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School of Social Sciences

Department of Psychology

The Rhythm Is Gonna Get You:
Circadian Mismatches at the Work-Nonwork Interface

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Submitted by

Jette Völker

Dean of the School of Social Sciences:

Prof. Dr. Michael Diehl

Supervisors:

Prof. Dr. Sabine Sonnentag

Prof. Dr. Jutta Mata

Thesis Reviewers:

Prof. Dr. Jutta Mata

Prof. Dr. Verena C. Haun

Defense Committee:

Prof. Dr. Jutta Mata *(Chair)*

Prof. Dr. Verena C. Haun

Prof. Dr. Sabine Sonnentag

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Be curious, not judgmental.

CONTENTS

CONTRIBUTIONS BASED ON THIS DISSERTATION

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- **Völker, J.**, Casper, A., Koch, T. J. S., & Sonnentag, S. (2023). It's a match: The relevance of matching chronotypes for dual-earner couples' daily recovery from work. *Journal of Occupational Health Psychology*, *28*(3), 174–191. https://doi.org/10.1037/ocp0000351

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- **Völker, J.**, Casper, A., & Sonnentag, S. (2022, September). *Zusammen besser erholt? Rahmenbedingungen gemeinsamer Erholungsprozesse von Doppelverdienerpaaren* [*Better recovered together? Boundary conditions of dual earner couples' joint recovery processes*]. Paper presented in a research talk session at the 52nd Congress of the German Psychological Society in Hildesheim, Germany.
- **Völker, J.**, Casper, A., & Sonnentag, S. (2022, August). *It's a match: The relevance of matching chronotypes for couples' daily recovery from work*. Paper presented in a symposium session at the 82nd Annual Meeting of the Academy of Management in Seattle (WA), USA.

SUMMARY

Circadian rhythms determine employees' peaks and troughs in energy, alertness, and arousal during the day. However, because the timing of circadian rhythms is subject to considerable interindividual differences (i.e., chronotypes), employees' circadian preferences can (mis-)match with their social environment (e.g., their job or their romantic partner). Despite the relevance of such circadian mismatches, the organizational sciences often overlooked how circadian processes impact employees' daily life. Specifically, first studies focused on employees' circadian preferences and experiences solely in the work domain, ignoring that employees' work and nonwork domains can be mutually connected and that employees frequently transition between these domains. Accordingly, combining core assumptions from circadian research with person-environment fit theory, this dissertation sheds light on the relevance of circadian mismatches for employees' larger work-nonwork interface. Specifically, supported by three empirical studies, I argue that three different circadian mismatches (i.e., week-level, day-level, and person-level) reflect person-environment (mis-)fit and thereby matter for employees' well-being and recovery processes.

In the first study, I investigated weekend catch-up sleep and social sleep lag as week-level circadian mismatches between employees' circadian preferences and their jobs (i.e., person-job misfit). Building on boundary theory and a circadian perspective, this study centered around the transition from the work-free weekend to employees' experiences during the workweek, which should be facilitated by transition experiences (i.e., reattachment). Specifically, I assumed that higher weekend catch-up sleep and social sleep lag imply that employees' workweek and weekend rhythms are set wider apart, thereby making it harder to reattach to work on Monday and, in turn, decreasing task performance and increasing workweek exhaustion. In contrast, weekend sleep quality should enable employees to restore cognitive resources, resulting in more favorable outcomes. Results of a weekly diary study

with 310 employees (933 weeks) demonstrated that higher weekend sleep quality was indirectly related to lower workweek exhaustion via higher Monday reattachment. In contrast, higher catch-up sleep was related to higher workweek exhaustion via lower Monday reattachment. Thereby, this study demonstrated that a week-level circadian mismatch (i.e., weekend catch-up sleep) can impair the transition between nonwork and work domains and thus result in decreased well-being during the entire workweek.

In the second study, I investigated daily social sleep lag as a day-level circadian mismatch between employees' circadian preferences and their job (i.e., person-job misfit). Building on the recovery paradox and a circadian perspective on recovery, I assumed that job stressors (i.e., interpersonal conflicts at work) are negatively related to next-morning well-being (i.e., vigor) via reduced recovery experiences after work (i.e., relaxation and mastery). Furthermore, because daily social sleep lag implies a discrepancy between actual (due to chronotype) and required (due to work) arousal levels, I proposed that daily social sleep lag changes the occurrence and the effectiveness of recovery experiences. Results of a daily diary study with 274 employees (1,926 days) demonstrated that low mastery experiences, but not relaxation, explained the negative association between interpersonal conflicts and next-morning vigor. Importantly, mastery experiences translated less to vigor on days with high (vs. low) social sleep lag. Hence, this study demonstrated that a day-level circadian mismatch (i.e., daily social sleep lag) matters for employees' nonwork domain by decreasing the effectiveness of recovery processes.

In the third study, I investigated a couple's chronotype match as a person-level circadian (mis-)match between employees and their partners' circadian preferences (i.e., person-person fit). First, I assumed that unfinished tasks impede engagement in time with the partner of cohabiting couples (absorption in joint activities, directing attention toward the partner), while engagement in time with the partner should boost recovery experiences

(detachment, relaxation). Integrating the circadian perspective, I proposed that employees from couples with matching (vs. not matching) chronotypes benefit more from engagement in time with their partners (i.e., stronger relationships with recovery experiences). Additionally, I explored whether a match between partners' chronotypes buffers the negative relationship between unfinished tasks and engagement in joint time. Results of a daily diary study with 143 employees (79 dual-earner couples; 1,052 days) showed that unfinished tasks were negatively related to absorption and detachment, whereas absorption positively predicted recovery experiences. Furthermore, for couples with a higher (vs. lower) chronotype match, experiencing detachment depended on absorption. In contrast, for couples with a lower (vs. higher) chronotype match, attention was even harmful to experiencing relaxation. Thus, this study demonstrated that a person-level circadian mismatch (i.e., couples' chronotype match) matters for employees' nonwork domain by changing the effectiveness of joint recovery processes with the partner.

Taken together, this dissertation underpins that circadian mismatches impact processes and experiences in employees' work-nonwork interface. Theoretically, combining the core tenets of person-environment fit theory with the two-process model of sleep regulation can help explain how circadian mismatches represent indicators of (mis-)fit and thus matter for employees' well-being and recovery processes. Empirically, the three studies demonstrated that week-level, day-level, and person-level circadian mismatches indeed matter directly or as boundary conditions for the transition from nonwork to work and the transition from work to nonwork. At the same time, the studies underscored that work and nonwork domains are reciprocally connected, hinting at paradoxical relationships between both domains. Thereby, this dissertation moves research forward, first, with respect to taking circadian processes seriously in the organizational sciences and, second, with respect to better understanding how employees' work and nonwork domains are connected.

CHAPTER I: GENERAL INTRODUCTION

In 2017, the highly recognized Nobel Prize in Physiology or Medicine was awarded to three researchers for their groundbreaking work in the field of circadian rhythms (The Nobel Assembly at Karolinska Institutet, 2017). Jeffery C. Hall, Michael Rosbash, and Michael W. Young demonstrated that genes in fruit flies control the timing of their internal biological clock (Hardin et al., 1990; Vosshall et al., 1994). Transferring these results to other organisms, their research demonstrated how humans adapt their daily sleep-wake rhythm to the light-dark cycle on Earth. Circadian rhythms control various physiological functions with a period length of approximately one day. For example, body temperature follows a circadian rhythm as it increases during the day until it peaks in the afternoon and decreases again (Hofstra & de Weerd, 2008). Most obviously, circadian rhythms also largely determine humans' sleep-wake rhythms (Borbély, 1982; Borbély et al., 2016). However, the timing of these circadian rhythms – humans' internal biological clock – differs between individuals. While some individuals have their peaks and troughs in energy earlier in the day, other individuals' sleep-wake rhythms are shifted to later times of the day. *Chronotype* captures this spectrum of the internal biological clock's timing by ranging from early to late chronotypes (Roenneberg et al., 2003). These circadian preferences can lead to pronounced interindividual differences in the timing of daily circadian rhythms such that the daily peaks and troughs in circadian rhythms are almost 12 hours apart (Adan et al., 2012).

Although research in the field of chronobiology was groundbreaking – highlighted not least by the Nobel Prize in 2017 – and looks back on a long tradition since the 1960s and 1970s (e.g., Horne & Östberg, 1977), many aspects of everyday life still neglect the existence of circadian preferences. Sayings such as "The early bird catches the worm" exist in many languages, suggesting that getting up early and being the first to get work done guarantees success. Furthermore, fixed work schedules often reflect the preferred timing of earlier

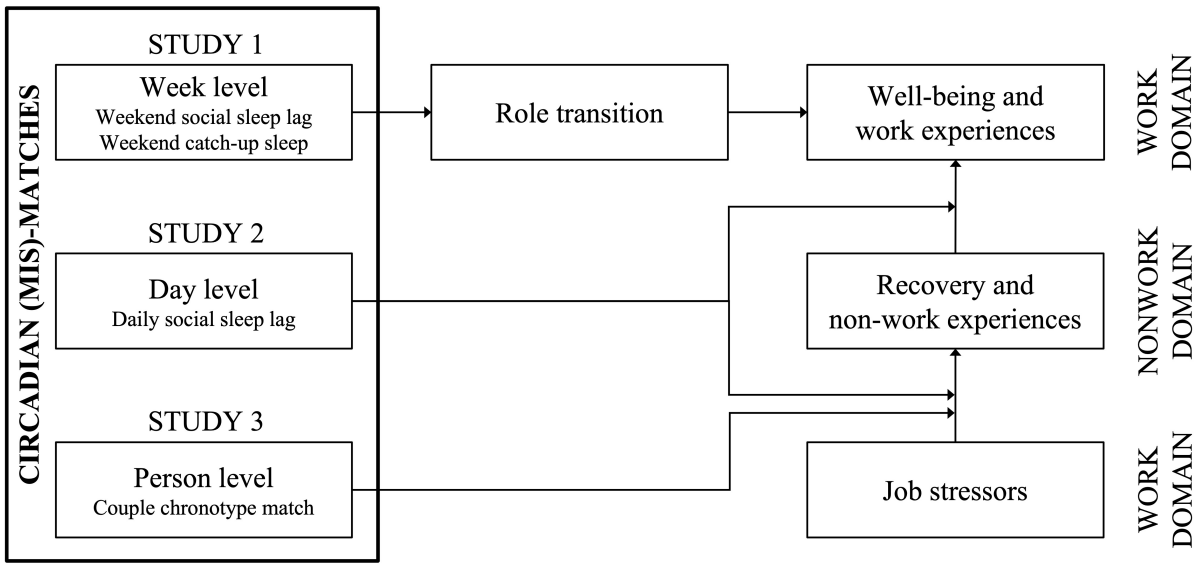
chronotypes, with work starting early in the morning and ending in the afternoon. However, intermediate to late chronotypes make up for most of the working population (Roenneberg et al., 2019), and the rhythms determined by employees' social environment cannot overrule their internal circadian preferences. Accordingly, employees often encounter circadian mismatches if their circadian preferences and the rhythms of their social environment collide (Wittmann et al., 2006).

In recent years, organizational behavior and occupational health psychology research started to acknowledge the relevance of these circadian processes for employees' behavior and experiences at work. For example, studies demonstrated synchrony effects between employees' chronotype and the time of the day on work behavior (Kühnel et al., 2022), highlighted the drawbacks of circadian misalignment (Kühnel et al., 2016), and suggested frameworks linking circadian processes to leadership (Volk et al., 2023). These approaches all have in common that they focus on employees' organizational behavior, specifically their experiences and behavior *at work*. However, occupational health psychology research highlighted that also employees' nonwork experiences largely matter for employees' well-being and organizational outcomes. For example, studies demonstrated the relevance of specific after-work recovery experiences (e.g., Bennett et al., 2018; Headrick et al., 2023; Steed et al., 2021). Even though first theoretical perspectives combined these recovery processes with assumptions from circadian research and advised researchers to consider this integration in empirical studies (Zijlstra et al., 2014), our field still lacks essential insights into how circadian processes affect employees at the work-nonwork interface. Only considering the relevance of circadian processes for one part of their lives – meaning for work – is too short-sighted because circadian rhythms can broadly influence employees' entire lives, hence, also the bigger work-nonwork interface.

Accordingly, to deepen our understanding of the role of circadian processes for employees, this dissertation focuses on how mismatches between employees' circadian preferences and their social environment arise at and matter for employees' larger work-nonwork interface. I conducted three separate empirical studies to shed light on this topic from three different angles. The three studies operationalize circadian mismatches in various ways and thereby underscore and replicate the relevance of circadian processes for the work-nonwork interface. Precisely, the studies capture week-level (Study 1), day-level (Study 2), and person-level (Study 3) circadian mismatches. Figure 1.1 displays the overall conceptual framework of this dissertation centered around the three different operationalizations of circadian mismatches.

Figure 1.1

Conceptual Framework of This Dissertation



In the following first chapter of this dissertation (General Introduction), I start by introducing the three different operationalizations of circadian mismatches, then review the current body of evidence on employees' work-nonwork interface, and finally combine the

circadian perspective with work-nonwork interface research. At the end of the first chapter, I go into detail about the three empirical studies of this dissertation and underscore the significant contributions they make to the literature.

Circadian Processes

Because circadian rhythms control various physiological functions with a period length of approximately one day (Hofstra & de Weerd, 2008), circadian processes matter during employees' entire day – both during work and during nonwork periods. In the following, I will draw from the two-process model of sleep regulation (Borbély, 1982; Borbély et al., 2016) to describe how interindividual differences in circadian preferences determine when humans are awake and alert during the day. Afterward, I will outline how employees' circadian preferences can collide with their jobs or partners, thereby introducing the three different circadian mismatches that are the center of this dissertation (i.e., day-level: social sleep lag, week-level: social sleep lag and catch-up sleep, person-level: couples' chronotype match).

Two-Process Model of Sleep Regulation

The two-process model of sleep regulation by Borbély et al. (1982; 2016) describes two different processes that regulate the sleep-wake cycle. One is the homeostatic process that depends on the time being awake and asleep, meaning that sleep pressure increases the longer a person is awake and decreases the longer a person is asleep. The other process is the circadian process which depends on the internal biological clock and governs the phase of the sleep-wake-rhythm. These two processes interact as the internal biological clock regulates the timeframe in which humans fall asleep while the homeostatic process leads to sleep initiation in this timeframe, depending on sleep pressure (Borbély, 1982; Borbély et al., 2016).

Interindividual differences in the timing of the circadian process are referred to as chronotypes. In the population, chronotype follows a normal distribution ranging from

extremely early chronotypes that prefer going to bed early and getting up early in the morning to extremely late chronotypes with later daily rhythms (Roenneberg et al., 2003). Because chronotype represents interindividual differences in the timing of the circadian process, employees with earlier and later chronotypes differ concerning the timing of peaks and troughs in energetic and self-regulatory resources during the workday (Kühnel et al., 2022; Wiegelmann et al., 2023).

Circadian Mismatches

In everyday work life, many employees encounter mismatches between their circadian preferences and their environment. The timing of the workday is mostly oriented towards the preferred timing of early chronotypes. Therefore, workdays usually start early in the morning when intermediate and late chronotypes would still be asleep following their biological preferences (Roenneberg et al., 2003; Wittmann et al., 2006). However, employees' social clock (social rhythm determined by work) is not strong enough to rule out their internal biological clock (determined by chronotype) because humans struggle to sleep outside their given "sleep gates" (Lavie, 2001). Therefore, employees with intermediate and late chronotypes usually experience a sleep deficit during the workweek as they go to bed late in line with their biological clock but must get up early in the morning due to their work schedule (Roenneberg et al., 2003). Accordingly, the work-free weekend is their only possibility to time their sleep according to their internal biological clock and make up for their sleep deficit (Roenneberg et al., 2003; Wittmann et al., 2006). The phenomenon of varying sleep-wake times can thus be reflected in differences in timing and duration of employees' sleep on workdays and non-workdays. With respect to timing, differences in the midpoint between sleep onset and waking up on workdays and non-workdays are referred to as *social jetlag* (Wittmann et al., 2006) or, more recently, *social sleep lag* (Kühnel et al., 2016). Similar to jetlag while traveling, employees thus sleep in two different "time zones"

during the week (i.e., on workdays vs. non-workdays). Besides, employees can use *weekend catch-up sleep* to cope with their accumulated sleep deficit during the workweek. In contrast to social sleep lag, weekend catch-up sleep refers to the difference in sleep duration between the workweek and the work-free weekend and not to the sleep timing per se (Leger et al., 2020; Wittmann et al., 2006).

Both social sleep lag and weekend catch-up sleep as important circadian mismatches have implications for employees' health and well-being. Chronic social sleep lag is associated with a range of adverse health-related outcomes such as increased obesity and cardiovascular risk factors (Roenneberg et al., 2012; Wong et al., 2015). Contrarily, result patterns are more diverse for catch-up sleep. While weekend catch-up sleep has been related to positive outcomes such as higher health-related quality of life in few studies (Oh et al., 2019), other studies suggest that it might not be sufficient to compensate for high amounts of sleep dept (Leger et al., 2020). Considering that several studies have consistently demonstrated that sleep *consistency* is beneficial for various health-related outcomes (Chaput et al., 2020) and cognitive functioning (Kim et al., 2011; Leong & Chee, 2023; Smevik et al., 2023), it seems that consistent sleep behavior (i.e., low social sleep lag, low weekend catch-up sleep), however, is crucial for individuals' health.

Despite the adverse consequences of circadian mismatches, research in the organizational sciences rarely accounted for circadian processes. Specifically, few studies investigated the relevance of chronic social sleep lag for employees' daily lives while catch-up sleep has largely been neglected. Research demonstrated that employees with high chronic social sleep lag depend more on good sleep quality in terms of their daily procrastination (Kühnel et al., 2016) and positive mood (Kühnel et al., 2021). Also, chronic circadian misalignment in shift workers increased procrastination directly (Kühnel, Sonnentag, et al., 2018). However, these studies focused on chronic person-level social sleep lag instead of

considering the dynamic nature of sleep timing during the workweek (Roenneberg, Pilz, et al., 2019). Social sleep lag and catch-up sleep might also yield relevant daily and weekly fluctuations similar to other sleep characteristics that change rapidly (e.g., sleep duration and quality, Liu et al., 2021). For example, days with unusual early-morning meetings might imply higher daily social sleep lag than days with flexible work schedules.

Coming back to the idea that humans differ in their chronotypes (Roenneberg et al., 2003), another way in which employees' circadian preferences can collide with their environment refers to their romantic partners. The phenomenon of *assortative mating* describes the tendency that two people are more likely to couple if they share similar characteristics, for example, if they have similar circadian preferences (Randler & Kretz, 2011). Even though assortative mating might apply to chronotypes, studies found considerable differences between partners' circadian preferences (e.g., Randler et al., 2014; Randler & Kretz, 2011). In addition, participants indicated they would prefer their partner to be a more similar chronotype than they are (Randler et al., 2014). Thus, even though the number of studies is limited, they hint at only moderate associations between both partners' chronotypes, leaving room for considerable differences within couples.

This difference between partners' chronotypes represents an important circadian mismatch because employees who cohabit with their partner cannot exclusively follow their own rhythm but also need to consider their partners' circadian rhythms and preferences. An older study (Larson et al., 1991) found that couples with mismatched sleep patterns spent less time in joint activities and reported more conflicts, providing first hints at the relevance of the couples' chronotype match. Few other studies investigated the relationship between chronotype match and relationship satisfaction, but results were mixed. While some studies found significant negative associations (Díaz-Morales et al., 2019; Jocz et al., 2018), others did not (Bulian et al., 2018; Randler & Kretz, 2011) and result patterns point to moderator

effects (e.g., relationship stronger for younger couples; Díaz-Morales et al., 2019). Accordingly, research examining couples' chronotype match is still in its infancy but nevertheless provides first hints for its relevance in daily life.

The Work-Nonwork Interface

Because circadian processes determine employees' entire day, considering the different life domains that employees navigate during this time is essential. Employees spend about a third of their day at work, a third of their day with leisure after work, and a third of their day asleep (Barnes et al., 2012; U.S. Bureau of Labor Statistics, 2023). Accordingly, the work and nonwork domains make up for employees' wake period in equal shares. While the organizational sciences neglected the relationship between the nonwork and the work domain until the 1970s (French & Johnson, 2016), later research increasingly shed light on the reciprocal relationship between employees' different life domains. For example, theoretical assumptions such as the introduction of work-family conflict (Greenhaus & Beutell, 1985) and work-family enrichment (Greenhaus & Powell, 2006) have underlined that employees' work and nonwork domains are notably connected. These theoretical developments led to a great research interest in employees' work-nonwork interface (Beigi et al., 2019).

The term "work-nonwork interface" is an umbrella term that incorporates how employees' work and nonwork domains can be connected (Beigi et al., 2019). In this dissertation, I use the term "work-nonwork interface" to describe reciprocal relationships between work and nonwork. On the one hand, nonwork experiences can impact work experiences such that, for example, resources from the nonwork domain spill over to the work domain (e.g., weekend sleep quality benefits workweek experiences; ten Brummelhuis & Bakker, 2012a). On the other hand, work experiences can impact nonwork experiences such that, for example, demands from the work domain spill over to the nonwork domain (e.g., job stressors hamper evening recovery experiences; Sonnentag, 2018). A prevailing

theory that pertains to employees' different roles in their work and nonwork domains and captures the transition between these domains is boundary theory (Ashforth et al., 2000).

Boundary theory (Ashforth et al., 2000) describes the work-nonwork interface from a role perspective by theorizing that employees have different roles in their various life domains. The theory assumes that these different life domains are separated by psychological boundaries that employees need to cross to transition from one role to another. For example, a parent needs to psychologically exit their private role at home (i.e., role exit) to enter their professional role as an employee (i.e., role entry). The difficulty of these boundary-crossing processes depends on whether the roles are highly separated or integrated (Ashforth et al., 2000). Thus, building on boundary theory, two relevant transitions emerge for the work-nonwork interface: the transition from the nonwork domain to the work domain before starting work and from the work domain to the nonwork domain after ending work.

Transition from Nonwork to Work

To transition from nonwork to work, employees must exit their private role to enter their professional role, for example during the morning. Thereby, the morning before work can largely determine how employees experience their workday (Rothbard & Wilk, 2011). While specific environmental conditions such as morning weather (Venz & Pundt, 2021) or commuting to work (Gerpott et al., 2022) can contribute to workday experiences, also psychological processes before work shape the upcoming workday. For example, research demonstrated that cognitive processes before work, such as being mindful (Sawyer et al., 2022) or anticipating the upcoming workday (Gabriel et al., 2021) determine employees' well-being and engagement. Thus, before-work experiences in the nonwork domain can affect subsequent experiences in the work domain.

Following the boundary theory perspective (Ashforth et al., 2000), a process that reflects this transition is psychological *reattachment* to work. When reattaching to work

before work, employees, for example, mentally prepare for work, think about work-related goals, or reflect on upcoming work tasks (Sonnentag & Kühnel, 2016). Accordingly, reattachment reflects a micro-role transition during which employees exit their private role and enter their work role by activating work-related cognitions (Ashforth et al., 2000).

Previous research focused mainly on how daily reattachment in the morning can benefit the upcoming workday. As such, studies demonstrated that daily morning reattachment facilitates employees' work engagement because they were better focused on their work tasks, experienced higher positive affect, and were more aware of job-related resources (Sonnentag et al., 2020). Additionally, a reattachment intervention increased the speed with which employees experience engagement at work (Vogel et al., 2022). Regarding more behavioral outcomes, reattachment was directly related to proactive work behaviors (Schleupner et al., 2023) and indirectly related to leaders' task accomplishment via higher task focus (Fritz et al., 2021). Thus, morning reattachment to work benefits both workday experiences and behaviors.

However, reattachment might not only operate daily but also matter after more extended nonwork periods. For example, during the COVID-19 pandemic, researchers highlighted that reattachment to work after weeks of lockdowns benefited their subsequent work engagement (Yuan et al., 2021). Apart from these special occasions during the COVID-19 pandemic, reattachment to work might be crucial on a weekly level. In Western cultures, the typical structure of the week dictates a schedule with five days of work followed by two days of work-free weekend. Accordingly, employees are confronted with a boundary between their private and work roles every Monday (Ashforth et al., 2000). On Monday, employees must exit their primarily private role during the weekend and enter their professional role to approach their workweek. However, even though Monday can play a central role in

employees' week, the relevance of Monday reattachment to work for the following workweek remains unclear.

In addition to understanding the consequences of successful role entry, it is also essential to understand what facilitates or hampers the transition from nonwork to work. With respect to reattachment, however, knowledge on its preconditions is largely missing. One first study tested competing hypotheses to investigate whether psychological reattachment mediates or moderates the relationship between daily sleep quality and subsequent work outcomes. However, the authors only demonstrated that reattachment buffers the association between sleep quality and work engagement (Schleupner et al., 2023). Apart from reattachment, research indicated that work-related anticipatory processes in the morning can benefit from resources that were rebuilt in the evening in the private domain (Casper & Wehrt, 2022). Thus, having cognitive and energetic resources available might facilitate transitioning from the private role to the work role.

Transition from Work to Nonwork

From a boundary theory perspective, the transition from work to nonwork again confronts employees with a boundary because they need to exit their work role to be able to enter their private role during after-work hours (Ashforth et al., 2000). Accordingly, leaving the work-role behind can be challenging even though after-work experiences can help recover from work-related efforts and demands (Sonnentag, 2018). Since the early 2000s, the research stream on the transition from work to nonwork has focused mainly on recovery from work. Sonnentag and Fritz (2007) proposed the four recovery experiences *psychological detachment* (mentally disengaging from work), *relaxation* (low physiological activation), *mastery* (mastering challenges), and *control* (experiencing control and autonomy) to be relevant for the recovery process. These recovery experiences represent psychological

mechanisms, but not specific nonwork activities, that underlie the recovery process (Sonnentag & Fritz, 2007).

The four recovery experiences enable employees to refill their depleted energetic and cognitive resources. Following the effort-recovery model (Meijman & Mulder, 1998), work effort requires investing psychological resources and these depleted resources are recovered when work ends. Accordingly, successfully exiting their work role enables employees to restore important resources in their private role (Ashforth et al., 2000). Psychological detachment is beneficial because it implies that work-related demands are no longer mentally present and work effort is reduced. Similarly, relaxation as a state of low physiological arousal is considered to reduce the load from work and thereby fosters well-being. Mastery and control might benefit well-being by increasing personal resources like self-efficacy that facilitate dealing with stressors (Bennett et al., 2018; Sonnentag & Fritz, 2007). Even though many studies focused on psychological detachment as one specific recovery experience, recent meta-analyses support that all four recovery experiences are widely relevant for employees' well-being (e.g., higher vigor and lower fatigue: Bennett et al., 2018; lower exhaustion: Headrick et al., 2023; higher positive and lower negative affect: Steed et al., 2021).

While the recovery experiences might benefit employees' well-being, a paradoxical pattern seems to exist between work, recovery, and well-being. Specifically, the recovery paradox (Sonnentag, 2018) describes that employees might especially benefit from recovery after stressful workdays but that recovering is also especially hard after such stressful days. The stressor-detachment model (Sonnentag & Fritz, 2015) also builds on this key assumption by suggesting that low psychological detachment explains the association between high job stressors and low well-being. These job stressors can be adverse work conditions or experiences of various kinds, including task-related stressors (e.g., not being able to finish

work tasks on time; Syrek et al., 2017) and social stressors (e.g., interpersonal conflicts with coworkers or supervisors; Spector & Jex, 1998).

Job stressors might undermine employees' private life by hindering their role transition from their work role to their private role (Ashforth et al., 2000). Specifically, when experiencing job stressors, employees' detachment and relaxation might be at stake because cognitive rumination prevents them from mentally exiting their work role (Syrek & Antoni, 2014; Volmer et al., 2012). Similarly, struggling to exit the work role (Ashforth et al., 2000) can consume energetic and self-regulatory resources that are needed to experience mastery after work (Sonnentag, 2018). Hence, job stressors have the power to undermine employees' recovery experiences even though recovery experiences might be especially beneficial on stressful workdays. While most empirical research demonstrated job stressors as predictors of psychological detachment, meta-analyses suggest that job stressors also impair relaxation and control experiences (Bennett et al., 2018; Steed et al., 2021). In contrast, the picture is not as conclusive for mastery experiences with meta-analyses demonstrating no significant relationships with some job stressors (e.g., emotional demands; Steed et al., 2021) or even positive associations (e.g., hindrance demands; Bennett et al., 2018). However, it is important to note that these meta-analytic results on mastery experiences are based on a limited number of studies (Bennett et al., 2018; Steed et al., 2021).

Similarly, job stressors might also affect other nonwork experiences. Specifically, because cohabiting with a partner is one of the most prevalent ways of living among employees in European countries (United Nations Economic Commission for Europe [UNECE], 2021), employees might spend a large part of their nonwork hours together with their partner (Voorpostel et al., 2010). By engaging in joint time with the partner, employees can switch from their work to their private role (Ashforth et al., 2000; Rothbard, 2001) and experience recovery (Hahn et al., 2012, 2014). However, again, experiencing job stressors

can prevent employees from entering their private role at home (Ashforth et al., 2000), thereby focusing on themselves instead of their partners (Mor & Winquist, 2002; Rothbard, 2001; Wood et al., 1990) and impairing their joint time.

Integrating Circadian Mismatches Into the Work-Nonwork Interface

To gain a more complete picture on the role of circadian processes in employees' daily life, I now outline how circadian mismatches matter for employees' work-nonwork interface. While the first section of this introductory chapter highlighted that many employees encounter circadian mismatches in their daily life when their circadian preferences collide with their social environment, the previous section demonstrated that work and nonwork domains can be reciprocally connected. To integrate the mainly physiological assumptions behind circadian mismatches (Borbély, 1982; Borbély et al., 2016) into work-nonwork interface research, I now build on person-environment fit theory as an acknowledged theoretical model within the organizational sciences (Caplan & Harrison, 1993; Edwards et al., 1998) as well as the circadian perspective on recovery suggested by Zijlstra et al. (2014). Combining these theories helps to understand how circadian mismatches result in a misfit (Edwards et al., 1998) between employees' required and actual arousal levels (Zijlstra et al., 2014) – either due to requirements of employees' jobs or employees' partners.

From Circadian Mismatches to Person-Environment (Mis-)Fit

The key tenet of person-environment fit theory is that a fit between an individual's characteristics (i.e., an employee) and an individual's social environment (i.e., work) is associated with desirable outcomes while a misfit between an individual's characteristics and the social environment relates to undesirable outcomes (Kristof-Brown et al., 2005; van Vianen, 2018). Specifically, stress research used person-environment fit theory to explain that a misfit between a person and their environment can result in impaired well-being (Edwards et al., 1998). Thereby, this misfit can be either objective, representing a misfit between

objective characteristics of the person and the environment (e.g., requirements of the job exceed physical abilities of one person) or subjective, representing a misfit between subjective characteristics of the person and the environment (e.g., the self-perceptions of a person contradict the perceived values of the organizations; Edwards et al., 1998).

Building on these basic tenets, scholars have identified different possibilities of (mis-)fit. For example, research has investigated person-job fit, meaning a fit between employees' and their jobs' characteristics, and person-person fit, meaning a stronger focus on social aspects such as a fit between employees' and their supervisors' characteristics (van Vianen, 2018). Meta-analytically, person-job and person-person fit have been demonstrated to be beneficial for employees' satisfaction and well-being, among others (Kristof-Brown et al., 2005). These results underline that a misfit between employees' characteristics and their environment's characteristics is undesirable.

Integrating the tenets of person-environment fit theory (Edwards et al., 1998) with the circadian literature (Borbély, 1982; Borbély et al., 2016), I propose that circadian mismatches reflect specific facets of person-environment fit. Specifically, circadian preferences represent objective characteristics of a person that can conflict with the requirements of their environment either in terms of their job (i.e., person-job fit) or with their social environment (i.e., person-person fit). On the one hand, social sleep lag and catch-up sleep represent person-job misfit. Precisely, social sleep lag and catch-up sleep arise if employees' circadian preferences (i.e., person characteristics) do not match the requirements of their job as reflected in social rhythms due to their work schedule (i.e., job characteristics) – either on a daily or on a weekly basis. Since this evaluation is based on daily and weekly changes in employees' sleep-wake rhythm (i.e., timing and duration), it is not a subjective perception but represents an objective person-job misfit. On the other hand, a couple's chronotype match represents a facet of person-person fit. Transferring the idea of person-supervisor fit (van

Vianen, 2018) to the private domain, chronotype match describes that employees' circadian preferences (i.e., own person characteristics) match their partners' circadian preferences (i.e., the other person's characteristics). Again, because this evaluation is based on employees' and their partners' sleep-wake rhythms, a couple's chronotype match does not reflect subjective perceptions but rather represents an objective person-person fit.

Circadian Perspective on the Work-Nonwork Interface

Returning to the idea that a misfit between a person and its environment can impair well-being (Edwards et al., 1998; Kristof-Brown et al., 2005), I now integrate circadian mismatches with research at the work-nonwork interface. Even though a circadian perspective on recovery processes has been suggested theoretically (Zijlstra et al., 2014), this perspective has not yet arrived in empirical research. In their framework, Zijlstra et al. (2014) suggest that "'recovery' is the continuous process of harmonizing the 'actual state' with the state that is 'required' at that moment" (p. 244). Thereby, the authors build on circadian research demonstrating that arousal and energy levels follow circadian rhythms during the day (Borbély, 1982; Borbély et al., 2016) and suggest that recovery matters for aligning these current levels with the requirements of the environment. Specifically, if employees' environment requires them to have different levels of arousal or energetic activation than they have available, up- or downregulation processes are needed (Zijlstra et al., 2014).

When experiencing circadian mismatches, the need for up- or downregulation should be particularly high. Specifically, suppose that employees experience social sleep lag or catch-up sleep. In that case, they experience person-job misfit because their actual level of arousal (i.e., person characteristics due to circadian preferences) does not fit their required level of arousal for their work (i.e., job characteristics due to social rhythm). Accordingly, upregulating arousal is needed at work and downregulating arousal is needed after work because employees' circadian preferences dictate a different rhythm than the rhythm they

need for work. However, this up- and downregulating process itself costs energetic and self-regulatory resources (Zijlstra et al., 2014) that would be needed, for example, to reattach to work in the morning (cf., Study 1) or to effectively deal with job stressors (cf., Study 2). Similarly, if employees experience high daily social sleep lag, downregulation is needed after work because employees' arousal level is too high to sleep (Zijlstra et al., 2014). Thus, social sleep lag might increase the need for downregulating recovery experiences (cf., Study 2).

Furthermore, the core assumptions of this framework (Zijlstra et al., 2014) also apply to a couple's chronotype match as an aspect of person-person fit. Suppose that employees' chronotypes (i.e., own person characteristics) and their partners' chronotypes (i.e., other person's characteristics) match and the partners engage in time together. In that case, they share the same arousal levels and depend less on up- or downregulation. If their circadian preferences do not match, however, their joint time might not fit the partners' arousal levels and they need to up- or downregulate accordingly, depleting energetic and self-regulatory resources that are required for recovery processes (Zijlstra et al., 2014). Despite engaging in joint time together, partners might thereby benefit less from their joint time. Thus, couples with matching (vs. not matching) chronotypes might experience more recovery while engaging in joint time together (cf. Study 3).

Hence, integrating this circadian perspective on recovery (Zijlstra et al., 2014) with person-environment fit theory (Edwards et al., 1998) helps to understand why circadian mismatches as indicators of person-environment misfit should be reflected in impaired well-being. Specifically, all three circadian mismatches imply an investment of self-regulatory and energetic resources that are needed to make their person characteristics (i.e., their current arousal levels) meet the requirements of their environment (i.e., the required arousal levels) – either at work or after work. Accordingly, circadian mismatches come at a cost such that they

ultimately hamper recovery processes and employees' well-being during the transition from nonwork to work and from work to nonwork (see also Figure 1.1).

Dissertation Outline and Overview of Empirical Studies

To empirically test the role of circadian mismatches in employees' work-nonwork interface, I conducted three empirical studies that serve as basis for this dissertation. Each of the three studies refers to one of the three circadian mismatches that I introduced before: week-level mismatch (weekend social sleep lag and catch-up sleep; Study 1), day-level mismatch (daily social sleep lag; Study 2), and person-level (mis-)match (couples' chronotype match; Study 3). These three studies are presented in Chapter II to IV of this dissertation and include separate Introduction, Methods, Results, and Discussion sections so they can be read independently.

