to the participants' feedback, a common reason for drop out was being too busy to participate. Despite efforts to minimize participant burden, the study required relatively high effort from the participants due to the physiological measurements that were also collected (see Torrente et al., 2017) in the intervention study. Participant burden was also a concern in Studies I and III as the data were collected as a part of a larger research effort and consequently the questionnaires were relatively long. The length of the questionnaire was a typical complaint in participants' feedback. Thus it is likely that those who were more stressed or fatigued chose not to complete the questionnaire at baseline. Researchers in our field should therefore endeavor to limit participant burden in order to increase the response rates.

Finally, the findings of this study cannot be generalized outside the occupations studied, that is, employees working in knowledge-intensive or emotionally demanding jobs. The employees in this study worked primarily in education, public administration, media, or information technology or engineering. Employees who work in physically demanding jobs have different recovery needs during workday breaks and free evenings and would likely benefit from different types of recovery activities (e.g., taking naps during lunch breaks).

Time lags. It is difficult to choose the most theoretically appropriate time lags for longitudinal research, as we lack theories of change (Kelloway & Francis, 2013). When the time lag cannot be theoretically determined, it would be optimal to include multiple measurement waves over different time lags (Taris & Kompier, 2014). However, as mentioned earlier in the discussion, the reality of collecting data in organizations often limits the number of measurement points that can be included. Moreover, studies with multiple waves may suffer from significant participant dropout. A time lag of twelve months was chosen in this study as it controls for potential seasonal effects that may affect employees' workload, how recovered they feel, or well-being (e.g., effects of returning to work from a vacation). Twelve months has also been found to be an appropriate time lag to reveal long-term effects between stressors or recovery and strain (De Lange, Taris, Kompier, Houtman, & Bongers, 2004; Kinnunen & Feldt, 2013; Siltaloppi et al., 2011; Sonnentag et al., 2010). Regarding the lagged effects of stressors on strain, Ford et al. (2014) found that the magnitude of effects tended to increase up to three years before declining. They also found that lagged effects between stressors and strain tend to be fairly small compared to the synchronous effects, which was also the case in the present study between detachment and strain (Study III).

By contrast, Dormann and Griffin (2015) argued recently that using time lags shorter than one year is recommended in panel studies. They also suggest conducting a pilot study to determine the most appropriate time lag in regard to the constructs to be studied, which would also address the issues related to meeting the organizations' wishes and preventing participant dropout. Regarding the present study, the time lag of 12 months was likely too long in Study I to detect practically meaningful effects between lunchtime recovery and exhaustion or vigor. Future studies should examine whether successful lunchtime recovery over the working week influences well-being at the end of the week or at the end of the month. A final concern when choosing the time lag relates to the stability of certain outcome measures. For example, as mentioned earlier, Sonnentag et al. (2014) concluded that finding a non-significant lagged relationship between detachment and exhaustion over four weeks could be due to the stability of exhaustion over this time. Thus when using time lags shorter than 12 months, studies should focus on outcomes that are likely to change over shorter time periods.

4.3 Directions for future research

In addition to the recommendations mentioned above, in this section I will discuss some important directions for future research.

First, regarding study designs, future studies should more often adapt field experiments or intervention studies to establish causality between recovery activities or experiences and well-being. Earlier intervention studies have shown that recovery training programs can increase employees' recovery experiences and improve well-being (e.g., by providing psychoeducation on recovery, teaching transition rituals to separate work and non-work time, and teaching PMR and mindfulness; Ebert et al., 2015; Hahn, Binnewies, Sonnentag, & Mojza, 2011). These studies have typically aimed to increase all recovery experiences at once and combined this with other changes, such as teaching employees about sleep hygiene (Hahn et al., 2011), sleep restriction (Ebert et al., 2015), or increasing social support at work (Poulsen, Sharpley, Baumann, Henderson, & Poulsen, 2015). This makes it difficult to distinguish which part of the training is responsible for the positive effects on well-being. For example, it is possible that the combination of all intervention activities is effective, or the positive effects on well-being could result from a single part of the training (e.g., from training targeting sleep). Thus from a theoretical perspective it would be interesting to test interventions that aim to influence only one recovery

experience at a time in order to confirm that the positive well-being effects are caused by specific recovery experiences, and to compare which recovery experiences are the most effective in improving well-being. For example, detachment could be targeted by reducing work-related emails and phone calls during off-job time (see Kinnunen, Feldt, de Bloom, et al., 2017), or lunchtime detachment could be potentially improved by asking participants to refrain from work-related conversations during lunch breaks (see von Dreden & Binnewies, 2017). However, asking employees to refrain from work-related conversation can decrease control during lunch breaks. This type of intervention might therefore be effective only when employees can choose this approach from several optional intervention activities (cf. Ebert et al., 2015).

Furthermore, lunchtime intervention studies should adapt designs where each participant alternates between different lunchtime recovery activities in order to compare the effects of different lunch break activities within-persons. Collecting qualitative data in addition to the quantitative measurements is also strongly recommended. This enables evaluating the implementation of the intervention study. In the present study systematically collecting qualitative data was not feasible as the resources in terms of research staff were very limited.

Future intervention studies should also examine how organizational culture can be changed to be more supportive of employees' recovery needs. For example, as suggested above, reducing work-related emails and phonecalls during off-job time may benefit detachment, but it is unlikely that individual employees would adopt these behaviors if their supervisors and colleagues expect them to be constantly available. Similarly taking time off to recover, whether it means taking a longer lunch break when feeling fatigued, leaving work at a reasonable hour, or using vacation days is largely shaped by organizational culture and norms. Changing the organizational culture so that supervisors are explicit about what is expected in terms of availability during off-job time, showing support for taking breaks or working reasonable hours, and understanding that lack of recovery is therefore not only an individual employee's problem would probably enhance employees' ability to recover from work. Creating a culture where productivity and commitment are measured in terms of getting the work done instead of staying long hours at the workplace or being constantly available would also likely be helpful (see Kelly et al., 2014).

Another interesting option would be to follow employees who start working in a new organization. This would shed light on the temporal order of job demands, recovery, and strain thus providing further evidence of causality. For example, it

would be important to know whether poor recovery emerges after some exposure to high job demands, or whether some employees tend to recover poorly from the beginning. It is also important that researchers pay attention to both within- and between-person effects when examining the relationship between recovery and well-being (cf. Ilies, Aw, & Pluut, 2015). For example, employees who take more micro-breaks (e.g., having a snack, looking out of the window) at work seem to experience more fatigue than others (Fritz, Lam, & Spreitzer, 2011), but within-persons taking a micro-break at work relates to feeling less fatigued and more energetic after the breaks (Zacher, Brailsford, & Parker, 2014).

The effects of lunch break recovery and evening recovery were investigated separately in the present study. Future studies should investigate the interrelations between different temporal recovery settings. For example, someone who recovers successfully during their lunch break and is less fatigued when returning home may engage in more active recovery activities in the evening after work. These recovering evening activities, such as physical exercise, may in turn result in further resource gain. It therefore seems possible that engaging in recovery activities across multiple temporal recovery settings could result in a gain cycle of resources. Additionally, recovery in one temporal setting may compensate for lack of recovery in other temporal settings. For example, it may be less necessary to recover during lunch breaks for someone who recovers well in the evenings after work and vice versa. Similarly, taking micro-breaks at work could compensate for lack of recovery during lunch breaks, as micro-breaks have been associated with feeling energetic after them (Zacher et al., 2014). An interesting approach to study this would be to carry out a person-oriented analysis to identify latent subgroups (i.e., unobserved or not previously known subgroups) based on how well employees recover during micro breaks, lunch breaks and free evenings. In this way if subgroups of employees who only recover during micro-breaks, lunch breaks or free evenings emerged, well-being across these subgroups could be compared.

4.4 Theoretical and practical implications

This study contributes to theory by demonstrating that the E-R model and the COR theory are suitable for explaining recovery during lunch breaks. The ideas drawn from these theories received overall support in this study, i.e., lunch breaks that are free from job demands and lunchtime activities that restore resources such as positive mood are conducive to lunchtime recovery. The idea that a temporary

respite from job demands and restoring positive mood are mechanisms underlying lunchtime recovery was supported in the intervention study, as lunchtime detachment and enjoyment were found to mediate the beneficial effects of lunch break activities on well-being. This study moreover showed that the ideas from attention restoration theory and psycho-evolutionary theory can be used to identify restorative environments that enhance recovery from work in an occupational context.

Contributing to the stressor-detachment model, the results demonstrated that the long-term relationship between detachment and strain may unfold in two distinct ways over time. First, detachment may have a lagged effect on strain, i.e., experiencing a low level of detachment at baseline predicts increase in strain over one year. Second, detachment had a strong synchronous effect on strain, suggesting that when employees experience a decrease on detachment over one year they will likely experience an increase in strain over the same year. Thus both the within- and between-person variation in detachment are important in explaining changes in strain over time.

This study also has several practical implications. First, spending lunch breaks in ways that enable detachment from work and allowing employees to have control over their lunch break activities seems to promote lunchtime recovery. If breaks are spent with colleagues but employees still wish to recover during the breaks, it is recommended that they do not engage in work-related conversations. Breaks should be regular and long enough for employees to experience a break from job demands and have time to engage in resource-recovering activities.

Second, engaging in break activities that are specifically designed to replenish employees' resources offer benefits that are greater than those of typical lunch break activities and these benefits are still observable at the end of the working day. As park walks and relaxation exercises were found to improve employees' self-reported concentration at the end of the working day, engaging in activities that promote recovery during lunch breaks may also enhance work performance in the afternoon. Park walks are particularly recommended for employees wishing to enjoy their lunch breaks more and who have access to urban park near their office. Relaxation exercises are recommended for employees wishing to detach from work during their lunch breaks and experiencing high levels of strain at work.

Finally, in order to foster occupational well-being over time, both employees and organizations should aim to create a healthy working culture that allows employees to detach from work during their free time. For example, it is important to limit unnecessary emails and calls in the evenings, as these may disrupt the recovery

process. Both experiencing less detachment than others and experiencing an intra-individual decrease in detachment over time puts employees at a risk of experiencing increased exhaustion and sleep difficulties over time. The findings also underline the importance of moderate job demands and sufficient job resources for employee well-being. In addition to recovery activities and experiences, job autonomy may contribute to successful lunchtime recovery and high job demands pose a significant risk factor for employee well-being.

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ORIGINAL ARTICLE

Recovery during Lunch Breaks: Testing Long-Term Relations with Energy Levels at Work

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This study had two aims. First, we examined whether lunch break settings, activities, and recovery experiences were associated with lunchtime recovery cross-sectionally. Second, we investigated whether lunchtime recovery was related to energy levels (i.e., exhaustion and vigor) across a 12-month period.

We collected longitudinal questionnaire data among 841 Finnish workers (59% female, mean age 47 years) from 11 different organizations in various fields at two time points (spring 2013 and 2014). We used hierarchical regression analysis to test our hypotheses.

We found that recovery experiences, that is, psychological detachment from work and control during the lunch break, were related to successful lunchtime recovery. After controlling for background factors, main job characteristics (workload and autonomy), and the outcomes at baseline, successful lunchtime recovery was related to a decrease in exhaustion and to an increase in vigor one year later.

To conclude, lunch breaks offer an important setting for internal recovery during working days and seem to relate to energy levels at work over time.

Keywords: lunch breaks; recovery; detachment; control; exhaustion; vigor

Introduction

Recovery from work stress, that is, psycho-physiological unwinding after effort expenditure at work that restores employees' energy and mental resources, is a mechanism explaining how employees can protect their well-being and health in demanding working conditions (Craig & Cooper, 1992; Geurts & Sonnentag, 2006; Meijman & Mulder, 1998). Recovery plays an intervening role in the relationship between stressful job characteristics and the development of chronic load reactions, such as prolonged fatigue, sleep disorders, and cardiovascular diseases (Geurts & Sonnentag, 2006). Therefore, a more profound understanding of recovery processes is essential in promoting sustainable working life.

Recovery occurs during breaks from work when job demands are no longer present (Meijman & Mulder, 1998). Different forms of breaks range from sabbaticals and vacations to short micro-breaks within the working day. Recovery within working days, referred to as internal recovery, has received far less attention in the recovery research literature than off-job recovery, referred to as external recovery (Sonnentag & Fritz, 2015). Although recovery during breaks within the working day may not be as self-evident as recovery during leisure time, internal recovery has potential in preventing stress from accumulating early on, helping to maintain performance throughout the day and preventing high need for recovery at the end of the working day (Coffeng, van Sluijs, Hendriksen, van Mechelen, & Boot, 2015; Geurts, Beckers, & Tucker, 2014).

As workers typically spend a third to a half of their day at the workplace it is important to recognize the recovery potential of within working day breaks, and especially of the lunch break, which is typically the longest and most common of breaks in the course of the working day. Furthermore, organizations have a greater opportunity to influence employees' internal recovery than external recovery and, therefore, lunch breaks as a recovery setting may be of special interest to employers. For example, organizations may encourage regular lunch breaks and provide restorative environments (e.g., quiet rooms for relaxation). The question of how to recover successfully during lunch breaks has recently gained some research attention (Brown, Barton, Pretty, & Gladwell, 2014; Krajewski, Wieland, & Sauerland, 2010; Trougakos, Hideg, Cheng, & Beal, 2014). Nevertheless, research on internal recovery is still scarce (Sonnentag & Fritz, 2015).

In this study we examine which lunchtime settings, activities, and recovery experiences are related to lunchtime recovery (i.e., how often employees recuperate successfully from work during lunch breaks) in a cross-sectional sample (Study 1). Furthermore, we test whether lunchtime recovery is related to energy levels at work, that is, exhaustion and vigor, over a 12-month period (Study 2). Our study contributes to the literature on work stress

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recovery by extending the understanding of how to promote internal recovery and exploring its relation with maintaining energy at work. **Figure 1** presents the model of the study with hypothesized relationships.

Recovery during lunch break: Theoretical and empirical perspectives

In the effort-recovery (E-R) model (Meijman & Mulder, 1998) recovery has been defined as a process of the psycho-biological system returning to its pre-stressor level. Recovery occurs when the demands causing strain are no longer present (Meijman & Mulder, 1998). When recovery is insufficient, an individual has to invest additional effort at work, which may cause strain and lead to accumulating strain reactions in the long term. Recovery therefore plays a significant role in counteracting strain caused by job demands and helps in maintaining well-being and energy at work.

Besides seeing recovery as a passive process (i.e., caused by mere absence of demands), active perspectives on recovery have also been introduced. According to conservation of resources (COR) theory (Hobfoll, 2002; Hobfoll, 1989), people are motivated to gain new resources and protect their existing resources. Resources are defined broadly as "objects, personal characteristics, conditions, or energies that are valued by the individual" (Hobfoll, 1989, p. 516). When resources are lost, threatened with loss, or new resources are not gained after effort investment, strain occurs. During breaks from work, people have the opportunity to engage in pleasant activities and to regain resources (e.g., energy and positive mood). Thus, to recover during a break, a break must ensure absence of job demands and provide an opportunity for employees to regain valued resources (Hobfoll, 2002; Meijman & Mulder, 1998). This also implies that breaks should be regular and long enough to allow enough time for recovery.

Additionally, break location (the place where the break is spent), break activities, and experiences during the break may influence its recovery potential as they are closely related to the absence of job demands and opportunities for resource gain. These aspects have been argued (Sonnentag & Natter, 2004) and shown (Sonnentag & Fritz, 2015; Sonnentag & Zijlstra, 2006; van Hooff & Baas, 2013) to be of importance in terms of recovery during leisure time. Some of these (e.g., activities) have also been identified in earlier research as important aspects of internal recovery (see Sianoja, Kinnunen, De Bloom, & Korpela, 2015).

When looking at recovery research on where breaks are spent, a recent 5-day diary study found no difference between spending breaks inside or outside the office in terms of resource recovery (Hunter & Wu, 2016). However, in this study carried out among 95 university staff members, the outside condition also included different spaces inside the office building (e.g., a break room), which may not offer as beneficial conditions for detachment from work as spaces outside the office building (e.g., a café or restaurant). Other studies have been specifically interested in natural environments. According to an intervention study by Brown et al. (2014), spending one's lunchtime walking in a natural environment was beneficial in terms of improved mental health when compared to walking in built environments. Accordingly, this study suggests that

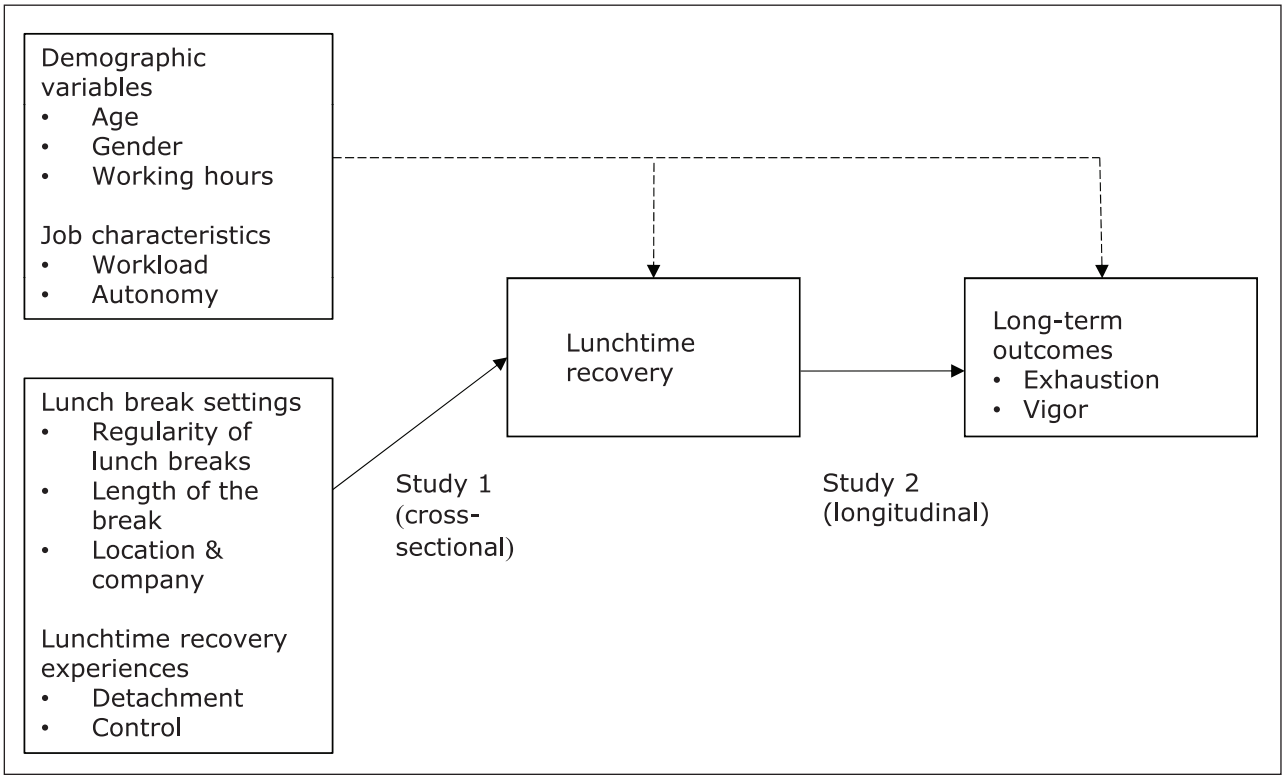

Figure 1: Model of the study.

break location may be significant in terms of recovery. To conclude, spending the lunch break outside the office building should, in theory, aid recovery, as it ensures better mental detachment from work offering a "change of scenery" where job demands are not present (e.g., Korpela, De Bloom, & Kinnunen, 2015).

Concerning break activities, earlier studies on internal recovery have associated relaxing, physical, and social activities with positive recovery outcomes (Coffeng et al., 2015; Krajewski et al., 2010; Trougakos et al., 2014). Of these, we focused on social activities. Wendsche et al. (2014) showed that collective rest breaks (i.e., breaks including social activities) were associated with less turnover than breaks spent alone. In addition, a study by Trougakos et al. (2014) focusing on different lunch break activities revealed that social activities that were based on individuals' own choice, were conducive to recovery.

In sum, in addition to absence of job demands, as suggested by the E-R model, earlier research shows that recovery may be also enhanced by engaging in activities that enable resource replenishment, as suggested by the COR theory.

Hypothesis 1: a) Having lunch breaks regularly, b) having longer lunch breaks, c) spending lunch breaks outside the office building and d) spending lunch breaks with others are positively associated with recovery during lunch breaks.

Furthermore, it has been argued that a recovering break should promote recovery experiences (Coffeng et al., 2015; Trougakos et al., 2014). According to Sonnentag and Fritz (2007), there are four such mechanisms: psychological detachment, relaxation, mastery, and control. Of these, we examined detachment, that is, not thinking about work, and control, that is, getting to choose how to spend one's free time (e.g., lunch breaks). These two experiences were chosen as they have gained most support in earlier studies. In studies focusing on recovery during leisure time, detachment has been identified as a core recovery experience (Sonnentag & Fritz, 2015). Psychological detachment from work, in addition to physical detachment, is crucial, as continuing to think about job demands during breaks may result in strain (Sonnentag & Fritz, 2007). In fact, in a cross-sectional study detachment during work breaks was connected to less need for recovery at the end of the day (Coffeng et al., 2015). Furthermore, autonomy (i.e., control) during lunch breaks has previously been linked to beneficial outcomes (Trougakos et al., 2014). More specifically, autonomy during lunch breaks was recognized as a moderator between lunch break activities and recovery outcomes: autonomy strengthened the positive effects of the activities. In addition, preferred work break activities have been associated with increased resources after the break (Hunter & Wu, 2016). Therefore break characteristics that enhance psychological detachment from work and allow control, may provide beneficial setting for recovery.

Hypothesis 2: Recovery experiences (detachment and control) during lunch breaks are positively associated with recovery during lunch breaks.

Long-term associations between lunchtime recovery and energy levels at work

As long-term outcomes of recovery we focused on energy, specifically on exhaustion and vigor at work. According to the E-R model (Meijman & Mulder, 1998), when recovery is insufficient, high and continuous demands lead to negative load effects and depletion of energy, which in the long term can lead to emotional exhaustion. Emotional exhaustion is one of the core burnout dimensions and refers to "feelings of being overextended and depleted of one's emotional and physical resources" (Maslach, Schaufeli, & Leiter, 2001, p. 399). Research has shown that emotional exhaustion predicts mental and physical illness, such as depression and cardiovascular diseases (Ahola, 2007), as well as increased sickness absence (Toppinen-Tanner, Ojajärvi, Väänänen, Kalimo, & Jäppinen, 2005).

Hunter and Wu (2016) found that resource recovery during workday breaks across one working week was associated with lower levels of exhaustion at the end of the week. As far as we know, the long-term effects between poor recovery during lunch breaks and exhaustion have not yet been examined. However, over time employees go through numerous cycles of daily lunchtime recovery processes, which may ultimately result in either gain or loss of energy depending on whether recovery is successful or incomplete. Therefore, insufficient recovery may, over time, result in cumulative resource loss in terms of higher exhaustion.

Hypothesis 3: Insufficient recovery during lunch breaks is related to high level of emotional exhaustion over time.

In contrast, successful recovery ensures that energy levels are sufficient for people to experience vigor at work (Meijman & Mulder, 1998). Vigor is one of the core dimensions of work engagement and is characterized by high activation, energy, and mental resilience while working (Schaufeli, Salanova, González-Romá, & Bakker, 2002). Work engagement, and particularly vigor, has been shown to be important in terms of motivation and performance at work (Bakker, Demerouti, & Sanz-Vergel, 2014). It has also been shown that exhaustion and vigor are not endpoints of the same energy construct (Demerouti, Mostert, & Bakker, 2010; Mäkikangas, Feldt, Kinnunen, & Tolvanen, 2012). Thus we cannot conclude that absence of exhaustion automatically implies high levels of vigor. It is therefore important to measure both when examining the energy levels of individuals.

To the best of our knowledge, studies on internal recovery and its relation to vigor are so far lacking. However, on a daily level taking micro-breaks at work has been associated with vitality, a concept related to vigor (Zacher, Brailsford, & Parker, 2014). Furthermore, earlier research has established a positive link between external recovery and work engagement (Kühnel, Sonnentag, & Westman, 2009; Sonnentag, 2003). If recovery is repeatedly insufficient during lunch breaks, it may lead to loss of energy and over time reduce vigor. In addition, recovery is associated with resource gain (e.g., energy), and resources tend to accumulate and generate other resources in the long term (Hobfoll, 2002). Accordingly, successful

recovery during lunch breaks may result in energy gain, resulting in higher levels of vigor over time.

Hypothesis 4: Successful recovery during lunch breaks is related to high level of vigor over time.

Methods

Participants and Procedure

The data were collected as a part of larger project on recovery from work (see Kinnunen et al., 2016). The participants of this study were Finnish employees working in 11 different organizations in various fields, mostly working in cognitively or emotionally demanding jobs. The most common fields were education, information technology, and media. The questionnaire data were collected in two phases. First, in spring 2013 (Time 1), an electronic questionnaire was sent either directly to the employees' work e-mail addresses (in seven organizations) or the link to the questionnaire was delivered to the employees by our contact persons (in four organizations). Of the employees contacted (N = 3,593), 1,347 returned the completed questionnaire after two reminders, yielding a response rate of 37.5%. Second, in spring 2014 (Time 2) the electronic questionnaire was sent to those employees' e-mail addresses who responded in 2013 and who were still employed in the same organizations (N = 1,192). Of these, a total of 841 employees returned the completed questionnaire, yielding a response rate of 70.6%. In both study phases the employees were informed about the goals of the study, assured that responses would be treated confidentially and reminded that participation was voluntary.

In Study 1, we used the cross-sectional sample collected at T2, because not all variables (i.e., spending lunch breaks outside, spending breaks with others, lunchtime detachment, and lunchtime control) were measured at T1. A cross-sectional design was considered appropriate because we were interested in the immediate relations of break settings, activities, and experiences with lunchtime recovery. Study 2 was based on the longitudinal sample covering both measurements with a 12-month time lag between the measurements. It is difficult to theoretically determine the most appropriate time lag as we lack theories of change, and therefore even descriptive research on the time courses of important relationships has been recommended (Kelloway & Francis, 2013). We consider one year to be an appropriate time lag, as it is so far the most typical time period used in earlier recovery studies showing long-term effects (Kinnunen & Feldt, 2013; Siltaloppi, Kinnunen, Feldt, & Tolvanen, 2011; Sonnentag, Binnewies, & Mojza, 2010). Additionally, the reality of data collection in organizations imposed certain limitations. We were not able to schedule measurements more frequently because we had to consider the organizations' wishes and time constraints.

Of the sample used in both studies (N = 841), 58.6% were women. The participants' average age was 47.1 years (range 21–67, SD = 10.0). Most of the participants (76.4%) were living with a partner (either married or cohabiting), and 45.6% had children (average of two) living at home. Of the sample, 38.2% held a university degree (master's level or higher), 26.6% had a polytechnic degree, and the rest (35.2%) had a vocational school qualification or less. Of the participants, 8.3% were blue-collar workers (e.g., cleaners), 30.0% lower white-collar workers (e.g., office workers), 57.8% senior white-collar workers (e.g., teachers) and 3.8% senior-level managers (e.g., chief executive officers). The majority had a permanent job (89.0%), worked full-time (96.8%) and had a regular day shift (89.7%). Average weekly working hours were 39.1 (SD = 5.9). Of the participants, 53.6% worked in the public sector as teachers or administrative staff in vocational or upper secondary schools, or in a polytechnic (university of applied sciences). The rest (46.4%) worked in the private sector in various jobs.

In analyzing sample attrition we compared the respondents (n = 841) of the longitudinal sample with the non-respondents. The results indicated that the respondents did not differ from the non-respondents in terms of gender, age, having a partner, number of children or level of education. They also did not differ in terms of the study variables measured at both time points (regularity of taking lunch breaks, lunch break length, lunchtime recovery, exhaustion, or vigor). However, the respondents were more often employed as senior white-collar workers (58% vs. 50%) than the non-respondents ($p < .05$) and more often on a permanent job contract (89% vs. 79%) than the non-respondents ($p < .001$). Also, the respondents worked more hours per week (39.1 vs. 37.9 hours, $p < .01$) and more often on regular day shifts (90% vs. 83%, $p < .01$) than the non-respondents. As we used the data collected at T2 in our cross-sectional study, this sample attrition concerns both Study 1 and Study 2.