In the second chapter of this dissertation, I present a study (Study 1) capturing week-level circadian mismatches. In this study, I build on boundary theory (Ashforth et al., 2000) combined with circadian research (Borbély, 1982; Borbély et al., 2016) to investigate weekend sleep characteristics as antecedents of Monday reattachment to work. I assume that weekend sleep quality improves Monday reattachment while weekend catch-up sleep and social sleep lag as indicators of week-level circadian mismatch hamper Monday reattachment. In turn, Monday reattachment should reduce employees' workweek exhaustion and increase workweek task performance. I tested these hypotheses in a weekly diary study with 310 employees who provided data on 933 weeks.

In the third chapter of this dissertation, I present a study (Study 2) that captures a day-level circadian mismatch. In this study, I build on the recovery paradox (Sonnentag, 2018) and the circadian perspective on recovery (Zijlstra et al., 2014) to investigate daily social sleep lag as a boundary condition for employees' after-work recovery processes. Specifically, I propose that daily social sleep lag as day-level circadian mismatch impedes the occurrence

(i.e., moderates the relationship between job stressors and recovery experiences) and the effectiveness (i.e., moderates the relationship between recovery experiences and well-being) of after-work recovery experiences. I tested these hypotheses in a daily diary study with 274 employees who provided data on 1,926 days.

In the fourth chapter of this dissertation, I present a study (Study 3) that captures a person-level circadian (mis-)match. In this study, I build on the stressor-detachment model (Sonnentag & Fritz, 2015) and research on family engagement (Rothbard, 2001) combined with the circadian perspective (Zijlstra et al., 2014) to investigate partners' chronotype match as a boundary condition for dual-earner couples' joint recovery from work. I propose that employees from couples with matching (vs. not matching) chronotypes benefit more from engagement in time with their partners (i.e., stronger relationships between engagement in joint time and recovery experiences). Additionally, I explore whether the partners' chronotype match buffers the negative relationship between job stressors and engagement in joint time with the partner. I tested these hypotheses in a daily diary study with 143 employees from 79 dual-earner couples who provided data on 1,052 days.

In the fifth and last chapter of this dissertation (General Discussion), I summarize and integrate the findings from the three empirical studies into a bigger picture. For this purpose, I derive theoretical and practical implications of the findings, reflect on the strengths and limitations of this dissertation, and identify directions for future research.

Goals and Contributions of This Dissertation

The main goals of this dissertation – and accordingly its significant contributions to the fields of organizational behavior and occupational health psychology – divide into two overarching themes. The first main theme of this dissertation is to advance the field with respect to considering circadian processes of employees at their work-nonwork interface. By proposing three different circadian mismatches and their unique roles for the work-nonwork

interface, I underline the relevance of circadian processes for employees' everyday work life. The second main theme of this dissertation is to advance research at the work-nonwork interface by refining our understanding of the relation between work and nonwork domains. By investigating how experiences from the work domain spill over to the nonwork domain – and vice versa – I paint a more accurate picture of how employees' most important life domains are reciprocally connected. Both overarching themes break down into specific goals and result in relevant contributions to theory and practice that I will elaborate on in the following.

Integrating Circadian Mismatches Into Work-Nonwork Interface Research

With respect to the first overarching theme, the goals and contributions to the literature are threefold. First, generally speaking, I integrate a circadian perspective into research on employees' work-nonwork interface. Research incorporating circadian or sleep processes into organizational research is still in its infancy (e.g., Kühnel et al., 2022; Volk et al., 2023). Specifically, research on the work-nonwork interface largely neglected circadian processes and put circadian sleep characteristics in second place, for example, by solely focusing on employees' sleep quality as a predominantly used sleep indicator (Litwiller et al., 2017). However, holistically considering employees' circadian processes is necessary because circadian rhythms and individual differences in circadian preferences structure employees' everyday life and determine their peaks and troughs in energy throughout the day (Borbély, 1982; Borbély et al., 2016; Roenneberg et al., 2003). Hence, in this dissertation, I build on first theoretical approaches combining recovery research with circadian perspectives (Zijlstra et al., 2014) to integrate a circadian perspective into empirical work-nonwork interface research. This central goal of my dissertation is reflected in all three empirical studies as they uniquely approach the relevance of circadian aspects for employees at the work-nonwork interface – both at the transition from nonwork to work (Study 1) as well as at

the transition from work to nonwork (Study 2 and 3). Thereby, my research program enhances our understanding of how circadian processes affect employees at work, outside of work, and specifically at the transitions between their work and nonwork domains.

Second, in the three studies of this dissertation, I propose three different and novel ways in which employees' circadian preferences and their social environment can collide. On the one hand, previous organizational behavior research focused on chronic social sleep lag (Kühnel et al., 2016; Kühnel, Sonnentag, et al., 2018) and thereby neglected the dynamic nature of sleep during the week (Kühnel, Syrek, et al., 2018; Roenneberg, Pilz, et al., 2019). To overcome this limitation, I transfer the concept of circadian mismatches to the week level (weekend catch-up sleep and social sleep lag; Study 1) and to the day level (daily social sleep lag; Study 2). These day- and week-level perspectives allow me to investigate meaningful fluctuations in circadian mismatches and thereby go beyond previous approaches investigating stable between-person differences. On the other hand, previous approaches focused on employees' own circadian mismatches between their work and their biological preferences (Kühnel et al., 2016, 2021; Kühnel, Sonnentag, et al., 2018) but neglected other aspects of their social environment that can result in mismatches. Cohabiting with a partner is widespread life concept (Adema et al., 2020; United Nations Economic Commission for Europe [UNECE], 2021). While cohabiting, employees can no longer only rely on their own circadian preferences but also need to consider their partners' preferences. Accordingly, I transfer the concept of circadian mismatches to the larger social environment by suggesting a match between partners' chronotypes (Study 3) as a meaningful circadian (mis-)match employees can encounter. Taken together, all three studies employ unique and novel approaches to portray circadian mismatches in employees' everyday life and accordingly contribute to our understanding of how employees' circadian preferences and their social environment can come into conflict.

Third, with this dissertation, I introduce the concept of circadian mismatches as a specific facet of person-environment fit. While organizational behavior and occupational health psychology can benefit from incorporating insights from physiological models and frameworks, more guidance is needed in how these physiological processes combine with classic theoretical assumptions of the field. For example, Mullins et al. (2014) pursued an approach to embed physiological sleep research into a framework that explains relationships between sleepiness and important work antecedents and outcomes. In a similar manner, I draw on the two-process model of sleep regulation (Borbély, 1982; Borbély et al., 2016) as a powerful physiological model that explains the regulation of the human sleep-wake rhythm. The tenets of this model are the building blocks of all three of my empirical studies. To combine these physiological assumptions on circadian processes with the psychological perspectives of the organizational sciences, I propose that circadian mismatches resemble a specific facet of person-environment fit. As a key theory in industrial and organizational psychology, research on person-environment fit looks back on a long tradition since its starting points in the 1960s and 1970s (Caplan & Harrison, 1993). Embedding circadian mismatches into person-environment fit theory enables researchers to derive better psychological predictions and conclusions than purely physiological models could ever offer. Accordingly, I transfer the concept of circadian mismatches to person-job fit (i.e., social sleep lag and catch-up sleep; Study 1 and Study 2) and to person-person fit (i.e., couples' chronotype match; Study 3) to finally link misfit with impaired well-being and recovery processes. Thereby, this dissertation provides a novel theoretical perspective on how circadian processes can be combined with established theories in the organizational sciences.

Reciprocal Relations Between Work and Nonwork

With respect to the second overarching theme of this dissertation, the goals and contributions to the literature are twofold. First, with this dissertation, I underline important

boundary conditions for employees' recovery processes. Since the first publications on employees' after-work recovery processes in the early 2000s (Sonnentag, 2003; Sonnentag & Fritz, 2007), research started to paint a more nuanced picture of how employees after-work recovery integrates in their everyday life. However, previous recovery research often implicitly assumed that these processes are similar for everyone and on every day (Steed et al., 2021). Thereby, research neglected the role employees' social environment plays. Accordingly, we need to know more about the day- and person-level boundary conditions that change the occurrence and the effectiveness of after-work recovery processes (Sonnentag, 2018; Sonnentag & Fritz, 2015). Study 2 and Study 3 of this dissertation tackle this issue by investigating social sleep las as day-level and partners' chronotype match as person-level boundary conditions of employees' recovery processes. Both social sleep lag as well as the couple's chronotype match thereby consider how employees' social environment acts as a limiting or expanding factor for employees' recovery process: limiting, when employees' social environment collides with their circadian preferences (high social sleep lag, low chronotype match), or expanding, when employees' social environment fits their circadian preferences (low social sleep lag, high chronotype match). Understanding these boundary conditions matters to provide employees with more concrete guidance on what conditions allow them to recover most effectively and, in turn, to sustainably manage the psychological and physiological capital they need for work (Barnes et al., 2023).

Second, with this dissertation, I provide a better understanding of the reciprocal relations between employees' work and nonwork domains. In recent years, a paradoxical pattern has been discussed in the recovery literature, suggesting that recovery is both especially needed and especially hard after stressful workdays (Sonnentag, 2018). However, previous research mainly focused on exploring how job stressors affect psychological detachment as one specific recovery experience (Sonnentag, 2018). I further underscore this

paradoxical pattern by considering the detrimental impact of job stressors on different nonwork experiences, namely relaxation and mastery experiences as well as engagement in joint time with the partner (Study 2 and 3). Thereby, my dissertation further refines our understanding of the paradoxical interplay at the work-nonwork-transition. At the same time, I suggest that a similar paradoxical pattern might exist at the nonwork-work-transition (Study 1). By investigating the differential impact of three different sleep characteristics on Monday reattachment to work, I propose that also reattachment to work depends on energetic and cognitive resources, while reattachment in turn benefits energetic well-being. Thereby, reattachment might be especially needed when employees' resources are low because of its well-being benefits but at the same time itself depends on energetic and cognitive resources. Accordingly, my dissertation advances our field by underlining the paradoxical ways in which work and nonwork can be connected – both at the transition from work to nonwork (Study 2 and 3, recovery paradox; Sonnentag, 2018) and at the transition from nonwork to work (Study 1, reattachment paradox).

CHAPTER II: STUDY 1 – WEEK-LEVEL MISMATCH

"It's Monday Again: Weekend Sleep Differentially Impacts the Workweek via Reattachment on Monday"[1]

Summary

The weekend constitutes an important recovery period and thus can influence employees' following workweek. However, psychologically reattaching to work on Monday can be difficult because employees must transition from their private role to their work role. Building on boundary theory and integrating a circadian perspective, we shed light on this transition by investigating antecedents and outcomes of Monday reattachment. We propose that three weekend sleep characteristics differentially relate to reattachment on Monday: weekend sleep quality, catch-up sleep (extended sleep duration on the weekend), and social sleep lag (differences in sleep times workweek vs. weekend). Successful reattachment on Monday should, in turn, be related to lower exhaustion and higher task performance during the workweek. We conducted a weekly diary study with 310 employees (933 weeks) over four workweeks to test our hypotheses. Two-level path models demonstrated that higher weekend sleep quality was indirectly related to lower workweek exhaustion via higher Monday reattachment. In contrast, higher catch-up sleep was related to higher workweek exhaustion via lower Monday reattachment. Accordingly, our results underpin that continuous sleep behavior throughout the week is particularly relevant for employees' well-being. At the same time, we demonstrate that considering differential sleep characteristics is relevant for organizational behavior research.

[1] Study 1 is an earlier version of the original manuscript by Völker, Wiegelmann, Koch, & Sonnentag submitted to Wiley's *Journal of Organizational Behavior* on April 11th 2023. Chapter II is identical to the submitted manuscript, except for a few minor editorial changes.

Introduction

Monday is likely up front when thinking of unpopular days of the week. While the weekend offers two days of leisure and thereby constitutes a central opportunity for employees' recovery (Fritz, Sonnentag, et al., 2010), returning to work on Monday implies refocusing on work with all its joys and sorrows. Not surprisingly, employees' mood hits bottom on Monday – the infamous Blue Monday effect (Hülsheger et al., 2022; Weigelt et al., 2021). From a psychological perspective, readjusting to work on Monday can be challenging because the transition from the weekend to the workweek constitutes a micro-role transition (Ashforth et al., 2000). During this micro-role transition, employees must shift their focus from their private role during the weekend to their work role during the workweek. Psychological *reattachment* describes such a transition experience when employees mentally reconnect to work, for example, by reflecting on work and thinking about work-related goals before actually starting work (Sonnentag & Kühnel, 2016).

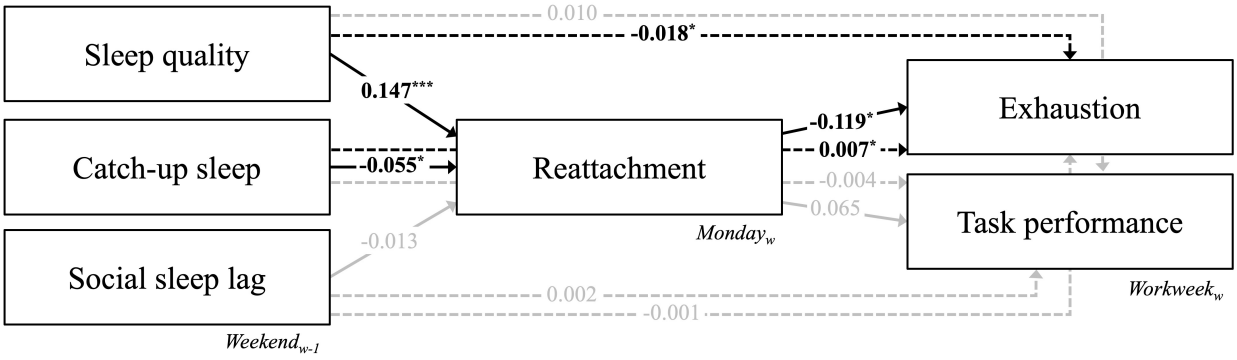
While research has emphasized that switching off from work during the weekend is relevant for employees' well-being and organizational behavior (Fritz, Sonnentag, et al., 2010; Steed et al., 2021), we know little about how effectively tuning into work on Monday (i.e., reattachment) can impact the entire workweek in terms of well-being and job performance. Previous research centered around day-level reattachment, demonstrating that morning reattachment shapes daily behavior and experiences (Fritz et al., 2021; Sonnentag et al., 2020; Sonnentag & Kühnel, 2016). Building on these results, researchers acknowledged that reattachment also matters after extended nonwork periods (e.g., during the COVID-19 pandemic, Yuan et al., 2021). However, even though the common week schedule forces employees to transition from their private to their work role every Monday, the way Monday reattachment shapes the following workweek remains unclear.

At the same time, understanding the preconditions of Monday reattachment is crucial to enable employees to master the transition from the weekend to the workweek effectively. As a fundamental recovery process, sleep during the weekend can affect how employees reattach to their work on Monday. While organizational research started to acknowledge the relevance of sleep quality for work (Litwiller et al., 2017), also the timing and consistency of sleep largely affect humans' health and well-being (Chaput et al., 2020; Leger et al., 2020). Thus, to portray sleep as the multi-faceted experience it is, we draw on circadian research (Borbély, 1982; Borbély et al., 2016) and disentangle the unique roles of different weekend sleep characteristics for the reattachment process.

Accordingly, combining the tenets of boundary theory (Ashforth et al., 2000) with a circadian perspective (Borbély, 1982; Borbély et al., 2016), this study focuses on antecedents and outcomes of Monday reattachment. We investigate how three weekend sleep characteristics differentially shape how employees reattach to work on Monday. On the one hand, high-quality sleep during the weekend might enable employees to restore cognitive resources (Leong & Chee, 2023) that can be used to reattach to work on Monday effectively. On the other hand, sleep inconsistency in terms of sleeping longer during the weekend (catch-up sleep) and at different times than during the workweek (social sleep lag) might hinder the transition from the weekend to the workweek because employees' workweek and weekend rhythms are set wider apart (Chaput et al., 2020). In turn, successfully reattaching to work on Monday should enable employees to perform better on their work tasks and be less exhausted during the workweek. Thus, we propose that weekend sleep characteristics differentially impact the workweek via reattachment on Monday. Figure 2.1 displays our full conceptual model.

Figure 2.1

Conceptual Model Including Within-Person Results From Two-Level Path Analysis



Note. Solid lines indicate direct paths (Hypotheses 1 to 3). Dashed lines indicate indirect paths (Hypotheses 4 to 6). Black and bold = significant paths that were in line with our hypotheses. Direct paths from predictors (sleep quality, catch-up sleep, social sleep lag) to outcomes (exhaustion, task performance) were specified in our analyses but omitted from the figure for clarity reasons.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

This study offers significant contributions to both research and practice. First, our study contributes to research on micro-role transitions by focusing on the role of reattachment for the following workweek. Building on boundary theory (Ashforth et al., 2000), we consider a new timeframe and propose that Monday reattachment can affect the entire following workweek because it serves as a micro-role transition between the private role during the weekend and the work role during the workweek. Accordingly, we suggest that experiences on Monday set the tone for well-being and performance during the upcoming workweek. While previous research mainly focused on day-level reattachment processes (Sonnentag et al., 2020; Sonnentag & Kühnel, 2016), the transition between the weekend and the workweek might imply an even higher need to reattach to work because the period during which employees are disconnected from work is longer than on a daily basis. Thus, reattachment after a work-free weekend might be more complex and – at the same time –

even more critical than after work-free evenings, highlighting the need to understand the workweek consequences of Monday reattachment.

Second, our study integrates a circadian perspective into the recovery literature by considering the differential impact of three sleep characteristics as determinants of employees' reattachment. While sleep quality is a frequently examined sleep indicator in organizational research (e.g., Barnes et al., 2015; Liu et al., 2021), sleep characteristics focusing on circadian aspects have largely been neglected (with few exceptions, e.g., Kühnel et al., 2016). However, building on circadian research (Roenneberg et al., 2003), both the quality and the timing and consistency of one's sleep matter. As circadian preferences can lead to large differences in sleep behavior between the weekend and the workweek (Leger et al., 2020; Wittmann et al., 2006), it is relevant to better understand how these differences in sleep behavior affect employees when returning to work. This inconsistency in sleep duration and timing might impair employees' cognitive functioning (e.g., Chaput et al., 2020; Smevik et al., 2023), and thus, also their workweek. Accordingly, we paint a more nuanced picture of sleep's role in organizational behavior by focusing on quality as well as inconsistency in timing and duration as circadian aspects of sleep.

Third, we contribute to reattachment research by investigating what facilitates and hinders Monday reattachment. While first studies demonstrated the relevance of daily reattachment for employees' well-being and behavior (Fritz et al., 2021; Sonnentag et al., 2020), knowledge on the preconditions of reattachment is largely missing (Schleupner et al., 2023). By investigating three weekend sleep characteristics as antecedents of reattachment, our study provides a new in-depth look into reattachment processes. We suggest that – similar to psychological *detachment* (i.e., mentally disconnecting from work) – also psychological reattachment depends on energetic and cognitive resources that employees need to have available (Sonnentag, 2018). In this way, we illustrate more clearly how

reattachment integrates into employees' working life by shedding light on its antecedents. Over and above, understanding the role of different sleep characteristics as preconditions of reattachment also matters for practice. For example, organizations might employ interventions to improve weekend sleep quality and sleep consistency to help facilitate employees' reattachment process on Monday because reattachment on Monday might set the tone for the entire workweek.

Monday Reattachment as a Micro-Role Transition

Boundary theory (Ashforth et al., 2000) describes that humans have different roles in their different life domains, which are separated by boundaries. For example, an employee might have a professional role as a leader at work that differs from their private role as a parent at home. These different roles can be separated (i.e., *segmentation*), blurred (i.e., *integration*), or something in between. To (psychologically) transition from one role to the other, one needs to exit one role (i.e., *role exit*) and enter the other role (i.e., *role entry*). While these role transitions can represent longer-term changes such as moving from employment to retirement (i.e., *macro transitions*), boundary theory mainly focuses on frequent short-term transitions (i.e., *micro transitions*), for example, within one day (Ashforth et al., 2000).

Applying the tenets of boundary theory (Ashforth et al., 2000), we characterize psychological *reattachment* as an experience representing a micro-role transition. While recovery research frequently underpinned the relevance of psychological *detachment*, meaning mentally disconnecting from work (Sonnentag & Fritz, 2007; Steed et al., 2021), research started to acknowledge that also mentally reconnecting to work matters for employees (Sonnentag & Kühnel, 2016). Reattachment describes such an experience during which employees mentally reconnect to their work. This reattachment process can encompass mentally preparing for work, reflecting on the upcoming work period, and thinking about

work-related plans and goals (Sonnentag & Kühnel, 2016). Accordingly, when experiencing reattachment after an off-work period, employees mentally exit their private role and enter their work role as they refocus their attention back on work. Thus, reattachment is a micro-role transition occurring when crossing the boundary from the work to the private role (Ashforth et al., 2000).

Research primarily focused on day-level reattachment, meaning mentally preparing for the workday in the morning before work (e.g., Sonnentag et al., 2020; Sonnentag & Kühnel, 2016). However, reattachment does not only matter on a daily basis. The common structure of the week with five days of work followed by two days of work-free weekend confronts many employees with an even more noticeable boundary every week. Accordingly, the beginning of the workweek plays a unique role in many employees' weeks as Monday implies a transition from two days of engaging in mainly private roles to five days of engaging in mainly work roles. Because most employees experience a drop in energy and well-being on Monday, it is often also referred to as "Blue Monday" (Hülsheger et al., 2022; Weigelt et al., 2021). However, little is known about how this transition from the weekend to the workweek can succeed. Accordingly, we apply the concept of daily reattachment to the week level and suggest that successfully reattaching to work is crucial on Monday as it covers the transition from the weekend to the workweek. In the following, we build on boundary theory (Ashforth et al., 2000) and examine weekend antecedents (i.e., sleep characteristics) and workweek outcomes (i.e., exhaustion and task performance) of Monday reattachment as a highly relevant micro-transition between the weekend and the workweek.

Weekend Sleep and Monday Reattachment

Sleep is a crucial recovery period during which employees replenish the cognitive and energetic resources needed at work (Litwiller et al., 2017). According to the two-process model of sleep regulation (Borbély, 1982; Borbély et al., 2016), the human sleep-wake cycle

is regulated by two interacting processes. A circadian process determines the time frame during which sleep is initiated, while a homeostatic process leads to sleep initiation during this timeframe as soon as the physiological need to sleep reaches a threshold. While sleeping, the sleep need decreases until humans awake recharged in the morning. The timing of the circadian process can vary between individuals, such that some have a natural proclivity to wake up late and go to bed late, while others prefer earlier daily rhythms (i.e., humans' chronotype, Roenneberg et al., 2003). However, these circadian preferences do not only reflect differences *between* individuals but also lead to variations in sleep *within* individuals. Due to circadian preferences, sleep behavior during the workweek and the weekend might vastly differ such that employees sleep longer and at different times during the weekend (Roenneberg et al., 2003; Wittmann et al., 2006). Combining these insights from sleep research with research on micro-role transitions, we propose that the three sleep characteristics of weekend sleep quality, catch-up sleep, and social sleep lag differentially impact employees' reattachment on Monday.

First, Monday reattachment might benefit from weekend sleep quality. Especially during the work-free weekend, sleep is often not restrained by social schedules (e.g., work) and employees can therefore follow their circadian preferences of when to sleep (Roenneberg et al., 2003). Accordingly, lower sleep regulation is needed (Borbély, 1982; Borbély et al., 2016), allowing employees to sleep well. Thus, sleep on the weekend can be of particularly high quality and of high relevance for recovery processes. Sleep quality is a frequently studied sleep indicator and reflects a subjective assessment of how restful humans perceive their sleep, closely linked to objectively measured sleep efficiency (Åkerstedt et al., 1994). Sleep efficiency and quality are crucial for diverse aspects of cognitive functioning (Leong & Chee, 2023; Scullin & Bliwise, 2015). For example, high sleep efficiency can lead to decreased activation which is needed to control thoughts and actions (i.e., cognitive control,

Smevik et al., 2023). Thus, thanks to high-quality sleep during the weekend, employees successfully replenished their cognitive resources and might more easily control their thoughts and attention on Monday. Refocusing back on work after the weekend might benefit from these replenished cognitive resources as reattachment implies that attention must be deliberately focused on the workweek. Accordingly, we assume that high-quality sleep during the weekend might facilitate employees' exit from the private role to enter the work role (Ashforth et al., 2000). Previous research started to acknowledge the interplay of sleep quality and reattachment on the day level but only demonstrated that reattachment might buffer the effect of a bad night's sleep on employees' work engagement (Schleupner et al., 2023). However, we rely on our theoretical reasoning on the direct relationship between weekend sleep quality and Monday reattachment and propose that the better employees sleep during the weekend, the better they reattach to work on Monday.

Hypothesis 1: *Weekend sleep quality is positively related to reattachment on Monday.*

In addition to sleep quality, we further propose that the weekly inconsistency of timing and duration of one's sleep matters for reattachment. Many employees encounter a circadian mismatch as workdays usually start early in the morning and thereby might contradict employees' circadian preferences of when to be asleep and awake (Roenneberg et al., 2003). While work schedules are usually oriented toward the preferred timing of earlier chronotypes, most of the population classifies as intermediate or late chronotype (Roenneberg, Pilz, et al., 2019). However, employees' social rhythm determined by their work hours is not strong enough to overrule their internal circadian preferences (Roenneberg et al., 2003; Wittmann et al., 2006). Specifically, humans hardly fall asleep outside their biologically determined "sleep gate" because this implies a higher need for sleep regulation (Borbély, 1982; Borbély et al., 2016; Lavie, 2001). Consequently, employees might fall asleep late following their circadian preferences but must get up early in the morning,

resulting in a sleep deficit as well as a mismatch with their circadian preferences during the workweek (Roenneberg et al., 2003). Due to this mismatch, employees might try to compensate for their sleep deficit and follow their circadian preferences on the work-free weekend by sleeping much longer and at different times than on workdays (Roenneberg et al., 2003; Roepke & Duffy, 2010). *Social sleep lag* describes the phenomenon of differences in sleep-wake times (i.e., differences in the midpoint between sleep onset and waking up) on workdays and non-workdays (Kühnel et al., 2016). Resembling jetlag while traveling, social sleep lag implies that employees live in two different time zones: a social time zone during the workweek and a circadian time zone during the weekend (Wittmann et al., 2006). Besides, employees might use the weekend to cope with their sleep deficit by extending their sleep duration, also called *catch-up sleep* (Leger et al., 2020). In contrast to weekend social sleep lag, weekend catch-up sleep refers to the difference in sleep duration between the workweek and the weekend and not to the sleep timing per se. Both weekend catch-up sleep and social sleep lag reflect inconsistencies in sleep that have adverse implications for employees' health and functioning. Specifically, while weekend catch-up sleep might have short-time positive effects (e.g., Kubo et al., 2011), it is not a suitable strategy to compensate for a high sleep deficit (e.g., Leger et al., 2020; Taylor et al., 2008). Moreover, research underpinned that sleep inconsistency impairs individuals' health (Chaput et al., 2020).

We assume that weekend catch-up sleep and social sleep lag hinder employees' reattachment to the new workweek because both make it difficult for employees to get used to the social rhythm of the workweek after the weekend. First, when catching up on sleep during the weekend, employees' sleep need decreases, making it harder to fall asleep early on Sunday evening. Following the two-process model of sleep regulation (Borbély, 1982; Borbély et al., 2016), low sleep need prevents employees from sleeping and, accordingly, higher sleep regulation is needed. While employees might get increasingly used to their

workweek social rhythm because sleep need increases and they adapt their sleep times accordingly (Kühnel, Syrek, et al., 2018), the transition from Sunday to Monday should be especially severe (van Hooff et al., 2006). Previous research demonstrated that sleeping in during the weekend results in increased Monday sleepiness (Taylor et al., 2008) – a state that makes it difficult to control thoughts and attentional processes (Mullins et al., 2014). However, being able to control thoughts and attention is needed to successfully reattach to work on Monday.

Second, experiencing social sleep lag implies that employees followed a different sleep-wake rhythm during the workweek than during the weekend. Because their sleep timing is likely less constrained during the weekend, employees follow their circadian preferences during the weekend (Wittmann et al., 2006). On weeks with high social sleep lag, these differences between the workweek and weekend are especially pronounced. Most employees delay their sleep-wake rhythm on the weekend to match to their circadian preferences. However, when the transition back to the next workweek is due, employees need to readjust to their earlier social rhythm. Hence, employees must sleep outside their preferred timeframe governed by the circadian process and, accordingly, have a high need for sleep regulation on Sunday evening (Borbély, 1982; Borbély et al., 2016). Consequently, the transition from the weekend to the workweek is compounded by the fact that employees need to invest additional resources to adapt to the sleep-wake rhythm of the workweek. Again, this should result in poor sleep behavior and alter the ability to control thoughts and attentional processes needed to reattach to work on Monday successfully.

Thus, combining boundary theory (Ashforth et al., 2000) with this circadian perspective (Borbély, 1982; Borbély et al., 2016), weekend catch-up sleep and social sleep lag imply that employees' private and work roles are separated because their sleep-wake rhythm during the workweek and weekend are set wider apart. Hence, weekend catch-up

sleep and social sleep lag should hamper employees' role exit from their private role, thereby decreasing the likelihood that employees successfully enter their work role on Monday. At the same time, variations in sleep timing and duration can make it difficult to exert cognitive control and direct attention at work (Kim et al., 2011; Smevik et al., 2023). Again however, being able to control thoughts and attention and make use of energetic and cognitive resources is needed to exit the private role and refocus attention back on work (i.e., enter the work role, Sonnentag & Kühnel, 2016). Thus, we propose that weekend catch-up sleep and social sleep lag negatively relate to Monday reattachment.

Hypothesis 2: *Weekend a) catch-up sleep and b) social sleep lag are negatively related to reattachment on Monday.*

Workweek Consequences of Monday Reattachment

We propose that reattaching to work on Monday, in turn, benefits employees during the workweek. First, higher Monday reattachment should result in lower exhaustion during the workweek. Exhaustion is described as a state of physical fatigue and drained energetic resources during work. When being exhausted, employees report, for example, that they feel like their "batteries are dead" (Melamed et al., 2006; Shirom & Melamed, 2006). Reattachment as a micro-role transition implies a successful role entry into employees' work role (Ashforth et al., 2000). Accordingly, employees activate work-related goals and successfully allocate the resources needed for work (Sonnentag et al., 2020; Sonnentag & Kühnel, 2016). This resource allocation should make it easier for employees to get through their workweek without spending additional energy, thereby decreasing exhaustion. Similarly, reattachment benefits work engagement which encompasses energetic aspects of work-related well-being (Sonnentag et al., 2020; Sonnentag & Kühnel, 2016). Hence, we assume that the better employees reattached on Monday, the less exhausted they are during the workweek.

Second, apart from energetic aspects, reattachment should benefit employees' task performance during the week. Task performance is a subjective assessment of how well employees attained work-related goals and accomplished their work tasks (Fisher & Noble, 2004). Completing and accomplishing tasks is a crucial objective at work and has positive implications for employees and organizations (Dalal et al., 2014; Ohly & Schmitt, 2015). By activating work-related goals when reattaching to work, employees might already think about ways to reach their goals. These planning and preparation processes can enable employees to be more successful in accomplishing their goals and tasks during the week (Sonnentag & Kühnel, 2016). At the same time, successful reattachment enables employees to focus more on their work tasks (Sonnentag et al., 2020) as they successfully exited their private role and entered their work role (Ashforth et al., 2000). Due to the successful exit from the private role, attentional demands on private topics stemming from this role are reduced, which can further foster task performance (Beal et al., 2005). Similarly, Fritz et al. (2021) demonstrated that morning reattachment is indirectly related to leaders' daily task accomplishment via anticipated and actual focus on work tasks. Accordingly, we propose that the higher the Monday reattachment, the higher the workweek task performance.

Hypothesis 3: *Reattachment on Monday is a) negatively related to exhaustion and b) positively related to task performance during the workweek.*

Reattachment as a Mechanism Between Weekend Sleep and Workweek Consequences

Looking at the reattachment process as a whole, we assume that weekend sleep characteristics (sleep quality, catch-up sleep, social sleep lag) differentially impact workweek exhaustion and task performance via reattachment on Monday. Building on boundary theory (Ashforth et al., 2000), reattachment as a micro-role transition links the private role during the weekend to the work role during the workweek. On the one hand, cognitive and energetic

resources that were built up by high-quality sleep during the weekend (Leong & Chee, 2023; Scullin & Bliwise, 2015) can transfer into the work domain by successfully reattaching to work and, in turn, decrease workweek exhaustion and increase task performance. On the other hand, higher cognitive and energetic demands due to catch-up sleep and social sleep lag (Ashforth et al., 2000; Kim et al., 2011; Smevik et al., 2023) can hamper the transition to the workweek by decreasing the likelihood of reattaching and consequently increase workweek exhaustion and decrease task performance. By reducing or increasing personal resources, private demands or resources can spill over to the work domain (ten Brummelhuis & Bakker, 2012a). Accordingly, we suggest that Monday reattachment serves as a connecting link between weekend (sleep quality, catch-up sleep, and social sleep lag) and workweek (exhaustion, task performance) experiences and behavior.

Hypothesis 4: *Weekend sleep quality is indirectly a) negatively related to exhaustion and b) positively related to task performance during the workweek via reattachment on Monday.*

Hypothesis 5: *Weekend catch-up sleep is indirectly a) positively related to exhaustion and b) negatively related to task performance during the workweek via reattachment on Monday.*

Hypothesis 6: *Weekend social sleep lag is indirectly a) positively related to exhaustion and b) negatively related to task performance during the workweek via reattachment on Monday.*

Methods

Study Design and Sample

To test our hypotheses, we conducted a weekly diary study in Germany. After participating in a general survey, participants answered surveys on Mondays and Fridays over the course of five weeks. The diary surveys started and ended on a Friday, resulting in nine

weekly surveys in total (five Friday surveys and four Monday surveys). During the registration process, participants reported when they usually wake up on Monday and end their work on Friday. Individually tailored to these times, we sent invitations to all surveys via e-mail (i.e., after waking up on Monday and after work on Friday) and reminded participants after two hours upon sending the invitation e-mails if the surveys were not completed. All weekly surveys were answered online and were available for eight hours after receiving the first e-mail invitation.

We recruited participants online in social networks and via personal contacts. To be eligible to participate, participants had to be employed for at least 20 hours per week (excluding shift work). As an incentive, participants who completed at least seven of the nine surveys could win one of 30 vouchers for various online shops (total value of 800€). Of the 505 employees who expressed interest in participating, 465 finished the general survey. From those, we had to exclude 75 participants who could not freely choose their sleep times on non-workdays, implying we could not calculate their social sleep lag under these circumstances.[2] We matched participants' $Friday_{week(w)-1}$, $Monday_{w}$, and $Friday_{w}$ surveys such that each participant could provide up to four complete weekly data sets. Of the remaining 390 participants, 315 answered at least one weekly survey (in total: 1,153 weeks). We then excluded 124 weeks ($week_{w-1}$ and $week_{w}$) during which employees did not work and 77 $Monday_{w}$ surveys that were answered on non-workdays because the reattachment items referred to Monday as a workday (see Measures). We also checked for careless responding

[2] Social sleep lag describes a discrepancy between employees' sleep times during the workweek (dictated by their social rhythm) and their sleep times during the weekend (dictated by their biological circadian preferences). However, if employees cannot freely choose their sleep times on non-workdays, their weekend sleep times do not reflect their biological preferences. Accordingly, we excluded these participants to increase the accuracy of our social sleep lag measure (Roenneberg et al., 2003; Wittmann et al., 2006).

(Goldammer et al., 2020) and excluded surveys with response invariance (e.g., always choosing the middle of the Likert scale) as well as extremely low response time (using an index of our survey provider; Leiner, 2019). Finally, we included all weeks in which either the $Monday_w$ or $Friday_w$ survey was completed, resulting in a final sample of 310 participants providing data on 933 weeks. Participants included in the final sample did not differ from excluded participants with regard to gender, χ^2 (1) = 0.190, p = .663, or education, t(341.32) = 0.83, p = . 405, but with respect to age, t(390.11) = -2.09, p = .037. Participants included in the final sample (M = 41.24 years) were slightly older than excluded participants (M = 39.31 years).

Most of the 310 participants were female (80.6 %), and their mean age was M = 41.24 (SD = 11.05) years. Participating employees worked in various industries and professions, for example, in health, social, and educational professions (41.9 %), in administrative and office professions (25.5%), or in technical professions (10.7%). Most of them held a university degree (55.2%) and lived without children in the household (77.4%). The majority of the sample worked full-time, with an average of M = 39.57 (SD = 8.84) hours per week.