Measures

Recovery during lunch breaks

To measure the degree of *recovery during lunch breaks* at T1 and T2, we used one item "I recuperate from work during my lunch break" from the Recovery after Breaks Scale (Demerouti, Bakker, Sonnentag, & Fullagar, 2012) aiming to capture specifically how well and regularly employees recover during their lunch breaks. The item was rated on a scale from 1 (very seldom or never) to 5 (very often or always). Earlier studies have provided support for the validity of single item measures (e.g., Drolet & Morrison, 2001; Elo, Leppänen, & Jahkola, 2003). Concerning recovery, it has been shown that recovery from work measured with one item correlated highly with longer recovery scales, such as need for recovery (Kinnunen, Feldt, Siltaloppi, & Sonnentag, 2011).

Break settings, activities and experiences

Of *break settings and activities*, we measured regularity of lunch breaks [dichotomized to 0 = occasionally (1–3 times a week), 1 = regularly (4–5 times a week)] and length of the lunch break (in minutes). Those participants (n = 36 at T1 and n = 32 at T2) who reported not taking lunch breaks, were not asked to answer any further lunch break related questions (recovery during lunch break, break activities, or experiences) and as lunch break recovery was the main focus in our study, they were excluded from the analyses.

In addition at T2, we asked whether the employees habitually spent their lunch breaks outside the office building ["I spend my lunch break outside my company building (e.g., in a restaurant or in a café)"] or with others ["I spend my lunch break with others (e.g., with colleagues, acquaintances, friends or family members)"]. The answers were dichotomized [0 = no (hardly ever or once a week), 1 = yes (2–5 times a week)].

Of *recovery experiences*, we measured detachment and control during lunchtime at T2. Both detachment and control were measured with one item (respectively: "I distance myself mentally from my work during lunch breaks" and "I decide myself how to spend my lunch breaks") from the Finnish version of the Recovery Experience Questionnaire (Kinnunen et al., 2011; Sonnentag & Fritz, 2007). The items were adapted to concern lunch breaks and measured on a scale from 1 (very seldom or never) to 5 (very often or always).

Potential long-term outcomes

Emotional exhaustion was measured at T1 and T2 with the five-item scale (e.g., "I feel emotionally drained from my work") from the Maslach Burnout Inventory (Kalimo, Hakanen, & Toppinen-Tanner, 2006; Maslach, Jackson, & Leiter, 1996) with response options on a seven-point response scale from 0 (never) to 6 (every day). The Cronbach's alphas were .93 at T1 and .93 at T2.

Vigor was measured at T1 and T2 with the three-item shortened scale (e.g., "At my work, I feel bursting with energy") from the Utrecht Work Engagement Scale (Schaufeli, Bakker, & Salanova, 2006) using a seven-point response scale ranging from 0 (never) to 6 (every day). The Cronbach's alphas were .89 at T1 and .90 at T2.

Control variables

Of the background factors, we controlled for age (in years), gender (1 = woman, 2 = man) and working hours per week, as these may play a role in recovery (e.g., Mohren, Jansen, & Kant, 2010; Siltaloppi et al., 2011). *Working hours* were measured with a single question: "How many hours do you actually work per week? (Include paid and unpaid overtime, but not your commuting time)".

We also controlled for main *job characteristics*, namely workload and autonomy, measured at T1 and T2 as they may act as confounding variables in our study. First, appropriate job design may above all promote internal recovery (Geurts et al., 2014) as it enables the employees to adjust their work according to their current need for recovery. Furthermore, job demands and resources play a pivotal role in maintaining energy as job demands may start a health deteriorating process leading to exhaustion, and job resources, in turn, to a health promoting process leading to an increase in vigor (Bakker et al., 2014). *Workload* was measured with three items (e.g., "How often does your job require you to work under time pressure?", Cronbach's alphas .88 at T1 and .87 at T2) from the Quantitative Workload Inventory (Spector & Jex, 1998). *Autonomy* was measured with five items (e.g., "I can influence decisions that are important for my work", Cronbach's alphas .77 at T1 and .78 at T2) from the QPS Nordic-ADW (Dallner et al., 2000). All job characteristics were measured with a five-point scale from 1 (very seldom or never) to 5 (very often or always).

Analyses

In both studies (Studies 1 and 2), we used hierarchical regression analyses to test our hypotheses. In the cross-sectional Study 1 lunchtime recovery served as a dependent variable. At the first step, we added the control variables (age, gender, weekly working hours, workload, and autonomy). At the second step we added variables describing lunch break settings and activities (regularity of the lunch breaks, length of the lunch break, break outside, and with others). Finally, at the third step we added recovery experiences (detachment and control) during lunch breaks.

In the longitudinal Study 2, we followed similar steps with both outcomes (exhaustion and vigor). At the first step, we controlled for the outcome at Time 1. At the second step, we added control variables (age, gender, weekly working hours, workload, and autonomy). Lunchtime recovery at Time 1 was added at the final step, as we were interested in its explanatory power after controlling for the outcome at Time 1, background factors and work characteristics.

Results

Descriptive results

Means, standard deviations, and zero-order correlations of the study variables are presented in **Table 1** (Study 1) and **Table 2** (Study 2). We first looked at the frequencies of lunch break characteristics examined in Study 1, in which all variables were measured at T2. To have a regular lunch break was common in our sample, as 86% of the participants reported taking a lunch break 4–5 times a week. Of those participants who took lunch breaks at least once a week, 37% reported habitually spending the break outside the office building and 71% with other people. In Study 1, of the lunch break settings and activities, regular lunch breaks (r = .21), longer lunch breaks (r = .16), breaks outside the office building (r = .17), and breaks with others (r = .08) showed positive associations with lunchtime recovery. However, both recovery experiences – detachment and control – during lunch breaks showed the strongest correlations: high level of detachment (r = .59) and control (r = .30) during lunch breaks were associated with successful lunchtime recovery. In addition, of the control variables, workload was negatively (r = –.12) and autonomy positively (r = .33) associated with recovery during lunch breaks.

In Study 2 there were significant longitudinal correlations between lunchtime recovery and both potential long-term outcomes (**Table 2**). Lunchtime recovery at T1 was negatively related to exhaustion at T2 (r = –.35) and positively related to vigor at T2 (r = .36). Of the control variables gender (female), long weekly working hours, high workload and low autonomy were related to exhaustion at T2, and gender (female) and high level of autonomy were related to vigor at T2. In addition, lunchtime recovery (r = .48) and both outcomes (r = .69 for exhaustion and

	M / %	*SD*	1	2	3	4	5	6	7	8	9	10	11
1. Lunchtime recovery	3.42	0.97	–										
2. Age	48.13	10.02	.04	–									
3. Gender[1]	58.6%	–	.03	.04	–								
4. Weekly working hours	38.65	5.90	−.03	−.06	.07*	–							
5. Workload	3.82	0.79	−.12***	−.07	−.15***	.27***	–						
6. Autonomy	3.20	0.80	.33***	−.06	.16***	.05	−.24***	–					
7. Regularity of lunch breaks[2]	86.2%	–	.21***	−.13***	−.04	.04	−.05	.10**	–				
8. Length of lunch break	29.02	8.55	.16***	−.05	.11**	−.02	−.05	.06	.08*	–			
9. Lunch break outside[3]	36.9%	–	.17***	−.04	.11**	.12**	.08*	.14***	.15***	.15***	–		
10. Lunch break with others[4]	71.4%	–	.08*	−.09**	−.13***	.03	.02	.05	.21***	.07*	.12**	–	
11. Detachment at lunch break	3.33	1.06	.59***	.01	.01	−.09*	−.16***	.18***	.21***	.18***	.19***	.03	–
12. Control at lunch break	4.27	0.96	.30***	.03	.11**	.03	–.05	.38***	.05	.19***	.22***	.05	.24***

Table 1: Means, standard deviations, and zero-order correlations of the study variables in Study 1.

Note. [1]Gender: 1 = female, 2 = male; [2]Regularity of lunch breaks: 0 = occasionally (1–3 times a week), 1 = regularly (4–5 times a week); [3]Break outside: 0 = no (hardly ever or once a week), 1 = yes (2–5 times a week); [4]Break with others: 0 = no (hardly ever or once a week), 1 = yes (2–5 times a week).

The second column shows percentages for categorical variables: [1] % of female participants; [2] % of participants taking lunch breaks regularly; [3] % of participants typically spending lunch breaks outside; [4] % of participants typically spending lunch breaks with others.

* $p < .05$; ** $p < .01$; *** $p < .001$; $807 < N < 841$.

	M / %	*SD*	1	2	3	4	5	6	7	8	9
1. Lunchtime recovery T1	3.39	1.00									
2. Age T1	47.13	10.02	.08*								
3. Gender[1]	58.6%	–	.01	.04							
4. Weekly working hours T1	39.09	5.94	−.09*	−.01	.06						
5. Workload T1	3.89	0.82	−.16***	.03	−.16***	.28***					
6. Autonomy T1	3.18	0.82	.30***	−.08*	.16***	.05	−.30***				
7. Exhaustion T1	1.92	1.45	−.41***	.04	−.11**	.12**	.36***	−.35***			
8. Vigor T1	4.53	1.21	.43***	.01	−.06	.05	.01	.26***	-.45***		
9. Exhaustion T2	1.92	1.41	−.35***	−.02	−.15***	.08*	.31***	−.30***	.69***	−.35***	
10. Vigor T2	4.37	1.32	.36***	.00	−.09**	.07	.04	.19***	−.37***	.68***	-.45***

Table 2: Means, standard deviations, and zero–order correlations of the study variables in Study 2.
Note. [1]Gender: 1 = female, 2 = male.
The second column shows percentages for categorical variables: [1] % of female participants.
* $p < .05$; ** $p < .01$; *** $p < .001$; $785 < N < 841$.

$r = .68$ for vigor) were relatively stable between T1 and T2. No mean level changes occurred in lunchtime recovery or exhaustion between T1 and T2. However, vigor was significantly lower at T2 than at T1 ($p < .001$).

Testing the hypotheses

Study 1

The results of the hierarchical regression analysis concerning the associations between lunch break settings, activities, recovery experiences, and lunchtime recovery are shown in **Table 3**. At step 1, control variables (background variables and job characteristics) explained 12% of the variance in lunchtime recovery and autonomy at work significantly contributed to lunchtime recovery. Regular lunch breaks, longer lunch breaks and habitually spending lunch breaks outside the office building contributed to successful lunchtime recovery, increasing the explanation rate of the model to 17%. Spending lunch breaks with others did not contribute to lunchtime recovery. After adding recovery experience variables to the model at step 3, only regularity of the lunch breaks (of the lunchtime characteristics entered at step 2) continued to be associated with lunchtime recovery. Both detachment and control were positively related to recovery, and they raised the explanation rate of the model to 41%. Detachment ($\beta = .51$, $p < .001$) predicted lunchtime recovery more strongly than control ($\beta = .09$, $p < .01$).

In sum, Hypothesis 1 was partially supported, as most of the positive effects of lunchtime settings and activities disappeared when lunchtime recovery experiences were entered into the model. More specifically, Hypothesis 1a was fully supported, as taking lunch breaks regularly contributed to successful lunchtime recovery. Hypotheses 1b and 1c were partially supported, as longer lunch breaks and spending breaks outside were only significant before recovery experiences were entered into the model. Hypothesis 1d did not receive support, as spending lunch breaks with others did not contribute to recovery. Furthermore, Hypothesis 2 was fully supported, as both high levels of detachment and control during lunch break contributed to successful lunch break recovery.

Study 2

The results of hierarchical regression analyses exploring the longitudinal relationships of lunchtime recovery with exhaustion and vigor are shown in **Table 4**. Concerning *exhaustion*, at step 1, exhaustion at T1 strongly predicted exhaustion at T2 explaining 47% of the variance. At the second step, adding the control variables, the explanation rate of the model increased by 1 %, as gender (female) was significantly related to exhaustion. At the final step, lunchtime recovery at T1 contributed significantly ($\beta = -.07$) to exhaustion at T2. The increase in the explanation rate was significant, although it increased only 0.3%. The explanation rate of the final model was 48%. Thus, in line with Hypothesis 3, successful recovery at lunch breaks seems to explain – to a minor degree – a decrease in exhaustion across one year.

In the model predicting *vigor*, at step 1, vigor at T1 strongly predicted vigor at T2 explaining 47% of the variance. At the second step, adding the control variables neither background factors nor job characteristics were significant predictors of vigor. At the final step, lunchtime recovery at T1 contributed significantly ($\beta = .10$) to vigor at T2 and added 1% to the explanation rate. The explanation rate of the final model was 48%. Thus, in line with Hypothesis 4 successful recovery at lunch breaks seems to explain – to a minor degree – an increase in vigor across one year.

Discussion

This study had two main aims. First, we investigated whether certain lunch break settings, activities, and experiences were related to recovery during lunch breaks. Second, we examined whether lunchtime recovery was associated with energy levels at work one year later. We based our study on the E-R model and the COR theory.

	Lunchtime recovery		
	Step 1	Step 2	Step 3
Predictors	β	β	β
Age	.06	.09*	.06*
Gender[1]	−.03	−.04	−.03
Weekly working hours	−.04	−.05	.00
Workload	−.04	−.04	.01
Autonomy	.33***	.30***	.22***
Regularity of lunch breaks[2]		.15***	.07*
Length of lunch break		.11**	.03
Lunch break outside[3]		.11**	.01
Lunch break with others[4]		–.00	.02
Detachment at lunch break			.51***
Control at lunch break			.09**
ΔR^2	.12***	.06***	.24***
R^2	.12***	.17***	.41***

Table 3: Results of hierarchical regression analysis for lunchtime recovery (Study 1), N = 774.
Note. [1]Gender: 1 = female, 2 = male; [2]Regularity of lunch breaks: 0 = occasionally (1–3 times a week), 1 = regularly (4–5 times a week); [3]Break outside: 0 = no (hardly ever or once a week), 1 = yes (2–5 times a week); [4]Break with others: 0 = no (hardly ever or once a week), 1 = yes (2–5 times a week).
* $p < .05$; ** $p < .01$; *** $p < .001$.

	Model 1			Model 2		
	Exhaustion			Vigor		
	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3
Predictors at T1	β	β	β	β	β	β
Dependent variable at T1[1]	.68***	.65***	.63***	.69***	.68***	.64***
Age T1		−.04	−.03		−.03	−.04
Gender[2]		−.07*	−.07*		−.05	−.05
Weekly working hours T1		−.02	−.02		.04	.05
Workload T1		.05	.06		.02	.03
Autonomy T1		−.03	−.02		.03	.01
Lunchtime recovery T1			−.07*			.10**
ΔR^2	.47***	.01**	.003*	.47***	.01	.01**
R^2	.47***	.48***	.48***	.47***	.48***	.49***

Table 4: Results of hierarchical regression analysis for exhaustion (Model 1) and vigor (Model 2) at T2 (Study 2), N = 745.
Note. [1]Dependent variable at T1: For the first model Exhaustion at T1, for the second model Vigor at T1. [2]Gender: 1 = female, 2 = male.
* $p < .05$; ** $p < .01$; *** $p < .001$.

Among our sample of Finnish workers, having lunch breaks was common, as 86% of the participants took them 4–5 times a week. On average, the participants felt occasionally recovered after their lunch breaks and no changes in this regard were observed across one year. In line with our expectations, of the break settings or activities, regularity of the lunch breaks, length of the lunch break and spending lunch breaks outside the office contributed to successful lunchtime recovery. Thus, our study supports the importance of taking regular lunch breaks. However, associations between break length and breaks outside were no longer significant after taking recovery experiences into account. As expected, we found that higher levels of detachment and control during lunch breaks were related to more successful lunchtime recovery. This finding concurred with earlier research on internal recovery (Coffeng et al., 2015; Trougakos et al., 2014). In light of our results, it seems that detachment is more meaningful in terms of lunchtime recovery than control. This is logical, as detachment ensures total absence of job

demands, whereas employees with high level of control may still choose to engage, for example, in discussing work issues. Our result therefore extends the earlier finding that detachment from work is a powerful recovery experience during non-work time (Sonnentag & Fritz, 2015). However, our one-item measure for control did not necessarily capture all dimensions of control as a recovery experience, for example control over when to take lunch breaks (cf. Sonnentag & Fritz, 2007). The measure used may therefore have underestimated the importance of control during breaks. We recommend future studies to assess recovery experiences at lunchtime with multiple items to capture their full meaning.

Both taking longer lunch breaks and habitually spending breaks outside the workplace premises were correlated with higher levels of detachment. Thus our results suggest that lunch break length and spending lunch breaks outside the office building may matter for lunchtime detachment, which in turn relates to lunchtime recovery. We recommend that future studies, with longitudinal designs enabling appropriate mediation analysis, test whether lunchtime recovery experiences mediate the effects of lunchtime settings and activities on recovery. One earlier study found that spending the break inside versus outside one's office (outside = in the same building or outside the building) did not have an effect on recovery after breaks during the working day (Hunter & Wu, 2016). As our results suggest that where lunch breaks are spent could matter, it is important to note that our measure (outside = outside the office building) was different from the one used by Hunter and Wu (2016). Therefore we suggest that future studies use more comprehensive measures in differentiating where breaks are spent to disentangle these differing results. For example, spending breaks in the break room of the department could have different recovery outcomes from spending breaks outside the office building in a restaurant. Furthermore, our outside condition was quite general, and did not take specific recovery enhancing environmental factors (e.g., natural settings) into account. Given that natural settings are more likely to afford restorative experiences than are built environments, comparing them would be a good option for future studies (Brown et al., 2014).

Furthermore, in our study, spending the lunch breaks with others was not associated with recovery. This is surprising, as earlier research suggests that breaks including social activities are more beneficial for recovery than breaks spent alone (Wendsche et al., 2014). However, earlier research has also suggested that social activities are more beneficial when based on one's own choice (Trougakos et al., 2014). Our study took no account of this issue, which may explain our non-significant finding. Additionally, we did not distinguish between spending the break with colleagues and spending the break with other people, like friends and family. This may be important, as in theory spending the lunch break with friends or family may relate to more successful detachment from work than spending the break with colleagues. Therefore we recommend that future studies take into account whether social activities are based on employees' own choice and with whom employees spend their breaks.

When looking at lunchtime recovery and its long-term relationship with energy levels, we found that successful lunchtime recovery was associated with less exhaustion one year later, as expected. Although the effects we found were small, it is worth noting that this relationship was still valid after controlling for baseline level of exhaustion and several controls. Thus successful lunchtime recovery explained a minor decrease in exhaustion in the long term. Our findings lend tentative support to our expectations derived from the E-R model: insufficient recovery during lunch breaks is related to loss of energy. When this loss of energy accumulates over time due to repeated episodes of insufficient recovery, it may partly explain increased levels of exhaustion. Furthermore, our result is in line with the conclusions of earlier studies linking internal recovery with less exhaustion in the short term (Hunter & Wu, 2016).

Similarly, the connection between lunchtime recovery and vigor was supported. Successful recovery was related to a minor increase in vigor one year later after controlling for baseline level of vigor and several other controls. These findings tentatively support our expectations derived from the E-R and COR theories that successful recovery prevents energy loss and increases internal resources (e.g., energy). When lunchtime recovery is repeatedly successful, it accumulates and generates new resources across time, relating to a small increase in vigor. As the levels of exhaustion and vigor at work were reasonably stable over one year (i.e., the T1 level explained about half of their variance at T2), our findings estimating the long-term change in energy levels due to lunchtime recovery can be considered promising. Taken together, lunchtime recovery seems to be of importance in terms of energy at work over time.

Limitations, strengths, and suggestions for future studies

This study has certain limitations that should be considered. First, choosing the best time lag for studying longitudinal relations between internal recovery and energy is not self-evident and the one-year time lag used in our study is debatable. Our results explained variation in energy levels only to a minor degree. The effects would likely be stronger if more frequent measures over shorter time lags (e.g., every couple of months) were applied. Future research may benefit from testing similar long-term effects with more frequent measurements over different time spans. Nevertheless, our longitudinal analysis supported long-term relationships between lunchtime recovery, exhaustion and vigor, supporting the view that employees' degree of recovery during their lunch breaks may have significance, not only on a daily level, but also in the long-term.

Second, although previous studies have demonstrated one item measures to be valid substitutes for longer scales (Drolet & Morrison, 2001; Elo et al., 2003; Fisher, Matthews, & Gibbons, 2016; Kinnunen et al., 2011) future research may benefit from using multiple item measures for lunchtime recovery and recovery experiences. Third,

a further limitation concerning the measures is that our study relies solely on self-report measures and may therefore suffer from common method bias. This limitation mainly concerns the cross-sectional part of this study, as temporal separation can be an effective way to reduce common method bias (Spector, 2006). Still, future studies may benefit from using measures that are more objective, such as physiological measures, in examining internal recovery. Also, the cross-sectional study permits no causal interpretations. In the future the question of what factors promote recovery during lunch breaks may best be tested with intervention studies.

Fourth, the response rate was relatively low (37.5% at T1 and 23.4% at T2 relative to baseline respondents) and self-selection occurred between T1 and T2 in terms of a permanent job contract, occupational status (more often senior white-collar workers), working more often on regular day shifts, and longer working hours per week. This self-selection also concerns the cross-sectional part of our study, where we used the sample collected at T2. This was due to the fact that our T1 questionnaire did not include all items related to lunch breaks (spending lunch breaks outside, spending breaks with others, detachment, or control). Therefore, the generalizability of our results may be limited. However, the response rate is similar to those of other studies conducted in organizational settings (see Baruch & Holtom, 2008, for a review), and our large and diverse sample makes the results more generalizable to wider populations. Nevertheless, it would be useful to replicate our results in other samples in future.

Fifth, our study included a limited variety of lunchtime activities and only examined their frequency. For example, we asked how often employees engaged in social activities or spent their breaks outside the office building, but did not differentiate with whom and where exactly the breaks were spent. Therefore we recommend that future studies take these issues into account using more specific and comprehensive measures. We also recommend measuring other experiences in addition to detachment and control during workday breaks. For example, relaxation may be important in terms of internal recovery, as it reduces psycho-physiological activation and elicits positive affect (Sonnentag & Fritz, 2007). It may be possible to increase the experience of relaxation during breaks by engaging in relaxation exercises (Krajewski et al., 2010) or less deliberately by engaging in other relaxing activities, such as listening to music or going for a walk.

Despite these limitations, our study has several strengths. Earlier research on recovery has focused almost exclusively on external recovery. This study provides new insights on recovery during within working day breaks. Specifically, it demonstrated that although lunch breaks are limited in time, taking regular lunch breaks, which enhance mental detachment and control over how to spend the break, relate positively to successful recovery. Our study also demonstrated that lunchtime recovery has importance in terms of long-term exhaustion and vigor. Our results on lunchtime recovery may be of particular interest to organizations, as compared to external recovery, organizations may influence the settings they provide for recovery during within working day breaks.

Conclusions

This study demonstrated that lunchtime recovery may best be promoted by ensuring control and especially detachment during lunch breaks. In practice, organizations could promote lunchtime recovery by giving options to spend lunch breaks in different ways that enable detachment, such as spending the break in a non-work environment or offering a space for relaxing activities. This recommendation is suitable for fields where workers are at risk of insufficient recovery, for example, employees in cognitively or emotionally demanding jobs, and where the work tasks enable flexibility in terms of lunch break settings and activities. Furthermore, our study suggests that recovery during lunch breaks and energy levels at work are related across time. Thus if lunchtime recovery is repeatedly successful, it may contribute to a decrease in exhaustion and an increase in vigor. In summary, lunch breaks offer an important recovery setting to promote occupational health and well-being alongside recovery during leisure time.

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Competing Interests

The authors declare that they have no competing interests.

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TESTING THE DIRECT AND MODERATOR EFFECTS OF THE STRESSOR-DETACHMENT MODEL OVER ONE YEAR: A LATENT CHANGE PERSPECTIVE

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Testing the Direct and Moderator Effects of the Stressor-Detachment Model over One Year: A Latent Change Perspective

Abstract

To test the direct and moderator effects of the stressor-detachment model from a long-term perspective, we investigated whether workload and detachment are related to changes in exhaustion and sleep difficulties over one year. We also examined whether detachment attenuates the relationship between high workload and these outcomes both cross-sectionally and over time. Questionnaire data with 1,722 respondents at Time 1 and 1,182 respondents at Time 2 were collected. We used a latent change score approach to analyze the data in order to identify intra-individual change among the studied constructs. Our results showed that high workload and low detachment at baseline were related to an increase in exhaustion over one year. Additionally, an increase in workload and a decrease in detachment were related to a simultaneous increase in exhaustion over time. Low detachment, but not high workload, was related to an increase in sleep difficulties over time, and a decrease in detachment across one year was related to a simultaneous increase in sleep difficulties. A high level of detachment only attenuated the relationship between workload and exhaustion at baseline. Our results underline the significance of poor psychological detachment as a risk factor for the development of strain outcomes over time.

Keywords: detachment, exhaustion, longitudinal, recovery, sleep difficulties, workload

Testing the Direct and Moderator Effects of the Stressor-Detachment Model over One Year: A Latent Change Perspective

Contemporary working life is characterized by high job demands, which are reflected in employees' experiences of high workload, unrealistic job expectations, and having to work at high speed almost all the time (American Psychological Association, 2015; Eurofound, 2015). Over time, excessive job demands pose a significant threat to employees' health and well-being (e.g., Kivimäki et al., 2012). Recovery from work (i.e., "psychophysiological unwinding after effort expenditure," Geurts & Sonnentag, 2006, p. 485) has been identified as a mechanism that protects against the negative effects of heavy job demands on employees, such as health complaints, exhaustion, and impaired job performance (Sonnentag, Venz, & Casper, 2017). One particularly powerful experience promoting recovery is psychological detachment from work, defined as mental disengagement from work-related thoughts during off-job time (Sonnentag & Fritz, 2007).

Inspired by the research findings that highlight the importance of psychological detachment for employee well-being, Sonnentag and Fritz (2015) introduced a theoretical framework called the stressor-detachment model, which argues that, in addition to stressors, detachment from work is a key factor predicting employees' experience of strain. Moreover, detachment can attenuate the relationship between stressors and strain. This is because sustained activation, rather than the acute stress reaction, is detrimental to employee well-being and health over time (McEwen, 1998). Lack of detachment from work during free time maintains sustained activation, even when the stressor is no longer present (Ottaviani et al., 2016).

Whereas multiple cross-sectional and daily diary studies have reported concurrent associations or short-term effects of detachment on strain (for reviews, see Bennett, Bakker, & Field, 2017; Sonnentag et al., 2017; Wendsche & Lohmann-Haislah, 2017), studies examining the long-term effects of detachment are scarce, and the findings remain inconclusive (Kinnunen & Feldt, 2013; Sonnentag, Arbeus, Mahn, & Fritz, 2014; Sonnentag, Binnewies, & Mojza, 2010). At

the same time, it is important to understand whether the general tendency to detach from work will predict long-term change in chronic strain outcomes. This knowledge of the long-term associations between detachment and strain has valuable practical implications for employees and organizations when assessing the long-term costs (e.g., burnout, insomnia) against supposed benefits of letting work interrupt free time. Additionally, only few earlier studies have examined whether detachment actually moderates the relationship between job demands and strain across time, although this is one of the key arguments made in the stressor-detachment model (Sonnentag & Fritz, 2015).

Our aim is to address these gaps and test the direct and moderator effects of the stressor-detachment model across one year. More specifically, we examine how workload and detachment relate to change in strain (i.e., exhaustion and sleep difficulties) over a one-year period. In addition, we investigate whether detachment moderates the relationship between workload and the strain outcomes.