Measures

We assessed employees' sleep times in the $Friday_{w-1}$ and $Monday_w$ surveys to calculate their weekend catch-up sleep and social sleep lag. Additionally, we assessed their weekend sleep quality and reattachment in the $Monday_w$ surveys, as well as their workweek exhaustion and task performance in the $Friday_w$ surveys. All items were presented in German and translated with the back-translation method if necessary (Brislin, 1970). Descriptive statistics and two-level Cronbach's alphas (Geldhof et al., 2014) of all variables are presented in Table 2.1.

Table 2.1

Descriptive Statistics, Cronbach's Alphas, Intraclass Correlations, and Inter-Correlations of all Variables

	M	SD_{L1}	SD_{L2}	α_{L1}	α_{L2}	ICC	1	2	3	4	5	6	7
1 Weekend sleep quality	3.4	0.5	0.8	-	-	.46	-	.05	-.05	.15***	-.02	-.02	-.17***
2 Weekend catch-up sleep[a]	1.0	0.8	1.1	-	-	.34	.12	-	-.05	-.09*	.00	-.03	-.04
3 Weekend social sleep lag[a]	1.3	0.5	0.7	-	-	.40	.19**	.21***	-	-.02	-.02	.04	-.05
4 Monday reattachment	3.4	0.5	0.8	.81	.97	.56	.07	.04	.07	-	-.09*	.04	.00
5 Workweek exhaustion	2.5	0.5	0.9	.87	.97	.63	-.29***	.07	.04	.04	-	-.35***	.03
6 Workweek task performance	3.8	0.4	0.7	.72	.93	.56	.25***	-.05	.11	.08	-.40***	-	-.07
7 Monday negative affect	1.5	0.4	0.6	.80	.95	.52	-.29***	.04	-.08	.04	.30***	-.27***	-

Note. [a] in decimal hours. L1 = week level (Level 1), L2 = person level (Level 2). Intraclass correlations (ICC) demonstrate the proportion of variance that is attributable to the person level. Correlations below the diagonal are person-level correlations ($N = 310$). Correlations above the diagonal are week-level correlations ($N = 933$).
*$p < .05$. **$p < .01$. ***$p < .001$.

Sleep Quality

In the Monday$_{w}$ surveys, we retrospectively assessed employees' sleep quality during the weekend using a one-item measure (Monk et al., 1994). Participants answered the item "How do you evaluate the overall quality of your sleep during the weekend?" on a 5-point Likert scale ranging from 1 = *very bad* to 5 = *very good*.

Catch-up Sleep and Social Sleep Lag

To be able to calculate participants' catch-up sleep and social sleep lag, we assessed their sleep times on workdays in the Friday$_{w-1}$ surveys and their sleep times during the weekend in the Monday$_{w}$ surveys. Participants indicated when they went to bed, how long it took them to fall asleep, and when they woke up (Roenneberg et al., 2003) separately for each day (i.e., Monday to Thursday in the Friday$_{w-1}$ survey and Friday to Sunday in the Monday$_{w}$ survey). To increase the accuracy of this weekly sleep data, we provided participants with a sleep diary in the general survey and instructed them to keep track of their sleep times during the study period.

Weekend catch-up sleep describes the difference between workweek and weekend sleep duration. Using the daily sleep times, we separately calculated the mean sleep duration during the previous workweek and during the weekend (i.e., the period between sleep onset and waking up). We then calculated employees' catch-up sleep as the difference between the mean workweek and the mean weekend sleep duration. Higher values indicate higher catch-up sleep, such that a value of 1, for example, refers to a week in which the respective employees' sleep duration was, on average, one hour longer per night during the weekend than during the workweek.

Weekend social sleep lag refers to the difference between the workweek and the weekend midpoint of sleep. Using the daily sleep times, we separately calculated the mean of the daily midpoints of sleep during the previous workweek (midpoint between sleep onset

and waking up) as well as the mean daily midpoints of sleep during the weekend. We then calculated social sleep lag as the absolute difference between the mean workweek and the mean weekend midpoint of sleep. Thus, social sleep lag represents the difference between actual sleep times during the workweek and biologically preferred sleep times during the weekend (Roenneberg et al., 2012; Wittmann et al., 2006). Higher values describe a higher weekend social sleep lag. For instance, a social sleep lag of 1 indicates a one-hour difference between employees' workweek midpoint of sleep and their weekend midpoint of sleep.

Reattachment

We assessed reattachment to work in the $Monday_w$ surveys using the five-item measure from Sonnentag and Kühnel (2016) slightly adapted to the week level. Participants answered items such as "Before I started my work this morning, I prepared mentally for the upcoming workweek" on a five-point Likert scale ranging from 1 = *not at all true* to 5 = *absolutely true*.

Exhaustion

We assessed weekly exhaustion in the $Friday_w$ surveys using five items from Shirom and Melamed (2006). The items such as "I felt tired" referred to the whole workweek and were answered on a five-point Likert scale ranging from 1 = *not at all true* to 5 = *absolutely true*.

Task Performance

We measured weekly task performance in the $Friday_w$ surveys with four items used in previous research (Sonnentag et al., 2018) such as "I completed my tasks successfully." The items again referred to the whole workweek and were answered on a five-point Likert scale ranging from 1 = *not at all true* to 5 = *absolutely true*.

Control Variables

To demonstrate the robustness of our results, we relied on two control variables.[3] First, we controlled for employees' Monday state negative affect because we wanted to ensure that self-reports on subsequent experiences were not driven by bad mood at the beginning of the workweek (cf. Rothbard & Wilk, 2011). We measured negative affect using six items from the German version (Krohne et al., 1996) of the Positive and Negative Affect Schedule (Watson et al., 1988). Participants were instructed to indicate how they currently feel and answered the items (e.g., "distressed") on a 5-point Likert scale ranging from 1 = *not at all* to 5 = *absolutely*. Second, we controlled for the week of data collection (i.e., 1 = *week one* to 4 = *week four*) to rule out systematic changes throughout the study participation (Beal & Weiss, 2003).

Analytic Strategy and Preliminary Analyses

We used two-level path analysis in Mplus 8.7 (Muthén & Muthén, 2017) to test our hypotheses (Preacher et al., 2010). Two-level analysis is necessary to take the nested data structure (i.e., weeks nested within persons) into account. We used all data available and handled missing data using full information maximum likelihood estimation as suggested by guidelines (Newman, 2014). To correctly decompose week-level and person-level variance, we specified our path model at both the within- as well as the between-person level, even though our primary level of interest was the within-person level. Thus, we modeled paths from the sleep characteristics (sleep quality, catch-up sleep, social sleep lag) to reattachment (Hypotheses 1 and 2), from reattachment to the outcomes (exhaustion and task performance, Hypothesis 3) as well as from the sleep characteristics to the outcomes on both levels.

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[3] We also ran all analyses without the two control variables. This additional analysis did not change significance or direction of any of the results.

Additionally, we modeled paths from the control variables (Monday negative affect and week of data collection) to reattachment and the two outcomes. Lastly, we allowed correlations between (1) the three sleep characteristics and (2) the two outcomes. Using the described path model, we tested which within-person paths varied significantly between persons (LeBeau et al., 2018). However, we decided to stick with a random-intercept model for the sake of parsimony because none of the within-person paths yielded significant variation between persons. To calculate indirect effects from the sleep characteristics to the outcomes via reattachment (Hypotheses 4 to 6), we obtained unstandardized path estimates from Mplus 8.7 (Muthén & Muthén, 2017) and computed confidence intervals using the Monte Carlo method with 20,000 simulations (Selig & Preacher, 2008).

Before testing our hypotheses, we conducted a set of preliminary analyses. Table 2.1 displays descriptive statistics, intraclass-correlations (ICCs), and correlations of all variables. The ICCs ranged between .34 for catch-up sleep and .60 for exhaustion, indicating a considerable amount of within-person variance. Thus, two-level analysis was suitable for our data and our constructs of interest yielded meaningful week-level variation. Further, results of two-level confirmatory factor analysis (CFA) with all items loading on distinct factors demonstrated construct validity of our measures, χ^2 (214) = 435.771, $p < .001$, RMSEA = 0.042, CFI = 0.950, TLI = 0.936. The model with all items loading on distinct factors fit the data better than a model with the two outcomes (exhaustion, task performance) loading on the same factor, χ^2 (224) = 790.045, $p < .001$, RMSEA = 0.066, CFI = 0.862, TLI = 0.845; Satorra-Bentler $\Delta\chi^2$ (10) = 420.377, $p < .001$. A two-level CFA with the three sleep characteristics (sleep quality, catch-up sleep, social sleep lag) loading on the same factor did not converge.

Results

Hypotheses Testing

The results of the two-level path analysis are presented in Table 2.2 (direct effects) and Table 2.3 (indirect effects). Figure 2.1 gives a graphical overview of the within-person results. The first hypothesis stated that weekend sleep quality is positively related to Monday reattachment. Supporting Hypothesis 1, the path estimate from sleep quality to reattachment was positive and significant (unstandardized estimate [est.] = 0.147, *SE* = 0.042, $p < .001$). In Hypothesis 2, we proposed that weekend a) catch-up sleep and b) social sleep lag are negatively related to reattachment on Monday. Supporting Hypothesis 2a, but not Hypothesis 2b, weekend catch-up sleep was significantly related to reattachment (est. = -0.055, *SE* = 0.024, $p = .023$) while social sleep lag was not (est. = -0.013, *SE* = 0.052, $p = .801$). The third hypothesis stated that reattachment on Monday is a) negatively related to exhaustion and b) positively related to task performance during the workweek. Indeed, reattachment was negatively associated with exhaustion (est. = -0.119, *SE* = 0.053, $p = .023$), providing support for Hypothesis 3a. However, we found no support for Hypothesis 3b as reattachment was not related to task performance during the workweek (est. = 0.065, *SE* = 0.044, $p = .137$).

Hypotheses 4 to 6 referred to indirect effects. In Hypothesis 4, we proposed that weekend sleep quality is indirectly a) negatively related to exhaustion and b) positively related to task performance during the workweek via reattachment on Monday. We found support for Hypothesis 4a because the indirect effect from weekend sleep quality to exhaustion via reattachment was significant and negative (est. = -0.018, *SE* = 0.009, 95%-confidence interval [CI] = [-0.040; -0.002]). However, Hypothesis 4b was not supported by the data (indirect effect from sleep quality to task performance via reattachment: est. = 0.010, *SE* = 0.007, 95%-CI = [-0.003; 0.025]).

Table 2.2

Results of Two-Level Path Analysis: Direct Effects

	Monday reattachment		Workweek exhaustion		Workweek task performance	
	Est.	***SE***	**Est.**	***SE***	**Est.**	***SE***
Intercept	3.172***	0.404	2.848***	0.640	3.147***	0.435
Within person (Level 1)						
Monday negative affect	0.024	0.062	0.031	0.060	-0.051	0.051
Week of data collection[a]	-0.019	0.019	0.007	0.022	-0.007	0.017
Weekend sleep quality	0.147***	0.042	-0.012	0.045	-0.018	0.038
Weekend catch-up sleep	-0.055*	0.024	-0.003	0.029	-0.005	0.026
Weekend social sleep lag	-0.013	0.052	-0.039	0.051	0.050	0.042
Monday reattachment			-0.119*	0.053	0.065	0.044
Residual variance	0.340***	0.032	0.370***	0.030	0.237***	0.021
Between person (Level 2)						
Monday negative affect	0.093	0.105	0.619***	0.151	-0.349**	0.106
Weekend sleep quality	-0.035	0.107	-0.480***	0.119	0.253**	0.083
Weekend catch-up sleep	0.080	0.106	0.118	0.107	-0.089	0.079
Weekend social sleep lag	0.100	0.143	0.260	0.153	0.005	0.115
Monday reattachment			-0.003	0.100	0.114	0.067
Residual variance	0.432***	0.053	0.443***	0.057	0.241***	0.038

Note. [a] coded 1 = *first week* to 4 = *last week*. Est. = unstandardized path estimate. $N = 310$ employees providing data on 933 weeks. Monday negative affect and week of data collection were included as control variables.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 2.3

Results of Two-Level Path Analysis: Within-Person Indirect Effects

Path	Est.	*SE*	95%-CI
Weekend sleep quality → Monday reattachment → Workweek exhaustion	**-0.018**	**0.009**	**[-0.040; -0.002]**
Weekend sleep quality → Monday reattachment → Workweek task performance	0.010	0.007	[-0.003; 0.025]
Weekend catch-up sleep → Monday reattachment → Workweek exhaustion	**0.007**	**0.004**	**[0.0001; 0.017]**
Weekend catch-up sleep → Monday reattachment → Workweek task performance	-0.004	0.003	[-0.010; 0.001]
Weekend social sleep lag → Monday reattachment → Workweek exhaustion	0.002	0.006	[-0.012; 0.016]
Weekend social sleep lag → Monday reattachment → Workweek task performance	-0.001	0.003	[-0.011; 0.006]

Note. Est. = unstandardized path estimate obtained from two-level path analysis in Mplus 8.7 (Muthén & Muthén, 2017). CI = confidence interval computed using the Monte-Carlo Method with 20,000 simulations (Selig & Preacher, 2008). Confidence intervals that do not include zero are shown in bold.

Hypothesis 5 stated that weekend catch-up sleep is indirectly a) positively related to exhaustion and b) negatively related to task performance during the workweek via reattachment on Monday. Indeed, the indirect effect from catch-up sleep to exhaustion via reattachment was positive and significant, supporting Hypothesis 5a (est. = 0.007, *SE* = 0.004, 95%-CI = [0.0001; 0.017]). However, the indirect effect to task performance was not significant, not supporting Hypothesis 5b (indirect effect from catch-up sleep to task performance via reattachment: est. = -0.004, *SE* = 0.003, 95%-CI = [-0.010; 0.001]). Lastly, in Hypothesis 6, we assumed that weekend social sleep lag is indirectly a) positively related to exhaustion and b) negatively related to task performance during the workweek via reattachment on Monday. Neither Hypothesis 6a (indirect effect from social sleep lag to exhaustion via reattachment: est. = 0.002, *SE* = 0.006, 95%-CI = [-0.012; 0.016]) nor Hypothesis 6b (indirect effect from social sleep lag to task performance via reattachment: est. = -0.001, *SE* = 0.003, 95%-CI = [-0.011; 0.006]) was supported by the data. Taken together, we found evidence for two indirect effects via reattachment on Monday: weekend sleep quality was indirectly negatively related to workweek exhaustion (Hypothesis 4a) and weekend catch-up sleep was indirectly positively related to workweek exhaustion (Hypothesis 5a).

Additional Analyses

Building on these results, we further examined whether cyclical effects exist. One could assume that not only weekend sleep characteristics have an effect on the workweek but also that the workweek has an effect on next weekend's sleep characteristics. Accordingly, we added the next weekend's sleep characteristics as outcomes into our existing path model. Specifically, we modeled all direct paths from weekend sleep characteristics, Monday reattachment, as well as workweek exhaustion and task performance to next-weekend sleep characteristics. Because the weekend sleep characteristics now predict the next weekend's

sleep characteristics, the results describe changes in sleep characteristics from the previous to the next weekend. Analysis showed that neither workweek exhaustion (est. = 0.061, *SE* = 0.048, $p = .203$) nor task performance (est. = -0.154, *SE* = 0.081, $p = .059$) significantly predicted changes in weekend sleep quality. Considering weekend catch-up sleep, both exhaustion (est. = 0.281, *SE* = 0.068, $p = .001$) and task performance (Est. = 0.606, *SE* = 0.103, $p < .001$) positively predicted changes in weekend catch-up sleep from the previous to the next weekend. Lastly, neither workweek exhaustion (est. = -0.022, *SE* = 0.049, $p = .662$) nor task performance (est. = -0.092, *SE* = 0.064, $p = .148$) predicted changes in weekend social sleep lag. Thus, the results of this additional analysis suggest that a vicious cycle might exist for weekend catch-up sleep: while higher weekend catch-up sleep was related to higher exhaustion during the workweek via lower reattachment on Monday (see Hypothesis 5a), higher workweek exhaustion, in turn, predicted an increase in weekend catch-up sleep from the previous to the next weekend.

Discussion

Combining the tenets of boundary theory (Ashforth et al., 2000) with a circadian perspective (Borbély, 1982; Borbély et al., 2016), we investigated antecedents and outcomes of Monday reattachment to work after a work-free weekend. We proposed that high weekend sleep quality indirectly benefits the workweek (low exhaustion, high task performance) via high reattachment on Monday, while high weekend catch-up sleep and social sleep lag indirectly impede the workweek (high exhaustion, low task performance) via low reattachment on Monday. Indeed, when employees reported higher sleep quality during the weekend, they better reattached to their work on Monday and, in turn, were less exhausted during the workweek. Contrarily, when employees tried to catch up on sleep during the weekend, they reattached less to their work on Monday and, in turn, were more exhausted during the workweek. Not supporting our assumptions, we found no relationships for

weekend social sleep lag as an antecedent and for workweek task performance as an outcome of Monday reattachment.

Theoretical Implications

Reattachment on Monday has implications for the entire workweek and thus serves as a meaningful micro-role transition when crossing the boundary from the private role during the weekend to the work role during the workweek. Adding to previous research on daily morning reattachment (Sonnentag et al., 2020; Sonnentag & Kühnel, 2016; Vogel et al., 2022), our study reinforces that tuning into work enables employees to foster their work-related well-being. Especially, we could emphasize that reattachment processes can cover extended time frames (Yuan et al., 2021) and that their benefits not only unfold daily but can have implications for an entire workweek. That is, employees were less exhausted during the workweek, suggesting that reattachment enabled employees to better allocate their energetic resources at work. However, similar to day-level research demonstrating that morning reattachment only indirectly benefits daily task performance (Fritz et al., 2021), we did not find that Monday reattachment directly affects workweek task performance. Probably, especially considering the time frame of an entire workweek, task performance depends on many other factors and is not purely under employees' control. For example, receiving unexpected customer requests may take time away from other tasks and thus limit workweek task performance regardless of Monday reattachment. However, these findings do not depreciate the relevance of Monday reattachment as decreasing workweek exhaustion is of crucial importance for organizations to sustainably maintain the human capital needed at work (Barnes et al., 2023). Accordingly, our findings imply that experiences on Monday can set the tone for the entire week, thereby underscoring the relevance of investigating how employees can return to work best after a work-free weekend.

We further demonstrate how different facets of sleep matter for organizational behavior. By combining boundary theory (Ashforth et al., 2000) with sleep research (Borbély, 1982; Borbély et al., 2016), we integrated a circadian perspective into the recovery literature. This circadian perspective on the work-nonwork interface is highly needed as circadian processes strongly influence employees' lives (Roenneberg et al., 2003). Still, circadian aspects such as timing and consistency in sleep have been largely neglected in organizational behavior research in general (with few exceptions, e.g., Kühnel et al., 2016) and in research at the work-nonwork interface in particular (Völker, Casper, et al., 2023; Zijlstra et al., 2014). Concerning weekend social sleep lag, we found none of the assumed relationships with Monday reattachment and workweek outcomes. We can only speculate that circadian misalignment arising from social sleep lag is more relevant as a person-level (Kühnel et al., 2016) or day-level boundary condition for employees' well-being and behavior at work and does not critically impact the transition from one week to another. Importantly however, high weekend catch-up sleep impaired employees' workweek exhaustion via Monday reattachment, and high weekend sleep quality indirectly benefited employees' exhaustion throughout the workweek. This result pattern is in line with previous research demonstrating the resource-restoring benefits of high-quality sleep (Leong & Chee, 2023; Liu et al., 2021; Scullin & Bliwise, 2015). Accordingly, weekend sleep can play a role in employees' entire workweek and, thus, our study highlights the role of sleep as a critical recovery process for employees.

Furthermore, we emphasize that weekend catch-up sleep relates to employees' role transition between their private and work roles (i.e., their reattachment). Thereby, we argue that catch-up sleep reflects a situation in which employees' private and work roles are separated (Ashforth et al., 2000) due to differences in the sleep-wake rhythm during the workweek and weekend. While employees who experience a mismatch between their

circadian preferences and their work schedules might use catch-up sleep as a short-term solution to overcome their sleep deficit during the previous workweek (Roenneberg et al., 2003; Roepke & Duffy, 2010), our findings show that it can harm the next workweek via low reattachment on Monday. This result is in line with previous research highlighting the disadvantages of catching up on sleep (Han & Kim, 2020; Leger et al., 2020; Taylor et al., 2008). Our additional analysis further underscored the drawbacks of catch-up sleep by suggesting a vicious cycle: Higher workweek exhaustion – as an indirect result of weekend catch-up sleep – again predicted higher next-weekend catch-up sleep. Taken together, our findings imply that sleeping consistently long throughout the week is crucial for employees' next workweek. Accordingly, organizational behavior research benefits from investigating circadian aspects of employees' sleep (e.g., consistency in sleep duration and timing) and not just the sheer quality or duration.

Finally, our result pattern on sleep characteristics as antecedents of reattachment highlights that certain requirements must be met for employees to reattach to work successfully. On the one hand, high-quality sleep during the weekend positively related to Monday reattachment, implying that reattachment depends on energetic and cognitive resources provided by high-quality sleep. On the other hand, high weekend catch-up sleep negatively related to Monday reattachment, implying that higher separation between work and private roles makes role entry more difficult for employees (Ashforth et al., 2000). Accordingly, employees need to control their attention to their work role and invest available resources to reattach to work. We speculate that reattachment does not happen automatically while starting to work on Monday but can also be demanding and must be initiated deliberately. Similar to psychological detachment, also psychological reattachment might thereby be subject to a paradox. As described in the *recovery paradox* (Sonnentag, 2018), mentally detaching from work is especially important in demanding situations due to its

positive well-being consequences but at the same time also more challenging when facing these demanding situations. Our findings suggest a similar paradoxical pattern for psychological reattachment. Monday reattachment might be especially needed in demanding weeks when work and private roles are separated and energetic and cognitive resources are low because reattachment can help to efficiently allocate these limited resources to work and foster well-being throughout the week (Sonnentag et al., 2020; Sonnentag & Kühnel, 2016). However, our results suggest that reattachment itself might require low barriers to transition (i.e., low segmentation) and might depend on replenished energetic and cognitive resources to reveal its benefits during the workweek, resulting in a paradoxical pattern.

Limitations and Directions for Future Research

Some limitations of our study must be considered. First, we relied on self-report data to measure our constructs of interest. Thus, our data might be subject to common-method bias such that the shared measurement method biased the relationship between the constructs (P. M. Podsakoff et al., 2003). To prevent common-method bias, we followed recommendations (P. M. Podsakoff et al., 2012) and temporally separated assessment of our constructs by using two weekly surveys (i.e., measuring antecedents in the $Friday_{w-1}$ and $Monday_{w}$ surveys, reattachment in the $Monday_{w}$ survey and outcomes in the $Friday_{w}$ survey). At the same time, weekend catch-up sleep and social sleep lag were calculated based on employees' sleep times, thereby assessed in a different response format. However, future research might further reduce concerns about common-method bias, for example, by obtaining other-ratings of exhaustion (e.g., ratings from significant others, Fritz, Yankelevich, et al., 2010).

Second, building on the first limitation, we retrospectively assessed employees' daily sleep characteristics at the end of the workweek and the weekend instead of every day. We chose this approach to reduce participant burden while still obtaining detailed sleep data for each day of the week. However, this retrospective assessment could be problematic if

employees do not recall their sleep times in detail. To support participants in reporting their daily sleep times, we provided them with a sleep diary in the general survey (i.e., a template to note their daily sleep times). However, we still cannot rule out recall errors when reporting sleep times. Accordingly, we encourage future research to a) measure sleep objectively (e.g., using accelerometers, Kühnel et al., 2021) or b) employ a fine-grained assessment within daily surveys.

Third, the generalizability of our findings might be limited because we assessed our data during the COVID-19 pandemic. Research suggests that the social restrictions during the pandemic might have changed employees' sleep behavior. Specifically, working from home because of the social restrictions enabled some employees to better follow their circadian preferences (Blume et al., 2020; Korman et al., 2020). At the same time, working from home might have led to a stronger blurring of work and private roles (Cho, 2020), potentially facilitating role transitions. Because we were interested in within-person relationships rather than differences between persons, we suppose that these circumstances did not massively change our results. However, we encourage future research to replicate our findings in other samples as well as research settings that are not as strongly affected by the COVID-19 pandemic.

Beyond said approaches to address the limitations of our study, we hope to inspire more research to study the work-nonwork interface and its relation to sleep. First, future research could dig deeper into antecedents and mechanisms that enable or hamper employees' reattachment to work. Our results suggest that reattachment does not happen automatically but also depends on employees' cognitive and energetic resource availability. Future research could build on these results, for example, by more explicitly measuring mechanisms through which sleep benefits reattachment (e.g., cognitive liveliness, Shirom, 2011). Additionally, scholars could apply our results to other recovery opportunities as a

prerequisite for reattachment. For example, future studies could investigate whether recovery experiences during the weekend or the previous evening matter for reattachment. While experiencing relaxation (i.e., low physiological arousal; Sonnentag & Fritz, 2007) might help increase energetic and cognitive resources similar to sleep quality and thereby benefit reattachment, experiencing detachment might represent higher role separation similar to catch-up sleep and thereby hamper reattachment.

Second, scholars could further investigate the role of weekend sleep and Monday reattachment for employees' entire workweek. We offered a starting point by demonstrating that weekend catch-up sleep increases and weekend sleep quality decreases workweek exhaustion via reattachment on Monday. However, due to our summarized measurement at the end of the week, we could not focus on temporal dynamics during the workweek. It might be that the indirect effects of weekend sleep on employees' exhaustion are stronger at the beginning of the week than at the end of the week. Accordingly, the benefits and drawbacks of weekend sleep might fade out over the course of the week similar to daily fade-out effects of sleep quality (Hülsheger, 2016; Wiegelmann et al., 2023). Future research might thus focus on the role of weekend sleep for exhaustion trajectories during the workweek instead of using a summary assessment at the end of the week (see Weigelt et al., 2021, for a similar approach). At the same time, because we could not demonstrate that Monday reattachment benefits employees' task performance throughout the workweek, future research could focus on other work-related outcomes of reattachment. For example, translating results from day-level studies to the week level (e.g., Sonnentag et al., 2020; Sonnentag & Kühnel, 2016), Monday reattachment could benefit employees' weekly work engagement.

Third, future research could further uncover the relevance of weekend catch-up sleep for employees' everyday work life. On the one hand, it would be interesting to consider weekend catch-up sleep as predictor of other work-related outcomes (e.g., counterproductive

work behavior or organizational citizenship behavior, Barnes et al., 2013) to further demonstrate how catching up sleep during the weekend might harm subsequent organizational behavior. At the same time, it would be interesting to investigate possible short-term effects of catch-up sleep (e.g., decreased weekend exhaustion) to better disentangle its positive short-term and negative long-term effects. On the other hand, scholars could build on our findings suggesting vicious cycles for catch-up sleep by investigating which weekly characteristics increase or decrease sleep inconsistency (e.g., sleep hygiene, Barber et al., 2012). These insights could help to better understand employees' sleep behavior during the entire week.

Practical Implications

Besides its implications for research at the work-nonwork interface, our study also offers practical implications. First, our results suggest that mentally reconnecting to work on Monday matters for the entire workweek by decreasing workweek exhaustion. Accordingly, organizations could implement interventions or prompts that facilitate the transition from the weekend to the workweek. Similar to previous approaches to increase psychological detachment (e.g., Hahn et al., 2011), also psychological reattachment can be taught (Vogel et al., 2022). For example, employees might start the workweek by taking the first few minutes after arriving at work to reflect upon goals and planning the upcoming week. Such planning tactics might not only help increase reattachment to work but also benefit other organizational goals (Parke et al., 2018). Integrating psychological reattachment to work in a fixed morning routine can further benefit employees' experiences and behaviors (McClean et al., 2021). Accordingly, training or interventions directly targeted to increase reattachment might help to foster employees' well-being during the workweek (Vogel et al., 2022).

Second, we demonstrated that high-quality and consistent sleep during the weekend matters for the workweek exhaustion via reattachment on Monday. Accordingly,

organizations could implement interventions targeted to promote sleep that indirectly also benefit the transition from the weekend to the workweek as well as subsequent work-related well-being. Wearing blue-light filtering glasses before sleep, for example, constitutes a viable intervention that can increase sleep quality as well as sleep duration (Guarana et al., 2021). At the same time, organizations need to recognize their employees' circadian preferences to prevent the need for weekend catch-up sleep in the first place. By increasing flexibility to follow circadian preferences during the workweek, employees' sleep deficit will decrease, thereby reducing the need to catch up on sleep during the weekend (Roenneberg et al., 2003; Roepke & Duffy, 2010). Lastly, more education on the interplay of circadian and homeostatic processes of sleep (Borbély, 1982; Borbély et al., 2016) is needed. Misconceptions about the relevance of timing and consistency of sleep are a widespread sleep myth (Robbins et al., 2019, 2022) and can even have detrimental effects in the organizational context by leading to biased supervisor ratings (Yam et al., 2014). Without knowing about the potential downsides of catch-up sleep, employees might mistake catch-up sleep for a viable strategy to overcome their sleep deficit instead of working on its cause.

Conclusion

Building on the tenets of boundary theory (Ashforth et al., 2000) and adopting a circadian lens (Borbély, 1982; Borbély et al., 2016), we investigated antecedents and outcomes of Monday reattachment after a work-free weekend. Our findings suggest that high-quality sleep during the weekend is beneficial but catching up on sleep during the weekend is detrimental to Monday reattachment and, in turn, indirectly to workweek exhaustion. Accordingly, we demonstrate that Monday reattachment can set the tone for the entire workweek but the capability to reattach depends on weekend sleep as a critical recovery process.

CHAPTER III: STUDY 2 – DAY-LEVEL MISMATCH

"Mind the Misalignment: Daily Social Sleep Lag as Boundary Condition for Employees' Recovery"[4]

Summary

Even though organizational behavior research started to acknowledge that circadian processes are important for employees and organizations, these perspectives have not yet arrived in empirical recovery research. We embedded the concept of circadian misalignment into the recovery literature by investigating employees' daily social sleep lag (i.e., a discrepancy between employees' actual and biologically preferred sleep-wake times) as a boundary condition for their recovery processes. Building on the recovery paradox and a circadian perspective on recovery, we proposed that low relaxation and mastery experiences explain the relationship between workplace interpersonal conflicts and low next-morning vigor. Concerning circadian misalignment, we proposed daily social sleep lag as a boundary condition impeding the occurrence and the effectiveness of after-work recovery experiences (i.e., moderating the relationships with interpersonal conflicts and vigor, respectively). Results of a daily diary study with 274 employees (1,926 days) demonstrated that low mastery experiences, but not relaxation, explained the negative association between interpersonal conflicts and next-morning vigor. Additionally, mastery experiences translated less to next-morning vigor on days with high (vs. low) social sleep lag. Investigating circadian misalignment can thus help determine under which circumstances employees recover from work best, highlighting the need to take circadian processes into account in recovery research.

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[4] Study 2 is an earlier version of the original manuscript by Völker, Koch, Wiegelmann, & Sonnentag submitted to Wiley's *Journal of Organizational Behavior* on November 24th 2022. Chapter III is identical to the submitted manuscript, except for a few minor editorial changes.

Introduction

Organizationally prescribed working hours often reflect the preferred timing of employees with a natural proclivity to wake up early, namely *early chronotypes*. Further, employees appear more conscientious if they start working earlier in the day (Yam et al., 2014). However, starting work early is the opposite of what many employees – *intermediate and late chronotypes* – prefer (Roenneberg et al., 2003). If employees' social clock (determined by work) does not match their biological clock (determined by chronotype), employees experience a circadian misalignment, also referred to as social sleep lag (i.e., a discrepancy between actual and biologically preferred sleep times, Kühnel et al., 2016; Wittmann et al., 2006). Circadian misalignment, in turn, has negative implications for employees' health (e.g., Wong et al., 2015) and organizational outcomes (e.g., Kühnel et al., 2016).

In contrast to previous research focusing on stable between-person differences in circadian misalignment (e.g., Kühnel et al., 2016), we emphasize the relevance of its within-person fluctuations for employees' daily life. Similar to other sleep characteristics (e.g., Liu et al., 2021), sleep timing might change rapidly from day to day and thus social sleep lag can yield meaningful daily fluctuations. On days with unusually high social sleep lag, employees' work requires them to be energized at times of the day they would not be when following their biological clock (Roenneberg et al., 2003; Wittmann et al., 2006). Consequently, employees need to invest additional effort throughout the workday to reach the arousal their work requires for fulfilling their tasks (e.g., Zijlstra et al., 2014). Especially after such workdays, recovering from work is essential to replenish energetic resources but at the same time, recovery can be challenging (Bennett et al., 2018; Sonnentag, 2018; Steed et al., 2021).

While research has started to acknowledge the importance of circadian processes at the workplace (e.g., Kühnel et al., 2016, 2022; Volk et al., 2023), it rarely examined the role

of circadian processes in recovery after work (Völker, Casper, et al., 2023). However, recovery after work can be a crucial foundation for organizational behavior by enabling employees to sustainably maintain their human capital needed for work (Barnes et al., 2023). Because recovery can be seen as a process regulating arousal throughout the day, research would benefit from taking a circadian perspective to better understand these crucial recovery processes (Zijlstra et al., 2014). As daily social sleep lag increases the discrepancy between actual (determined by chronotype) and required (determined by work) arousal levels, we propose that it can change the occurrence (i.e., *if* and *how* employees recover after stressful workdays) and the effectiveness (i.e., how well employees *benefit* from recovery) of daily recovery experiences.

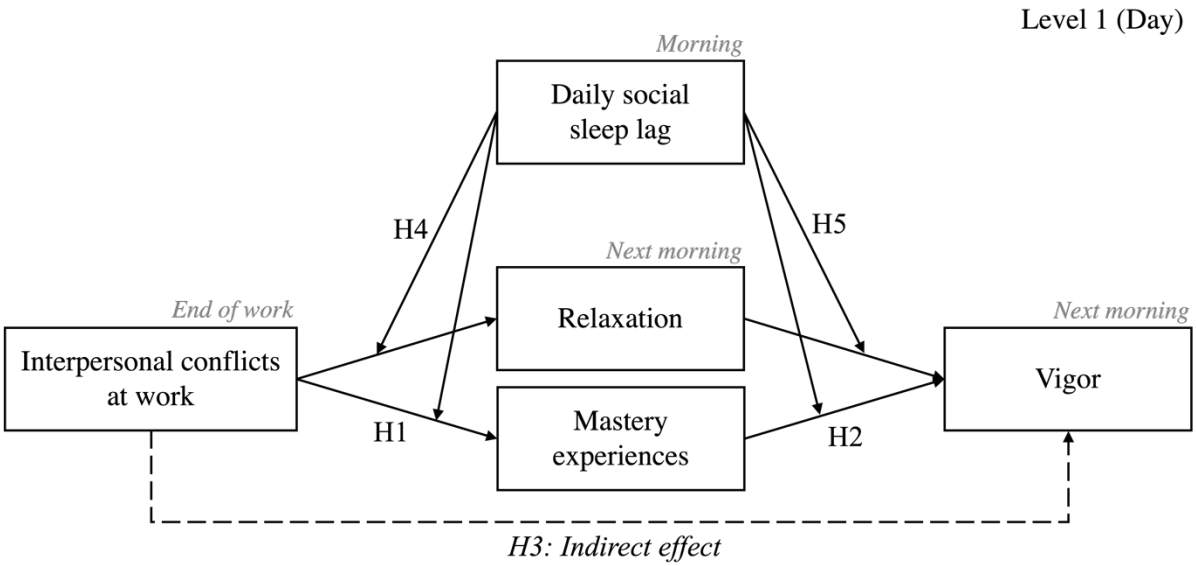
Our study links research on circadian misalignment with research on recovery by investigating employees' daily social sleep lag as a boundary condition for their recovery after work. Building on the recovery paradox (Sonnentag, 2018) and a circadian perspective on recovery (cf. Zijlstra et al., 2014), we propose that job stressors (i.e., interpersonal conflicts at work) are negatively related to next-morning energetic well-being (i.e., vigor) via reduced recovery experiences after work (i.e., relaxation and mastery). Further, we propose daily social sleep lag as a boundary condition impeding the occurrence and the effectiveness of after-work recovery experiences (i.e., moderating the relationships with interpersonal conflicts and vigor, respectively). Figure 3.1 shows our conceptual model.