Our study makes a novel contribution to the recovery literature by examining these relationships with a latent change score approach. The benefit of using a latent change score (LCS) modeling as opposed to the more commonly used cross-lagged panel model (CLPM) is that with LCS we can predict intra-individual change in the outcomes. Instead, when using CLPM in longitudinal research, the outcome modeled is a combination of change and between-person level differences at the previous time point. In this regard, the LCS approach is similar to latent growth curve modeling, which also makes it possible to distinguish within-person change ("slope") from the between-person differences at the baseline level ("intercept"). However, latent growth curve modeling typically requires a minimum of three measurement waves, whereas LCS can be used with only two (Curran, Obeidat, & Losardo, 2010; Ferrer & McArdle, 2010). As our primary interest is to examine *within-person change* in employee strain as an outcome of detachment from work and workload, using LCS over CLPM as an analytic method is a preferred choice for us (see Usami, Hayes, & McArdle, 2016).

Disentangling within-person change from between-person differences also allows us to test two distinct ways in which stressor-strain or detachment-strain effects may vary over time: synchronous effects and lagged effects (see Ford et al., 2014). By synchronous effects we refer to predicting change in the outcomes with concurrent change in the predictors, and by lagged effects we refer to using the baseline level of the predictors to predict upcoming change in the outcomes. Specifying how the detachment-strain relationship unfolds in time by investigating whether detachment has both synchronous and lagged effects on strain will contribute to the theoretical development of the stressor-detachment model. It also offers important knowledge to employees and organizations who wish to better understand how detachment may relate to strain over time. Finally, predicting intra-individual change controls for many stable differences across people and thus helps to rule out certain confounding variables (e.g., negative affectivity).

Theoretical Perspectives on Psychological Detachment

Recovery can be defined as a process during which psycho-physiological functioning returns to its pre-stressor level and employees' resources are restored (Geurts & Sonnentag, 2006). According to the effort-recovery (E-R) model (Meijman & Mulder, 1998), incomplete recovery between work shifts can lead to a sub-optimal working condition, requiring increased effort to perform adequately, resulting in stress reactions such as strain and fatigue. Continued exposure to workload and incomplete recovery can lead to chronic health problems or decreased well-being in the long term (McEwen, 1998). The E-R model states that the absence of job demands is a necessary condition for recovery. However, refraining from job-related activities is not enough to ensure sufficient recovery, as merely thinking about work during free time can result in prolonged physiological activation (Ottaviani et al., 2016).

Building on these ideas, the stressor-detachment model (Sonnentag & Fritz, 2015) identifies psychological detachment from work as a core experience enhancing recovery. Detachment may vary between and within individuals, meaning that people differ from each other in the extent to

which they typically detach from work, and how well an employee is able to detach from work may change over time. Based on this idea, we suggest that both between-person level at baseline (e.g., typically having more difficulty than others in detaching from work), and within-person change in detachment over time (e.g., experiencing a decrease in detachment as a result of starting to read work emails more often in the evenings) may contribute to increasing strain over time. Thus, detachment may have both lagged and synchronous effects on strain (see Ford et al., 2014).

Workload and Psychological Strain

Workload is a quantitative job demand characterized by a high quantity of work and pressure to work at high speed (van Veldhoven, 2014). Job demands refer to the "physical, social, or organizational aspects of the job that require sustained physical or mental effort" and are associated with corresponding costs (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001, p. 501). Thus, a continuously high workload requires sustained effort, which in turn might lead to chronic strain reactions, especially in combination with insufficient recovery (Meijman & Mulder, 1998).

As outcomes exemplifying chronic strain reactions, we focused on emotional exhaustion and sleep difficulties, as these constructs reflect psychological strain that may develop gradually after long-term exposure to job demands and insufficient recovery. Exhaustion is the core burnout dimension, and it refers to "feelings of being overextended and depleted of one's emotional and physical resources" (Maslach, Schaufeli, & Leiter, 2001, p. 399). Earlier research has linked exhaustion to long sickness absences, and mental and physical illness, such as depression and cardiovascular diseases (Ahola, 2007). High job demands may lead to constant overtaxing of employees' resources and thus increase exhaustion over time (Demerouti et al., 2001). Cross-sectional studies have supported this view, systematically linking workload to exhaustion (see Alarcon, 2011, for a review). Longitudinal between-person studies have found that people who experience high job demands also experience more exhaustion one year later (Sonnentag et al., 2010; Taris, Kompier, Geurts, Houtman, & Van Den Heuvel, 2010). One earlier study examining

intra-individual change in job demands found that an increase in job demands (including workload, emotional demands, and work-home interference) predicted an increased level of burnout one year later (Schaufeli, Bakker, & Van Rhenen, 2009).

Sleep difficulties are characterized by trouble initiating or maintaining sleep, waking up too early, or nonrestorative sleep (Edinger et al., 2004). Sleep difficulties have been associated with burnout symptoms, depression, increased alcohol consumption, sickness absence, and decreased productivity at work (Lindblom, Linton, Fedeli, & Bryngelsson, 2006; Stoller, 1994). It is generally assumed that workload relates to increased physiological and psychological activation, which in turn may interfere with sleep (Åkerstedt, Nordin, Alfredsson, Westerholm, & Kecklund, 2012). Recent reviews have concluded that high job demands are systematically associated with sleep disturbances in cross-sectional studies (Litwiller, Snyder, Taylor, & Steele, 2017) and in prospective studies with time intervals ranging from three months to five years (Linton et al., 2015). Although these studies have mainly focused on between-person differences, some studies have used dichotomized scores of sleep difficulties to identify participants with new cases of sleep disturbances at follow-up. For example, Åkerstedt et al. (2012) found that high job demands at baseline, and shifting from low demands at baseline to high demands at follow-up, predicted belonging to the group with new cases of sleep difficulties five years later.

Focusing on intra-individual change in strain over one year, we examine whether the level of workload at baseline is related to change in exhaustion or sleep difficulties over time, and whether a change in workload between the two time points relates to a simultaneous change in exhaustion or sleep difficulties. Examining these two different ways of how workload may relate to strain over time corresponds to testing a) lagged effects and b) synchronous effects, between stressors and strain (Ford et al., 2014). Following the review by Ford et al. (2014), we assume that stressors may have lagged effects on strain because certain chronic strain reactions develop slowly after extended exposure to occupational stressors. More specifically, in line with the stressor-detachment model

(Sonnentag & Fritz, 2015), we expect a high level of workload to have lagged effects on strain, as a constantly high workload will likely result in increases in exhaustion and sleep difficulties over time beyond any immediate short-term effects. This likely occurs via the accumulation of strain due to the constant overtaxing of employees' resources (Demerouti et al., 2001). That is to say, we expect that employees who experience a higher level of workload than others at baseline will likely experience an increase in exhaustion and sleep difficulties during the following year.

Synchronous effects, in turn, refer to associations where "increases/decreases in stressor levels are accompanied by concurrent increases/decreases in strains" (Ford et al., 2014, pp. 11). Ford et al. (2014) note that synchronous effects are observed as cross-sectional correlations. Following their definition of synchronous effects ("the strain changes concurrently with the stressor and both are measured at all time points", pp. 18), we suggest that synchronous effects can also be operationalized as predicting change (or slope, or trajectory) in strain with a concurrent change (or slope, or trajectory) in the stressor. Accordingly, we expect that employees who experience an increase in workload over one year also experience a concurrent increase in exhaustion and sleep difficulties. Additionally included in our study is the relationship between the baseline level of workload and baseline level of strain, which corresponds to between-person cross-sectional effects.

Regarding the long-term effects in our study, we chose one year as the time lag. Sonnentag and Fritz (2015) suggest that as short-term dynamics typically operate within longer-term dynamics, psychological detachment from work can be described within different time frames such as days, weeks, or years. Choosing one year helps to eliminate seasonal effects that may potentially cause temporary changes in employees' workload or well-being (e.g., effects of returning from a longer summer vacation). Additionally, one year has been found to be an appropriate time period for revealing long-term effects in earlier between-person studies in our field (De Lange, Taris, Kompier, Houtman, & Bongers, 2004; Kinnunen & Feldt, 2013; Siltaloppi, Kinnunen, Feldt, & Tolvanen, 2011; Sonnentag et al., 2010).

Hypothesis 1a: High levels of workload are related to high levels of exhaustion and sleep difficulties at baseline.

Hypothesis 1b: Employees who experience a high level of workload at baseline will experience an increase in exhaustion and sleep difficulties over time.

Hypothesis 1c: Employees who experience an increase in workload over time will experience a simultaneous increase in exhaustion and sleep difficulties.

Detachment and Psychological Strain

Successful psychological detachment from work during free time can stop acute load reactions from accumulating, and thus prevent an increase in chronic strain reactions over time (Sonnentag & Fritz, 2015). Detachment is a particularly powerful recovery experience because it signifies the full absence of job demands, and thus enhances recovery from work (Meijman & Mulder, 1998). As detachment signifies a break from job demands, it has the potential to cease the energy loss cycle that may otherwise continue during off-job time. Thus, not detaching from work during free time may relate to increases in emotional exhaustion in the long term. Two recent reviews show that detachment is systematically associated with less exhaustion; however, most of the evidence comes from cross-sectional or diary studies focusing on short-term effects (Sonnentag & Fritz, 2015; Wendsche & Lohmann-Haislah, 2017). One earlier longitudinal study focusing on between-person differences found that employees experiencing high detachment at baseline experienced less exhaustion one year later (Sonnentag et al., 2010). However, contradictory results also exist, as in two prospective studies detachment was not related to exhaustion four weeks later (Sonnentag et al., 2014), or to fatigue including exhaustion one year later (Kinnunen & Feldt, 2013). To the best of our knowledge, earlier longitudinal studies have not examined detachment in relation to intra-individual change in exhaustion.

Poor detachment increases difficulties in falling asleep and hampers sleep quality on the daily level, as thinking about work evokes prolonged physiological activation (Ottaviani et al., 2016). In

the long term, poor detachment may result in more persistent sleep difficulties. Successful detachment has been associated with better sleep quality and fewer sleeping problems in cross-sectional (e.g., Sonnentag & Fritz, 2007) and within-person daily diary studies (e.g., Hülsheger et al., 2014). Regarding longitudinal studies, worry and work preoccupation, which are related but not identical to lack of detachment (Sonnentag & Fritz, 2015), have been associated with increased levels of sleep complaints one and five years from baseline (Van Laethem et al., 2015; Åkerstedt et al., 2012). To our knowledge, earlier longitudinal studies have not addressed the relationship between sleep difficulties and psychological detachment as conceptualized by Sonnentag and Fritz (2007). Nevertheless, in a study by Siltaloppi et al. (2011), those employees who experienced reasonably high levels of recovery experiences, including detachment, experienced the fewest sleep difficulties over one year.

To address the gaps identified above, we investigated lagged and synchronous effects of detachment on strain over one year. That is, we examined whether low levels of detachment at baseline predicted an intra-individual increase in exhaustion or sleep difficulties over one year, or whether an intra-individual decrease in detachment was associated with a simultaneous increase in exhaustion or sleep difficulties. Again, we also included the relationship between the baseline level of detachment and baseline level of strain in our study, which corresponds to cross-sectional between-person effects.

Hypothesis 2a: Low levels of detachment are related to high levels of exhaustion and sleep difficulties at baseline.

Hypothesis 2b: Employees who experience low levels of detachment at baseline will experience an increase in exhaustion and sleep difficulties over time.

Hypothesis 2c: Employees who experience a decrease in detachment over time will experience a simultaneous increase in exhaustion and sleep difficulties.

Detachment as a Moderator between Workload and Psychological Strain

With the help of detachment employees facing a high workload can replenish their resources (e.g., energy) during off-job time and maintain their well-being (Sonnentag & Fritz, 2015). As successful recovery ceases the accumulation of load effects (Meijman & Mulder, 1998), detachment during free time can help employees to restore energy resources and improve sleep quality after a demanding day at work. Thus, detachment can protect against the accumulation of chronic strain reactions over time when the workload is high.

Few earlier studies have examined detachment as a moderator between workload and exhaustion or sleep difficulties. In an earlier cross-sectional study, detachment did not moderate the relationship between workload and exhaustion (Siltaloppi, Kinnunen, & Feldt, 2009). One diary study found that detachment during the previous break period moderated the effect of workload on fatigue during a night shift after four hours, but not after eight or 12 hours, and not during a day shift (Korunka, Kubicek, Prem, & Cvitan, 2012). In a longitudinal study by Sonnentag et al. (2010), detachment at baseline did not moderate the relationship between workload and exhaustion one year later. Other studies examining detachment as a moderator between stressors and strain have either examined dissimilar stressors (e.g., job insecurity or self-control demands; Kinnunen, Mauno, & Siltaloppi, 2010, Rivkin, Diestel, & Schmidt, 2015) or outcomes (e.g. perceived stress, cognitive failures, or life satisfaction; Safstrom & Hartig, 2013). One of these studies reported a significant stressor-detachment interaction when predicting exhaustion: Detachment was found to attenuate the effect of self-control demands on exhaustion in a cross-sectional design (Rivkin, Diestel, & Schmidt, 2015).

In summary, both cross-sectional and longitudinal empirical evidence on detachment as a moderator between workload and exhaustion or sleep difficulties is scarce. Nevertheless, based on the stressor-detachment model we propose the following hypotheses:

Hypothesis 3a: Detachment moderates the relationship between high workload and exhaustion and sleep difficulties at baseline. The relationship between a high workload and high levels of

exhaustion and sleep difficulties is attenuated for employees experiencing high levels of detachment at baseline.

Hypothesis 3b: Detachment moderates the relationship between high baseline workload and an increase in exhaustion and sleep difficulties over time. Employees experiencing high levels of detachment at baseline will experience a smaller increase in exhaustion and sleep difficulties as the result of a high workload than those with low levels of detachment.

Hypothesis 3c: The change in detachment moderates the relationship between an increase in workload and an increase in exhaustion and sleep difficulties over time. The relationship between an increase in workload and an increase in exhaustion and sleep difficulties is attenuated with a simultaneous increase in detachment.

Methods

Participants and Procedure

The data were collected as a part of a larger project on recovery from work (see Kinnunen et al., 2017). The participants of this study were Finnish employees mostly working in cognitively or emotionally demanding jobs from 12 different organizations in various fields. The questionnaire data were collected in two phases in spring 2013 and 2014 from 11 of the organizations with a 12-month time lag between the measurements. The remaining organization (603 employees contacted) entered the study one year later, and the participants from this company completed the questionnaires in 2014 and 2015. At Time 1 (henceforth T1), an electronic questionnaire was sent either directly to the employees' work e-mail addresses (in eight organizations) or the link to the questionnaire was delivered to the employees by our contact persons (in four organizations). Of the employees contacted (N = 4,196), 1,722 returned the questionnaire after two reminders, yielding a response rate of 41.0%. At Time 2 (henceforth T2), the electronic questionnaire was sent to those employees' via e-mail who responded at T1 and who were still employed in the same organizations (N = 1,533). Of these, a total of 1,182 employees returned the questionnaire, yielding a response

rate of 77.1%. In both study phases, the employees were informed about the goals of the study, assured that the responses would be treated confidentially, and reminded that participation was voluntary.

Of the sample (N = 1,722) at T1, 63.2% were women. The participants were on average 46.7 years old (range 20–68, SD = 10.3). Most participants (69.4%) were living with a partner (either married or cohabiting), and 47.9% had children (average of two) living at home. Of the sample, 40.2% held a university degree (master's level or higher), 24.8% held a polytechnic degree, and the rest (35.0%) had a vocational school qualification or less. The majority had a permanent job (86.0%), worked full-time (95.5%), and worked a regular day shift (93.7%). The average weekly working hours were 35.6 (SD = 7.9). The most common fields were education (41.9%), public administration (21.8%), information technology (17.1%), and media (13.6%). In analyzing sample attrition, we compared the respondents of the longitudinal sample (n = 1,182) with the non-respondents at T2. The respondents did not differ from the non-respondents in terms of gender, age, having a partner, number of children, or level of education. They also did not differ in terms of the study variables (workload, detachment, exhaustion, or sleep difficulties). However, the respondents more often had a permanent job contract (88.5% vs. 80.2%, $p < .001$), a daytime job (94.5% vs. 91.8%, $p < .05$), and worked more hours per week (35.9 vs. 35.0, $p < .05$).

Measures

All study variables (workload, detachment, exhaustion, and sleep difficulties) were measured at both at T1 and at T2.

Workload was measured with three items (e.g., "How often does your job require you to work very fast?") from the Quantitative Workload Inventory (Spector & Jex, 1998) on a scale from 1 (= *very seldom or never*) to 5 (= *very often or always*).

Psychological detachment from work was assessed with three items (e.g., "During time after work… I don't think about work at all") from the Finnish version of the Recovery Experience

Questionnaire (Kinnunen, Feldt, Siltaloppi, & Sonnentag, 2011; Sonnentag & Fritz, 2007) on a scale from 1 (= *strongly disagree*) to 5 (= *strongly agree*). As this study was conducted as a part of a larger research project, in order to limit the burden on participants, the measures had to be kept short. Consequently detachment was measured with only three items, selected based on the strongest factor loadings reported in earlier studies (Kinnunen & Feldt, 2013; Kinnunen et al., 2011; Sonnentag & Fritz, 2007).

Emotional exhaustion was measured with five items (e.g., "I feel emotionally drained from my work") from the Maslach Burnout Inventory (Kalimo, Hakanen, & Toppinen-Tanner, 2006; Maslach, Jackson, & Leiter, 1996) on a scale from 0 (= *never*), 1 (= a few times a year) … to 6 (= *always/every day*). *Sleep difficulties* were assessed with four items ("How often have you perceived any of the following complaints during the last month?") on a scale from 1 (= *very seldom or never*) to 5 (= *very often or always*). The four items, derived from the Karolinska Sleep Questionnaire (Åkerstedt, Hume, Minors, & Waterhouse, 1994), included difficulty falling asleep, repeated awakenings, premature (final) awakening, and not feeling refreshed upon waking.

Control variables. To take into account any confounding factors, we controlled for age (*in years*), gender (1 = *female*; 2 = *male*), and shift work (1 = *daytime job*; 2 = *shift work*). Gender is known to relate to exhaustion, as women often report experiencing higher levels of exhaustion than men (Maslach et al., 2001). Furthermore, older workers (compared to younger workers) and shift workers (compared to those with a daytime job) may experience a higher level of sleep difficulties (Åkerstedt et al., 2012).

Statistical Analysis

We analyzed the data using a latent change score (LCS) approach in a structural equation modeling framework to test both direct and moderating effects (Ferrer & McArdle, 2010; McArdle, 2009) using the Mplus 7.3 program (Muthén & Muthén, 1998-2015). The parameters were estimated using maximum-likelihood estimation with robust standard errors to take into account the

effect of any non-normality in the variables (MLR estimator; Muthén & Muthén, 1998-2015). The default setting for handling missing values in Mplus was used, which takes into account all observations in the data without imputing the data (Muthén & Muthén, 1998-2015).

Measurement models. We used latent variables constructed with original items for each scale, as the latent variable approach enables measurement errors to be taken into account. To ensure that there is no structural change in the latent constructs over time, we examined the time invariance of factor loadings, and observed variables' intercepts and error variances between T1 and T2. To compare the different models, we used the Satorra-Bentler scaled χ^2 difference test (Satorra & Bentler, 2001). As the χ^2 difference test is known to be oversensitive with large samples, and as such may suggest rejecting a model although the discrepancy is trivial (Bollen, 1983), we also used the Root Mean Square Error of Approximation (RMSEA) to evaluate the time invariance. Values smaller than .06 for the RMESEA point to an acceptable model fit (Hu & Bentler, 1999), and following Li, Fay, Frese, Harms, and Gao (2014), we applied change $\leq .015$ in the RMSEA to indicate time invariance. In addition, the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Standardized Root Mean Square Residual (SRMR) were used for model fit estimation. Acceptable values are greater than .95 for the CFI and TLI, and smaller than .08 for the SRMR (Hu & Bentler, 1999).

Structural models. The benefit of the LCS is that it represents change as a distinct latent construct demonstrating "change in the true scores for each variable from the previous occasion" (Ferrer & McArdle, 2010, p. 151). Thus, it overcomes the limitations of using mere change scores (i.e., the changes may be due to measurement error) (McArdle, 2009). Recent studies in the field of work and organizational psychology have used latent change scores to model change in work characteristics (Li et al., 2014) and occupational well-being (Toker & Biron, 2012).

To test our hypotheses, we first created the latent change score factors for workload ($\Delta W_{[T1-T2]}$), detachment ($\Delta D_{[T1-T2]}$), exhaustion ($\Delta E_{[T1-T2]}$), and sleep difficulties ($\Delta SD_{[T1-T2]}$). We tested

hypotheses 1, 2, and 3 for exhaustion (Model 1) and sleep difficulties (Model 2) in separate models. For the hypotheses *a*, *b* and *c*, we regressed a) the baseline level of the outcomes on the baseline level of the predictors (workload, detachment, and their interaction term); b) latent change in the outcomes on the baseline level of predictors; and c) latent change in the outcomes on latent change in the predictors. We controlled for age, gender, and shift work by regressing exhaustion (in Model 1) or sleep difficulties (in Model 2) at T1 on these background factors. Only the control variables that were significantly related to the outcomes were included in the final models.

To test the interactions, we defined two latent interaction terms: detachment at T1 × workload at T1, and $\Delta W_{[T1\text{-}T2]} \times \Delta D_{[T1\text{-}T2]}$. Including an interaction term between continuous latent variables in Mplus requires defining the type as random and incorporating integration (Montecarlo) in the analysis (see Muthén & Muthén, 1998-2015, pp. 76-77). When type is defined as random in Mplus, standardized coefficients, R-square values, or model fit information with χ^2, CFI, TLI, RMSEA, or SRMR are not available. Thus, we provide the explained variance in the outcomes and the model fit information before the inclusion of the interaction terms, and report the unstandardized estimates for the final Models 1 and 2.

Results

The descriptive results—i.e., the means, standard deviations, Cronbach's alphas, and zero-order correlations between the study variables—are presented in Table 1.

Measurement model results

As a preliminary analysis, we tested the factor structure and time invariance for each variable separately. Within each factor, autocorrelations between the same items at T1 and T2 were allowed when it improved the model fit. Three autocorrelations were estimated in longitudinal models of workload and exhaustion, two in detachment, and four in sleep difficulties. Additionally, two pairs of measurement errors were estimated in the measurement models of exhaustion and sleeping difficulties. The fit indices for the time invariance tests are displayed in Table 2. The results from

the Satorra-Bentler scaled χ^2 difference test supported time invariance for workload, exhaustion, and sleep difficulties. For detachment, the changes in the RMSEA supported time invariance. All the factor loadings were appropriate, with standardized estimates ranging from .61 to .92.

Structural model results

Both final models (Models 1 and 2; see Figures 1 and 2), including simultaneously estimated time invariant stability models for all latent variables, showed good fit to the data before the interaction terms were added (Model 1: $\chi^2 = 555.24$, $df = 233$, scaling correction for MLR = 1.08, CFI = .98, TLI = .98, RMSEA = .03, SRMR = .04; Model 2: $\chi^2 = 640.86$, $df = 230$, scaling correction for MLR = 1.05, CFI = .97, TLI = .97, RMSEA = .04, SRMR = .04).

Emotional exhaustion. The findings for exhaustion (Model 1) are presented in Figure 1 and Table 3. Of the control variables, only gender was related to exhaustion, indicating that women experienced higher levels of exhaustion at baseline than men did. High workload at baseline was related to high levels of exhaustion at baseline, and to an increase in exhaustion from T1 to T2. Additionally, an increase in workload between T1 and T2 was related to a simultaneous increase in exhaustion. Thus, hypotheses 1*a*, *b*, and *c* regarding the relationship between workload and exhaustion were fully supported. Detachment was also related to exhaustion, as expected: low levels of detachment at T1 were related to high levels of exhaustion at T1, and to an increase in exhaustion over time. Furthermore, a decrease in detachment between the two time points was related to a simultaneous increase in exhaustion. Therefore, hypotheses 2*a*, *b*, and *c* concerning the relationship between detachment and exhaustion were also fully supported. Model 1 explained 20% of the variance in exhaustion at T1, and 27% of the variance in the change in exhaustion from T1 to T2 (compared to 16% with only exhaustion at T1 as a predictor). Note that we report the beta coefficients from the final models, but the explained variance is from the models before the interaction terms were included, as R-square values are not available in Mplus for type random.

Regarding the interactions, the interaction between the level of workload and detachment was significantly related to the level of exhaustion at T1. The interaction is illustrated in Figure 3. To examine the interaction further, we conducted a simple slope test. The relationship between a high level of workload and high level of exhaustion at T1 was more pronounced when detachment was low (1 *SD* below the mean; $B = .71$, $t = 8.17$, $p < .001$) compared to when detachment was high (1 *SD* above the mean; $B = .37$, $t = 4.94$, $p < .001$). In conclusion, hypothesis 3*a* for exhaustion was supported, demonstrating that high levels of detachment attenuate the relationship between high levels of workload and exhaustion at baseline. On the contrary, the interaction between workload and detachment at T1 was not related to the change in exhaustion over time. Furthermore, the interaction term between the change in workload and detachment from T1 to T2 was not significantly related to the change in exhaustion. Thus, hypotheses 3*b* and *c* for exhaustion were not supported.

Sleep difficulties. Findings for sleep difficulties (Model 2) are presented in Figure 2 and Table 3. Of the control variables, gender, age, and shift work were related to sleep difficulties at T1. Women compared to men, older workers compared to younger workers, and those working in shifts compared to daytime jobs experienced a higher level of sleep difficulties at baseline. High levels of workload at T1 were related to more sleep difficulties at T1. By contrast, workload at T1 did not predict change in sleep difficulties across time. Additionally, change in workload was not related to change in sleep difficulties from T1 to T2. This means that hypothesis 1*a* was supported for sleep difficulties, but hypotheses 1*b* and *c* were not. Concerning the relationship between detachment and sleep difficulties, hypotheses 2*a*, *b*, and *c* were supported. Specifically, low levels of detachment at baseline were related to high levels of sleep difficulties at baseline, and to an increase in sleep difficulties from T1 to T2. Moreover, a decrease in detachment predicted a simultaneous increase in sleep difficulties from T1 to T2. Model 2 explained 19% of the variance in sleep difficulties at T1, and 18% of the variance in the change in sleep difficulties over time (compared to 11% with only

sleep difficulties at T1 as a predictor).

The interaction term between workload and detachment was not related to the level of sleep difficulties at baseline. Similarly, the interaction terms between the level of workload and detachment, or between the changes in workload and detachment, were not related to the change in sleep difficulties. Therefore, hypotheses 3*a*, *b*, and *c* were not supported for sleep difficulties.

Alternative model testing. Although the models tested above were based on the theoretical assumptions of the stressor-detachment model (Sonnentag & Fritz, 2015), reversed relationships between the studied constructs are possible. That is, experiencing poor well-being may lead to higher levels of perceived workload and more trouble with detaching from work. To account for this possibility, instead of reversed causality models, we directly estimated reciprocal models according to common practice in studies with bidirectional hypotheses using the LCS approach (Ferrer & McArdle, 2010; Toker & Biron, 2012). The reciprocal models included relationships from the baseline level of exhaustion/sleep difficulties, detachment, and workload at T1 to changes in all these constructs between T1 and T2, including the same control variables as in our original models, but without the interaction terms. For both models, Bayesian Information Criterion (BIC) suggested selecting the original normal causality model over the reciprocal model ($BIC_{exhaustion}$ = 75157.74 vs. 75177.92; $BIC_{sleep\ diff.}$ = 63634.68 vs. 63652.69).

Discussion

This study contributes to our current knowledge of the long-term effects of psychological detachment from work on employee well-being. We tested both the direct and moderator effects of the stressor-detachment model (Sonnentag & Fritz, 2015) at baseline and over one year in the framework of latent change scores. Specifically, by distinguishing intra-individual change from between person differences in detachment, workload, exhaustion, and sleep difficulties over time, we examined whether workload and detachment have lagged and/or synchronous effects on exhaustion and sleep difficulties over one year. Overall, our results supported the long-term direct

effects drawn from the stressor-detachment model, but the moderator effects received only partial support.