Our study contributes to research in three important ways. First, we introduce circadian misalignment into the recovery literature. Even though previous research demonstrated that circadian misalignment matters for employees at work (Kühnel et al., 2016) and scholars suggested circadian perspectives on recovery (Völker, Casper, et al., 2023; Zijlstra et al., 2014), circadian processes and particularly circadian misalignment did not yet arrive in empirical recovery research. We connect these previously unconnected

streams of research and investigate social sleep lag as a boundary condition for recovery processes. This provides the unique opportunity to identify which daily boundary conditions change the occurrence and effectiveness of after-work recovery processes and, hence, to determine when and how employees recover from work best while taking circadian processes into account. Thereby, we respond to calls to further investigate which boundary conditions change employees' daily recovery processes (e.g., Steed et al., 2021).

Figure 3.1

Conceptual Model



Second, we introduce *daily fluctuations* in social sleep lag into organizational behavior research. Previous studies considered social sleep lag a person-level construct (e.g., Kühnel et al., 2016). However, the relevance of daily fluctuations in various other aspects of sleep has already been demonstrated (e.g., Liu et al., 2021). Similarly, social sleep lag (Roenneberg, Pilz, et al., 2019) and other aspects of sleep timing (Kühnel, Syrek, et al., 2018) can change from day to day, calling for taking a day-level perspective. By considering day-level instead of person-level social sleep lag, we take daily fluctuations into account and paint

a more accurate picture of circadian misalignment and its consequences for employees and organizations.

Third, we contribute to research on the interplay of work, recovery, and well-being. We apply the recovery paradox (Sonnentag, 2018) to relaxation and mastery experiences as explaining mechanisms in the relationship between workplace interpersonal conflicts and next-morning vigor. While previous research focused on psychological detachment from work (Sonnentag & Fritz, 2015), we argue that the core assumptions of the recovery paradox also apply to relaxation and mastery experiences. Focusing on relaxation and mastery experiences characterized by low and high energetic arousal, respectively, can help better understand how recovery might regulate employees' arousal when taking a circadian perspective (cf. Zijlstra et al., 2014). Thus, by investigating the role of relaxation and mastery as explaining mechanisms, we deepen our understanding on why interpersonal conflicts as an important job stressor (Ilies et al., 2011) are accompanied by reduced well-being.

Interpersonal Conflicts, Recovery Experiences, and Next-Morning Vigor

Interpersonal conflicts at work refer to disagreements with coworkers and supervisors or experiences of mistreatment (Spector & Jex, 1998). Specifically, we focus on relationship conflicts with coworkers and supervisors, such as personal tensions arising from diverging personal beliefs (Giebels & Janssen, 2005). Almost all occupations imply the need to interact with others because the majority of employees works in teams (Eurofound & Cedefop, 2020). Accordingly, because work is a social process, it is likely that interpersonal conflicts occur when working together. However, because relatedness is one of humans' basic needs (Deci et al., 2017), maintaining good relationships and not experiencing conflicts with others is desirable for most humans – also at work as a vastly important life domain (U.S. Bureau of Labor Statistics, 2023). Accordingly, interpersonal conflicts arising from disagreements about personal beliefs with coworkers or supervisors can represent a threat to the self (Semmer et

al., 2019). Feeling threatened can yield strong physiological stress reactions with relevant implications for humans' energy budget (Lazarus & Folkman, 1984). Thus, interpersonal conflicts constitute a relevant job stressor with detrimental effects on employees' well-being, behavior, and performance (Gerhardt et al., 2021; Ilies et al., 2011; van Woerkom & van Engen, 2009). Importantly, the adverse effect of interpersonal conflicts is not only limited to the work domain but also likely to spill over to the private domain (Pluut et al., 2022). Specifically, interpersonal conflicts can limit energetic and self-regulatory resources that are needed for recovery processes (Baumeister et al., 2019; Zijlstra et al., 2014). In contrast to quantitative job demands such as workload and time pressure, interpersonal conflicts thereby especially undermine recovery processes (for a review see, e.g., Sonnentag, 2018).

Building on the recovery paradox (Sonnentag, 2018), we propose that interpersonal conflicts are negatively related to employees' well-being (i.e., next-morning vigor) via reduced relaxation and mastery experiences after work. The recovery paradox (Sonnentag, 2018) describes a lack of recovery as an explaining mechanism for the negative relationship between job stressors and subsequent well-being even though job stressors increase the need for recovery. Building on the recovery paradox, we investigate recovery experiences as underlying psychological experiences of the recovery process. Different experiences can matter for recovery (e.g., detachment, relaxation, mastery, and control; Sonnentag & Fritz, 2007). Previous research mainly focused on psychological detachment (i.e., mentally leaving work behind) as a specific recovery experience, for instance, within the stressor-detachment model (Sonnentag & Fritz, 2015). However, we argue that relaxation (i.e., experiencing low physiological arousal) as well as mastery (i.e., experiencing competence due to overcoming challenges; Sonnentag & Fritz, 2007) likewise constitute relevant recovery experiences that can explain the relationship between job stressors and well-being. These two recovery experiences are particularly relevant when taking a circadian perspective on recovery (cf.

Zijlstra et al., 2014), as they can be characterized by low and high energetic arousal, respectively, and thus may have opposing implications for the recovery process (Sonnentag & Fritz, 2007). Specifically, while mastery is associated with high-aroused and high-energetic states, relaxation is associated with low-aroused and low-energetic states (Ouyang et al., 2019; Sonnentag et al., 2008). Detachment, instead, focuses on cognitive aspects of the recovery process and less on underlying energetic processes (Sonnentag & Fritz, 2007). Thus, while detachment represents one important recovery experience (Steed et al., 2021), mastery and relaxation experiences are uniquely suited to investigate energetic and circadian aspects of recovery.

Regarding the relationship between job stressors and recovery, interpersonal conflicts at work should impede relaxation and mastery experiences after work. One possible explanation of the paradoxical relationship between interpersonal conflicts and recovery experiences is lacking energetic and self-regulatory resources (Sonnentag, 2018). Undergoing interpersonal conflicts at work can limit employees' energetic and self-regulatory resources (Baumeister et al., 2019) because it represents a threat to employees and triggers physiological stress reactions (Deci et al., 2017; Lazarus & Folkman, 1984; Semmer et al., 2019). However, to be able to recover after work, employees need to regulate themselves (Zijlstra et al., 2014). As relaxation involves experiencing low physiological arousal (Sonnentag & Fritz, 2007), employees need to downregulate their arousal to be able to experience relaxation (Zijlstra et al., 2014). Interpersonal conflicts, however, make it harder for employees to downregulate their arousal because energetic and self-regulatory resources are limited after having experienced interpersonal conflicts (Baumeister et al., 2019). Accordingly, interpersonal conflicts decrease the likelihood that employees naturally experience relaxation after work. Conversely, experiencing mastery comes along with a higher arousal level and requires a certain level of energetic resources (Sonnentag & Fritz,

2007). Encountering conflicts at work should decrease energetic and self-regulatory resources needed for mastering challenges because these resources are occupied with dealing with the consequences of the physiological stress reaction (Baumeister et al., 2019; Nixon et al., 2011). After having experienced interpersonal conflicts, it is thus harder for employees to upregulate their arousal and to experience mastery (Zijlstra et al., 2014). Accordingly, interpersonal conflicts decrease the likelihood that employees naturally experience mastery after work.

Empirical evidence on the relationship between interpersonal conflicts at work and recovery experiences is scarce. Nevertheless, two meta-analyses focused on the broader concepts of hindrance stressors and emotional demands that can comprise interpersonal conflicts. In line with our assumptions, findings suggested negative associations with experiencing relaxation (Bennett et al., 2018; Steed et al., 2021). On the contrary, hindrance stressors and emotional demands were slightly positively related to mastery experiences (Bennett et al., 2018; Steed et al., 2021). However, most included studies focused on stressors such as organizational constraints that are not comparable to the possible self-threatening effects of interpersonal conflicts (cf. Semmer et al., 2019). Considering these inconclusive empirical results, we rely on our theoretical reasoning suggesting that workplace interpersonal conflicts are negatively related to relaxation and mastery experiences.

Hypothesis 1: *Interpersonal conflicts at work are negatively related to (a) relaxation and (b) mastery experiences after work.*

Recovery experiences, in turn, should translate into higher next-morning well-being. Specifically, we investigate vigor as a positive, activated, and aroused aspect of energetic well-being (Russell, 1980). When employees feel vigorous, they feel, for example, “lively” or “full of pep” (McNair et al., 1971). Morning vigor represents an important outcome within organizational behavior research as energetic well-being matters for subsequent behavior

(Venz et al., 2018) and performance (Binnewies et al., 2009). Thereby, we see vigor as an indicator of how recovery experiences served maintaining the human capital needed for work (Barnes et al., 2023).

We propose that relaxation and mastery experiences should boost employees' next-morning vigor. Experiencing relaxation reduces the load from work as it includes low physiological arousal and low tension (Sonnentag & Fritz, 2007). Thereby, energetic resources can constantly be restored during the evening because no work-related demands are present (Meijman & Mulder, 1998). Accordingly, employees downregulate their arousal and recover their energetic and self-regulatory resources (Zijlstra et al., 2014). Thus, relaxation experiences after work should increase employees' next-morning vigor. Mastery experiences arise from more challenging activities (Sonnentag & Fritz, 2007) and give employees the feeling of competency (Deci et al., 2017; van Hooff & de Pater, 2019; Vandercammen et al., 2014). Thereby, experiencing mastery can feel energizing and uplifting. Accordingly, when experiencing mastery, employees strategically invested their energetic and self-regulatory resources to ultimately acquire new resources as reflected in vigor (Ouyang et al., 2019; Zijlstra et al., 2014). Empirically, meta-analyses support our assumptions by suggesting that relaxation and mastery experiences are positively related to vigor and negatively related to low-energetic states such as fatigue (Bennett et al., 2018; Headrick et al., 2023; Steed et al., 2021). These effects also seem to last until the following day (ten Brummelhuis & Bakker, 2012b; ten Brummelhuis & Trougakos, 2014).

Hypothesis 2: *(a) Relaxation and (b) mastery experiences after work are positively related to next-morning vigor.*

Synthesizing the previous hypotheses within the framework of the recovery paradox (Sonnentag, 2018), we suggest that relaxation and mastery explain why interpersonal conflicts at work are negatively related to employees' next-morning vigor. Having

interpersonal conflicts with coworkers or supervisors, employees struggle to regulate their arousal and invest energetic and self-regulatory resources that are needed to experience relaxation and mastery (Baumeister et al., 2019; Zijlstra et al., 2014). Thus, while experiencing relaxation and mastery would be especially beneficial for restoring energetic and self-regulatory resources, interpersonal conflicts hamper experiencing relaxation and mastery in the first place. Reduced relaxation and mastery, in turn, result in fewer energetic and self-regulatory resources being restored and, thus, in decreased next-morning vigor (Meijman & Mulder, 1998). Hence, we propose that workplace interpersonal conflicts are negatively related to next-morning vigor via reduced relaxation and mastery experiences.

Hypothesis 3: *Interpersonal conflicts at work are indirectly related to next-morning vigor via reduced (a) relaxation and (b) mastery experiences after work.*

Daily Social Sleep Lag as Boundary Condition

We propose that daily social sleep lag serves as a boundary condition for the relationship between interpersonal conflicts and recovery experiences, as well as between recovery experiences and vigor. As suggested by Zijlstra et al. (2014), recovery represents "the continuous process of harmonizing the 'actual state' with the 'required state'" (Zijlstra et al., 2014, p. 250). Consequently, recovery aligns the current arousal level (determined by chronotype) to the required level (determined by work). Building on this idea, we now reason why circadian misalignment indicated by social sleep lag impedes the occurrence and effectiveness of recovery experiences.

The human biological clock causes various physiological functions to follow circadian rhythms with a period length of approximately one day (Roenneberg et al., 2003; Wittmann et al., 2006). Thereby, the interaction of a circadian process (determined by the biological clock) and a sleep-dependent process (determined by the time being awake) regulates humans' sleep-wake rhythm and energy levels throughout the day (Borbély, 1982;

Borbély et al., 2016). Specifically, the circadian process opens a "sleep gate" as a specific timeframe in which sleep can occur (Lavie, 2001), while the sleep-dependent process leads to sleep initiation during this timeframe (Borbély, 1982; Borbély et al., 2016). Interindividual differences in the timing of the biological clock are referred to as chronotype such that earlier chronotypes have an earlier sleep gate and reach their peak energy level earlier in the day than later chronotypes (Roenneberg et al., 2003).

In daily work life, employees' biological clock can conflict with a social clock that is largely determined by the timing of the workday. For example, workdays usually start early when late chronotypes would prefer to be still asleep (Roenneberg et al., 2003; Wittmann et al., 2006). However, employees' social clock is not strong enough to rule out their biological clock, as humans struggle to sleep outside their biological sleep gates (Borbély et al., 2016; Lavie, 2001). Thus, employees are forced to follow daily rhythms that do not align with their biological clock (Roenneberg et al., 2003; Wittmann et al., 2006). This discrepancy between employees' actual and preferred sleep times has been labeled as social jetlag (Wittmann et al., 2006) or, more recently, social sleep lag (Kühnel et al., 2016). Research has shown that stable between-person differences in social sleep lag, in turn, can have negative implications for employees' health (Rutters et al., 2014; Wong et al., 2015) and work behavior (e.g., Kühnel et al., 2016).

Similar to other sleep aspects that change drastically from day to day (e.g., sleep duration and quality, Liu et al., 2021), we argue that social sleep lag also yields relevant daily fluctuations instead of only representing a time-invariant, person-level characteristic. For example, employees might experience higher-than-usual social sleep lag on days when they are forced to get up unusually early to attend an important early-morning meeting. While they might still sleep sufficiently long by going to bed earlier, sleeping outside their biological sleep gates (Lavie, 2001) will be less effective and require higher regulation (Wyatt et al.,

1999). Accordingly, circadian misalignment due to higher daily social sleep lag poses challenges for employees' regulation throughout the workday (cf. Kühnel et al., 2016). On such days, employees need to continuously regulate themselves to align their actual arousal level to the required arousal level (Zijlstra et al., 2014). In the morning, employees' work requires them to be aroused and energized at times of the day when they are not in an optimal state following their biological clock (Wittmann et al., 2006). Thus, employees need to invest additional effort to upregulate their arousal to accomplish work tasks. In the evening, on the contrary, downregulation might be needed as employees' arousal levels are too high to sleep.

Therefore, we propose that daily social sleep lag impedes the occurrence of daily recovery processes (i.e., if and how employees recover after stressful workdays). The relationship between job stressors and recovery experiences can be subject to boundary conditions such as having low self-regulatory resources (Sonnentag, 2018; Sonnentag & Fritz, 2015). We assume that days with high social sleep lag resemble days with low self-regulatory resources because employees are occupied with handling circadian misalignment. On these days with high social sleep lag, employees need to continuously regulate themselves to overcome the discrepancy between required and actual arousal levels, resulting in fewer energetic and self-regulatory resources being available (Barnes, 2012; Zijlstra et al., 2014). Despite having undergone a stressful workday, a certain level of energetic and self-regulatory resources will be needed to leave work behind and experience recovery after work (cf. Hypothesis 1; Sonnentag, 2018; Zijlstra et al., 2014). Therefore, interpersonal conflicts should relate to fewer relaxation and mastery experiences especially on days with higher social sleep lag as energetic and self-regulatory resources which are needed to experience relaxation and mastery are exhausted by dealing with circadian misalignment. On the contrary, employees do not have to invest additional effort into their work on days with low social sleep lag. As a result, they have more energetic resources available to cope with

interpersonal conflicts effectively. In doing so, employees are better able to relax and experience mastery after work. Therefore, we propose that the negative relationship between interpersonal conflicts and relaxation as well as mastery is stronger on days when social sleep lag is higher (vs. lower).

Hypothesis 4: *Daily social sleep lag moderates the relationships between interpersonal conflicts and (a) relaxation as well as (b) mastery experiences, respectively, such that the negative relationships are stronger on days when social sleep lag is higher (vs. lower).*

We further propose that daily social sleep lag affects the effectiveness of recovery processes (i.e., how well employees benefit from recovery). Specifically, we argue that high daily social sleep lag increases the effectiveness of relaxation experiences but decreases the effectiveness of mastery experiences in promoting employees' next-morning vigor. The reasoning behind that is that relaxation and mastery have different implications for arousal regulation (cf. Zijlstra et al., 2014): While relaxation experiences can decrease arousal after work by coming along with low physiological activation, mastery experiences can increase arousal after work by mastering challenges (Sonnentag & Fritz, 2007). This differentiation is also reflected in empirical results demonstrating relationships between relaxation and low-activated affective states as well as between mastery and high-activated affective states – but not the other way around (e.g., Ouyang et al., 2019; Sonnentag et al., 2008).

Employees might need to downregulate after work on days with high social sleep lag (Zijlstra et al., 2014). On these days, relaxation will be especially beneficial for restoring energetic resources. Not requiring any additional energetic activation (Sonnentag & Fritz, 2007), experiencing relaxation helps downregulate arousal after work and, thus, aligns the actual arousal level to the required level before going to sleep (Zijlstra et al., 2014). Thereby, relaxation will enable energetic and self-regulatory resources to recover until the next day,

reflected in higher next-morning energetic states. Thus, we propose that relaxation is more strongly associated with higher next-morning vigor on days when social sleep lag is higher (vs. lower). Similarly, previous research demonstrated that employees with high person-level social sleep lag depend more on high sleep quality (stronger relationships with procrastination and positive mood; Kühnel et al., 2016, 2021).

Experiencing mastery, on the contrary, implies a certain level of self-regulatory and energetic resources (Sonnentag & Fritz, 2007). Employees who experience mastery on days with high social sleep lag feel activated even though they should downregulate after work to fit the required arousal levels to sleep. Thereby, mastery as a recovery experience could increase arousal before sleep, resulting in the actual arousal level deviating even more from the required level and, hence, decreasing the likelihood that energetic and self-regulatory resources are restored overnight (Zijlstra et al., 2014). Consequently, we assume that on days when social sleep lag is high (vs. low), the relationship between mastery and next-morning vigor will be less favorable (i.e., weaker).

Hypothesis 5: *Daily social sleep lag moderates the relationship between (a) relaxation as well as (b) mastery experiences and next-morning vigor such that the positive relationship between relaxation and vigor is stronger and the positive relationship between mastery experiences and vigor is weaker on days when social sleep lag is higher (vs. lower).*

Methods

Study Design and Sample

To test our hypotheses, we conducted a daily diary study. Data for this study were collected within a larger research project on promoting health behavior at work that received ethics approval by the institutional review board. Participants were employees working at least 30 hours per week and on four or more days per week (excluding self-employed individuals or shift workers). We recruited participants mainly online via social networking

sites (e.g., Facebook). As an incentive, participants could win one of three travel vouchers worth 1,200€ each. We collected data between May 2020 and December 2021 in Germany during the COVID-19 pandemic.[5]

Participants received invitations to all online surveys via e-mail. Ahead of the daily diary phase, participants answered a general questionnaire. Afterward, they responded to daily surveys throughout two workweeks (Monday to Friday). While the greater research project encompassed three daily surveys (morning, noon, and after-work surveys), we only used two daily surveys for this study (morning, after-work, and next-morning surveys). The morning surveys were available from 5 a.m. to 10 a.m. (participants were instructed to answer the survey before work), and the after-work surveys were available from 3 p.m. to 10 p.m. (participants were instructed to answer the survey right after work).

In total, 700 participants expressed interest in participating in the study. Of the 495 participants who answered the general survey, 448 answered at least one daily survey (total number of daily surveys completed: 2,946 days). We had to exclude 44 participants who reported that they could not freely choose their sleep times on non-workdays. If employees cannot freely choose their sleep times on non-workdays, their sleep times do not reflect their biologically preferred sleep times, making us unable to compute social sleep lag (see Measures; Roenneberg et al., 2003). Because we were interested in day-level relationships reaching the next morning and did not collect data on Saturdays, we could only use data from

[5] As part of the larger research project, participants were randomly assigned to two intervention groups and one control group. In the two intervention groups, participants received a daily intervention targeted to promote physical activity and avoid unhealthy snacking at work. However, the intervention was not relevant for this study. We ensured that the intervention in the larger research project did not affect this study's results by testing group membership as cross-level moderator on our hypothesized research model. We found no associations between group membership and our proposed day-level relationships. Thus, we conclude that the intervention within the larger research project did not affect this study's results.

Monday to Thursday and accordingly excluded 446 surveys completed on Fridays. To ensure data quality, we screened for careless responding patterns (e.g., response invariability; Goldammer et al., 2020) and excluded daily surveys completed with large interruptions (i.e., not finished within two hours after starting). Because of limited variance in their daily data, we excluded 128 participants who did not answer each daily survey (morning, after-work, next-morning survey) at least three times.

The final sample comprised 274 employees providing data on 1,926 days (1,789 morning, 1,748 after-work, and 1,750 next-morning surveys). Participants in the final sample were predominantly female (81.8%), and their mean age was $M = 39.7$ ($SD = 11.0$) years. They mostly worked between 30 and 40 hours (44.9%) or more than 40 hours (46.7%) per week in various occupations (most frequent: office and administrative occupations: 45.6%; health, social, and educational occupations: 25.5%; technical occupations: 15.0%). Most participants did not hold a leadership position (67.9%). Participants worked from home on 644 days (33.4%) with 61 participants working from home on none and 16 participants working from home on all of the days. Excluded participants did not differ from participants included in our final sample with regard to their age, $t(405.71) = 0.79$, $p = .432$, gender, $\chi^2 (1) = 0.847$, $p = .357$, education, $t(379.31) = -0.049$, $p = .961$, working in leadership positions, $\chi^2 (1) = 0.0001$, $p = .993$, or living with others in the same household, $\chi^2 (1) = 1.31$, $p = .252$.

Measures

In a general survey, we measured employees' biologically preferred sleep times. In the daily surveys, we measured daily sleep times (morning survey), interpersonal conflicts (after-work survey), relaxation and mastery (next-morning survey, referring to the previous evening), and vigor (next-morning survey). All items were presented in German. If unavailable in German, we translated items using the back-translation method from Brislin

(1970). To fit the daily assessment, we shortened scales and adapted items if necessary. Two-level Cronbach's alphas (Geldhof et al., 2014) of all scales are presented in Table 3.1.

Daily Social Sleep Lag

To calculate employees' daily social sleep lag, we first assessed their biologically preferred sleep times in a general survey using the Munich Chronotype Questionnaire (Roenneberg et al., 2003). Participants indicated when they usually fall asleep and wake up on non-workdays (e.g., weekends, vacation), representing their biologically preferred sleep times not constrained by work. Second, we assessed participants' daily sleep onset and waking-up time in all morning surveys. We then calculated daily social sleep lag as the absolute discrepancy between participants' usual midpoint of sleep (midpoint between sleep onset and waking up) on non-workdays and the daily midpoint of sleep on workdays (i.e., when answering the daily surveys; Roenneberg et al., 2012; Wittmann et al., 2006). Thus, daily social sleep lag represents the discrepancy between biologically preferred and actual sleep times during the respective day. Higher values indicate higher daily social sleep lag, such that a value of 2, for example, refers to a day with a two-hour difference between the respective employee's daily midpoint of sleep and the biologically preferred midpoint of sleep.

Interpersonal Conflicts at Work

In all daily after-work surveys, we assessed interpersonal conflicts at work using four items capturing relationship conflicts from Giebels and Janssen (2005). Items such as "Today, there were emotional conflicts between me and my colleagues or supervisors." had to be answered on a 5-point Likert scale ranging from 1 = *not at all true* to 5 = *absolutely true*.

Table 3.1

Descriptive Statistics, Cronbach's Alphas, Variance Decomposition, and Correlations of all Variables

	M	*SD*	σ^2	τ_{00}	$\sigma^2/(\sigma^2+\tau_{00})$	α_{L1}	α_{L2}	1	2	3	4	5	6	7	8
1 Social sleep lag[a]	1.3	0.9	0.24	0.49	0.33	-	-		.04	.00	.00	.01	-.01	-.003	.01
2 Sleep duration[a]	6.9	1.2	0.85	0.48	0.64	-	-	-.05		.20***	-.04*	-.02	.01	-.001	-.01
3 Sleep quality	3.4	0.9	0.59	0.29	0.67	-	-	-.02	.05		-.002	-.02	-.001	.02	.02
4 Interpersonal conflicts	1.3	0.7	0.26	0.16	0.62	.84	.96	-.01	-.03	-.02		-.01	-.02*	-.02*	-.01
5 Relaxation	3.6	1.0	0.55	0.37	0.60	.81	.95	-.02	.05	.13***	-.07**		-.02	.06***	.05***
6 Mastery	2.4	1.0	0.57	0.38	0.60	.76	.95	.03	.04	.08**	-.004	.02		.04**	.03*
7 Vigor	2.0	0.9	0.35	0.51	0.41	.85	.98	-.09*	.03	.22***	-.02	.18***	.22**		.15***
8 Serenity	3.1	0.9	0.31	0.43	0.42	.76	.95	-.06*	.04	.18***	-.04*	.21***	.08*	.33***	

Note. [a] in decimal hours. σ^2 = within-person variance from variance decomposition. τ_{00} = between-person variance from variance decomposition. $\sigma^2/(\sigma^2+\tau_{00})$ = proportion of total variance that is attributable to the within-person level. L1 = day level (Level 1), L2 = person level (Level 2). Correlations below the diagonal are person-level correlations (N = 274). Correlations above the diagonal are day-level correlations (n = 1,926).
*$p < .05$. **$p < .01$. ***$p < .001$.

Relaxation and Mastery

In all daily next-morning surveys, we assessed relaxation and mastery using three items each from the Recovery Experience Questionnaire (Sonnentag & Fritz, 2007). All items referred to the previous evening after work. Sample items are "Yesterday, after work, I used the time to relax." for relaxation and "Yesterday, after work, I did something to broaden my horizons." for mastery. Participants answered all items on a 5-point Likert scale ranging from 1 = *not at all true* to 5 = *absolutely true*.

Vigor

In all daily next-morning surveys, we assessed employees' momentary vigor using four items from the Profile of Mood States (German version: Bullinger et al., 1990; original version: McNair et al., 1971). Employees indicated whether they currently felt "vigorous", "lively", "active", and "full of pep" on a 5-point Likert scale ranging from 1 = *not at all* to 5 = *very much*.

Control Variables

To increase the robustness of our results, we included three control variables. First, we controlled for the day of the week on which the surveys were answered (coded 0 = *Monday* to 3 = *Thursday*). Controlling for day-of-the-week effects can be relevant as literature hints at considerable differences in sleep timing between weekdays (cf. Kühnel, Syrek, et al., 2018; Roenneberg, Pilz, et al., 2019). Second, we controlled for participants' work location while answering the surveys (0 = *not working from home*, 1 = *working from home*) as working from home might impact some of our primary constructs (e.g., reduced interpersonal conflicts at work due to a lack of in-person contacts with colleagues). Third, we controlled for affective tendencies in our self-report data by including low-aroused positive affect (i.e., serenity) in all analyses (cf. Rothbard & Wilk, 2011). Specifically, we measured

serenity with the same instructions as vigor using four items from a German mood measure ("calm", "relaxed", "laid-back", and "placid"; Abele-Brehm & Brehm, 1986).

Analytic Strategy

To account for the two-level structure of our data (days nested within persons), we used two-level path analysis in Mplus 8.7 (Muthén & Muthén, 2017) to test our hypotheses. As in most diary studies, our data set included missing data on the day level because participants missed single daily surveys. Therefore, we followed recommendations to handle missing data (Newman, 2014) and used multiple imputation in Mplus 8.7 (Muthén & Muthén, 2017). We imputed 50 data sets using our research model as imputation model, including the assumed interaction terms (Enders et al., 2014; Grund et al., 2018; Lüdtke et al., 2017).

For testing our research model, we first computed a two-level path model including only the main effects on both levels. By specifying paths at both the day level and person level, variance is decomposed into day-level and person-level variance, and variables are implicitly centered at the respective level (Preacher et al., 2010). Specifically, we specified paths from interpersonal conflicts to vigor, from interpersonal conflicts to relaxation and mastery (Hypothesis 1), as well as from relaxation and mastery to vigor (Hypothesis 2) on both levels. In addition, we specified the main effects of our moderator daily social sleep lag to relaxation, mastery, and vigor, respectively. Finally, we included direct paths from our two control variables (day of the week, working from home) to all other variables (social sleep lag, interpersonal conflicts, relaxation, mastery, and vigor) on the day level. We also tested for random slopes (LeBeau et al., 2018), finding that only the day-level slope from relaxation to vigor significantly varied between persons. To avoid convergence issues, we only specified this slope as random in our model and kept the other slopes fixed. To test indirect effects (Hypothesis 3), we calculated the estimates of the indirect effects in our two-level path model

and generated 95% confidence intervals using the Monte-Carlo method with 20,000 simulations (Selig & Preacher, 2008).

In a second step, we extended the previous path model by including interaction terms with daily social sleep lag to test Hypotheses 4 and 5. Therefore, we specified interaction terms between interpersonal conflicts and daily social sleep lag to predict relaxation and mastery (Hypothesis 4) as well as between relaxation and mastery and daily social sleep lag to predict vigor (Hypothesis 5) at the day level. To only capture day-level variance, we computed interaction terms using person-mean centered variables (Preacher et al., 2016). For significant interaction terms, we calculated simple slope tests and conditional indirect effects at low (-1*SD*) and high (+1*SD*) values of social sleep lag (Aiken et al., 1991; Preacher et al., 2016).

Preliminary Analyses

Descriptive statistics, variance decomposition, and correlations of all variables are displayed in Table 3.1. All variables exhibited considerable variance on the day level (ranging between 33% and 67%), emphasizing the need for two-level analyses decomposing day-level and person-level variance. Daily social sleep lag ranged from 0 to 6.8 hours, with a mean of $M = 1.3$ ($SD = 0.9$) hours. Thus, on average, participants experienced 1 hour and 18 minutes discrepancy between their biologically preferred midpoint of sleep and their actual midpoint of sleep on workdays. With a maximum of 6 hours and 48 minutes, the respective employee experienced a daily social sleep lag larger than time zone differences when traveling from Paris, France, to New York City, USA.

Multilevel confirmatory factor analyses in Mplus 8.7 (Muthén & Muthén, 2017) demonstrated the construct validity of our measures. A five-factor model with all items of the Likert-scaled variables loading on distinct factors (interpersonal conflicts, relaxation, mastery, vigor, and serenity) on both levels fit the data very well, $\chi^2 (218) = 451.220$,

$p < .001$, SCF = 1.07, RMSEA = 0.024, CFI = 0.979, TLI = 0.974, and better than all alternative models (for model comparisons see Table A3.1 in the Appendix).

Results

Hypotheses Testing

To test Hypotheses 1 to 3, we first relied on the path model with main effects only (see Analytic Strategy). Results of this two-level path model are displayed in Table 3.2, while we now focus on day-level results. In Hypothesis 1, we proposed that interpersonal conflicts at work are negatively related to (a) relaxation and (b) mastery experiences after work. Supporting Hypothesis 1b, but not 1a, interpersonal conflicts at work were negatively related to mastery (unstandardized path estimate [est.] = -0.082, *SE* = 0.037, $p = .026$), but not relaxation (est. = -0.026, *SE* = 0.040, $p = .511$) after work. Hypothesis 2 suggested that (a) relaxation and (b) mastery experiences are positively related to next-morning vigor. Indeed, both relaxation (est. = 0.066, *SE* = 0.021, $p = .002$) and mastery (est. = 0.047, *SE* = 0.021, $p = .022$) positively predicted next-morning vigor, supporting Hypothesis 2a and 2b. Lastly, we tested indirect effects from interpersonal conflicts to next-morning vigor via (a) low relaxation and (b) mastery experiences as proposed in Hypothesis 3. In line with Hypothesis 3b, but not Hypothesis 3a, low mastery (est. indirect effect = -0.004, *SE* = 0.003, 95% CI [-0.010;-0.001]) but not relaxation (est. indirect effect = -0.001, *SE* = 0.002, 95% CI [-0.007;0.004]) explained how interpersonal conflicts were negatively associated with next-morning vigor.

We then relied on the path model including the interaction terms to test Hypotheses 4 and 5. Results of this two-level path model are displayed in Table 3.3, while we now again focus on day-level results.

Table 3.2

Results of Two-Level Path Analysis: Model With Main Effects Only

	Social sleep lag		Interpersonal conflicts		Relaxation		Mastery		Vigor (next morning)	
	Est.	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***
Intercept	1.238***	0.050	1.333***	0.044	2.531***	0.249	1.854***	0.339	-0.659	0.495
Within person (Level 1)										
Day of the week[a]	0.035**	0.011	0.007	0.012	0.003	0.017	-0.012	0.017	-0.003	0.012
Working from home[b]	-0.158***	0.040	-0.087**	0.036	-0.041	0.056	0.109	0.062	-0.021	0.043
Serenity (next morning)					0.169***	0.038	0.098*	0.039	0.474***	0.034
Social sleep lag					0.012	0.046	-0.051	0.043	-0.025	0.029
Interpersonal conflicts					-0.026	0.040	-0.082*	0.037	-0.069*	0.031
Relaxation									0.066**	0.021
Mastery									0.047*	0.021
Residual variance	0.228***	0.022	0.259***	0.027	0.536***	0.031	0.553***	0.033	0.262***	0.016
Between person (Level 2)										
Serenity (next morning)					0.467***	0.060	0.173*	0.090	0.561***	0.102
Social sleep lag					0.003	0.050	-0.031	0.060	-0.090	0.070
Interpersonal conflicts					-0.311**	0.097	0.018	0.128	0.176	0.103
Relaxation									0.371*	0.166
Mastery									0.168***	0.062
Residual variance					0.258***	0.030	0.363***	0.042	0.400**	0.149

Note. [a] coded 0 = *Monday* to 3 = *Thursday*. [b] coded 1 = *working from home* and 0 = *not working from home*. Est. = Unstandardized path estimate. Day of the week, working from home, and serenity (next morning) were included as control variables. $N = 274$ employees providing data on 1,926 days.

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

Table 3.3

Results of Two-Level Path Analysis: Model With Within-Person Interaction Effects

	Social sleep lag		Interpersonal conflicts		Relaxation		Mastery		Vigor (next morning)	
	Est.	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***
Intercept	1.241***	0.049	1.332***	0.044	2.540***	0.247	1.859***	0.337	-0.682	0.491
Within Person (Level 1)										
Day of the week[a]	0.035**	0.011	0.006	0.012	0.004	0.017	-0.012	0.017	-0.001	0.012
Working from home[b]	-0.164***	0.039	-0.082*	0.036	-0.046	0.054	0.111	0.060	-0.020	0.045
Serenity (next morning)					0.171***	0.038	0.101**	0.038	0.474***	0.034
Social sleep lag (SSL)					0.016	0.046	-0.051	0.041	-0.027	0.030
Interpersonal conflicts (IC)					-0.022	0.041	-0.080*	0.0378	-0.066*	0.030
Relaxation (RX)									0.109**	0.024
Mastery (MS)									0.044*	0.020
IC x SSL					0.055	0.107	0.106	0.086		
RX x SSL									0.053	0.048
MS x SSL									-0.126*	0.050
Residual variance	0.227***	0.022	0.259***	0.027	0.535***	0.031	0.551***	0.033	0.261***	0.016
Between Person (Level 2)										
Serenity (next morning)					0.466***	0.060	0.173*	0.080	0.563***	0.102
Social sleep lag					0.005	0.050	-0.028	0.061	-0.086	0.069
Interpersonal conflicts					-0.318**	0.096	0.013	0.127	0.183	0.103
Relaxation									0.372*	0.164
Mastery									0.166**	0.063
Residual variance					0.259***	0.031	0.363***	0.042	0.382*	0.152

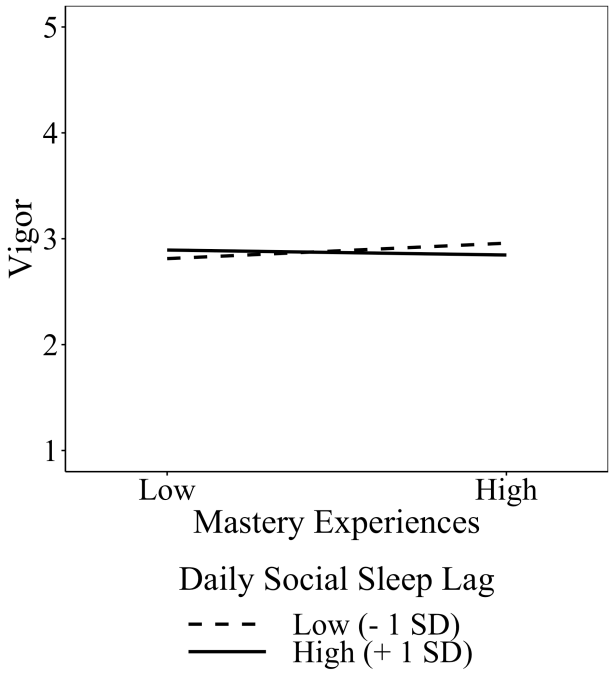
Note. [a] coded 0 = *Monday* to 3 = *Thursday*. [b] coded 1 = *working from home* and 0 = *not working from home*. Est. = Unstandardized path estimate. Day of the week, working from home, and serenity (next morning) were included as control variables. $N = 274$ employees providing data on 1,926 days.