We first examined the relationship between *workload and strain*, as outlined in the stressor-detachment model (Sonnentag & Fritz, 2015). According to our expectations, our results showed that high levels of workload were related to high levels of exhaustion at baseline, which is in line with earlier cross-sectional studies (Alarcon, 2011). Moreover, our results indicated that workload had both lagged and synchronous effects on exhaustion over time: both a high level of workload at baseline and an increase in workload over time were related to an intra-individual increase in exhaustion over one year. Similar effects have been found in previous longitudinal studies, where high job demands have been associated with high levels of exhaustion in between-person designs (Taris et al., 2010) and in one earlier intra-individual study (Schaufeli et al., 2009). These findings support the direct relationship between work-related stressors and increased strain, as hypothesized in the stressor-detachment model (Sonnentag & Fritz, 2015), and the idea that stressors may have both lagged and synchronous effects on strain over time (Ford et al., 2014).

In line with earlier cross-sectional studies, we also found that a high level of workload at baseline was related to high levels of sleep difficulties at baseline (see Litwiller et al., 2017 for a review). However, in contrast to our expectations, high levels of workload at baseline or increases in workload over one year were not related to changes in sleep difficulties over time. This is somewhat surprising, as high job demands have been consistently linked to sleep disturbances in earlier longitudinal studies (Linton et al., 2015). It is difficult to offer a definite reason for our contradictory findings, but differences in study designs or samples could offer some explanations. Most of the previous longitudinal studies that found significant relationships between job demands and sleep difficulties used longer time lags, thus allowing more time for change to occur in sleep difficulties (e.g., five years; Åkerstedt et al., 2012).

Regarding the relationship between *detachment and strain*, we found that low detachment

was related to more exhaustion and sleep difficulties at baseline, as expected in light of earlier cross-sectional studies (Sonnentag & Fritz, 2007, 2015; Wendsche & Lohmann-Haislah, 2017). However, the major finding in our study was that detachment had both lagged and synchronous effects on strain over time: low level of detachment at baseline predicted intra-individual increase in exhaustion and sleep difficulties over one year, and employees who experienced a decrease in detachment over one year simultaneously experienced an increase in exhaustion and sleep difficulties. Thus it seems that both the between-person level at baseline, and the within-person change in detachment over time, relate to increases in strain over time. These results were expected in light of one earlier longitudinal study, where low detachment was associated with high levels of exhaustion one year after baseline (Sonnentag et al., 2010), and studies where related concepts, such as worry or preoccupation, have been associated with increased sleep difficulties over time (Van Laethem et al., 2015; Åkerstedt et al., 2012). The fact that low detachment and decreasing detachment were related to increasing exhaustion over time emphasizes the importance of the absence of job demands for successful recovery, as underlined in the E-R model (Meijman & Mulder, 1998). Our findings also suggest that thinking about work during free time, as demonstrated by low detachment, can lead to prolonged physiological activation (Ottaviani et al., 2016) and consequently impair sleep quality, leading to an increase in sleep difficulties in the long term. Accordingly, our study supported the direct effects of detachment on strain over one year drawn from the stressor-detachment model (Sonnentag & Fritz, 2015), and served to further demonstrate how the detachment-strain effects may unfold over time.

To the best of our knowledge, our study is the first to provide empirical support for the hypothesis that detachment moderates the relationship between workload and exhaustion, as earlier studies have failed to show significant interaction effects between these constructs (Siltaloppi et al., 2009; Sonnentag et al., 2010). We found that high detachment attenuates the relationship between high workload and high exhaustion at baseline. Employees who experience high workload and low

detachment also experience higher levels of exhaustion than those employees who experience high workload but still successfully detach from work. This finding further supports the importance of psychological detachment from work, as those employees who successfully detach from work during free time are less vulnerable to the harmful effects of high job demands. This is likely because detachment offers a full break from job demands, thus ensuring replenishing resources and therefore ceasing the depletion of energy between work shifts (Meijman & Mulder, 1998).

One explanation for finding a significant moderator effect between detachment and workload on exhaustion while Siltaloppi et al. (2009) did not may relate to the fact that they included different set of variables in their models (they tested the effects of all recovery experiences – detachment, relaxation, mastery, and control – and not only detachment). Regarding the longitudinal moderator effects, and in line with Sonnentag et al. (2010), we found that detachment did not attenuate the relationship between workload and exhaustion over time. Thus high level of detachment seems to attenuate the effect of high workload on immediate experience of exhaustion, but does not buffer against increasing exhaustion over time. Furthermore, in our study detachment did not moderate the relationship between workload and sleep difficulties at baseline or over time. This suggests that low levels of detachment relate to increased sleep difficulties regardless of workload. It seems reasonable that detachment during off-job time alone is important for sleep, as employees most typically have some time away from work before going to bed. Consequently our study only partially supports the expected moderator effects based on the stressor-detachment model.

Limitations and Suggestions for Future Research

The results of our study should be interpreted with caution. First, although a latent change score approach provides information about the changes in employees' experiences and how changes in different experiences relate to each other, our study does not establish causality between the studied constructs. Consequently randomized experimental designs manipulating psychological detachment are needed to strictly establish the causal relationships between detachment and strain.

One strength of our design is that when modeling intra-individual change over time, stable third variables (e.g., negative affectivity) should not influence our findings (Zapf, Dormann, & Frese, 1996). Nevertheless, our study cannot rule out all possible third variables, especially if they vary over time.

Second, as our study relied solely on self-reports, we acknowledge that our results reflect employees' internal experiences, for example, perceived workload and subjective experience of sleep difficulties. Future studies could incorporate measures that are more objective, for example the use of outsider reports for measuring workload or sleep actigraphs for measuring sleep difficulties. As psychological detachment from work and exhaustion are internal experiences, self-reports may be the most appropriate measures of these constructs. Future studies may benefit from measuring all three aspects of burnout (exhaustion, cynicism, and personal accomplishment) to gain a more complete picture of the relationship between detachment and burnout. As we modeled latent changes in each variable between two occasions, our results are unlikely to be affected by biases associated with common method variance (Li et al., 2014).

Third, it is difficult to determine the most appropriate time lag to study long-term effects of detachment. Our results demonstrated that one year is a reasonable timeframe to find significant long-term associations between detachment, exhaustion, and sleep difficulties. Future research could benefit from testing different time lags to reveal potential long-term moderation effects between detachment, workload, and the tested outcomes. We acknowledge that this might be difficult as the reality of data collection in several organizations makes it challenging to schedule multiple and frequent measurements. This was the case in our study, as we had to balance between carrying out an optimal research design and respecting the organizations' wishes.

Fourth, when examining the role of detachment as a moderator in the stressor-strain relationship, future research may benefit from examining a wide variety of stressors, or focusing on stressors that have been identified as most crucial for the long-term development of strain in a given

occupation. For example, Diestel and Schmidt (2012) found that among financial consultants and insurance company service employees, self-control demands mediated the effect of workload on strain. Thus, among professionals who face high levels of self-control demands, it may be particularly interesting to note that detachment has been shown to moderate the effects of self-control demands on strain (Rivkin, Diestel, & Schmidt, 2015).

Fifth, future studies should take the valence of work-related thoughts into account. Based on our study, we cannot conclude what the benefit of detaching from positive work-related thoughts is compared to negative, or ruminative, work-related thoughts, as detachment covers both. For example, in earlier studies positive work-related thoughts during leisure time have been even associated with high levels of well-being (Meier, Cho, & Dumani, 2016).

Finally, as the response rates (41.0% at T1 and 28.2% at T2 relative to the baseline respondents) were relatively low, the generalizability of our results may be affected by a response bias. However, the response rate was similar as in earlier studies conducted in organizational settings (see Baruch & Holtom, 2008, for a review). Some self-selection occurred between the T1 and T2 questionnaires. The respondents more often had a permanent job contract, more often had a daytime job, and worked more hours per week. Nevertheless, we had a rather large and diverse sample, making the results more generalizable to wider populations.

Theoretical and practical implications

As longitudinal research on the effects of detachment on employee well-being has been scarce and previous findings inconclusive, our study makes theoretical contributions by reporting evidence of the long-term effects between detachment and strain. Our findings support the idea that the hypothesized direct relationships in the stressor-detachment model operate not only within days or weeks, but are also relevant over longer periods of time, such as years (Sonnentag & Fritz, 2015). As a novel theoretical contribution, we were able to specify two distinct ways in which the detachment-strain relationship unfolds over time. First, detachment seems to have lagged effects on

strain, suggesting that experiencing less detachment than others predicts increase in strain over time. Second, detachment has a strong synchronous effect on strain, meaning that when an individual experiences a decrease in detachment, a simultaneous increase in strain will likely follow. Our findings confirm that both between- and within-person variation in detachment are important in predicting long-term intra-individual changes in strain. Finally, our study was also among the first to show that detachment attenuates the effects of high workload on exhaustion cross-sectionally. Our study therefore supports the key idea of the stressor-detachment model of detachment as a moderator between stressors and strain cross-sectionally, but not over time. It may be that the moderator effects of detachment depend on the demands and outcomes studied in line with the match principle, i.e., detachment from work that matches particular demands and outcomes will be most effective (de Jonge, Spoor, Sonnentag, Dormann, & van den Tooren, 2012).

Our findings underscore the long-term costs of not detaching from work: both employees experiencing less detachment than others and those experiencing increasing difficulty in detaching from work over time are at risk of experiencing increased exhaustion and sleep difficulties over time. Consequently, to promote employee health and well-being in the long-term, organizations should make sure that employees have an opportunity for sufficient uninterrupted recovery time between work shifts. In practice, this could mean encouraging employees not to work during their free time, and to form workplace policies that restrict phone calls or emails during off-job time. Employees can advance their own detachment by separating work and leisure when possible (e.g., creating clear boundaries between work and non-work), and by engaging in leisure activities that help them to detach from work-related thoughts.

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Table 1.

Means, Standard Deviations, Cronbach's Alphas, and Correlations of the Study Variables (1,064 ≤ N ≤ 1,671).

Variable	*M* / %	*SD*	1	2	3	4	5	6	7	8	9	10	11
1. Gender[1]	36.8%	-	-										
2. Age	46.72	10.32	.06*	-									
3. Shift work[2]	6.3%	-	-.03	-.05*	-								
4. Workload T1	3.85	0.81	-.12***	-.03	.07**	(.88)							
5. Detachment T1	2.99	0.99	-.05*	-.03	.06*	-.21***	(.87)						
6. Exhaustion T1	1.92	1.47	-.08**	.02	.03	.33***	-.32***	(.93)					
7. Sleep difficulties T1	2.59	0.90	-.10***	.09**	.05*	.17***	-.31***	.46***	(.79)				
8. Workload T2	3.80	0.81	-.12***	-.07*	.09**	.69***	-.17***	.27***	.13***	(.87)			
9. Detachment T2	3.05	0.97	-.05	-.03	.05	-.19***	.62***	-.22***	-.27***	-.20***	(.86)		
10. Exhaustion T2	1.96	1.44	-.14***	-.04	.02	.29***	-.25***	.68***	.40***	.35***	-.28***	(.93)	
11. Sleep difficulties T2	2.65	0.91	-.06*	.02	.02	.14***	-.25***	.39***	.71***	.12***	-.31***	.50***	(.80)

Note. Cronbach's alphas are shown on the diagonal. [1]Gender: 1 = female, 2 = male; [2]Shift work: 1 = Daytime job, 2 = Shift work. T1 = Time 1; T2 = Time 2. The second column shows percentages for categorical variables: [1]% of male participants, [2]% of shift workers.
* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 2.

Fit Indices for the Analysis of Time Invariance.

Factor and model	χ^2 (*df*)	Scaling correction	Satorra-Bentler scaled χ^2 difference test	RMSEA	CFI	TLI	SRMR
Workload							
Equal form	3.21 (5)	1.20		.00	1.00	1.00	.01
Equal factor loadings	3.94 (7)	1.21	$\Delta\chi^2(2) = 0.74$, $p = .69$	.00	1.00	1.00	.01
Equal intercepts	5.75 (9)	1.16	$\Delta\chi^2(2) = 1.92$, $p = .38$	.00	1.00	1.00	.01
Equal error variances	9.39 (12)	1.22	$\Delta\chi^2(3) = 3.42$, $p = .33$	.00	1.00	1.00	.01
Detachment							
Equal form	3.84 (6)	1.07		.000	1.00	1.00	.01
Equal factor loadings	9.00 (8)	1.01	$\Delta\chi^2(2) = 5.91$, $p = .052$	.009	1.00	1.00	.02
Equal intercepts	19.00 (10)	1.01	$\Delta\chi^2(2) = 10.02$, $p < .01$	.023	1.00	1.00	.03
Equal error variances	21.78 (13)	1.04	$\Delta\chi^2(3) = 3.04$, $p = .39$	.020	1.00	1.00	.02
Exhaustion							
Equal form	75.19 (25)	1.27		.03	.99	.99	.02
Equal factor loadings	79.52 (29)	1.22	$\Delta\chi^2(4) = 1.96$, $p = .74$	.03	.99	.99	.02
Equal intercepts	83.73 (33)	1.19	$\Delta\chi^2(4) = 2.68$, $p = .61$	.03	.99	.99	.02
Equal error variances	87.40 (38)	1.22	$\Delta\chi^2(5) = 4.88$, $p = .43$	.03	.99	.99	.02
Sleep difficulties							
Equal form	80.05 (13)	1.15		.06	.98	.96	.03
Equal factor loadings	82.72 (16)	1.12	$\Delta\chi^2(3) = 0.67$, $p = .88$	.05	.98	.97	.03
Equal intercepts	87.27 (19)	1.10	$\Delta\chi^2(3) = 3.43$, $p = .33$	.05	.98	.97	.03
Equal error variances	93.07 (23)	1.08	$\Delta\chi^2(4) = 4.86$, $p = .30$	.04	.98	.98	.03

Note. Scaling correction = Scaling correction used for the Chi-square difference test in models estimated with maximum-likelihood with robust standard errors (MLR). RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; SRMR = Standardized Root Mean Square Residual.

Table 3.

Unstandardized Path Coefficients for Predicting Exhaustion (Model 1) and Sleep Difficulties (Model 2) in the Final Models.