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

In Hypothesis 4, we proposed that daily social sleep lag moderates the relationship between interpersonal conflicts and (a) relaxation as well as (b) mastery experiences such that the negative relationships are stronger on days when social sleep lag is higher (vs. lower). None of the interaction terms was significant (predicting relaxation: est. = 0.055, *SE* = 0.107, *p* = .611; predicting mastery: est. = 0.106, *SE* = 0.086, *p* = .220), resulting in Hypothesis 4a und 4b not being supported. In Hypothesis 5, we proposed that daily social sleep lag moderates the relationships between (a) relaxation as well as (b) mastery experiences and next-morning vigor. Specifically, we assumed that the positive relationship between relaxation and vigor is stronger and the positive relationship between mastery and vigor is weaker on days when social sleep lag is higher (vs. lower). Social sleep lag did not moderate the relationship between relaxation and next-morning vigor (est. = 0.053, *SE* = 0.048, *p* = .268), failing to support Hypothesis 5a.

Figure 3.2

Interaction Plot of Significant Within-Person Moderation Effect of Social Sleep Lag on the Association Between Mastery and Next-Morning Vigor



However, in line with Hypothesis 5b, social sleep lag moderated the relationship between mastery experiences and next-morning vigor (est. = -0.126, *SE* = 0.050, *p* = .011). In line with our assumptions, the relationship between mastery experiences and next-morning vigor was positive and significant on days with lower social sleep lag (-1*SD*, est. = 0.099, *SE* = 0.029, *p* = .001) and not significant on days with higher social sleep lag (+1*SD*, est. = -0.012, *SE* = 0.030, *p* = .702). The interaction effect is displayed in Figure 3.2.

Conditional indirect effects (see Table 3.4) demonstrated that low mastery experiences explained that interpersonal conflicts at work were negatively related to next-morning vigor on days with lower social sleep lag (-1*SD*, estimate indirect effect = -0.013, *SE* = 0.006, 95% CI [-0.027;-0.002]) but not on days with higher social sleep lag (+1*SD*, estimate indirect effect = 0.000, *SE* = 0.002, 95% CI [-0.002;0.008]). Thus, on days with lower social sleep lag, interpersonal conflicts at work especially impeded next-morning vigor, as employees would have benefited from experiencing mastery after work, but interpersonal conflicts hampered mastery.

Table 3.4

Day-Level (Conditional) Indirect Effects Depending on the Moderator Social Sleep Lag

Day-level indirect effect	**Moderator: Social sleep lag**	**Est.**	***SE***	**95% CI**
Interpersonal conflicts → Relaxation → Vigor	-1*SD*	-0.002	0.004	[-0.011;0.005]
	Main effect	-0.001	0.003	[-0.007;0.004]
	+1*SD*	0.000	0.005	[-0.011;0.011]
Interpersonal conflicts → Mastery → Vigor	**-1*SD***	**-0.013**	**0.006**	**[-0.027;-0.002]**
	Main effect	**-0.004**	**0.002**	**[-0.010;-0.001]**
	+1*SD*	0.000	0.002	[-0.002;0.008]

Note. CI = confidence interval. Est. = unstandardized path estimates obtained from two-level path analysis in Mplus 8.7 (Muthén & Muthén, 2017). Confidence intervals were computed using the Monte-Carlo Method with 20,000 simulations (Selig & Preacher, 2008). Bold = confidence interval does not include zero.

With respect to our control variables, results displayed in Table 3.2 showed that day of the week was positively related to daily social sleep lag (est. = 0.035, *SE* = 0.011, *p* = .001), indicating that social sleep lag increased from Monday to Thursday. In addition, participants reported a lower daily social sleep lag (est. = -0.158, *SE* = 0.040 *p* < .001) and fewer workplace interpersonal conflicts (est. = -0.087, *SE* = 0.036, *p* = .016) when working from home (vs. not working from home). Next-morning serenity was significantly related to all variables (relaxation: est. = 0.171, *SE* = 0.038, *p* < .001; mastery: est. = 0.101, *SE* = 0.038, *p* = .008; vigor: est. = 0.474, *SE* = 0.034, *p* < .001).[6]

Additional Analyses

We conducted three sets of additional analyses to underpin the relevance of daily social sleep lag for employees' recovery processes. First, we tested whether daily social sleep lag is a relevant moderator over and above other frequently studied sleep variables. Thus, we included employees' sleep duration (calculated using daily sleep onset and wake-up times) and sleep quality (single item measure "How do you evaluate this night's sleep?", Monk et al., 1994) in the same manner as daily social sleep lag in our model. We computed a path model with the three moderators social sleep lag, sleep duration, and sleep quality (assessed in the morning) simultaneously moderating the day-level relationships (see Hypothesis 4 and 5). Results (see Table A3.2 in the Appendix) demonstrated that neither sleep duration nor sleep quality moderated any of the relationships. Social sleep lag still significantly moderated the relationship between mastery and vigor (as previously tested in Hypothesis 5b and illustrated in Figure 3.2), even when the interaction effects of sleep duration and sleep quality, respectively, were taken into account (est. = -0.113, *SE* = 0.051, *p* = .027). Thus, we

[6] We also tested both path models without control variables. Omitting the control variables did not change significance and direction of our results, neither in the path model with main effects nor in the path model with interaction effects.

conclude that daily social sleep lag is as a relevant boundary condition for how employees' mastery experiences boost next-morning vigor, over and above other sleep characteristics.

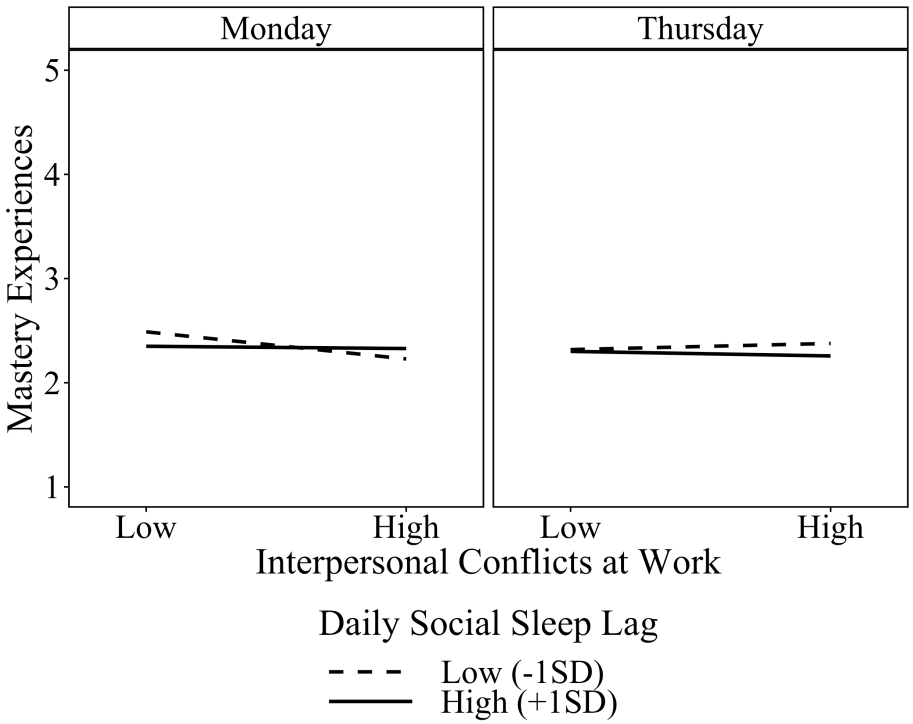
Second, we tested whether person-level social sleep lag, instead of day-level social sleep lag, serves as a significant moderator in our model. Therefore, we included person-level social sleep lag (calculated using the general midpoint of sleep on workdays and non-workdays from the general questionnaire as in previous studies; e.g., Kühnel et al., 2016) as a cross-level moderator in our model. To do so, we modeled random slopes between interpersonal conflicts and recovery experiences as well as between recovery experiences and next-morning vigor and predicted these random slopes by person-level social sleep lag. Results (see Table A3.3 in the Appendix) showed that person-level social sleep moderated neither the relationships between interpersonal conflicts and relaxation or mastery (cf. Hypothesis 4) nor the relationships between relaxation or mastery and next-morning vigor (cf. Hypothesis 5). Thus, day-level, and not person-level, social sleep lag served as a relevant boundary condition for day-level recovery processes.

Third, we included the day of the week (used as control variable in previous path models) as an additional moderator in our model. In addition to its main effects, the day of the week might be an important boundary condition for our hypothesized moderation effects. Thus, we modeled three-way interactions testing whether our previously assumed moderation effects (Hypothesis 4 and 5) additionally depend on the day of the week. Results (see Table A3.4 in the Appendix) showed one significant three-way interaction: the relationship between interpersonal conflicts at work and mastery experiences was moderated by daily social sleep lag and day of the week (est. = -0.148, *SE* = 0.070, $p = .035$; see Figure 3.3). On Mondays, interpersonal conflicts at work were negatively related to mastery experiences when daily social sleep lag was lower (-1*SD*, est. = -0.352, *SE* = 0.096, $p < .001$) but not when social sleep lag was higher (+1*SD*, est. = -0.042, *SE* = 0.098, $p = .670$). On Thursdays, the

relationship between interpersonal conflicts at work and mastery experiences was not significant at any level of social sleep lag (-1*SD*: est. = 0.078, *SE* = 0.082, *p* = .345; +1*SD*: est. = -0.002, *SE* = 0.079, *p* = .981). These findings contradict our assumption that the negative association between interpersonal conflicts at work and mastery experiences is stronger on days with higher social sleep lag (Hypothesis 4b). However, interestingly, the significant three-way interaction underpins the relevance of considering day-of-the-week effects while studying social sleep lag.

Figure 3.3

Three-Way Interaction Plot of Significant Within-Person Moderation of Social Sleep Lag and Day of the Week on the Relationship Between Interpersonal Conflicts and Mastery



Discussion

In our daily diary study, we embedded the concept of circadian misalignment into recovery research by investigating employees' daily social sleep lag as a boundary condition

for their recovery from work. Building on the recovery paradox (Sonnentag, 2018) and a circadian perspective on recovery (Zijlstra et al., 2014), we proposed that low levels of after-work relaxation and mastery experiences explain the relationship between workplace interpersonal conflicts and low next-morning vigor. Integrating the concept of circadian misalignment, we assumed that high social sleep lag impedes the occurrence and the effectiveness of daily recovery experiences (i.e., moderates the relationships with interpersonal conflicts and next-morning vigor, respectively). We found that low mastery experiences, but not low relaxation, explained the negative association between interpersonal conflicts and next-morning vigor. Additionally, in terms of their next-morning vigor, employees benefited less from mastery experiences on days with high (vs. low) social sleep lag.

Theoretical Implications

Our study bridges the gap between research on recovery from work and circadian misalignment, yielding several theoretical implications. Adding to previous research demonstrating the relevance of circadian misalignment for employees at work (e.g., Kühnel et al., 2016), our study revealed that circadian misalignment also plays a role for employees after work, namely for their recovery processes. In line with our theoretical reasoning based on the recovery paradox (Sonnentag, 2018) and a circadian perspective on recovery (cf. Zijlstra et al., 2014), employees' mastery experiences translated less to next-morning vigor on days with higher (vs. lower) social sleep lag. Specifically, we argued that mastery experiences can increase the discrepancy between the actual and the required arousal level especially on days with high social sleep lag, resulting in less energetic and self-regulatory resources being restored overnight (Zijlstra et al., 2014). Moreover, it is important to note that social sleep lag served as a boundary condition for the association between mastery experiences and next-morning vigor over and above other frequently studied sleep

characteristics (i.e., sleep duration and sleep quality). Consequently, circadian misalignment, and not just poor or short sleep, matters for employees' after-work hours, emphasizing the need to take a circadian perspective on recovery from work more seriously in future research. While this circadian perspective has been theoretically suggested (Zijlstra et al., 2014) and was already applied to other fields of organizational behavior (Volk et al., 2023), it rarely found its way into empirical recovery research (Völker, Casper, et al., 2023). Building on our findings, we further encourage scholars to link employees' circadian and recovery processes in their research.

Likewise, these results suggest that recovery experiences are not equally effective on any given day. Experiencing mastery was only related to next-morning vigor on days when social sleep lag was low. Previous research indicated recovery processes to be equally effective every day (Sonnentag et al., 2017). However, our results demonstrate that day-level boundary conditions make mastery experiences less effective in restoring employees' energetic resources on certain days (i.e., on days with a higher social sleep lag). Even though this effect was rather small[7] which is not unusual in daily diary studies (Gabriel et al., 2019), we believe that even slight increases in employees' well-being are meaningful and crucial to sustainably maintain the human capital needed in organizations (Barnes et al., 2023). Interestingly, experiencing relaxation was associated with higher next-morning vigor regardless of employees' daily social sleep lag. We speculate that this pattern arose because the activities needed to experience mastery (e.g., physical exercise) depend more on energetic and self-regulatory resources and, thus, social sleep lag plays a greater role. Hence,

[7] To evaluate the effect size, we calculated how much variance the significant interaction term between mastery experiences and social sleep lag explained in vigor over and above the other predictors and interaction terms (LaHuis et al., 2014). Results showed that the interaction term predicted 0.38% of day-level variance in vigor.

considering boundary conditions of recovery processes is crucial to paint a more accurate picture of how and when employees best benefit from *which* recovery experiences.

Furthermore, our study emphasizes that organizational behavior research can benefit from taking a day-level perspective on social sleep lag. Social sleep lag exhibited a notable amount of within-person variance, and day-level – not person-level – social sleep lag served as a boundary condition for the effectiveness of daily mastery experiences. Hence, we showed that sleep timing and the relevance of circadian misalignment differ from day to day and that it is, therefore, worthwhile to consider within-person fluctuations in social sleep lag. Neglecting within-person fluctuations and only taking person-level circadian misalignment into account might underestimate the dynamic nature of sleep and the circadian system during the week (Roenneberg, Pilz, et al., 2019). Similar to other sleep characteristics such as sleep quality (e.g., Diestel et al., 2015), future research might benefit from studying circadian misalignment on a day level. At the same time, we found that social sleep lag not only yields meaningful daily variation but also demonstrated that the effect of social sleep lag as boundary condition changes over the course of the week. Our additional analyses revealed that only at the beginning of the week (i.e., on Monday) but not at the end of the week (i.e., on Thursday), daily social sleep lag served as a boundary condition for the association between interpersonal conflicts and mastery experiences. We speculate that social sleep lag is most critical and prominent during the transition from the biologically preferred sleep-wake cycle (i.e., weekend) to the socially determined sleep-wake cycle (i.e., workweek) on Monday. Over the course of the workweek, however, the effects of social sleep lag on the relationship between interpersonal conflicts and mastery experiences might be overwritten by increased sleep debt and sleep need (Kühnel, Syrek, et al., 2018). Additionally considering the day of the week can thus be crucial to paint a more accurate picture of how circadian processes change as the week goes by.

Lastly, our study highlights that the detrimental effects of encountering workplace interpersonal conflicts on employees' next-morning well-being can be explained by low mastery experiences. Accordingly, interpersonal conflicts have the power to adversely affect employees' evening and, in turn, also their next workday as morning energetic states can be a prerequisite for behavior and performance during the day (Binnewies et al., 2009; Venz et al., 2018). However, interpersonal conflicts were not related to lower relaxation after work. These results underline that dealing with the physiological stress reaction following interpersonal conflicts limits employees' energetic and self-regulatory resources that are, in turn, not available for mastering challenges (Baumeister et al., 2019; Nixon et al., 2011). Accordingly, experiencing interpersonal conflicts made it harder for employees to upregulate their arousal and thus decreased the probability of experiencing mastery. On the contrary, experiencing relaxation might need fewer energetic and self-regulatory resources and rather depends on downregulation than upregulation energetic arousal such that the detrimental effect of coping with interpersonal conflicts especially affects mastery but not relaxation (Zijlstra et al., 2014). Taken together, our study shows that low mastery experiences explain the negative association between job stressors (i.e., interpersonal conflicts) and well-being (i.e., next-morning vigor). While previous research on the recovery-undermining effects of job stressors often focused on psychological detachment (Sonnentag & Fritz, 2015), we demonstrate that the core assumptions of the recovery paradox (Sonnentag, 2018) also translate to mastery as recovery experience.

Limitations and Directions for Future Research

Some limitations of our study must be considered. First, we used self-report measures to assess our constructs. Thus, our data might be subject to common-method bias, resulting in an over-estimation of relationships caused by variance attributed to the measurement (P. M. Podsakoff et al., 2012). To decrease the likelihood of common-method bias, we temporally

separated the assessment of our predictor (interpersonal conflicts at work), moderator (social sleep lag), and the remaining constructs (mastery, relaxation, vigor). In addition, we calculated social sleep lag using self-reported sleep times from the general and the daily surveys, making it less likely to be subject to common method bias. Lastly, moderation effects cannot simply arise from common-method variance (Siemsen et al., 2010). Still, future research might use other data sources, such as colleague reports of interpersonal conflicts or objectively assessed sleep times (e.g., using actigraphy, Kühnel et al., 2021), to reduce concerns about common-method bias further.

Second, we measured some of our constructs in the next morning, resulting in a next-day spillover design. On the one hand, to decrease the burden on participants, we retrospectively assessed employees' recovery experiences in the next morning instead of in an additional questionnaire before bedtime. Due to this procedure, we assessed our mediators (relaxation and mastery experiences) simultaneously with our outcome (vigor). Measuring the constructs on three different occasions would have been preferable but testing mediation using data assessed on two occasions is also common practice (Preacher, 2015). To facilitate recall of the previous evening, we first asked participants about their leisure activities during the previous evening before answering the recovery experiences items. At the same time, assessing recovery experiences in the next morning has the advantage of being able to refer to the whole evening and not only to the time until participants answer the last questionnaire before bedtime. On the other hand, the next-day spillover design resulted in a considerable time lag between our predictor (i.e., interpersonal conflicts) and our outcome (i.e., vigor). This relatively large time lag might lead to concerns about whether antecedents other than the intended predictor influenced the outcome. However, due to its highly activated nature, vigor is most desirable in the morning before work (McNair et al., 1971; Shirom, 2011). Thus, assessing vigor in the next morning represents a relevant well-being outcome. Still, future

research might implement an additional daily questionnaire before bedtime to better disentangle the day-level effects.

Third, generalizability of our results might be limited because we collected data during the COVID-19 pandemic with accompanying restrictions and lockdowns. These circumstances imply that employees' work situation could have been different compared to pre- and post-pandemic times as many organizations implemented home office mandates. In turn, a change in communication practices occurred (McGloin et al., 2022; Nguyen et al., 2020) which might have impacted whether and which interpersonal conflicts occurred with coworkers and supervisors. Unfortunately, however, we did not collect information on how often and by which communication tool employees interacted with their colleagues. At the same time, employees' sleep times as well as recovery opportunities could have been different because of the ongoing pandemic control measures during data collection that limited leisure opportunities. However, as we decomposed variance into within- and between-person parts, our hypothesized within-person relationships should not be subject to such stable between-person differences. Still, further replicating our findings in different samples could help increase their generalizability.

Furthermore, our study offers avenues for future research. First, scholars might investigate the temporal sequence of employees' recovery experiences in greater detail. Our results highlight that mastery experiences translated less to next-morning vigor on days when social sleep lag was higher (vs. lower). While we have referred to mastery experiences during the whole evening, future studies could focus on more complex temporal patterns such as trajectories of recovery experiences. For example, mastery experiences right after work might translate to high next-morning vigor, but especially increasing mastery experiences shortly before sleep will increase physiological arousal, impair employees sleep, and, thus, be detrimental for next morning vigor (cf. Sonnentag et al., 2017; Zijlstra et al., 2014). Social

sleep lag could act as a boundary condition in this relationship between mastery experiences, time, and next-morning vigor (i.e., three-way interaction) such that increasing mastery trajectories during the evening do not translate to next-morning vigor on days with higher social sleep lag. Thus, investigating the interplay of social sleep lag and recovery trajectories during the evening can be a promising research endeavor.

Second, other recovery opportunities during the day could be investigated. As proposed by Zijlstra et al. (2014), recovery is a continuous process of harmonizing actual and required arousal states during the whole day. We offered a starting point by demonstrating social sleep lag as a boundary condition for employees' recovery processes after work. However, recovery might also occur at work, for example, during lunch breaks (Bosch et al., 2018; Sianoja et al., 2018). Thus, future research could build on our results and investigate the interplay of circadian misalignment with other recovery opportunities, for example, before starting to work, during the workday, or during the weekend.

Third, future research could identify mechanisms by which interpersonal conflicts hamper employees' mastery experiences. We can only speculate that interpersonal conflicts lead to limited self-regulatory and energetic resources (Baumeister et al., 2019) that are needed for mastering challenges (Sonnentag, 2018). Future studies could directly address these mechanisms, for example, by testing energetic resource depletion as explaining mechanisms between interpersonal conflicts at work and mastery experiences. These insights can then help in designing interventions to improve experiencing mastery even after encountering interpersonal conflicts at work.

Practical Implications

Our study also offers several practical implications. First, employees should be aware of and consider their potential circadian misalignment when making decisions about their after-work hours. Employees benefited less from after-work mastery experiences on days

when their social sleep lag was high. On the contrary, experiencing after-work relaxation was beneficial for employees' next-morning vigor regardless of their social sleep lag. Consequently, employees could try to not engage in challenging activities offering mastery experiences (e.g., physical activity; Calderwood et al., 2021; or creative activities; Eschleman et al., 2014) on days with higher social sleep lag but instead reschedule those activities to days with lower social sleep lag.

Second, as not everyone might be aware of their social sleep lag, additional education about circadian processes might be needed for employees to make informed decisions and, hence, to be able to reduce their circadian misalignment. Thus, organizations should pay more attention to individual circadian preferences, educate their employees about the topic, and allow more flexibility to reduce circadian misalignment. Our study also offers a starting point by demonstrating that working from home might decrease employees' social sleep lag. Recently, the COVID-19 pandemic introduced employees in many occupations with new working-from-home regulations (Ker et al., 2021) and studies observed decreasing social sleep lag during the pandemic (Blume et al., 2020; Korman et al., 2020). Similarly, we found that employees' social sleep lag was lower on days when they worked from home (vs. not from home). Social schedules can be increasingly flexible when working from home, allowing employees to follow their biological clock (Blume et al., 2020). For example, many employees make use of the time otherwise spent commuting to work by sleeping longer in the morning. Hence, organizations could provide options for hybrid work or working from home (if possible) to reduce employees' daily circadian misalignment and, thus, the involved negative consequences.

Third, organizations should prevent interpersonal conflicts' detrimental impact on employees' recovery and well-being. On the one hand, organizations could reduce interpersonal conflicts, for example, by promoting positive tones in teams and highlighting

common goals to increase cohesion (Hentschel et al., 2013; Hobman et al., 2003). On the other hand, as not all interpersonal conflicts might be preventable, organizations could support employees in coping with encountered interpersonal conflicts. For example, increasing employees' personal resources (e.g., optimism; Martinez-Corts et al., 2015) or offering conflict-management interventions (Benitez et al., 2018) might help buffer adverse effects on employees' well-being.

Conclusion

By demonstrating daily social sleep lag as a boundary condition for employees' after-work recovery processes, our study bridges the gap between research on recovery from work and circadian misalignment. Combining these two streams of research can help determine under which circumstances employees recover from work best, highlighting the need to take circadian processes into account in recovery research.

Table A3.1

Results of Confirmatory Factor Analyses for Likert-Scaled Constructs Interpersonal Conflicts, Mastery, Relaxation, Vigor, and Serenity

	χ^2	*df*	SCF	CFI	TLI	RMSEA	S-B χ^2	Δ *df*	*p*
Model 1: Five-factor model	451.220	218	1.070	0.979	0.974	0.024			
Model 2a: Four-factor model Relaxation and mastery on one common factor	Model did not converge								
Model 2b: Four-factor model Vigor and serenity on one common factor	1557.856	226	1.075	0.880	0.956	0.056	975.71	8	< .001
Model 3: Three-factor model Interpersonal conlicts, mastery, and relaxation on one common factor	3859.857	232	1.082	0.664	0.606	0.091	2897.16	14	< .001
Model 4a: Two-factor model Mastery, relaxation, vigor, and serenity on one common factor	5219.555	268	1.084	0.583	0.523	0.099	4513.57	50	< .001
Model 4b: Two-factor model Interpersonal conflicts, mastery, and relaxation on one common factor	4360.203	236	1.092	0.618	0.560	0.096	3138,54	18	< .001
Model 5: One-factor model	Model did not converge								

Note. SCF = scale correction factor. CFI = comparative fit index. TLI = Tucker-Lewis index. RMSEA = root-mean-square error of approximation. S-B χ^2 = Satorra-Bentler chi-square. N = 274 employees providing data on 1,926 days.

Table A3.2

Results of First Additional Analysis: Two-Level Path Model Including Sleep Duration and Sleep Quality as Additional Moderators

	Social sleep lag		Sleep duration		Sleep quality		Interpersonal conflicts		Relaxation		Mastery		Vigor (next morning)	
	Est.	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***
Intercept	1.242***	0.049	6.658***	0.073	3.299***	0.060	1.330***	0.043	1.831***	0.445	1.008	0.601	-0.853	0.527
Within Person (Level 1)														
Day of the week[a]	0.035**	0.040	0.042*	0.019	0.018	0.017	0.007	0.012	0.008	0.017	-0.010	0.017	-0.001	0.012
Working from home[b]	-0.168***	0.011	0.347***	0.070	0.125*	0.055	-0.084*	0.036	-0.038	0.055	0.117	0.063	-0.022	0.044
Serenity (next morning)									0.176***	0.039	0.101**	0.039	0.474***	0.034
Interpersonal conflicts (IC)									-0.038	0.040	-0.090*	0.041	-0.068*	0.031
Social sleep lag (SSL)									0.026	0.046	-0.046	0.042	-0.023	0.029
Sleep duration (SD)									-0.021	0.023	0.002	0.026	-0.006	0.018
Sleep quality (SQ)									-0.024	0.028	-0.010	0.027	0.012	0.019
Relaxation (RX)													0.065**	0.021
Mastery (MS)													0.046*	0.020
IC x SSL									0.141	0.096	0.149	0.094		
IC x SD									-0.071	0.045	-0.042	0.052		
IC x SQ									-0.023	0.071	-0.011	0.072		
RX x SSL													0.048	0.046
RX x SD													-0.007	0.024
RX x SQ													-0.036	0.031
MS x SSL													-0.113*	0.051
MS x SD													-0.010	0.027
MS x SQ													0.021	0.033
Residual variance	0.227***	0.022	0.820***	0.057	0.583***	0.029	0.260***	0.027	0.534***	0.031	0.550***	0.033	0.260***	0.016
Between Person (Level 2)														
Serenity (next morning)									0.410***	0.069	0.097	0.090	0.486	0.098
Interpersonal conflicts									-0.328***	0.094	0.021	0.129	0.173	0.105
Social sleep lag									0.009	0.048	-0.021	0.061	-0.089	0.066
Sleep duration									0.043	0.052	0.051	0.066	-0.053	0.056
Sleep quality									0.181*	0.069	0.218*	0.097	0.287**	0.085
Relaxation													0.350*	0.174
Mastery													0.131*	0.064
Residual variance									0.249***	0.030	0.348***	0.039	0.365**	0.137

Note. [a] coded 0 = *Monday* to 3 = *Thursday*. [b] coded 1 = *working from home* and 0 = *not working from home*. Day of the week, working from home, and serenity were included as control variables. $N = 274$ employees providing data on 1,926 days. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table A3.3

Results of Second Additional Analysis: Two-Level Path Model Including Person-Level Social Sleep Lag as Cross-Level-Moderator

	Interpersonal conflicts		Relaxation		Mastery		Vigor (next morning)	
	Est.	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***
Intercept	1.333***	0.047	2.501***	0.982	1.667***	2.026	-1.241	13.205
Within Person (Level 1)								
Day of the week[a]	0.006	0.012	0.005	0.056	-0.015	0.106	-0.002	0.019
Working from home[b]	-0.087**	0.042	-0.053	0.085	0.118	0.096	-0.024	0.056
Serenity (next morning)			0.167**	0.048	0.098	0.066	0.474***	0.129
Interpersonal conflicts			-0.032	0.107	-0.060	0.116	-0.067	0.157
Relaxation							0.062	0.074
Mastery							0.052	0.054
Residual variance	0.260***	0.027	0.532***	0.073	0.550**	0.203	0.256***	0.023
Between Person (Level 2)								
Serenity (next morning)			0.469***	0.069	0.181	0.208	0.510	5.701
Interpersonal conflicts (IC)			-0.256	0.628	0.181	1.392	0.145	8.630
Social sleep lag (SSL)			0.019	0.475	-0.031	0.820	-0.186	1.573
Relaxation (RX)							0.287	19.645
Mastery (MS)							0.410	20.461
IC x SSL			-0.015	0.430	0.003	0.705		
RX x SSL							0.034	0.126
MS x SSL							0.007	0.081
Residual variance			0.298	1.936	0.373	4.476	0.482	4.406

Note. [a] coded 0 = *Monday* to 3 = *Thursday*. [b] coded 1 = *working from home* and 0 = *not working from home*. Day of the week, working from home, and serenity were included as control variables. $N = 274$ employees providing data on 1,926 days.

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

Table A3.4

Results of Third Additional Analysis: Two-Level Path Model Including Three-Way Interactions With Day of the Week

	Social sleep lag		Interpersonal conflicts		Relaxation		Mastery		Vigor (next morning)	
	Est.	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***
Intercept	1.274***	0.046	1.332***	0.037	2.482***	0.255	1.770***	0.342	-0.435	0.459
Within Person (Level 1)										
Day of the week[a] (DOTW)	0.033**	0.011	0.006	0.012	0.005	0.017	-0.011	0.017	0.000	0.012
Working from home[b]	-0.148***	0.038	-0.071*	0.036	-0.045	0.055	0.115	0.062	-0.025	0.045
Serenity (next morning)					0.166***	0.038	0.095	0.039	0.480***	0.033
Interpersonal conflicts (IC)					-0.027	0.065	-0.197**	0.067	-0.063*	0.030
Social sleep lag (SSL)					0.143	0.085	-0.076	0.075	-0.011	0.050
Relaxation (RX)									0.169***	0.038
Mastery (MS)									0.068*	0.031
DOTW x SSL					-0.082	0.042	0.019	0.043	-0.013	0.028
DOTW x IC					0.000	0.037	0.078*	0.036		
IC x SSL					0.176	0.153	0.353*	0.160		
DOTW x RX									-0.074***	0.021
RX x SSL									0.049	0.076
DOTW x MS									-0.017	0.019
MS x SSL									-0.135	0.084
DOTW x SSL x IC					-0.065	0.075	-0.148*	0.070		
DOTW x SSL x RX									0.012	0.042
DOTW x SSL x MS									0.022	0.046
Residual variance	0.226***	0.022	0.256***	0.027	0.525***	0.031	0.541***	0.032	0.258***	0.015
Between Person (Level 2)										
Serenity (next morning)					-0.483***	0.062	0.182*	0.080	0.591***	0.099
Interpersonal conflicts					-0.305**	0.098	0.047	0.130	0.153	0.097
Social sleep lag					-0.001	0.050	-0.031	0.062	-0.087	0.069
Relaxation									0.302	0.155
Mastery									0.149*	0.061
Residual variance					0.273***	0.032	0.378***	0.043	0.405**	0.151

Note. [a] coded 0 = *Monday* to 3 = *Thursday*. [b] coded 1 = *working from home* and 0 = *not working from home*. Day of the week, working from home, and serenity were included as control variables. $N = 274$ employees providing data on 1,926 days. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

CHAPTER IV: STUDY 3 – PERSON-LEVEL (MIS-)MATCH

"It's a Match: The Relevance of Matching Chronotypes for Dual-Earner Couples' Daily Recovery From Work"[8]

Summary

Cohabiting dual-earner couples are increasingly common. However, previous recovery research mainly focused on employees independently of others, thereby overlooking an essential part of their life. Therefore, we take a closer look at dual-earner couples' recovery processes and link this research to a circadian perspective. We assumed that unfinished tasks impede engagement in time with the partner (absorption in joint activities, directing attention toward the partner) as well as recovery experiences (detachment, relaxation), whereas engagement in time with the partner should boost recovery experiences. Integrating a circadian perspective, we proposed that employees from couples with matching circadian preferences (chronotype) benefit more from engagement in time with their partners (i.e., stronger relationships with recovery experiences). Additionally, we explored whether a match between partners' chronotypes buffers the negative relationship between unfinished tasks and engagement in joint time. We conducted a daily diary study with 143 employees from 79 dual-earner couples, providing data on 1,052 days. A three-level path model showed that unfinished tasks were negatively related to absorption in joint activities and detachment, whereas absorption positively predicted recovery experiences. Furthermore, the couples'

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chronotype match mattered in the interplay with engagement in joint time: for couples with higher (vs. lower) chronotype match, experiencing detachment depended on absorption while for couples with lower (vs. higher) chronotype match, attention was even harmful for experiencing relaxation. Thus, it is crucial to consider employees' partners when investigating their recovery processes because employees cannot act independently if they also need to take their partners' circadian rhythms into account.

Introduction

When employees experience a stressful day at work, recovering after work is essential to prevent adverse well-being consequences (Bennett et al., 2018; Sonnentag et al., 2022; Steed et al., 2021). In most studies examining recovery processes, however, employees are portrayed as individuals who experience recovery independently from one another. This approach does not reflect most employees' everyday life as it neglects the social context they are embedded in. Because employees are rarely independent of others, especially in romantic relationships, an essential aspect of recovery processes is neglected (e.g., Hahn et al., 2012, 2014).

Cohabiting with a partner is one of the most common life concepts (UNECE, 2021). Over and above, the number of dual-earner couples is steadily increasing (Adema et al., 2020), with both partners working and needing to recover after work. Cohabiting dual-earner couples might spend a large part of their leisure time and, thus, many recovery opportunities together. Engagement in time with the partner can boost employees' recovery by switching from their work role to their private role and leaving work behind (Hahn et al., 2012; Rothbard, 2001). At the same time, job stressors such as a high amount of unfinished tasks can make it difficult to focus on the partner after work (Rothbard, 2001). Unfinished tasks constitute a common and relevant job stressor due to increasing workload and limited possibility of finishing work tasks in time (Eurofound, 2017). Unfinished tasks can reach into

employees' after-work hours by increasing negative activation and self-focused attention (Mor & Winquist, 2002; Syrek & Antoni, 2014; Wood et al., 1990). By increasing employees' self-focused attention, unfinished tasks potentially limit engagement in the time with their partner and represent a threat to the partners' joint time. Accordingly, considering romantic relationships is crucial when investigating the interplay between work and recovery.

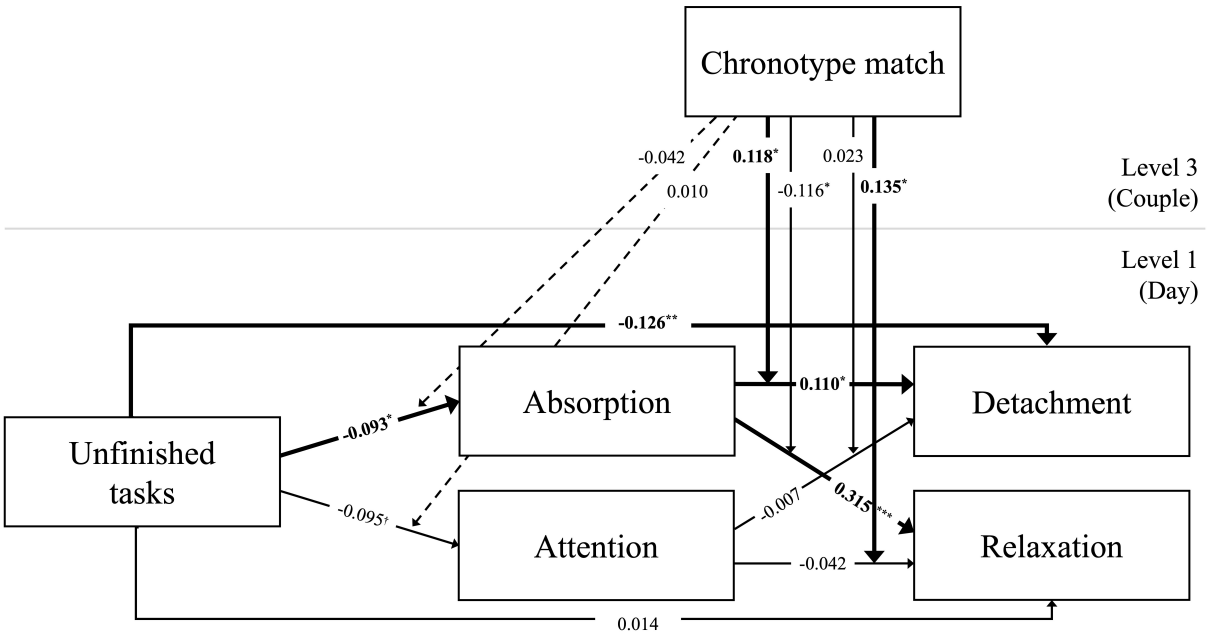
In daily life, cohabiting employees cannot only follow their own daily routines but also need to consider their partners' preferences – which can deviate considerably from their own (Randler et al., 2014). Specifically, people differ in their *chronotype*, meaning the individual timing of their circadian rhythms, such as their sleep-wake rhythm. While earlier chronotypes experience their highest activation level (energetic and cognitive) earlier in the day, the rhythms of later chronotypes are delayed (Matchock & Mordkoff, 2009; Roenneberg et al., 2003; Vitale et al., 2015). When both partners' chronotypes match, they have similar activation levels and, in turn, corresponding preferences and possibilities to recover at the same time of the day (Roenneberg et al., 2003; Vitale et al., 2015; Zijlstra et al., 2014). Thus, when couples with matching chronotypes engage in time together, they share the same recovery preferences, making engagement in their joint time especially beneficial for their recovery experiences. A match between the partners' chronotypes can therefore be an essential boundary condition for how engagement in joint time translates into recovery experiences.

In our study, we adopt a circadian perspective on recovery from work and propose that a match between partners' chronotypes plays a crucial role in dual-earner couples' daily recovery processes. Building on the stressor-detachment model (Sonnentag & Fritz, 2015) and research on family engagement (Rothbard, 2001), we propose that a higher amount of unfinished tasks impedes experiencing recovery and relates negatively to engagement in time spent with the partner after work. Engagement in time with the partner, in turn, should be

beneficial for experiencing recovery. Integrating the circadian perspective into these recovery processes, we propose that employees from couples with a higher (vs. lower) chronotype match benefit more from engagement in time with their partner, resulting in stronger relationships with recovery experiences. Additionally, we explore whether chronotype match buffers the negative relationship between unfinished tasks and engagement in time with the partner. Our full conceptual model is displayed in Figure 4.1.

Figure 4.1

Conceptual Model Including Results From Path Analyses



Note. Main effects from the cross-level moderator chronotype match to absorption, attention, detachment, and relaxation, respectively, were specified in our analyses but omitted from the figure for clarity reasons. Bold lines and numbers indicate significant paths that are in line with our hypotheses. Dashed lines indicate paths referring to our research question. Main effects were obtained from a model without cross-level interaction terms to allow for interpretation of estimates and significance. $^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Our study contributes to research in three main ways. First, we integrate a circadian perspective into the recovery literature by investigating couples' chronotype match as an important boundary condition for partners' recovery processes after work. We extend previous research that demonstrated that circadian preferences are crucial for employees at

work (e.g., Kühnel et al., 2022) by adding a new perspective that circadian preferences also relate to recovery processes after work. Especially when living together with a partner, employees cannot only follow their own preferences but also need to take their partners' circadian rhythms into account. Thus, considering partners' chronotypes can be essential when investigating their daily recovery processes.

Second, by examining couples' chronotype match as a moderator, we answer the call to investigate boundary conditions for employees' recovery processes (Sonnentag et al., 2017; Sonnentag & Fritz, 2015). Previous research focused on describing recovery for most employees, neglecting individual factors that change recovery processes (Sonnentag et al., 2017). We overcome these limitations of earlier research by introducing couples' chronotype match as a boundary condition for spending a recovering evening with the partner. These insights help to understand why some employees experience better recovery than others – and thus to derive implications for those in less favorable environments.

Third, we contribute to research on the stressor-detachment model (Sonnentag & Fritz, 2015) and the interplay between work and recovery by considering partner relationships. Many studies have already focused on the prerequisites of experiencing recovery for employees (see Sonnentag et al., 2017, 2022 for reviews). However, only few studies considered the relevance of romantic relationships for recovery. This is an unfortunate oversight as first studies demonstrated that partners are important for recovery processes (Hahn et al., 2012, 2014). Our study expands current knowledge by not only investigating the relevance of partners for recovery but also examining how unfinished tasks impede engagement in time with the partner. In doing so, we help paint a clearer picture of the tension between work and recovery for cohabiting dual-earner couples.

Unfinished Tasks and Recovery Experiences

Spending a recovering evening after work is essential to restore energetic resources

(Sonnentag et al., 2017, 2022). Apart from considering specific leisure activities leading to recovery, research mainly focuses on recovery experiences as psychological mechanisms that underlie the after-work recovery process (Sonnentag & Fritz, 2007). Two important recovery experiences that have been linked to favorable well-being states such as low fatigue and low negative affect (Bennett et al., 2018; Steed et al., 2021) are detachment and relaxation. Detachment refers to mentally disconnecting from work and thus includes that employees refrain from work-related thoughts during the evening. Relaxation describes experiencing a low level of physiological arousal (Sonnentag & Fritz, 2007). Thus, detachment and relaxation indicate that employees forget about work and relax, regardless of their specific leisure activities.

Unfinished tasks have been introduced as a relevant job stressor that delays employees' recovery (Syrek & Antoni, 2014). As a job stressor, unfinished tasks describe that employees did not complete important tasks they had planned to do during the day (Syrek et al., 2017). Since high-intensity work is prevalent and employees increasingly report high quantitative work demands (Eurofound, 2017), employees may frequently not be able to fulfill work tasks in time. Additionally, unfinished tasks do not only have implications for employees' work but also for their private life. As proposed by the stressor-detachment model (Sonnentag & Fritz, 2015), employees recover less after being exposed to job stressors. Thus, embedded in the complex interplay between work and recovery, we suggest that unfinished tasks have the potential to reach into employees' after-work hours – thereby negatively affecting their joint time with their partners and their recovery experiences.

Specifically, building on the stressor-detachment model (Sonnentag & Fritz, 2015), we suggest that unfinished tasks cut into employees' detachment and relaxation after work. The *Zeigarnik effect* (Zeigarnik, 1938) describes that unfinished tasks are more likely to be remembered than finished tasks. As a result, unfinished tasks potentially remain mentally

present even after work has ended. For example, employees might have recurring thoughts about tasks they left undone (Syrek et al., 2017; Syrek & Antoni, 2014; Weigelt et al., 2019). If work-related thoughts are still present in employees' minds, they can detach less during their after-work hours. At the same time, cognitive representation of job stressors can be accompanied by higher physiological arousal (Brosschot et al., 2005, 2006) and, thus, be associated with reduced relaxation. Indeed, previous research supports our assumptions by demonstrating that more unfinished tasks are related to experiencing less detachment (Heissler et al., 2022; Smit, 2016; only for participants working on the weekend: Weigelt & Syrek, 2017). However, Weigelt and Syrek (2017) did not find an association between unfinished tasks and relaxation, whereby they focused on a different time frame (week level instead of day level). Taken together, we assume that the amount of unfinished tasks after work is negatively related to detachment and relaxation during the evening.

Hypothesis 1: *Unfinished tasks after work are negatively related to experiencing detachment (H1a) and relaxation (H1b) during the evening.*

The Role of Engagement in Joint Time With the Partner

We argue that engagement in time with the partner is relevant for after-work recovery processes. Building on research on family engagement (Rothbard, 2001), we examine directing attention toward the partner and absorption in joint activities as key psychological facets of engagement in joint time with the partner. First, when employees direct attention toward their partners, they concentrate and focus on the partner. Second, when employees are absorbed in their time with their partners, they feel engrossed by it and lose track of time. Both facets differ such that attention relies on having a high amount of cognitive resources available, whereas absorption resembles flow experiences that involve intrinsic motivation (Rothbard, 2001). Thus, attention describes the more quantitative aspect of engagement in time together (i.e., the amount of focus on the partner), whereas absorption implies the more

qualitative aspect of engagement in time together (i.e., the intensity of focus on the partner; Rothbard, 2001). The facets are not interchangeable as they are differentially related to subsequent experiences (e.g., positive and negative affect; Rothbard, 2001). Conceptually, engagement in joint time differs from other after-work experiences such as detachment because engagement refers to the amount and intensity of employees' focus on the time they spend with their partner (Rothbard, 2001), while detachment refers to the absence of work-related thoughts during the whole evening (Sonnentag & Fritz, 2007). Although engagement in joint time with the partner and psychological detachment usually should be positively related, there are situations when this will not be the case. For example, when employees direct attention toward their partner and are absorbed in the joint time while talking about work, they would likely not detach from work while talking about it. In addition, because detachment refers to the whole evening and not just the period spent with the partner, other events during the evening might reduce detachment (e.g., receiving a work-related phone call before spending time with the partner).

Engagement in time with the partner will be challenging after stressful workdays. As research on work-family conflict (Greenhaus & Beutell, 1985) implies that aspects of the work role can make it difficult to fulfill the requirements of the private role, we propose that unfinished tasks impede directing attention toward the partner and being absorbed in joint activities. When having a high amount of unfinished tasks, employees might experience negative activation due to its nature as a job stressor (Syrek et al., 2017; Syrek & Antoni, 2014; Weigelt et al., 2019). This negative activation leads employees to focus on themselves instead of others (Mor & Winquist, 2002; Rothbard, 2001; Wood et al., 1990). However, cognitive availability for others is needed to engage in the private role at home. This availability will be limited when unfinished tasks are still negatively present in employees' minds (Syrek et al., 2017) and employees focus on themselves (Mor & Winquist, 2002;

Wood et al., 1990) rather than on their partners. Thus, unfinished tasks should impede directing attention toward the partner as employees instead focus on themselves. At the same time, unfinished tasks should impede absorption as a rather qualitative aspect of engagement in time with the partner. Because negative activation from work distracts from fully engaging in the private role (Rothbard, 2001), employees will experience a lower intensity of focus on the time with the partner as their work role still remains present. Therefore, unfinished tasks should be associated with lower absorption in joint activities. Similarly, Peifer et al. (2020) found that unfinished tasks were related to fewer flow experiences during social leisure activities – a positive and focused experience similar to absorption during joint activities with the partner. Taken together, we assume that unfinished tasks are negatively associated with engagement in time with the partner, namely being absorbed in joint activities and directing attention toward the partner.

Hypothesis 2: *Unfinished tasks after work are negatively related to experiencing absorption (H2a) and attention (H2b) as facets of engagement in time spent with the partner.*

Whether employees experience more engagement in the time with their partner should also relate to their recovery experiences after work. First, we propose that engagement in time with their partner boosts employees' detachment. Directing attention on the partner instead of work will distract employees from work-related topics and instead focus their attention on their private role. Consequently, recurring thoughts about work can be disrupted (Martin & Tesser, 1996). Thus, focusing attention on the partner should enhance employees' detachment by distracting them from work. Similarly, previous research demonstrated that employees experience fewer recurring thoughts about work when being with friends and family than when being alone (Cropley & Millward Purvis, 2003). At the same time, being absorbed in joint activities and intensely focusing on their partner enables employees to successfully switch from their work to their private roles (Rothbard, 2001). Thereby, they can leave their

work role behind such that absorption in joint activities should benefit employees' detachment. In line with this reasoning, Hahn et al. (2012) demonstrated a positive association between absorption in joint activities with the partner and detachment during the weekend.

Second, we assume that higher engagement in the time with their partners increases employees' relaxation. Directing attention toward the partner distracts employees from work-related thoughts, thereby decreasing tension stemming from the job stressors and enabling employees to relax (Brosschot et al., 2005, 2006; Greenhaus & Beutell, 1985). Likewise, intensely focusing on the partner when being absorbed in joint activities enables employees to switch from work to their private role, thus leaving work-related tension behind and being able to experience relaxation (Brosschot et al., 2005, 2006; Greenhaus & Beutell, 1985). Similarly, Hahn et al. (2012) demonstrated that absorption in joint activities with the partner during the weekend was positively associated with experiencing relaxation. Taken together, we propose that engagement in time with the partner positively relates to both detachment and relaxation after work.

Hypothesis 3: *Absorption and attention as aspects of engagement in the time spent with the partner are positively related to experiencing detachment (H3a: absorption, H3b: attention) and relaxation (H3c: absorption, H3d: attention) during the evening.*

Couples' Chronotype Match as Boundary Condition

We propose that a match between partners' circadian preferences, meaning a match between their *chronotypes,* is a relevant boundary condition for how engagement in joint time translates into recovery experiences. The two-process model of sleep regulation (Borbély, 1982; Borbély et al., 2016) suggests that a homeostatic and a circadian process interact to regulate humans' activation throughout the day, with a peak at the beginning of the day and a trough before going to sleep. The homeostatic process depends on the time spent awake and

asleep, meaning that energy, attention, and alertness naturally decrease while being awake (Dijk et al., 1992). The circadian process is subject to an internal pacemaker that governs daily circadian rhythms with a length of about 24 hours. However, interindividual differences in circadian preferences – humans' chronotypes – shift the timing of daily rhythms in activation (Borbély, 1982; Borbély et al., 2016; Roenneberg et al., 2003). In the population, chronotype follows a normal distribution, whereas earlier chronotypes have their activation peak and sleep onset earlier in the day than later chronotypes (Roenneberg et al., 2003). Thus, chronotype governs the timing of employees' peaks and troughs in cognitive as well as energetic activation throughout the day (Dijk et al., 1992; Matchock & Mordkoff, 2009; Roenneberg et al., 2003).

In a romantic relationship, both partners' chronotypes can differ. To a certain degree, circadian preferences within couples can be similar because humans are more likely to bond if they share similar characteristics (Randler & Kretz, 2011). However, previous research also demonstrated notable differences between partners. For example, Randler et al. (2014) found that participants' chronotypes differed considerably from their partners' and participants would have preferred partners with more similar chronotypes. In another study, Randler and Kretz (2011) observed only a moderate positive relationship between partners' chronotypes, leaving room for considerable differences within couples.

Since chronotype impacts daily energetic and cognitive activation rhythms, considering both partners' chronotypes is crucial when investigating dual-earner couples' daily recovery processes. Zijlstra et al. (2014) conceptualize employees' recovery from work as a dynamic process aligned with their daily rhythms in activation that are influenced by sleep processes (among others). As the circadian process interacts with the homeostatic process to regulate daily rhythms (Borbély, 1982; Borbély et al., 2016), partners with matching chronotypes in all likelihood share comparable activation levels throughout the day.

While having comparable activation levels, both partners share similar cognitive alertness, attention, and energy levels, thus having similar preferences and opportunities to recover at the same time of the day (Dijk et al., 1992; Matchock & Mordkoff, 2009; Roenneberg et al., 2003). For example, previous research demonstrated that circadian preferences can be crucial for recovery preferences with regard to specific recovery activities (e.g., daily peaks in physical activity; Vitale et al., 2015; preferred timing of music activities; Wright & Palmer, 2022). Thus, having matching chronotypes may help partners to benefit from the same recovery activities in terms of recovery experiences.

Building on this circadian perspective on recovery from work (Zijlstra et al., 2014), we propose that the cognitive and energetic alignment of partners with matching chronotypes will affect how engagement in their joint time translates into recovery experiences. In this context, we investigate the couples' chronotype match as a boundary condition for the relationship between the engagement in time with the partner (i.e., absorption and attention) and subsequent recovery experiences (i.e., detachment and relaxation). Especially when employees engage in joint time with their partners, a match between their own and their partner's chronotype becomes of relevance because their recovery no longer only depends on their own decisions, recovery preferences, and needs, but also their partner's. Thus, we assume that matching chronotypes are particularly beneficial in the interplay with employees' engagement in joint time with the partner by changing the way employees benefit from this engagement.

Specifically, we suggest that the more similar the partners' chronotypes are, the more engagement in time together translates into recovery experiences – both detachment, as the more cognitive aspect, and relaxation, as the more energetic aspect. First, the couples' chronotype match and the resulting cognitive alignment should strengthen the relationship between engagement in the time with the partner (i.e., attention and absorption) and

experiencing detachment. Detachment implies being mentally distanced from work and thereby refers to cognitive processes (Sonnentag & Fritz, 2007). When both partners' chronotypes match, they experience a similar cognitive activation at the same time of the day. Thus, the partners' engagement in their joint time fits both their cognitive activation levels and recovery preferences (Zijlstra et al., 2014). Mentally detaching from work requires self-regulation to stop recurring thoughts about work. By being absorbed in their joint time and aligning their attention to their respective partner, it will be more likely that partners succeed in directing their focus away from work and, consequently, that work-related thoughts are less present (Martin & Tesser, 1996).

Contrarily, if the partners' chronotypes do not match, the timing of their joint time might not fit both partners' cognitive activation levels. Thus, self-regulation to detach from work will be more challenging (Germeys & de Gieter, 2018; Sonnentag, 2018) because the partners' activation levels might counteract their willingness to detach from work. While they might still be absorbed in their joint time and focus attention on their partners, the engagement will not translate to experiencing detachment. Therefore, we propose that the more the partners' chronotypes match, the more engagement in time with the partner (i.e., absorption, attention) translates into experiencing detachment.

Moreover, the couples' chronotype match and the resulting energetic alignment should strengthen the relationship between engagement in joint time with the partner and experiencing relaxation. Relaxation implies having low physiological arousal and thereby focuses on energetic processes (Sonnentag & Fritz, 2007). When both partners' chronotypes match, they share similar energetic activation levels and can adjust their joint time to their shared activation levels. Thus, focusing attention on the partner and being absorbed in the joint time should be especially beneficial for experiencing relaxation. For example, when both partners experience low energetic activation, they might both prefer engaging in

relaxing activities, making the engagement in joint time especially beneficial for relaxation due to their aligned recovery preferences. Thereby, experiencing relaxation while engaging in the time together will be enhanced.

On the contrary, when their chronotypes do not match, partners might compromise on spending time together that does not fit both their energy levels. Therefore, the partners might invest energetic resources in engagement in the time with their partners and thus feel less relaxed. For example, partners with mismatched chronotypes might compromise on high-effort activities, although the partner being an earlier chronotype prefers relaxing activities following their advanced activity peak (Vitale et al., 2015). Hence, being fully absorbed in joint time and focusing attention on the partner comes with a cost when chronotypes do not match, ultimately reflected in experiencing less relaxation. Accordingly, engaging in joint time should especially translate into relaxation if both partners' chronotypes, and thus their energy levels, match.

Taken together, we propose that employees being in a couple with a higher (vs. lower) chronotype match benefit more from engagement in time with the partner (i.e., being absorbed in joint activities, directing attention toward the partner), resulting in stronger relationships between engagement in joint time and detachment and relaxation, respectively.

Hypothesis 4: *Chronotype match moderates the relationships between absorption and attention during time spent with the partner and detachment (H4a: absorption, H4b: attention) as well as relaxation (H4c: absorption, H4d: attention) such that the relationships are stronger positive when both partners' chronotypes are more similar than when their chronotypes are less similar.*

Apart from influencing how engagement in joint time with their partners relates to employees' recovery experiences, one might speculate whether the couples' chronotype match also matters in the interplay with employees' unfinished tasks. On the one hand, the

couples' chronotype match might not play a role in the interplay with unfinished tasks. The relationship between unfinished tasks and engagement in joint time could reflect an individual process and therefore not depend as much on the partner. Instead, individual boundary conditions referring to employees' specific work situation might have an impact on how unfinished tasks reach into their after-work hours. For example, previous research demonstrated that unfinished tasks primarily impair employees' after-work hours if their leaders have high performance expectations (Syrek & Antoni, 2014).

On the other hand, matching chronotypes might enable partners to experience higher engagement in their joint time despite having many unfinished tasks. While unfinished tasks can undermine employees' engagement in the time with their partners (see Hypothesis 2), the couples' chronotype match might act as a resource facilitating engagement in the joint time. Specifically, cognitive alignment of partners with matching chronotypes (Dijk et al., 1992; Matchock & Mordkoff, 2009) could help them more easily experience a higher amount and intensity of focus on each other, thereby facilitating leaving the work role and distracting from unfinished tasks. In doing so, the couples' chronotype match might buffer the negative relationship between unfinished tasks and attention as well as absorption such that the relationships are less negative when the partners' chronotypes match more. Given that there are valid arguments for both the existence and non-existence of a moderation effect, we exploratorily examine whether the couples' chronotype match also moderates the relationship between unfinished tasks and engagement in time with the partner.

Research Question 1: *Does chronotype match moderate the relationships between unfinished tasks and absorption (RQ1a) as well as attention (RQ1b) such that the negative relationships are weaker when both partners' chronotypes are more similar than when their chronotypes are less similar?*

Methods

Study Design and Sample

We tested our hypotheses using a daily diary study with cohabiting dual-earner couples. The study was part of a larger research project on dual-earner couples' daily work and non-work experiences.[9] Both partners had to work for 30 hours on at least four days of the week to be eligible for participation in the study. In addition, we excluded persons who were self-employed or worked night shifts. We recruited dual-earner couples online via various social media websites (e.g., Facebook) and, partly, with the help of undergraduate psychology students. During data collection, we followed recommendations on student-recruited samples from Wheeler et al. (2014) and supervised the undergraduate students closely. When completing at least 80% of the daily surveys, participants had the chance to win one of two vouchers (worth 50€) for an online retailer and received a PDF summary of the study results. Data collection took place between October 2020 and May 2021 in Germany. During this period, Germany was affected by the COVID-19 pandemic such that social distancing rules and partial restrictions on leisure activities (e.g., large-scale sports and cultural events were prohibited and the number of participants in private gatherings was limited) applied.

The dual-earner couples registered online to participate in our study. One partner started the registration process and was asked to provide an e-mail address of their partner. Using a feature of our survey provider, we were thus able to match the partners' data via individualized links without compromising their anonymity. Both partners then received invitations to all online surveys via e-mail and answered the surveys independently. Before the daily diary period started, we invited both partners to fill out a general survey. Afterward,

[9] This is the first publication from this dataset.

both partners filled out three surveys per day (in the morning, after work, before going to bed) for two workweeks (Monday to Friday). We invited participants to the daily surveys at individually tailored times to increase compliance and decrease burden due to receiving e-mails at inconvenient times of the day. To individually time the surveys, we asked participants to indicate when they usually wake up, end their work, and go to bed on each day of the week (Monday to Friday). Based on this information, we invited participants to the daily surveys. We sent reminders after two hours and limited the availability of all daily surveys to four hours after receiving the first invitation.

In total, 282 employees registered for the study, of which 244 could be matched to 122 dual-earner couples and were thus eligible to participate in our study. The general survey was completed by 233 participants. We had to exclude 18 participants because we could not compute their chronotype[10] and another 27 participants because information on their partner's chronotype was missing, so we could not compute the couple's chronotype match. Of the remaining 188 participants, 185 completed at least one daily survey. On the day level, we excluded days when participants did not work and days when the two partners did not spend time together during the evening. In addition, we ensured that there was a reasonable time lag between the after-work and the bedtime surveys (i.e., we only included after-work surveys with at least 30 minutes difference between completing the after-work survey and starting the bedtime survey). As the last step, we only included participants who completed each daily survey at least twice to allow for variance in their daily data. The final sample included 79 couples with 143 employees providing data on 1,052 days (morning survey: n = 1,006, after-

[10] When participants indicate that they cannot freely choose when they sleep on non-workdays, for example due to childcare or other obligations, chronotype cannot be computed with the questionnaire we used (Roenneberg et al., 2003). Thus, we excluded all participants who could not freely choose their sleep times and indicated that they wake up by an alarm clock on non-workdays.

work survey: n = 967, bedtime survey: n = 1,052). We included 15 participants in our final sample whose partners did not provide enough daily diary data (but answered the general survey) because we were mainly interested in individual day-level relationships.

Among our final sample, most dual-earner couples were married (60.8%), and one fourth lived with children in the same household (26.6%). A proportion of couples reported working in similar jobs (22.8%), in the same organization (16.5%), or directly together as colleagues (5.1%). Participants' mean age was 42.2 (SD = 11.7) years, and about half of the sample was female (51.8%). Participants worked in various occupations (e.g., healthcare, social, and educational jobs; administrative and office jobs; technical jobs) and mainly without leadership responsibilities (65.0%). On the day level, participants worked from home on about half of the days (48.1%), and the couples spent 3.1 (SD = 1.8) hours together during the evenings.

To rule out selective attrition in our data, we compared the 143 participants in our final sample to the 90 participants that also completed the general survey, but were not included in our analyses. Participants included in our final sample (M = 42.2 years) were slightly older than excluded participants (M = 39.2 years), $t(203.99) = 2.02$, $p = .044$. However, we found no differences regarding gender, $\chi^2\,(1) = 0.10$, $p = .748$, education, $t(168.61) = 1.02$, $p = .308$, weekly work hours, $t(220.68) = 1.50$, $p = .114$, working in leadership positions, $\chi^2\,(1) = 0.22$, $p = .642$, or living with children in the same household, $\chi^2\,(1) = 2.97$, $p = .084$. In addition, we found that chronotype did not differ between our final sample and the 72 participants whose chronotype we could compute but who were not included in our analyses, $t(130.95) = -1.00$, $p = .321$.

Measures

We assessed both partners' chronotypes in the general survey and used this information to compute the match between their chronotypes. In the daily surveys, we

measured unfinished tasks (after work), engagement in joint time with the partner (absorption and attention, before going to bed), recovery experiences (detachment and relaxation, before going to bed), as well as the control variables (positive affect, in the morning; working from home, after work). We shortened scales to reduce participant burden and adapted items to fit the daily assessment if necessary. In the daily surveys, all items had to be answered on a 5-point Likert scale ranging from 1 = *not at all true* to 5 = *absolutely true*. The items were presented in German.

Chronotype und Chronotype Match

We used the Munich Chronotype Questionnaire to assess both partners' chronotypes (Roenneberg et al., 2003). Participants reported their usual sleep times on workdays and non-workdays (e.g., weekends, holidays) during the last four weeks. Chronotype is then defined by the mid-point of sleep on non-workdays (MSF_{SC}), meaning the mid-point between sleep onset and waking up on non-workdays. To correct oversleeping on non-workdays, this index is corrected by subtracting half of the difference between the average sleep duration on workdays and non-workdays (Roenneberg et al., 2012; Wittmann et al., 2006). For example, when employees usually fall asleep at 11:30 p.m. and wake up at 7 a.m. on non-workdays, their mid-point of sleep is 3:15 a.m. Thus, their chronotype based on their MSF_{SC} is 3.25, assuming they did not oversleep on non-workdays. Higher values indicate later chronotypes. The MSF_{SC} is a reasonable indicator of humans' chronotype as it correlates highly with objective markers of the sleep-wake cycle (Kantermann et al., 2015). Based on both partners' chronotypes, we calculated the couples' chronotype match as the absolute difference of the partners' chronotypes. This procedure is in line with previous approaches to describing similarities between partners' chronotypes (Chen, 2018; Díaz-Morales et al., 2019; Jocz et al., 2018; Randler & Kretz, 2011) as well as other constructs in chronobiological research calculated as difference scores (Kühnel et al., 2016; Wittmann et al., 2006). For data analysis,

we grand-mean centered and recoded this variable such that higher values indicate a higher match of both partners' chronotypes.

Unfinished Tasks

In the daily after-work surveys, we measured unfinished tasks using four items from the scale by Syrek et al. (2017). A sample item is "I have not finished important tasks I had planned to do today." Cronbach's alpha was .82 on the day level and .98 on the person level (Geldhof et al., 2014).

Engagement in Joint Time With the Partner

In the daily bedtime surveys, we assessed absorption and attention as aspects of engagement in joint time with the partner using three items each adapted from a scale by Rothbard (2001). Because the original items focus on the whole family, we adapted them so that they refer to the time spent with the partner. As the items were not available in German, we translated them using the back-translation method from Brislin (1970). Sample items are "When I was together with my partner today after work, I was completely engrossed by it." for absorption and "Today after work, I focused a great deal of attention on my partner." for attention. Cronbach's alpha for absorption was .70 on the day level, .87 on the person level, and .96 on the couple level. Cronbach's alpha for attention was .83 on the day level, .98 on the person level, and .99 on the couple level (Geldhof et al., 2014).

Recovery Experiences

To capture the recovery experiences detachment and relaxation in the daily bedtime surveys, we used three items each from the Recovery Experience Questionnaire by Sonnentag and Fritz (2007). Sample items are "Today after work, I forgot about work." for detachment and "Today after work, I used the time to relax." Cronbach's alpha for detachment was .82 on the day level and .98 on the person level. Cronbach's alpha for relaxation was .80 on the day level and .93 on the person level (Geldhof et al., 2014).

Control Variables

We used three control variables to increase robustness of our results.[11] First, we used positive affect in the morning to control daily affective tendencies in our self-report data (cf. Rothbard & Wilk, 2011). Specifically, we used six items from the German version of the Positive and Negative Affect Schedule (Krohne et al., 1996; Watson et al., 1988). Participants indicated how they felt at the moment (e.g., "interested") on a 5-point Likert scale ranging from 1 = *not at all* to 5 = *completely.* Second, we controlled for the day of the week (coded 1 = *Monday* to 5 = *Friday*) on which the respective surveys were answered to rule out that our results were affected by day-of-the-week effects (Beal & Weiss, 2003). Third, we controlled for the work location during the respective day (coded 0 = *not working from home*, 1 = *working from home*) to ensure that our results were not affected by participants working from home.

Analytic Strategy

Our data has a three-level structure with days nested within employees and employees nested within couples. Following recommendations for missing-data handling, we imputed missing data prior to data analysis to use all data available (Newman, 2014). For imputation, we used the software Blimp 3 (Keller & Enders, 2022) to conduct model-based multiple imputations of 50 datasets (50,000 burn-in iterations, drawing imputations every 20,000 iterations) following recommendations for multilevel models with cross-level interaction effects from Enders et al. (2020).

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[11] We also tested person-level (e.g., age, relationship quality) as well as couple-level (e.g., having children, being married) characteristics as additional covariates in all models. Importantly, this inclusion did not change any of our results. Because of the day-level focus of our research model and considering the complexity of our analyses, we decided to remove these variables in our final analyses.

We tested our hypotheses using three-level path models in Mplus 8.7 (Muthén & Muthén, 2017; Preacher, 2011). We first specified a random-intercept path model without interaction terms to test all main effects (Hypotheses 1-3). To avoid convergence problems, we specified the respective paths at the day level (Level 1) only. However, we estimated the means, variances, and covariances of the day-level variables at all three levels to correctly decompose variance into day-level, person-level, and couple-level variance. Using this approach, we did not center the day-level variables beforehand, as they are implicitly centered in the model through variance decomposition (Preacher, 2011; Preacher et al., 2010). At the couple level (Level 3), we included the main effects from the cross-level moderator chronotype match (grand-mean centered) to absorption, attention, detachment, and relaxation, respectively. These main effects were omitted in our hypotheses but are necessary to correctly model the cross-level interactions in the next step (Preacher et al., 2016). To test Hypothesis 4, we then analyzed a full model with the respective main effects and the cross-level interaction effects on the relationship between engagement in joint time (absorption, attention) and recovery experiences (detachment, relaxation). To examine Research Question 1, we analyzed a similar model with the respective main effects and the cross-level interaction effects on the relationship between unfinished tasks and engagement in joint time (absorption, attention). In both models, we specified random slopes for the day-level paths later involved in the cross-level interactions (i.e., the paths between unfinished tasks and engagement in joint time as well as the paths between engagement and joint time and recovery experiences were modeled as random; Heisig & Schaeffer, 2019). In addition, we modeled the covariances between the variables, the covariances between the random slopes, and the covariances between the random slopes and the variables as recommended by Preacher et al. (2010). Then, we entered the grand-mean centered cross-level moderator chronotype match to predict the respective random slopes (Aguinis et al., 2013; Preacher et

al., 2016). In cases of significant interaction terms, we calculated simple slope tests at low (-1*SD*) and high (+1*SD*) values of our cross-level moderator chronotype match (Aiken et al., 1991; Preacher et al., 2016).

Preliminary Analyses

We conducted three-level confirmatory factor analyses in Mplus 8.7 (Muthén & Muthén, 2017) to test the construct validity of our measures. We specified a five-factor model with all items of the Likert-scaled variables loading on distinct factors (unfinished tasks, absorption, attention, detachment, and relaxation) on all three levels. This five-factor model fit the data well, χ^2 (282) = 370.102, $p < .001$, SCF = 1.036, RMSEA = 0.017, CFI = 0.987, TLI = 0.983. In addition, it fit the data better than two four-factor models with absorption and attention, χ^2 (294) = 491.748, $p < .001$, SCF = 1.019, RMSEA = 0.025, CFI = 0.971, TLI = 0.964; Satorra-Bentler $\Delta\chi^2$ (12) = 190.715, $p < .001$, as well as with detachment and relaxation, χ^2 (294) = 1488.424, $p < .001$, SCF = 0.946, RMSEA = 0.062, CFI = 0.822, TLI = 0.782; Satorra-Bentler $\Delta\chi^2$ (12) = 881.737, $p < .001$, loading on the same factor, respectively. Thus, we continued with our assumed five-factor structure of the day-level variables.

The descriptive statistics, day- and couple-level correlations, and intraclass correlations (ICC) of our variables are displayed in Table 4.1. Person-level correlations can be found in Table A4.1 in the Appendix. The partners' chronotypes deviated, on average, by 0.7 (*SD* = 0.7) hours, corresponding to 42 minutes. In the sample, chronotype match ranged from couples with a perfect match (deviation = 0 minutes) to couples with 3.3 hours, corresponding to 199.8 minutes, difference between their chronotypes. The ICCs demonstrated that the variables varied considerably between days, persons, and couples, justifying our three-level data analyses. Especially absorption and attention during time spent with the partner as well as positive affect in the morning exhibited variance between couples (with 29.8%, 24.4%, and 34.2%, respectively).

Table 4.1

Descriptive Statistics, Intraclass Correlations, and Correlations of all Variables

	M	*SD* (Day)	*SD* (Person)	*SD* (Couple)	ICC (Day)	ICC (Person)	ICC (Couple)	2	3	4	5	6	7
Couple level													
1 Chronotype match[a]	0.7	-	-	0.7	-	-	-	-.02	.13	.07	-.11	-.10	-.01
Day level													
2 Unfinished tasks	2.2	0.6	0.9	0.7	33.1%	54.0%	12.9%		-.23*	-.26*	-.42***	-.25*	-.29**
3 Absorption	3.0	0.6	0.8	0.7	48.8%	27.4%	29.8%	-.09**		.86***	.21	.47***	.20
4 Attention	3.3	0.6	0.7	0.6	50.7%	24.9%	24.4%	-.08*	.63***		.25*	.39***	.28*
5 Detachment	3.7	0.7	0.8	0.7	48.7%	39.4%	12.0%	-.12***	.11***	.07*		.27*	.24*
6 Relaxation	3.5	0.7	0.7	0.6	54.3%	24.7%	21.0%	.00	.28***	.15***	.21***		.38***
7 Positive affect	2.7	0.5	0.7	0.7	33.9%	31.9%	34.2%	.00	.06*	.03	.00	.04	

Note. [a] Deviation between partners' chronotypes in decimal hours. Day: Level 1. Person: Level 2. Couple: Level 3. Intraclass correlations (ICC) demonstrate the proportion of variance that is attributable to the respective level. Correlations below the diagonal are day-level correlations (N = 1,052). Correlations above the diagonal are couple-level correlations (N = 79). Person-level correlations are omitted from the table for clarity.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Results

Hypotheses Testing

An overview of the results of all path models can be found in Figure 4.1. First, to test Hypotheses 1 to 3, we specified a random-intercept three-level path model including only the main effects. On the day level, we included main effects from unfinished tasks to absorption, attention, detachment, and relaxation, as well as from absorption and attention to detachment and relaxation, respectively. On the couple level, we included the main effects from chronotype match to absorption, attention, detachment, and relaxation, respectively. Results of this path model are presented in Table 4.2.