Model 1			Model 2		
	Exhaustion T1	$\Delta E_{[T1\text{-}T2]}$		Sleep difficulties T1	$\Delta SD_{[T1\text{-}T2]}$
Variable	*B* (*SE*)	*B* (*SE*)	Variable	*B* (*SE*)	*B* (*SE*)
Exhaustion T1	–	-.32 (.03)***	Sleep difficulties T1	–	-.23 (.03)***
Workload T1	.54 (.06)***	.25 (.06)***	Workload T1	.08 (.04)*	-.01 (.03)
Detachment T1	-.40 (.04)***	-.11 (.04)**	Detachment T1	-.28 (.03)***	-.06 (.03)*
Workload T1 × Detachment T1	-.18 (.06)**	-.02 (.05)	Workload T1 × Detachment T1	-.03 (.04)	.01 (.04)
$\Delta W_{[T1\text{-}T2]}$	–	.57 (.08)***	$\Delta W_{[T1\text{-}T2]}$	–	.10 (.06)
$\Delta D_{[T1\text{-}T2]}$	–	-.27 (.06)***	$\Delta D_{[T1\text{-}T2]}$	–	-.21 (.04)***
$\Delta W_{[T1\text{-}T2]} \times \Delta D_{[T1\text{-}T2]}$	–	-.12 (.15)	$\Delta W_{[T1\text{-}T2]} \times \Delta D_{[T1\text{-}T2]}$	–	.12 (.14)
Gender[1]	-.18 (.07)**	–	Gender	-.20 (.04)***	–
Age	–	–	Age	.01 (.002)***	–
Shift work[2]	–	–	Shift work	.20 (.08)*	–

Note. [1]Gender: 1 = female, 2 = male; [2]Shift work: 1 = Daytime job, 2 = Shift work.
T1 = Time 1; T2 = Time 2. ΔE = change in exhaustion; ΔSD = change in sleep difficulties; ΔW = change in workload; ΔD = change in detachment.
* $p < .05$; ** $p < .01$; *** $p < .001$.

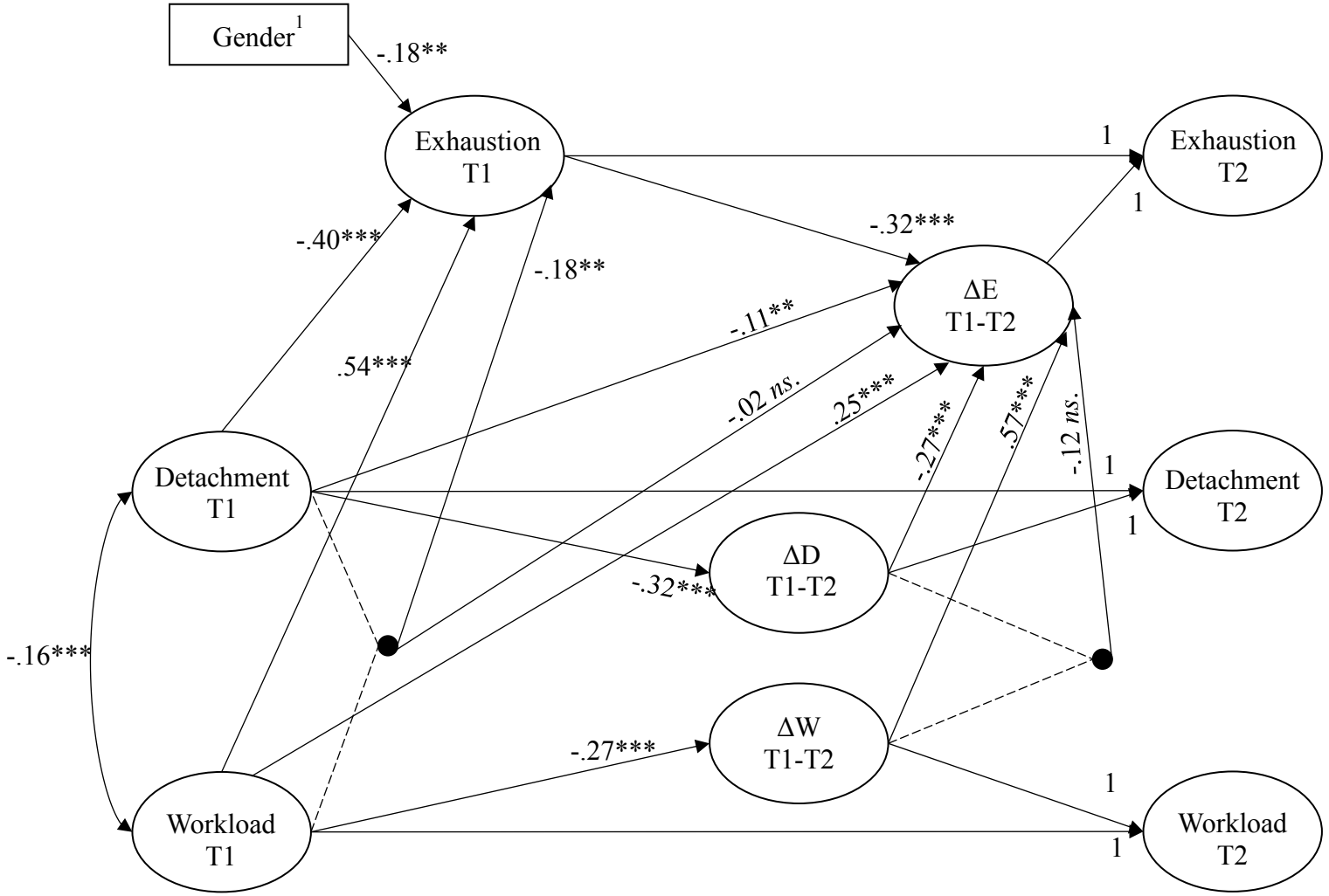

Figure 1. Final structural model for predicting exhaustion (Model 1). Rectangles represent the observed variables and ellipses the latent variables. Following Toker and Biron (2012), latent interactions were presented using small filled ellipses. For ease of presentation, the factor items and their respective loadings for latent variables are not presented. The model shows unstandardized estimates. T1 = Time 1; T2 = Time 2. [1]Gender: 1 = Female, 2 = Male. ΔE = change in exhaustion; ΔW = change in workload; ΔD = change in detachment.

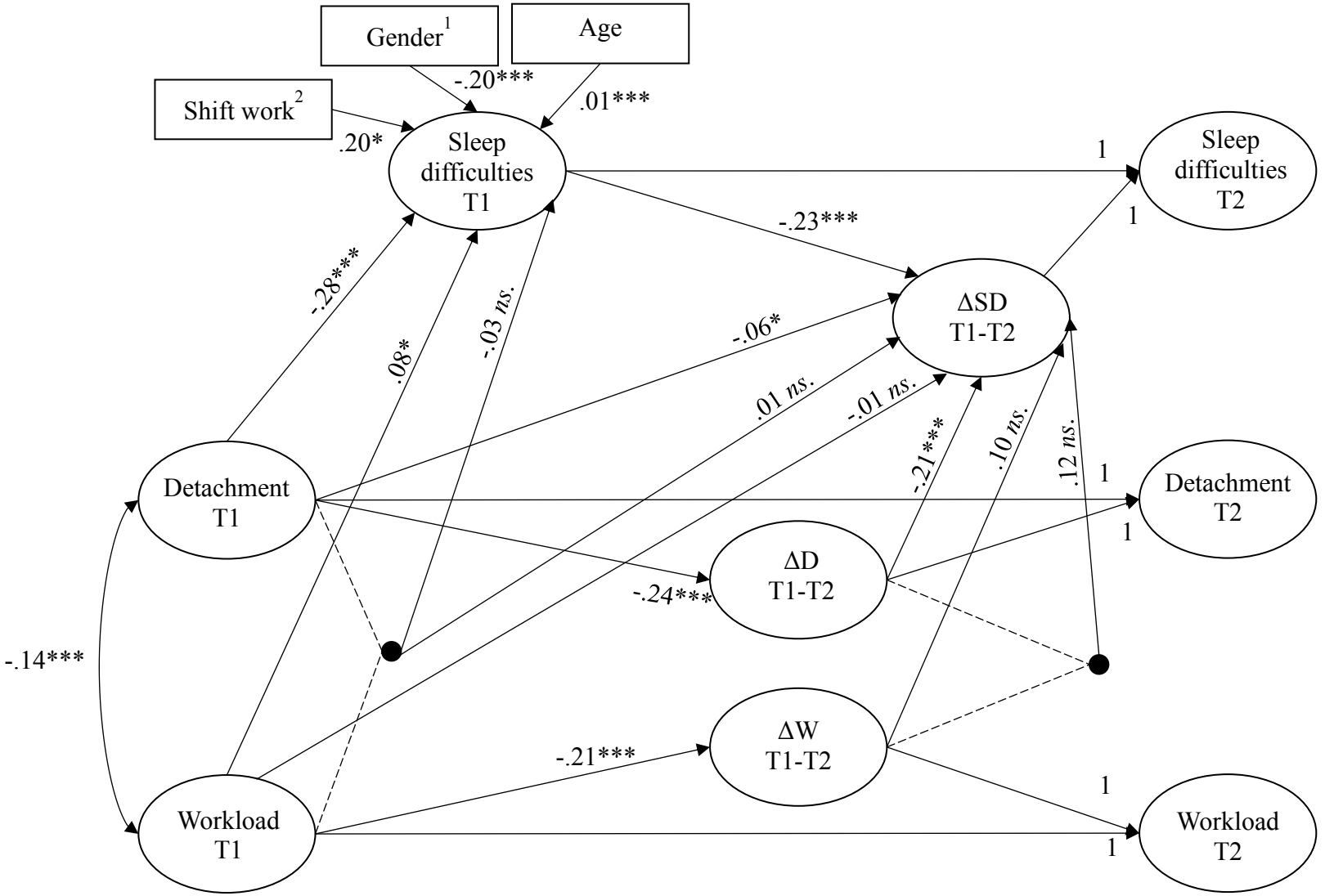

Figure 2. Final structural model for predicting sleep difficulties (Model 2). Rectangles represent the observed variables and ellipses the latent variables. Following Toker and Biron (2012), latent interactions were presented using small filled ellipses. For ease of presentation, the factor items and their respective loadings for latent variables are not presented. The model shows unstandardized estimates. T1 = Time 1; T2 = Time 2. [1]Gender: 1 = Female, 2 = Male, [2]Shift work: 1 = Daytime job, 2 = Shift work. ΔSD = change in sleep difficulties; ΔW = change in workload; ΔD = change in detachment.
ns. = non-significant; * $p < .05$; ** $p < .01$; *** $p < .001$.

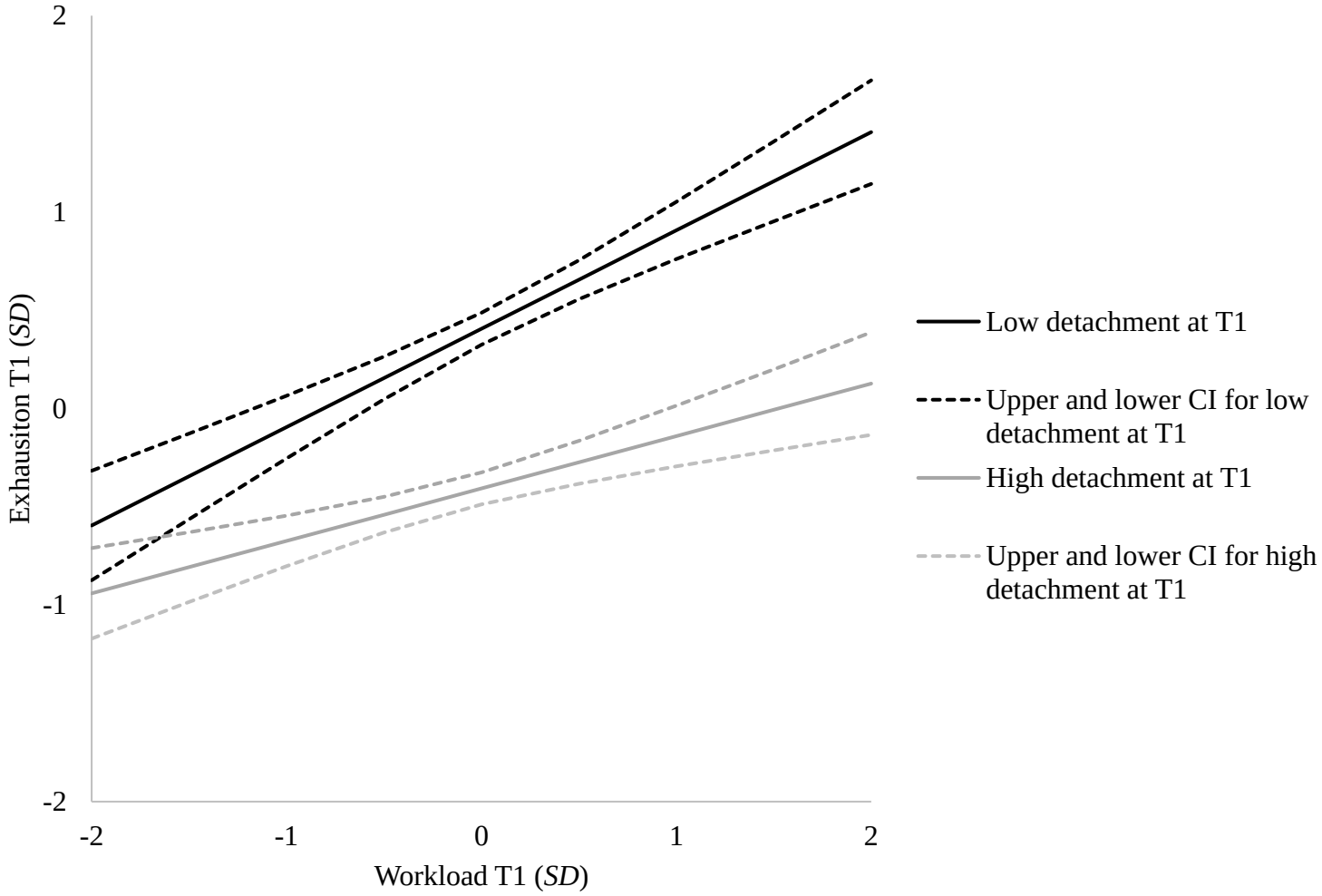

Figure 3. Interaction effect between workload and detachment at Time 1 (T1) predicting exhaustion at T1 with latent variables. CI = confidence intervals. When plotting the interaction, control variables (gender) were standardized, and the latent variables' variances were fixed at one for workload and detachment.