In Hypothesis 1, we assumed that unfinished tasks after work are negatively related to experiencing detachment (H1a) and relaxation (H1b) during the evening. In line with Hypothesis 1a, but not 1b, we found a significant negative association between unfinished tasks and detachment (unstandardized path estimate [est.] = -0.126, *SE* = 0.042, *p* = .003), but not between unfinished tasks and relaxation (est. = 0.014, *SE* = 0.034, *p* = .687). Hypothesis 2 stated that unfinished tasks are negatively related to experiencing absorption (H2a) as well as attention (H2b) during time spent with the partner. In line with Hypothesis 2a, unfinished tasks were negatively related to absorption in joint activities with the partner (est. = -0.093, *SE* = 0.042, *p* = .027). Unfinished tasks tended to be negatively related to directing attention toward the partner but failed to reach conventional significance levels (est. = -0.095, *SE* = 0.049, *p* = .052). Accordingly, Hypothesis 2b was not supported. In Hypothesis 3, we proposed that absorption and attention during joint time are positively related to detachment (H3a: absorption, H3b: attention) and relaxation (H3c: absorption, H3d: attention) during the evening. Indeed, being absorbed in joint activities with the partner was positively associated with detachment (est. = 0.110, *SE* = 0.054, *p* = .042) and with relaxation (est. = 0.315, *SE* = 0.046, *p* < .001). Accordingly, both Hypothesis 3a and Hypothesis 3c were supported.

Table 4.2

Results of Three-Level Path Analysis: Random-Intercept Model With Main Effects Only

	Unfinished tasks		Absorption		Attention		Detachment		Relaxation	
Predictor	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***
Intercept	2.462***	0.105	2.816***	0.115	3.232***	0.096	3.538***	0.097	2.286***	0.101
Day level (Level 1)										
Day of the week[a]	-0.060**	0.017	0.052**	0.016	0.017	0.016	0.019	0.018	0.033†	0.018
Working from home[b]	-0.132†	0.069	-0.009	0.081	0.028	0.076	0.048	0.077	0.024	0.072
Positive affect morning	0.003	0.053	0.084	0.051	0.048	0.049	-0.006	0.047	0.027	0.047
Unfinished tasks			-0.093*	0.042	-0.095†	0.049	-0.126**	0.042	0.014	0.034
Absorption							0.110*	0.054	0.315***	0.046
Attention							-0.007	0.054	-0.042	0.051
Residual variance	0.398***	0.037	0.419***	0.034	0.417***	0.034	0.546***	0.044	0.451***	0.029
Person level (Level 2)										
Intercept variance	0.654***	0.122	0.274***	0.059	0.210***	0.059	0.449***	0.081	0.214***	0.046
Couple level (Level 3)										
Chronotype match			0.117	0.091	0.053	0.089	-0.135	0.095	-0.080	0.088
Intercept variance	0.162	0.105								
Residual variance			0.218**	0.089	0.196**	0.071	0.122†	0.068	0.187***	0.049

Note. [a] coded 1 to 5 for Monday to Friday. [b] coded 1 = working from home and 0 = not working from home. Est. = Unstandardized path estimate. $N = 79$ couples with $N = 143$ employees providing data on $N = 1{,}052$ days. Day of the week, working from home, and positive affect in the morning were included as control variables.
$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 4.3

Results of Three-Level Path Analysis: Random-Slope Model With Cross-Level Interaction Effects Testing Hypothesis 4

	Unfinished tasks		Absorption		Attention		Detachment		Relaxation	
Predictor	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***
Intercept	2.464***	0.106	2.818***	0.114	3.234***	0.097	3.185***	0.175	2.520***	0.146
Day level (Level 1)										
Day of the week[a]	-0.061***	0.017	0.052**	0.016	0.017	0.017	0.018	0.018	0.032†	0.019
Working from home[b]	-0.132†	0.069	-0.009	0.082	0.032	0.078	0.070	0.079	0.011	0.073
Positive affect morning	-0.004	0.053	0.082	0.051	0.046	0.049	-0.013	0.045	0.035	0.048
Unfinished tasks			-0.091*	0.042	-0.093†	0.049	-0.127**	0.041	0.008	0.030
Absorption (ABS)							0.108†	0.056	0.314***	0.046
Attention (ATT)							-0.005	0.061	-0.034	0.052
Residual variance	0.400***	0.037	0.418***	0.034	0.416***	0.034	0.526***	0.046	0.434***	0.031
Person level (Level 2)										
Intercept variance	0.648***	0.120	0.275***	0.061	0.207***	0.048	0.389**	0.132	0.183**	0.060
Couple level (Level 3)										
Chronotype match (CTM)							-0.129	0.268	-0.640**	0.232
CTM x ABS							0.118*	0.056	0.023	0.051
CTM x ATT							-0.116*	0.055	0.135*	0.059
Intercept variance	0.161	0.104	0.319**	0.106	0.225**	0.085				
Residual variance							0.486	0.337	0.392	0.245
Slope ABS variance							0.021	0.052	0.021	0.029
Slope ATT variance							0.025	0.052	0.024	0.035
Intercept x slope ABS covariance							-0.036	0.082	-0.034	0.054
Intercept x slope ATT covariance							-0.051	0.091	-0.029	0.042
Slope ABS x slope ATT covariance							-0.014	0.044	-0.017	0.031

Note. [a] coded 1 to 5 for Monday to Friday. [b] coded 1 = working from home and 0 = not working from home. Est. = Unstandardized path estimate. $N = 79$ couples with $N = 143$ employees providing data on $N = 1{,}052$ days. Day of the week, working from home, and positive affect in the morning were included as control variables.
$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

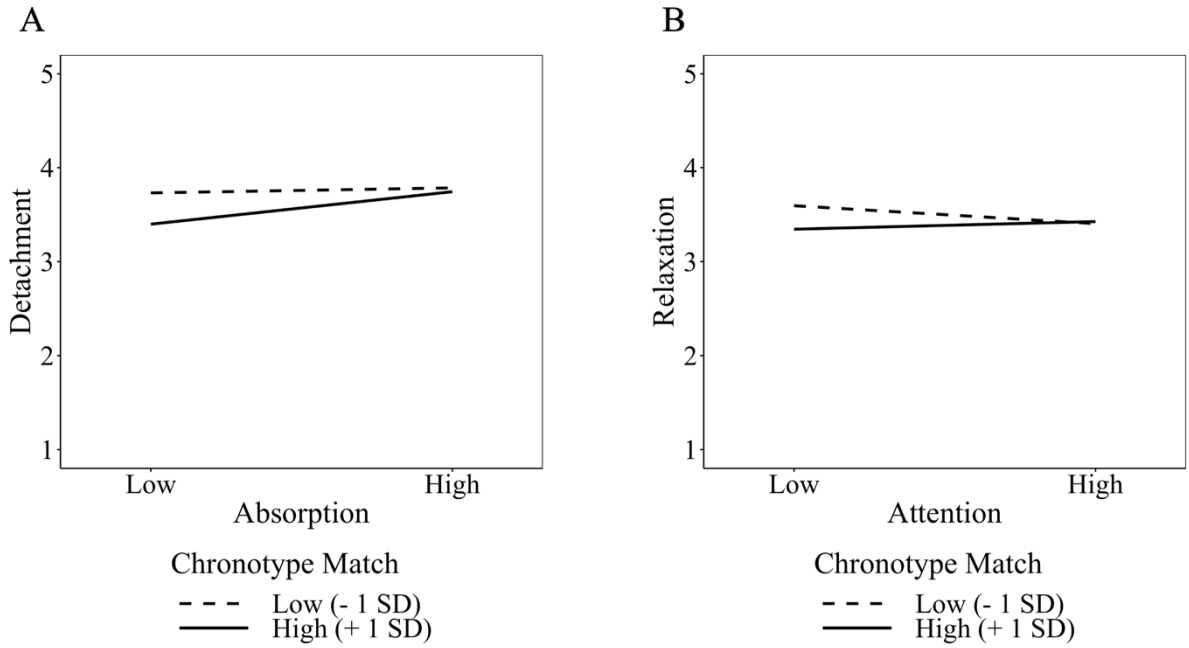
Directing attention toward the partner, however, was related to neither of the recovery experiences (predicting detachment: est. = -0.007, *SE* = 0.054, *p* = .904; predicting relaxation: est. = -0.042, *SE* = 0.051, *p* = .409), thus not supporting Hypotheses 3b and 3d. Lastly, the main effects of the couples' chronotype match to couple-level (Level 3) engagement in time with the partner (predicting absorption: est. = 0.117, *SE* = 0.091, *p* = .201; predicting attention: est. = 0.053, *SE* = 0.089, *p* = .549) as well as to recovery experiences (predicting detachment: est. = -0.135, *SE* = 0.095, *p* = .155, predicting relaxation: est. = -0.080, *SE* = 0.088, *p* = .364) were not significant. This indicates that couples with matching chronotypes experienced neither greater engagement in their joint time nor greater recovery experiences in general.

To test Hypothesis 4, we included the cross-level interaction effects of chronotype match on the relationship between engagement in time with the partner (absorption, attention) and recovery experiences (detachment, relaxation) into the main-effects three-level path model (see Table 4.3). In Hypothesis 4, we assumed that chronotype match moderates the relationships between absorption and attention during time spent with the partner and detachment (H4a: absorption, H4b: attention) and relaxation (H4c: absorption, H4d: attention), respectively, such that the relationships are more positive when both partners' chronotypes are more similar than when their chronotypes are less similar. Supporting Hypothesis 4a, chronotype match moderated the relationship between absorption and detachment (est. = 0.118, *SE* = 0.056, *p* = .034). In line with our assumptions, simple slope tests demonstrated that for couples with higher chronotype match, the relationship between absorption and detachment was positive and significant (+1*SD*; simple slope = 0.191, *SE* = 0.076, *p* = .012), but this relationship was not significant for couples with lower chronotype match (-1*SD;* simple slope = 0.025, *SE* = 0.059, *p* = .667). The interaction effect is displayed in Figure 4.2A. When visually inspecting this interaction effect, we noticed that

employees from couples with lower chronotype match reported higher detachment when absorption in joint time was *low* compared with employees from couples with higher chronotype match. Thus, it is important to note that the interaction pattern suggests that employees' detachment did not *benefit* more from absorption but rather *depended* more on absorption if the partners' chronotypes were more similar.

Figure 4.2

Interaction Plots of Significant Cross-Level Interaction Effects With Chronotype Match



Note. Panel A: Cross-level interaction effect of couples' chronotype match on the relationship between absorption in joint activities with the partner and detachment. Panel B: Cross-level interaction effect on the relationship between focusing attention on the partner and relaxation.

Chronotype match was a significant moderator of the relationship between attention and detachment (est. = -0.116, *SE* = 0.055, *p* = .036), but neither the simple slope for couples with lower chronotype match (-1*SD;* simple slope = 0.076, *SE* = 0.065, *p* = .246), nor the simple slope for couples with higher chronotype match (+1*SD;* simple slope = -0.086, *SE* =

0.079, p = .272) were significant. Thus, Hypothesis 4b was not supported. The relationship between absorption and relaxation was not moderated by the couples' chronotype match (est. = 0.023, SE = 0.051, p = .656), resulting in Hypothesis 4c not being supported. Lastly, chronotype match moderated the relationship between attention and relaxation (est. = 0.135, SE = 0.059, p = .023). However, in contrast to our assumptions, simple slope tests demonstrated that the relationship between attention and relaxation was negative and significant for couples with lower chronotype match (-1*SD*; simple slope = -0.128, SE = 0.054, p = .018) and positive but not significant for couples with higher chronotype match (+1*SD;* simple slope = 0.061, SE = 0.077, p = .426). Figure 4.2B displays the interaction effect. Therefore, this interaction effect suggests that employees' relaxation did not *benefit* more from attention if the partners' chronotypes were *more* similar but that focusing attention on the partner *harmed* employees' relaxation if the partners' chronotypes were *less* similar. Thus, because the overall result pattern of the simple slopes is not fully in line with our assumptions, Hypothesis 4d was not supported.

To examine Research Question 1, we included the cross-level interaction effects of chronotype match on the relationship between unfinished tasks and engagement in time with partner (absorption, attention) into the main-effects three-level path model (see Table 4.4). Research Question 1 referred to whether chronotype match moderates the relationship between unfinished tasks and absorption (RQ1a) as well as attention (RQ1b). However, none of these interaction terms were significant (predicting absorption: est. = -0.042, SE = 0.049, p = .394; predicting attention: est. = 0.010, SE = 0.049, p = .831). Thus, with regard to Research Question 1, we conclude that the partners' chronotype match did not buffer the negative relationship between unfinished tasks and engagement in time with the partner.

Table 4.4

Results of Three-Level Path Analysis: Random-Slope Model With Cross-Level Interaction Effects Examining Research Question 1

	Unfinished tasks		Absorption		Attention		Detachment		Relaxation	
Predictor	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***
Intercept	2.465***	0.105	3.028***	0.134	3.429***	0.134	3.569***	0.097	3.358***	0.100
Day level (Level 1)										
Day of the week[a]	-0.061***	0.018	0.051**	0.017	0.016	0.017	0.019	0.018	0.033†	0.018
Working from home[b]	-0.135*	0.068	-0.004	0.081	0.042	0.079	0.039	0.076	0.009	0.073
Positive affect morning	-0.001	0.051	0.089	0.052	0.054	0.048	-0.010	0.047	0.026	0.047
Unfinished tasks (UFT)			-0.081†	0.042	-0.077†	0.044	-0.127**	0.042	0.018	0.031
Absorption							0.120*	0.059	0.326***	0.050
Attention							-0.004	0.055	-0.035	0.051
Residual variance	0.399***	0.037	0.411***	0.035	0.404***	0.032	0.546***	0.044	0.450***	0.029
Person level (Level 2)										
Intercept variance	0.651***	0.122	0.277***	0.074	0.211***	0.056	0.447***	0.081	0.216***	0.050
Couple level (Level 3)										
Chronotype match (CTM)			0.203	0.125	0.017	0.122				
CTM x UFT			-0.042	0.049	0.010	0.049				
Intercept variance	0.161	0.104					0.122†	0.071	0.149**	0.049
Residual variance			0.153	0.327	0.189	0.097				
Slope variance			0.019	0.058	0.024	0.016				
Intercept x slope covariance			0.009	0.141	-0.026	0.033				
Slope x slope covariance			0.020†	0.011						

Note. [a] coded 1 to 5 for Monday to Friday. [b] coded 1 = working from home and 0 = not working from home. Est. = Unstandardized path estimate. $N = 79$ couples with $N = 143$ employees providing data on $N = 1{,}052$ days. Day of the week, working from home, and positive affect in the morning were included as control variables.
$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

In all path models, we included the main effects from our control variables positive affect in the morning, day of the week, and work location (working from home yes vs. no) on the main variables in our model: unfinished tasks, absorption and attention, as well as detachment and relaxation.[12] Day of the week[13] was negatively related to unfinished tasks (est. = -0.060, *SE* = 0.017, *p* = .001), positively related to absorption (est. = 0.052, *SE* = 0.016 *p* = .001), and tended to be positively related to relaxation (at *p* < .10; est. = 0.033, *SE* = 0.018, *p* = .074). These results imply that the amount of unfinished tasks decreased from Monday to Friday, whereas absorption in joint activities with the partner and relaxation (at *p* < .10) increased. In addition, working from home tended to be negatively related to unfinished tasks (at *p* < .10; est. = -0.132, *SE* = 0.069, *p* = .056), suggesting that the amount of unfinished tasks tended to be lower when employees worked from home on the respective day. Otherwise, working from home was not related to any of the variables, reinforcing that the large amount of working-from-home days in our sample did not affect the results (see Table 4.2). Positive affect in the morning did not relate to the day-level variables investigated (see Table 4.2). Taken together, our three control variables were only of limited relevance.

As the last step, we investigated how much variance was explained in the variables of our path model by using the approach from Raudenbush and Bryk (1992). To do so, we first analyzed random-intercept models (LaHuis et al., 2014) and computed the amount of day-level variance in our variables that was explained by the predictors over and above the

[12] We also tested the path models without the three control variables. The direction and significance of our results remained the same with one exception: The path between unfinished tasks and attention, which failed to reach conventional significance levels in the analyses with control variables, was significant at *p* < .05 when omitting the control variables from the main-effects model (est. = -0.104, *SE* = 0.049, *p* = .032).

[13] We also tested cyclical effects of day of the week by including its sine and cosine functions as predictors on Level 1 (within-person level). Only our predictor unfinished tasks was significantly and negatively predicted by its cosine function. Including cyclical effects did not change any results (i.e., direct effects or interaction effects) compared to the path model including only the linear effect of day of the week.

control variables. The predictors explained 0.7% of day-level variance in absorption, 1.0% of day-level variance in attention, 2.3% of day-level variance in detachment, and 7.6% of day-level variance in relaxation. Additionally, comparing our interaction-effects model to a main-effects model with random slopes, chronotype match explained 30.0% of day-level variance in the absorption-detachment slope, 28.6% of day-level variance in the attention-detachment slope, 19.2% of day-level variance in the absorption-relaxation slope, and 35.1% of day-level variance in the attention-relaxation slope.

Additional Analyses

We conducted three sets of additional analyses. First, we wanted to shed further light on whether engagement in joint time matters for recovery over and above the duration of time spent with the partner. On the one hand, we included the duration of time spent with the partner (in hours) as an additional day-level predictor for the recovery experiences in our main-effects path model. Results showed that the duration of time spent together with the partner was neither related to experiencing detachment (est. = 0.003, *SE* = 0.017, *p* = .874) nor to experiencing relaxation (est. = 0.026, *SE* = 0.022, *p* = .239). In addition, the direction and significance of the other paths (i.e., engagement in time with the partner predicting recovery experiences) did not change after including the duration in our model. Thus, how long partners spent time together during the evening did not matter for experiencing recovery, highlighting the relevance of actual engagement in time together and not just spending a certain amount of time together. On the other hand, we investigated the interaction effects between the duration of time spent with the partner and the couples' chronotype match in predicting detachment and relaxation (similar to Hypothesis 4). Results showed that none of the interaction terms was significant (predicting detachment: est. = 0.010, *SE* = 0.024, *p* = .667; predicting relaxation: est. = 0.052, *SE* = 0.033, *p* = .108). These results suggest that the couples' chronotype match matters more in the interplay with engagement in time with

the partner and not in the interplay with the amount of time spent together. Thus, especially when the partners engage in time together, their recovery is at stake because they depend on their partners' chronotypes.

Second, we computed conditional indirect effects from unfinished tasks to detachment and relaxation via absorption and attention during time spent with the partner (combining Hypotheses 2 and 3) because we proposed that the relationships between engagement in time with the partner and recovery experiences would depend on the couples' chronotype match (Hypothesis 4). For this purpose, we tested the day-level indirect effects depending on different values of our moderator. We calculated the estimates of the indirect effects in our three-level path model in Mplus 8.7 (Muthén & Muthén, 2017) and generated 95% confidence intervals using the Monte-Carlo method with 20,000 simulations (Selig & Preacher, 2008). The results are displayed in Table 4.5. The indirect effect from unfinished tasks to detachment via absorption was not significant for couples with lower (-1*SD*: est. = -0.002, *SE* = 0.006, 95%-CI [-0.016, 0.009]) or average (Mean: est. = -0.010, *SE* = 0.007, 95%-CI [-0.028, 0.001]) chronotype match. However, for couples with higher chronotype match, the indirect effect was significant and negative (+1*SD*: est. = -0.017, *SE* = 0.011, 95%-CI [-0.046, -0.0003]). Thus, when partners' chronotypes were more similar, having unfinished tasks after work was negatively related to experiencing detachment, probably because they would have especially depended on being absorbed in joint activities together, but unfinished tasks hindered absorption. The indirect effect from unfinished tasks to relaxation via absorption was significant at all three levels of our moderator. Thus, unfinished tasks were negatively related to relaxation via absorption for couples with lower (-1*SD*: est. = -0.027, *SE* = 0.013, 95%-CI [-0.055, -0.002]), average (Mean: est. = -0.028, *SE* = 0.015, 95%-CI [-0.060, -0.002]) as well as higher (+1*SD*: est. = -0.030, *SE* = 0.017, 95%-CI [-0.068, -0.002]) chronotype match. These results resemble our finding that the

relationship between absorption and relaxation did not depend on the couples' chronotype match. No other indirect effect was significant.

Table 4.5

Day-Level Conditional Indirect Effects Depending on the Cross-Level Moderator Chronotype Match

Day-level indirect effect	**Moderator: Chronotype match**	**Est.**	***SE***	**95%-CI**
Unfinished tasks → Absorption → Detachment	-1*SD*	-0.002	0.006	[-0.016, 0.009]
	0 (Mean)	-0.010	0.007	[-0.028, 0.001]
	+1*SD*	**-0.017**	**0.011**	**[-0.046, -0.0003]**
Unfinished tasks → Attention → Detachment	-1*SD*	-0.007	0.007	[-0.025, 0.006]
	0 (Mean)	0.001	0.006	[-0.011, 0.016]
	+1*SD*	0.008	0.009	[-0.005, 0.034]
Unfinished tasks → Absorption → Relaxation	**-1*SD***	**-0.027**	**0.013**	**[-0.055, -0.002]**
	0 (Mean)	**-0.028**	**0.015**	**[-0.060, -0.002]**
	+1*SD*	**-0.030**	**0.017**	**[-0.068, -0.002]**
Unfinished tasks → Attention → Relaxation	-1*SD*	0.012	0.008	[-0.001, 0.032]
	0 (Mean)	0.003	0.005	[-0.006, 0.018]
	+1*SD*	-0.006	0.007	[-0.023, 0.011]

Note. Est. = Unstandardized path estimate. CI = Confidence interval. Bold = confidence interval does not include zero. Unstandardized estimates were obtained from three-level path analysis in Mplus 8.7 (Muthén & Muthén, 2017). Confidence intervals were computed using the Monte-Carlo Method with 20,000 simulations (Selig & Preacher, 2008).

Third, we investigated reversed causality by testing whether employees from couples with matching chronotypes benefit more from recovery experiences in terms of higher engagement in time with their partner (instead of vice versa). Thus, we tested whether chronotype match also moderated the relationships from detachment and relaxation to absorption and attention. This was not the case as none of the interaction effects was significant (moderating path from detachment to absorption: est = 0.006, *SE* = 0.050, *p*

= .910; moderating path from detachment to attention: est = 0.043, *SE* = 0.053, *p* = .416; moderating path from relaxation to absorption: est = -0.069, *SE* = 0.044, *p* = .118; moderating path from relaxation to attention: est = 0.087, *SE* = 0.046, *p* = .061). However, not surprisingly due to the concurrent measurement, relaxation also directly predicted absorption (est = 0.257, *SE* = 0.033, *p* < .001) and attention (est = 0.138, *SE* = 0.030, *p* < .001) in the reversed model, while detachment did not predict engagement in joint time (predicting absorption: est = 0.023, *SE* = 0.028, *p* = .417; predicting attention: est = 0.031, *SE* = 0.030, *p* = .302). Taken together, these results further support our moderation-effect findings suggesting that chronotype match mainly changes the relationship between engagement in time with the partner and recovery experiences.

Discussion

In our daily diary study, we integrated a circadian perspective into the recovery literature by proposing chronotype match as a boundary condition for dual-earner couples' recovery processes. Building on the stressor-detachment model (Sonnentag & Fritz, 2015) and research on family engagement (Rothbard, 2001), we proposed that unfinished tasks impede engagement in time with the partner (i.e., directing attention toward the partner, being absorbed in joint activities) as well as recovery experiences (i.e., detachment, relaxation). In turn, engagement in time with the partner should facilitate recovery experiences. Integrating the circadian perspective, we proposed that employees whose chronotypes match their partners' chronotypes benefit more from engagement in time with their partners (i.e., stronger relationships with recovery experiences). Additionally, we explored whether the couples' chronotype match also moderates the relationship between unfinished tasks and engagement in time with the partner. We found that unfinished tasks after work impeded being absorbed in joint activities with the partner and detachment. Being absorbed in joint activities, in turn, benefited recovery experiences after work. Importantly, our findings imply that a match

between partners' chronotypes is relevant for their recovery experiences after work following engagement in joint time. On the one hand, for couples with *higher* (vs. lower) chronotype match, experiencing detachment depended on being absorbed in joint activities (i.e., positive relationship between absorption and detachment). On the other hand, for couples with *lower* (vs. higher) chronotype match, directing attention toward the partner was harmful for experiencing relaxation (i.e., negative relationship between attention and relaxation). Interestingly, the partners' chronotype match did not buffer the negative relationship between unfinished tasks and engagement in time with the partner.

Theoretical Implications

Our study offers a new perspective on recovery after work by integrating two previously unconnected streams of research. Building on the theoretical work by Zijlstra et al. (2014), we adopted a circadian perspective on recovery by investigating the match between partners' chronotypes as a boundary condition for dual-earner couples' recovery processes. In fact, the chronotype match did not enable employees to engage more in the joint time with their partner despite experiencing unfinished tasks but changed how employees' engagement in time with their partner translates into experiencing recovery. In addition, unfinished tasks especially impeded detachment when employees' chronotypes matched their partners' chronotype as they would have particularly depended on being absorbed in joint activities. This result pattern highlights that the couples' chronotype match takes an effect in the interplay with partners' engagement in their joint time: when partners engage in their time together, their recovery experiences are at stake because their recovery no longer only depends on their own preferences and needs, but also their partners'. However, how unfinished tasks impair engagement in their joint time does not seem to depend on the partners' chronotype match. Perhaps the relationship between unfinished tasks and engagement with the partner might be rather driven by individual job-related factors or by

other couple-related factors beyond chronotype match. Accordingly, our findings suggest that especially recovery processes are subject to alignment of employees' own and, if similar, the partners' circadian rhythms. Therefore, we demonstrate that circadian preferences not only affect employees at work (e.g., Kühnel et al., 2022) but also matter for how they recover after work. Consequently, studying recovery as a process aligned with employees' daily activation rhythms and circadian preferences (Zijlstra et al., 2014) can help paint a more accurate picture of how they best recover from work.

Digging deeper into the role of the couples' chronotype match, the diverging result patterns for detachment and relaxation suggest qualitative differences between cognitive and energetic alignment of partners with matching chronotypes. While couples with *higher* (vs. lower) chronotype match depended more on being absorbed in joint activities in terms of their detachment, couples with *lower* (vs. higher) chronotype match suffered a disadvantage from directing attention toward the partner in terms of their relaxation. Accordingly, in terms of cognitive alignment, being similar chronotypes is needed to actually experience detachment when being absorbed in joint activities with the partner. When being similar chronotypes, engagement in joint time fits both partners' cognitive activation levels (Dijk et al., 1992; Matchock & Mordkoff, 2009; Zijlstra et al., 2014). As mentally detaching from work requires self-regulation to stop recurring thoughts about work (Germeys & de Gieter, 2018; Sonnentag, 2018) and partners with matching chronotypes share similar activation levels, they more likely succeed in directing their focus away from work while being absorbed in their joint activities (Martin & Tesser, 1996). In contrast, in terms of energetic alignment of couples with matching chronotypes, experiencing relaxation does not depend on focusing attention on the partner. Maybe, in this case, relaxation depends on other – and more active – positive experiences with the partner because of their matching activation preferences (Vitale et al., 2015). Importantly, however, in terms of energetic *mis*alignment,

being different chronotypes can backfire by decreasing relaxation when focusing attention on the partner. Partners with mismatched chronotypes have different recovery preferences of when to be active (Vitale et al., 2015; Zijlstra et al., 2014). Thus, directing attention toward the partner itself might be strenuous and effortful because of the partners' mismatched needs and energetic activation levels. Hence, focusing attention on the partner comes with a cost when chronotypes do not match, reflected in experiencing less relaxation. Taken together, this result pattern suggests that the partners' cognitive alignment and energetic *mis*alignment drive the role of the couples' chronotype match as a crucial boundary condition for couples' after-work recovery processes.

At the same time, our findings on the couples' chronotype match imply that considering employees' partners is crucial when investigating their recovery processes following engagement in joint time. Previous research focused on recovery processes relevant for most employees (Sonnentag et al., 2017, 2022) and often neglected the role of living in romantic relationships. However, our results underline that employees who cohabit with a partner cannot only follow their own preferences but also need to consider their partners' daily rhythms. Cohabiting with a partner can create important boundary conditions that can change the effectiveness of employees' recovery processes. Investigating recovery after work without considering the partner is thus too simplistic and does not fully reflect the reality of the growing number of dual-earner couples.

Extending previous research, our results highlight that unfinished tasks not only impede employees' recovery experiences but also hamper engagement in time with their partners. First, when employees could not complete their tasks during the workday, work was still mentally present during their after-work hours (i.e., lower detachment). These results align with previous research demonstrating associations between unfinished tasks and detachment (Heissler et al., 2022; Weigelt & Syrek, 2017). Second, beyond previous

research, unfinished tasks tended to be negatively related to directing attention toward the partner and were negatively related to being absorbed in joint activities. Accordingly, employees had greater difficulty focusing intensely on their partners when having many unfinished tasks. These results reflect our theoretical reasoning grounded in research on work-family conflict (Greenhaus & Beutell, 1985), underlining that unfinished tasks from the work role can impede fulfilling the requirements of the private role. Thus, unfinished tasks, which may, at first glance, seem to be less severe than other job stressors (e.g., experiencing incivility), have the potential to impede employees' recovery as well as joint time with their partners. It is important to note that unfinished tasks might thereby also affect employees' partners as research suggests that negative implications of job stressors can be transferred from one partner to the other (e.g., Y. Park & Haun, 2018). Unfinished tasks thus constitute a relevant job stressor that can also be of relevance in the interplay with employees' partners. However, we do not believe that our results are limited to unfinished tasks as one specific job stressor. Similarly, also other job stressors, such as social conflicts or incivility at work, might undermine employees' engagement in time with their partners after work. For example, previous research demonstrated that experiencing incivility can transfer from employees' work to their private role and also affect their partners (e.g., Y. Park & Haun, 2018).

Lastly, our results underline that engagement in time with the partner can boost employees' recovery experiences from work. Being absorbed in joint activities with the partner was positively associated with both detachment and relaxation. Furthermore, absorption over and above the duration of joint activities was crucial for experiencing recovery, reinforcing the relevance of engagement in time with the partner. These results align with previous research demonstrating the relevance of absorption in joint activities for employees' recovery (Hahn et al., 2012). Our results go beyond that by demonstrating that decreased absorption in joint activities explains why unfinished tasks were negatively related

to experiencing relaxation after work. Therefore, being absorbed in joint activities with the partner plays a crucial role in the complex interplay between work and recovery for dual-earner couples. In contrast, directing attention toward the partner was not related to detachment and relaxation. Thus, our results suggest that being absorbed in joint activities but not necessarily directing attention toward their partner seems to be crucial for employees' recovery. Possibly, directing attention toward the partner does not benefit employees' own recovery experiences but instead their partners' recovery experiences. When employees direct their attention toward their partners, their partners' need for relatedness can be fulfilled by feeling connected and appreciated by another person (Ryan & Deci, 2000). Experiencing relatedness has previously been associated with recovery experiences (Bosch et al., 2018)

Limitations and Avenues for Future Research

Some limitations have to be considered when interpreting our study's results. First, we relied on self-report data that might be subject to common method bias. Common method bias occurs when variance is attributed to the measurement instead of the construct of interest (P. M. Podsakoff et al., 2003). To reduce common method bias, we temporally separated the assessment of our day-level variables (after-work vs. bedtime survey). Additionally, we calculated chronotype match using both partners' midpoint of sleep, making it unlikely to be affected by common method bias. Lastly, interaction terms such as our cross-level interaction do not seem to be subject to common method biases (Siemsen et al., 2010).

Second, we cannot draw causal inferences from our data. The hypothesized assumptions that engagement in time with the partner results in recovery experiences are in line with our theoretical reasoning and previous studies proposing the same relationship (see Hahn et al., 2012; absorption leading to detachment and relaxation). However, because we measured engagement in joint time with the partner (absorption, attention) as well as recovery experiences (detachment, relaxation) in the same survey (i.e., the bedtime survey),

we cannot rule out the possibility of reversed causality. It might be that high recovery experiences also enable employees to show higher engagement in the time with their partner and not only vice versa. Indeed, our additional analyses demonstrated that relaxation also significantly predicted absorption and attention, suggesting potential reciprocal effects between recovery experiences and engagement in time with the partner. Thus, we encourage future research to apply a more fine-grained approach and measure the constructs at multiple times during the evening to investigate whether engagement in time with the partner results in or stems from recovery experiences – or whether reciprocal relations might appear.

Third, we collected our data during the COVID-19 pandemic. During data collection, social distancing rules applied such that, for example, the number of participants in social meetings outside the own household was restricted and large-scale events (e.g., cultural or sports events) were prohibited. Hence, participants in our sample might not have been able to pursue their leisure activities as before the pandemic. However, we focused on underlying psychological processes capturing how employees experienced their after-work hours instead of relying on specific leisure activities. Social distancing rules might still have led to employees spending more time at home with their partners (Wellenius et al., 2021). However, joint activities with the partner increased even before the COVID-19 pandemic (Voorpostel et al., 2010). We conclude that it is unlikely that our results are strongly biased by the COVID-19 pandemic, but that results should still be interpreted while taking the specific circumstances into account.

Our study also offers avenues for future research. First, researchers could investigate the relevance of partners' circadian preferences for their recovery processes in greater detail. We offered a starting point by demonstrating that a match between partners' chronotypes is crucial for dual-earner couples' recovery after work. Our results suggest that cognitive alignment and energetic *mis*alignment drive the importance of the couples' chronotype match

as a boundary condition. Thus, future research could examine the couples' chronotype match and its consequences for other aspects of recovery processes to further uncover its unique cognitive versus energetic pathways. On the one hand, for example, when partners' chronotypes do not match and they share the same bedroom, do they benefit less from sleep in terms of next-morning energy levels match (i.e., energetic *mis*alignment)? On the other hand, for example, when partners' chronotypes match and they engage in joint time before work, do they benefit more in terms of higher reattachment to work (i.e., cognitive alignment)?

Second, future studies could consider to what extent employees can actually follow their circadian preferences during the workweek. As we focused on a match between partners' chronotypes, we could not shed light on how each partner's chronotype matches their work schedule. Caused by typical work hours mainly being oriented toward the preferred timing of earlier chronotypes, later chronotypes often experience a misalignment between their work schedules and circadian preferences, resulting in diverging sleep patterns on workdays and non-workdays. This phenomenon has been introduced as social jetlag (Wittmann et al., 2006) or, more recently, social sleep lag (Kühnel et al., 2016). By not being able to follow their circadian preferences during the workday, employees have to expend additional effort to fulfill their work tasks (Kühnel et al., 2016; Zijlstra et al., 2014). Thereby, employees' energetic resources will be limited after work. Thus, circadian misalignment might not only be relevant for employees at work (Kühnel et al., 2016) but also increase the need to spend a recovering evening with the partner.

Finally, future research on recovery could investigate more closely which mechanisms explain why employees' recovery benefits from spending time with their partners. The amount of time partners spend together seems to have increased over the decades (Voorpostel et al., 2010). Therefore, it is highly relevant to better understand how

employees can best gain from spending time with their partners. Our study is in line with previous research demonstrating that being absorbed in joint activities is beneficial for employees' recovery (Hahn et al., 2012). Other researchers investigated, for example, partners' recovery support as a predictor of their recovery from work (Y. Park & Fritz, 2015; Y. Park & Haun, 2017). Future research could identify additional mechanisms by which partners' joint time benefits their recovery. For example, partners might mutually encourage each other to recover and, thus, experience higher recovery-related self-efficacy as a significant predictor of recovery experiences (H. I. Park & Lee, 2015; Sonnentag & Kruel, 2006).

Practical Implications

Two main practical implications arise from our study. First, our results have implications for how employees can spend a recovering evening with their partners. When both partners' chronotypes match, employees' detachment depends on being absorbed in joint time with the partner. Thus, couples with matching daily rhythms should find and pursue joint activities on which both partners can focus. On the contrary, when both partners' chronotypes do not match, directing attention toward the partner is harmful for experiencing relaxation. Thus, couples with mismatched chronotypes could spend more time on their own so that they can pursue activities following their personal preferences. Over and above, couples with mismatched chronotypes should monitor which activities they compromise on during their joint after-work hours, taking both partners' chronotypes and their recovery preferences into account. However, this implies that employees are aware of their own (and their partners') circadian preferences and their consequences for work and non-work life – which might not always be the case. Therefore, it is also essential to educate employees about the relevance of chronotype not only for work but also for recovery from work, such that they can benefit from their after-work hours and their engagement in time with their partner.

Second, our results highlight the need to complete work tasks to spend a recovering evening with the partner. Ensuring that employees always complete their daily work tasks seems somewhat unrealistic based on external circumstances (e.g., leaders' performance expectations; Syrek & Antoni, 2014) and the characteristics of certain jobs (e.g., jobs with high workloads). While working during non-work time potentially buffers negative relationships between unfinished tasks and detachment, supplemental work itself impedes detaching from work (Weigelt & Syrek, 2017). Instead, Smit (2016) proposed an intervention targeted to make plans to complete unfinished goals. At the end of the workday, making specific plans about how and when to complete unfinished tasks (e.g., on the following day, right after starting work) could help stop employees' recurring thoughts about unfinished tasks. Thereby, completing unfinished tasks is mentally tied to a specific work situation in the future and can be checked off from todays' list, making it easier to detach and focus on the joint time with the partner. In addition, daily planning also improves employees' performance at work (Parke et al., 2018). Organizations can help with recovery by providing training to efficiently plan the next workday at the end of the current workday.

Conclusion

Taken together, we introduced chronotype match as a boundary condition for dual-earner couples' recovery processes. Extending previous research, we demonstrated that circadian preferences are not only relevant for employees at work but also for their after-work recovery processes. Therefore, it is crucial to consider employees' partners when investigating their recovery processes because employees cannot act independently if they also need to take their partners' circadian rhythms into account.

Appendix

Table A4.1

Person-Level Correlations of all Variables

	1	2	3	4	5
1 Unfinished tasks					
2 Absorption	-.09				
3 Attention	-.10	.83***			
4 Detachment	-.40***	.14	.16		
5 Relaxation	-.27**	.40***	.34***	.34***	
6 Positive affect	-.18*	.19*	.25**	.21*	.34***

Note. Correlations shown are person-level correlations (n = 143).
*p < .05. **p < .01. ***p < .001.

CHAPTER V: GENERAL DISCUSSION

This dissertation links circadian and work-nonwork interface research by proposing that circadian mismatches matter for employees' life at work, outside of work, and especially at the transitions between work and nonwork roles. Combining the core tenets of fit theory (Edwards et al., 1998) with the two-process model of sleep regulation (Borbély, 1982; Borbély et al., 2016), I outlined how three different circadian mismatches (i.e., week-level, day-level, and person-level circadian mismatches) can serve as indicators of person-environment fit and thereby matter for employees' well-being and recovery processes. In doing so, I integrated circadian processes and the occupational health psychology literature, which has been proposed theoretically (Zijlstra et al., 2014) but did not arrive in empirical research. In the following, I will first summarize the findings of the three individual studies that provided the basis of this dissertation. Thereafter, I will outline my dissertation's theoretical and practical implications while keeping its strengths and limitations in mind.

Summary of Findings

Returning to the two overarching themes of this dissertation, I will summarize the findings separately for circadian processes and for reciprocal relations between work and nonwork. First, regarding circadian processes, the three studies suggest that all three circadian mismatches differentially matter for employees' work-nonwork interface. On the one hand, Study 1 demonstrated that a week-level circadian mismatch (i.e., catch-up sleep) impaired employees' well-being during the entire workweek (i.e., indirect relationship with workweek exhaustion via reattachment on Monday). On the other hand, Study 2 and 3 demonstrated that a day-level (i.e., social sleep lag) and a person-level (i.e., couples' chronotype match) circadian mismatch served as boundary conditions for the effectiveness of employees' recovery processes (i.e., impairing the effectiveness of mastery experiences and changing the way engagement in joint time with the partner translates into recovery

experiences). Accordingly, the three studies underscore that circadian mismatches directly or indirectly impair employees' recovery processes and well-being during the transition from nonwork to work (Study 1) and the transition from work to nonwork (Study 2 and 3).

Second, with respect to the work-nonwork interface, the three studies suggest reciprocal relations between work and nonwork. On the one hand, Study 1 demonstrated that nonwork recovery processes (i.e., weekend sleep quality and catch-up sleep) affect weekly work-related experiences (i.e., workweek exhaustion) via a boundary-transition experience (i.e., reattachment). On the other hand, Study 2 and 3 highlighted that negative experiences at work (i.e., unfinished tasks and interpersonal conflicts) impair a variety of daily nonwork recovery experiences (i.e., detachment, relaxation, mastery, and engagement in joint time with the partner) – even though these nonwork experiences were beneficial for well-being (Study 2). Thereby, the three studies underline that both the transition from nonwork to work (Study 1) as well as the transition from work to nonwork (Study 2 and 3) confronts employees with boundaries that might be hard to cross in stressful and demanding situations (Study 1, 2, and 3) but might also enable employees to transfer their resources from one role to the other role (Study 1).

Theoretical Implications

Integrating the findings of the individual studies into a bigger picture yields critical theoretical implications. Again, referring to two overarching themes of this dissertation, I will first discuss its theoretical implications with respect to the integration of circadian mismatches into work-nonwork interface research and, afterward, with respect to reciprocal relations between the work and nonwork domains.

Integrating Circadian Mismatches Into the Work-Nonwork Interface

In general, this dissertation underscores the relevance of taking a circadian perspective in the organizational sciences. While this circadian perspective was applied to

employees' experiences at work (e.g., Kühnel et al., 2016, 2021, 2022), research so far neglected the relevance of circadian mismatches at the reciprocal transitions between work and nonwork. Building on the theoretical framework from Zijlstra et al. (2014), I highlighted that circadian mismatches matter not only for employees at work but also for employees outside of work and particularly at their work-nonwork interface. Specifically, circadian mismatches constantly require employees to actively up- or downregulate their arousal and activation throughout the day, which, in turn, impairs their recovery processes after work (Study 2 and 3) as well as their transition back to work (Study 1). Accordingly, the findings of my dissertation emphasize that circadian mismatches can impact employees' entire day and workweek and should therefore be taken seriously in organizational behavior and occupational health psychology research.

Above and beyond, this dissertation provides a theoretical guideline to better integrate circadian processes in the organizational sciences by transferring person-environment fit theory (Edwards et al., 1998) to the rather physiological assumptions of circadian mismatches (Borbély, 1982; Borbély et al., 2016). Thereby, circadian mismatches reflect (mis-)fit between person characteristics (i.e., employees' circadian preferences) and environment characteristics (i.e., employees' social environment). Specifically, I proposed that social sleep lag and catch-up sleep reflect person-job fit, while a couples' chronotype match reflects person-person fit. Combining these assumptions with a circadian perspective on recovery (Zijlstra et al., 2014), the three studies underlined how different types of misfit result in impaired well-being and recovery processes. In these cases, employees' actual level of arousal (person characteristics determined by their circadian preferences) does not fit their required level of arousal (environment characteristics determined by their social environment), and up- or downregulation is needed (Zijlstra et al., 2014). As these up- and downregulating processes cost energetic and self-regulatory resources, circadian mismatches

ultimately directly and indirectly impair well-being and recovery processes. Accordingly, this theoretical reasoning for circadian mismatches based on fit theory (Edwards et al., 1998) can help advance the field because it enables researchers to draw better psychological and work-related conclusions than can be derived from purely physiological models (e.g., two-process model of sleep regulation; Borbély, 1982; Borbély et al., 2016).

Going more into detail concerning the different circadian mismatches, my dissertation suggests that circadian mismatches can change dynamically and not only reflect chronic conditions. Previous research focused mainly on stable person-level circadian mismatches (e.g., Kühnel et al., 2016, 2021), neglecting the dynamic nature of sleep during the week (Roenneberg, Pilz, et al., 2019). By demonstrating that circadian mismatches (i.e., social sleep lag, catch-up sleep) yield significant day-level and week-level variation and that this variation is meaningful in employees' daily lives, my dissertation suggests that a purely chronic view of circadian mismatches is too short-sighted. Instead, similar to other sleep characteristics (Liu et al., 2021), circadian mismatches might change from day to day or from week to week. For example, day- and week-level fluctuations in circadian mismatches can originate from changing work schedules due to employees' own flexibility (Nold & Wöhrmann, 2022) or external events (e.g., unusually early morning meetings and weekly business trips). While social restrictions to sleep-wake schedules thereby change daily and weekly, employees' circadian preferences remain stable over time, resulting in daily and weekly fluctuations in circadian mismatches. This dynamic perspective on circadian mismatches advances our understanding not only within the organizational sciences but also concerning chronobiological research that largely focuses on chronic circadian mismatches (Roenneberg, Pilz, et al., 2019). At the same time, this dynamic perspective reflects recent approaches in person-environment fit research highlighting the necessity to account for temporal changes in (mis-)fit (Vleugels et al., 2023).

In addition to this dynamic perspective, my dissertation took a social view on circadian mismatches. Specifically, I highlighted that circadian mismatches not only stem from a misfit between employees and their jobs (i.e., social sleep lag, catch-up sleep) but also from a misfit with significant others (i.e., couples' chronotype match). Adding to previous studies that investigated a match between partners' chronotypes (Díaz-Morales et al., 2019; Jocz et al., 2018), my dissertation underlines that employees can not only rely on their own circadian preferences if they cohabit with a partner but also need to consider their partners' circadian preferences. These results underscore the necessity to understand the phenomenon of circadian mismatches more broadly and extend it to employees' entire social environment. Because work is often a social process, similar person-level circadian mismatches might also occur at work, for example, with supervisors (Volk et al., 2023, 2023) or within teams (Volk et al., 2017). Hence, taking a broad social perspective on circadian mismatches is necessary.

Taken together, my dissertation highlights that employees' circadian preferences and social environment can collide in a variety of ways and that these mismatches, in turn, significantly affect employees' well-being and recovery processes. While first studies centered around the relevance of employees' chronic social sleep lag (Kühnel et al., 2016, 2021) or a chronic misalignment in shift workers (Kühnel, Sonnentag, et al., 2018), more in-depth knowledge on other circadian mismatches was and is still missing. By introducing a dynamic and social perspective on circadian mismatches, I hope that my studies fire the starting pistol to broaden the way of thinking about circadian mismatches in employees' daily lives.

Reciprocal Relations Between Work and Nonwork

With respect to the reciprocal relations between work and nonwork, my dissertation suggests that nonwork recovery processes are not equally effective on any given day. In the past, recovery research often neglected important boundary conditions that can change the

occurrence or effectiveness of recovery processes (Sonnentag et al., 2017; Steed et al., 2021). However, similar to first studies suggesting that aspects related to employees' partnership and occupation can change the effectiveness of recovery processes (e.g., Y. Park & Haun, 2017; Walter & Haun, 2020), my dissertation demonstrates that the social environment could either be an expanding or limiting factor for recovery processes. Thereby, employees' recovery processes can be subject to social constraints from their job (i.e., high social sleep lag) and their living situation (i.e., low couples' chronotype match). Accordingly, it is too short-sighted to assume that recovery processes operate similarly for every person and every day. Instead, it is necessary to consider individual factors influencing how one recovers and which recovery experiences will be especially effective. Hence, recovery research requires in-depth knowledge about which aspects of employees' social environment can affect their nonwork recovery processes and how these aspects change their recovery experiences.

Focusing on the transition from work to nonwork, my dissertation's findings highlight that the core assumptions of the recovery paradox (Sonnentag, 2018) apply to a wide range of nonwork experiences. While psychological detachment was at the center of attention when investigating how job stressors affect nonwork experiences (Bennett et al., 2018; Sonnentag, 2018; Steed et al., 2021), my findings underpin that also other recovery experiences (i.e., mastery, relaxation) and experiences with the partner (i.e., engagement in joint time) can be impaired by job stressors. Thereby, applying assumptions from boundary theory (Ashforth et al., 2000), job stressors make boundary transitions from work to nonwork roles more difficult. Specifically, job stressors can broadly decrease cognitive, energetic, and self-regulatory resources needed to enter the private role and, thus, engage in nonwork activities and experiences (Sonnentag, 2018). Hence, even though nonwork experiences are beneficial to restore employees' cognitive, energetic, and self-regulatory resources on stressful workdays, stressful workdays hamper nonwork experiences. This paradoxical pattern seems

not to be limited to single recovery experiences but also translates to experiences with the partner.

Going one step further, my dissertation suggests a similar paradoxical pattern during the transition from nonwork to work. Mirroring the pattern of the transition from work to nonwork, reattachment seems to depend on energetic and cognitive resources even though reattachment itself can be beneficial for saving and restoring energetic and cognitive resources (i.e., reattachment paradox). Specifically, sleep quality as an indicator of restored resources during the weekend increased reattachment, while catch-up sleep as an indicator of energetic and cognitive demands due to changes in the sleep-wake rhythm decreased reattachment. Even though reattachment might thus be beneficial for well-being (i.e., reduced exhaustion), it appears to be impaired when it is needed most. Thus, the transition from nonwork to work also relies on energetic, cognitive, and self-regulatory resources that employees need to invest to transition between roles successfully.

Taken together, integrating both sides of this paradoxical interplay between work and nonwork, the findings prompt that the recovery paradox (Sonnentag, 2018) might be a more general work-nonwork paradox. This result pattern even further underscores possible reciprocal relations between nonwork and work. Previous research demonstrated that while adverse work experiences can, for example, result in impaired well-being, also impaired well-being can increase adverse work experiences (Casper et al., 2019; Guthier et al., 2020). Thereby, the work-nonwork interface might be subject to loss cycles (Hobfoll, 1989; Hobfoll et al., 2018). Specifically, job stressors could hinder employees' role transition from their work to their nonwork role such that fewer resources are built up in the nonwork domain, which are, in turn, not available for transitioning back to the work domain and so on. Especially in light of such loss cycles, it is inevitable to better understand the underlying processes and boundary conditions to uncover how to break loss cycles or even turn them

into gain cycles (Halbesleben et al., 2014). Hence, coming back to the overarching theme of my dissertation, considering employees' circadian processes can be a fruitful perspective to disentangle how employees' different life domains are connected and provide them with guidance on optimizing their boundary transitions and recovery processes.

Methodological and Theoretical Strengths and Limitations

When discussing the empirical results of this dissertation, it is indispensable to consider its methodological and theoretical strengths and limitations. Even if its limitations do not overshadow its strengths, it is essential to have both in mind to put the empirical results in perspective.

Strengths

My dissertation exhibits three core strengths. First, the three empirical studies of this dissertation relied on high-quality field data uniquely suited to answer the respective research questions. In all three studies, I collected intensive longitudinal data in the field (i.e., in employees' everyday lives), allowing realistic conclusions about within-person fluctuations in employees' activities and experiences (Gabriel et al., 2019). This dynamic within-person perspective is essential because relevant experiences at the work-nonwork interface largely fluctuate from day to day and within employees (e.g., more than 50% within-person variance for job stressors, recovery, and sleep; N. P. Podsakoff et al., 2019). Across all intensive longitudinal studies, I relied on different study designs tailored to the respective processes of interest: a weekly diary study to assess week-level processes (Study 1), a daily diary study to assess day-level processes (Study 2), and a dyadic daily diary study to assess day-level and couple-level processes (Study 3). Furthermore, all studies had large samples that met and partly exceeded current sample size recommendations in intensive longitudinal research (Arend & Schäfer, 2019).

Second, the three different operationalizations of circadian mismatches provide a comprehensive understanding of circadian processes at the work-nonwork interface from different angles that go beyond the rather chronic and individual perspectives in previous research (Kühnel et al., 2016; Kühnel, Sonnentag, et al., 2018; Roenneberg, Pilz, et al., 2019). Specifically, I considered circadian mismatches as week-level (catch-up sleep and social sleep lag; Study 1), day-level (social sleep lag; Study 2), and person-level (couples' chronotype match; Study 3) phenomena. Thereby, I replicate and underscore that a mismatch between employees' circadian preferences and their social environment matters broadly – across different time frames (daily and weekly) and different domains of employees' life (mismatch with job, mismatch with significant others). Thus, with its three different operationalizations of circadian mismatches, this dissertation paints a more holistic picture of circadian processes at the work-nonwork interface that individual studies focusing on single aspects could never offer.

Third, this dissertation yields a theoretical strength by suggesting a way to integrate the rather physiological assumptions of circadian processes into the organizational sciences. Drawing from person-environment fit theory (Edwards et al., 1998), I proposed that circadian mismatches reflect aspects of person-environment fit. Contrarily, current organizational research (Kühnel et al., 2021, 2022) only relied on the two-process model of sleep regulation (Borbély, 1982; Borbély et al., 2016) as a powerful model in sleep research. However, due to its nature as a model stemming from sleep research, it does not – and was also not meant to – make assumptions about psychological processes or work experiences in particular. A framework that integrates such physiological assumptions with psychological processes and/or the work setting can help build better theory in future research (see, e.g., Crain et al., 2018; Mullins et al., 2014). By using person-environment fit theory (Edwards et al., 1998) combined with a self-regulatory and circadian perspective on recovery (Zijlstra et al., 2014),

this dissertation bridges the gap between circadian and work-nonwork research – both theoretically and empirically.

Limitations

Aside from its important strengths, this dissertation is not without limitations. First, the three studies all relied on self-report measures, which resulted in limitations regarding the validity of the results and the composition of the samples. On the one hand, when only relying on self-report measures, results might be biased due to common-method variance (P. M. Podsakoff et al., 2012). Even though I undertook appropriate steps to reduce common-method bias in the three individual studies (P. M. Podsakoff et al., 2003, 2012), it would be preferable for future studies to use objective data to further reduce biases due to shared measurement of constructs (e.g., using other-ratings for well-being; Fritz, Yankelevich, et al., 2010; or capturing daily sleep using actigraphy; Kühnel et al., 2021). On the other hand, using the Munich ChronoType Questionnaire (MCTQ; Roenneberg et al., 2003) as a well-validated questionnaire (Kantermann et al., 2015) to assess circadian preferences in self-report resulted in another limitation with respect to the samples. Specifically, the core assumption of this questionnaire is that participants can freely choose their sleep timing on non-workdays such that their sleep timing on these days reflects their circadian preferences (Roenneberg et al., 2003). Accordingly, to be able to calculate the different mismatches based on the MCTQ, I had to exclude participants who were unable to choose their sleep timing on non-workdays deliberately. This includes participants who, for example, use an alarm clock to wake up during the weekend because of regular appointments and participants who have children determining their sleep-wake rhythm. Thus, future research should employ objective measures to assess circadian preferences (e.g., dim-light melatonin onset; Kantermann et al., 2015) to avoid excluding relevant groups of participants because of the limitation of self-report measures such as the MCTQ.

Second, the three operationalizations of circadian mismatches were calculated using difference scores and thereby focused exclusively on objective person-environment fit. From a methodological perspective, difference scores are criticized for oversimplifying the notion of fit (Edwards, 2001). Instead, studies applied polynomial regression analyses and response-surface plots to better and more reliably evaluate (mis-)fit (Shanock et al., 2010; van Vianen, 2018). First studies also applied such response-surface approaches to two-level data (Kleine et al., 2023; Nestler et al., 2019). However, these approaches cannot easily be transferred to the data structure in my studies because model complexity would increase rapidly (e.g., due to three-level data and interaction effects). Accordingly, I adhered to conventions in circadian research because using difference scores is widespread in this field, for example, in studies investigating social sleep lag (e.g., Kühnel et al., 2016, 2021; Wittmann et al., 2006) and a match between partners' chronotypes (Chen, 2018; Díaz-Morales et al., 2019; Jocz et al., 2018). Still, future studies might employ more sophisticated approaches, such as response surface analyses, to analyze circadian mismatches. From a substantial perspective, by focusing on objective fit characteristics (i.e., calculating mismatch based on sleep timing), the studies neglected subjective aspects of person-environment fit that might also largely matter for employees' well-being (Edwards et al., 1998; van Vianen, 2018). Thus, future studies should assess how employees subjectively experience the misfit between their circadian preferences and the characteristics of their environment (e.g., perceived differences between partners), thereby investigating how these subjective circadian mismatches impair employees' daily lives.

Third, the studies of this dissertation had implicit assumptions about why and how the proposed relationships occur, but explicitly measuring these mechanisms came up short. Concerning the relevance of circadian mismatches, all three studies built on the notion that circadian mismatches result in a higher investment of self-regulatory and energetic resources,

ultimately resulting in impaired well-being and recovery (Zijlstra et al., 2014). However, in none of the studies, I measured the underlying demands on self-regulatory and energetic resources. The results of the studies are still important, especially since research is still in its infancy and these were the first studies integrating circadian and work-nonwork interface research. However, future studies should build on the results of this dissertation and explicitly measure self-regulatory and energetic mechanisms to better understand the circadian processes that are happening. Similarly, concerning the work-nonwork interface, I had underlying assumptions about how the work and nonwork domains should be connected. Building on boundary theory (Ashforth et al., 2000), I assumed that employees need to cross boundaries between work and private roles, which might be challenging when demands are present in one role. In Study 1, I measured reattachment as an explicit boundary-transition experience while the other studies (Study 2 and 3) built on implicit assumptions about the (missing) boundary-transition experiences between work and private roles. Thus, I encourage future research to take implicit theoretical assumptions seriously and explicitly include them in research models.

Directions for Future Research

Building on the theoretical implications of this dissertation, my research paves the way for further research on circadian processes at employees' work-nonwork interface. However, before coming to the most important research directions for circadian processes and the work-nonwork interface, I want to highlight a more general necessity. My studies were the first to integrate circadian mismatches in research on employees' work-nonwork interface, but they were all conducted during a unique point in time: the COVID-19 pandemic. Resulting of social restrictions, the COVID-19 pandemic changed many aspects of employees' daily lives, for example, due to home office mandates (Ker et al., 2021). These changes have posed problems (e.g., higher demands) but also possibilities (e.g., higher

flexibility) to employees. While the *absolute levels* of some experiences related to the work-nonwork interface might have changed during this crisis (e.g., higher amount of demands and higher importance of personal resources), the within-person *relationships* between these experiences are unlikely to be different compared to pre- and post-pandemic times. Thus, basic theoretical assumptions from occupational health psychology also seem to apply to studies conducted during times of crisis (Demerouti & Bakker, 2023). Still, more research is needed to replicate the results of my dissertation in different contexts and samples to ensure their generalizability.

Importance of Circadian Processes in Organizational Research

Overall, my dissertation highlights the need to take circadian processes more seriously in the organizational sciences. Specifically, my studies underline that circadian mismatches matter for employees during the transition from nonwork to work and vice versa. To stay very close to the findings of my dissertation, I first encourage future research to further investigate the three circadian mismatches in the work-nonwork interface: daily social sleep lag, weekly social sleep lag and catch-up sleep, as well as couples' chronotype match. Future research could build on the results of the three empirical studies and investigate the relevance of circadian mismatches during other boundary transitions and other recovery opportunities such as, for example, the experiences and recovery potential of breaks during the workday (Bosch et al., 2018) or the occurrence and effectiveness of recovery experiences during the weekend (Fritz, Sonnentag, et al., 2010). At the same time, future research could consider other outcomes of circadian mismatches relevant to the work-nonwork interface. For example, positive affect and self-efficacy can follow circadian rhythms (Kühnel et al., 2022) and matter for spillover processes from the work and nonwork domain (e.g., Rothbard & Wilk, 2011), thereby representing relevant indicators and outcomes of circadian mismatches at the work-nonwork interface.

Additionally, building on the strengths and limitations of this dissertation, I want to note the importance of improving the theoretical foundation of future research. On the one hand, the circadian perspective on person-environment fit that I suggested may inspire future research to build on the assumptions of fit theories when theorizing about circadian processes at the workplace. This can help overcome the limitations of previous research lacking a theoretical model suitable to derive assumptions about psychological processes above the two-processes model of sleep regulation (Borbély, 1982; Borbély et al., 2016). Thereby, future research could stay closer to fit theories and investigate subjective circadian person-environment fit. Above, it would be worthwhile to investigate whether objective circadian person-environment fit is related to subjective-person-environment fit and thus indirectly results in strain and well-being (Edwards et al., 1998).

On the other hand, I deem it necessary to explicitly include implicit theoretical assumptions in future research on employees' circadian processes. Thereby, future research might explicitly measure energetic or self-regulatory mechanisms that underlie circadian mismatches (cf. Zijlstra et al., 2014). Measuring such energetic or self-regulatory states at multiple times during the day can yield important insights into how these states follow employees' circadian rhythms and whether individual differences in these rhythms are subject to employees' chronotypes (Wiegelmann et al., 2023). Transferring these ideas to circadian mismatches, future research could explicitly measure daily trajectories of energetic or self-regulatory mechanisms (Arnold & Sonnentag, 2023; Wiegelmann et al., 2023) to a) better capture circadian mismatches and b) better understand how and why circadian mismatches transfer into impaired well-being and recovery processes.

Transfer to Other Circadian Mismatches

Above and beyond the circadian mismatches I investigated in this dissertation, future research could focus on other situations in which employees' circadian preferences and social

environment collide. First, scholars could deepen our knowledge concerning circadian mismatches that reflect person-person fit. As employees naturally have at least one supervisor, their supervisor reflects a relevant interaction partner at work. Thus, person-environment fit theories also cover person-supervisor fit, demonstrating that fit between subordinates and supervisors matters for satisfaction (Kristof-Brown et al., 2005). Mirroring person-supervisor fit, employees' circadian preferences might fit – or misfit – with the circadian preferences of their supervisors, reflecting a person-level circadian mismatch. First insights suggest that a misfit between employees and supervisors' circadian preferences can lead to biased evaluations of employees' performance (Yam et al., 2014). Recent theoretical approaches suggested a circadian perspective on leadership (Volk et al., 2022, 2023), but empirical results on circadian mismatches between leaders and subordinates are lacking. Integrating these assumptions in my theoretical framework, a mismatch between employees' own and their supervisors' circadian preferences might imply a higher need to upregulate if, for example, the timing of joint meetings does not fit their circadian preferences (Borbély, 1982; Borbély et al., 2016; Zijlstra et al., 2014). Accordingly, both employees and supervisors might experience impaired well-being and a higher need to recover. Thus, circadian person-supervisor fit might affect employees during the entire day and, even beyond, at their work-nonwork interface.

In addition to the supervisor, employees' circadian preferences might also conflict with other people's preferences at work. Because many employees work together in teams and colleagues thereby represent important interaction partners (Eurofound & Cedefop, 2020), future research could investigate mismatches between team members. Like person-supervisor fit, the tenets of fit theories were also applied to person-group fit, which also matters for employee satisfaction (Kristof-Brown et al., 2005). Transferring these assumptions to circadian processes, employees' own circadian preferences might either fit or

misfit with the circadian preferences of their team members. On the one hand, if teams successfully structure their work to their members' chronotypes, team performance might increase because they use their individual potential. On the other hand, however, if teams fail to recognize their members' chronotypes, a relevant circadian mismatch can occur (for a theoretical framework, see Volk et al., 2017). Again, if the timing of their joint work does not fit their individual circadian preferences, a circadian person-group misfit might consequently have adverse implications for the need to up- and downregulate of the group members (Zijlstra et al., 2014), impairing their well-being and recovery processes.

Besides this social focus on person-person and person-group fit, researchers could also investigate other sources of circadian person-job fit. For example, scholars could focus on shift work as an aspect of person-job fit. Especially shift systems that include night shifts require employees to work against their circadian preferences because even extremely early or extremely late chronotypes experience their troughs in circadian rhythms at some point during the night and would thus naturally sleep during night shifts (Juda et al., 2013). However, not only night shifts but also morning and evening shifts might be detrimental for employees if they contradict their circadian preferences (Kühnel et al., 2022). The resulting misfit between employees (i.e., their circadian preferences) and their jobs (i.e., their shift systems) is accompanied by various physiological and psychological health complaints (e.g., Torquati et al., 2019; Vyas et al., 2012). At the same time, shift work poses relevant challenges to employees' social environment due to its perceived disruption of partners' and families' joint life (Matheson et al., 2014; Newey & Hood, 2004), potentially impairing nonwork experiences. Future research could thus focus on the specific population of shift workers and more closely investigate whether and how the resulting circadian mismatches due to shift work affect employees' work-nonwork interface. For example, researchers could

investigate shift workers' recovery processes and boundary transitions while simultaneously accounting for the relevance of shift workers' partners.

Another fruitful line of research for circadian person-job (mis-)fit refers to the transition to daylight saving time (DST), which confronts employees in many countries with circadian mismatches year by year. Importantly, these time changes affect all employees – even if individual differences might change the degree of the impairment (e.g., being a later chronotype; Völker, Kühnel, et al., 2023). Specifically, clocks are moved one hour forward in spring, facing employees with a desynchronization of their social clock (i.e., their job that follows the clock time) and their biological clock (i.e., their circadian preferences) because the respective sun time as important zeitgeber does not change during the clock change (Roenneberg, Wirz-Justice, et al., 2019). The transition to DST thereby results in acute circadian mismatches right afterward (Čulić & Kantermann, 2021), but the effects might also persist during the entire DST phase (i.e., until clocks are moved back to standard time in autumn; Coogan et al., 2022). First studies acknowledged the adverse impact of DST transitions at the workplace (Barnes & Wagner, 2009; Völker, Kühnel, et al., 2023; Wagner et al., 2012), but research is still in its infancy. Scholars might, in more detail, investigate how the transition to DST as an acute and chronic circadian person-job misfit affects employees' work-nonwork interface. Again, building on my theoretical assumptions, I suppose that the transition to DST increases the need to actively up- and downregulate arousal during the day (Zijlstra et al., 2014), thereby impairing employees' well-being and recovery processes.

Fine-Grained Perspective on the Work-Nonwork Interface

In addition to research directions concerning the integration of circadian processes and the work-nonwork interface, my dissertation may also inspire future research with respect to the reciprocal relations between the work and nonwork domains. Starting with the

transition from nonwork to work, researchers could focus on cognitive and anticipatory processes. While the transition from work to nonwork has been studied frequently, for example, with respect to the association between job stressors on the one hand and psychological detachment and ruminative processes on the other hand (Sonnentag, 2018; Sonnentag & Fritz, 2015), knowledge on the transition from nonwork to work is still limited. As suggested by my dissertation and previous research (e.g., Fritz et al., 2021; Sonnentag & Kühnel, 2016), reattachment represents a cognitive and deliberate micro-role transition between nonwork and work roles. Similarly, first studies suggest that anticipating work during nonwork time (Casper et al., 2017; Clark et al., 2021; Gabriel et al., 2021) matters for subsequent work experiences and behaviors. However, how these different before-work cognitions (e.g., reattachment and anticipation) interrelate remains unclear. Thus, future research could further investigate the relevance of cognitive and anticipatory processes during the transition from nonwork to work to better understand how employees can exit their private role to engage in their work role fully. For example, anticipating work demands (e.g., anticipating high workload; Casper et al., 2017; Clark et al., 2021) might either facilitate transitions from the nonwork to work domain because these anticipatory processes trigger work-related cognitions or, contrarily, be a result of transitioning from the nonwork to work domain because employees successfully entered their work role.

With respect to the transition from work to nonwork, researchers could investigate how work might also facilitate nonwork experiences. Because most previous studies focused on how negative work experiences (e.g., job stressors) relate to nonwork experiences, knowledge of positive spillover processes from work and nonwork roles is still limited (Steed et al., 2021). Even though losses due to adverse work experiences might have a stronger impact than gains due to positive work experiences (Meier et al., 2023), it would be worthwhile to better understand the positive associations between work and nonwork. First

meta-analytic results suggest that work-related resources can have the power to facilitate nonwork recovery processes (Steed et al., 2021), and studies examined how positive work-related experiences can alleviate recovery processes (Fritz et al., 2022). Future research could further underscore positive spillover between work and nonwork, for example, by investigating whether support from colleagues and leaders might benefit employees' after-work recovery. One could assume that the relationship quality between supervisors and employees (Volmer et al., 2023), or even explicit recovery support from the leader, could increase employees' nonwork recovery experiences.

Combining both transitions, future research could examine the paradoxical association between the work and nonwork domains in more detail. Specifically, my dissertation highlighted that during both, the transition from nonwork to work and the transition from work to nonwork, demanding situations call for role transitions but at the same time also hamper role transitions (cf. reattachment and recovery paradox; Sonnentag, 2018). More closely investigating processes happening during these crucial transitions could help better understand the paradoxical interplay and eventually dissolve the paradox. For example, shedding light on the underlying self-regulatory and affective mechanisms (Sonnentag, 2018; Zijlstra et al., 2014) can help to make more precise statements about why boundary transitions fail and when loss cycles emerge (Halbesleben et al., 2014; Hobfoll, 1989; Hobfoll et al., 2018). At the same time, explicitly defining and measuring the resources that are often implicitly addressed is critical to stay close to theoretical foundations and to move research forward (Halbesleben et al., 2014).

Finally, future studies could further uncover which moderators change the reciprocal relations between work and nonwork domains. While recovery research often implicitly assumes that recovery processes are equally effective on any given day and for any employee (Sonnentag et al., 2017; Steed et al., 2021), my dissertation suggests otherwise. Specifically,

the social environment can be an expanding or limiting factor for recovery processes and work-nonwork transitions. Similarly, other studies highlighted that, for example, work linkage with partners matters as a boundary condition for joint recovery processes (e.g., Y. Park & Haun, 2017; Walter & Haun, 2020). Scholars could follow this promising avenue and further investigate conditions in employees' social environment that increase or decrease the effectiveness of boundary transitions between the work and nonwork domains. For example, considering the transition from nonwork to work, family demands before starting work might reduce the likelihood that employees use their energetic and cognitive resources to reattach to work.

Practical Implications

Besides its essential theoretical implications and directions for future research, my dissertation also revealed several practical implications. With respect to circadian rhythms, all studies highlighted that it is crucial for employees to reduce mismatches with their social environment or – if not possible – adapt their behavior to the given circumstances. However, as misconceptions about circadian preferences and sleep timing are widespread (Robbins et al., 2019, 2022), the practical implications of my research address three different levels. First, it is inevitable to increase knowledge about the relevance of circadian processes in the population to decrease myths, misconceptions (Robbins et al., 2019, 2022), and prejudices (Yam et al., 2014). Similar to approaches for other health behaviors, science communication tactics such as the "truth sandwich" text format might help to debunk misinformation about circadian preferences while conveying relevant information (König, 2023). Thereby educating employees, supervisors, and organizations with respect to circadian processes builds the basis for every other intervention that can follow.

Second, if possible, circumstances need to be established so that employees can adapt their everyday life to their circadian preferences. For example, flexible work arrangements

can help to decrease social sleep lag and catch-up sleep. Due to social restrictions, the COVID-19 pandemic served as an interesting quasi-experiment, with many employees suddenly being forced to work from home (Ker et al., 2021). Research demonstrated that increased working time flexibility and no need for commuting decreased social sleep lag during this period (Blume et al., 2020; Korman et al., 2020). Beyond, aligning work time with circadian preferences can benefit sleep duration on workdays (i.e., decreasing the need to catch up on sleep during the weekend) and decrease social sleep lag (Juda et al., 2013; Vetter et al., 2015). Accordingly, being able to choose the location and timing of work might help employees to reduce circadian mismatches and thus to better align their circadian preferences with their environment.

Third, if circumstances cannot be changed, employees must be encouraged to adapt their behavior otherwise. On the one hand, for example, employees might employ individual strategies to adjust their circadian rhythms to their social rhythm. As light is one of the most important signals to entrain circadian rhythms (Roenneberg et al., 2007), exposing oneself to bright light during the day and reducing light exposure before going to bed can help to advance daily rhythms (K. P. Wright et al., 2013). This advancement might help to adapt to the social rhythm of work to a certain degree. However, research must still uncover whether this advancement can efficiently decrease social sleep lag (Zerbini et al., 2020). On the other hand, employees might strategically plan their day according to their circadian mismatches to not further impair their recovery processes. For example, employees might avoid engaging in certain recovery activities on days with high social sleep lag (i.e., challenging activities underlying mastery experiences) or consider also spending time apart from their partner if their circadian preferences do not match. However, note that increased flexibility and encouraging employees to live up to their circadian preferences might not be implemented or

even backfire if prejudices and misconceptions continue to exist (Yam et al., 2014). Again, this highlights the need to increase awareness of circadian processes first.

Regarding the reciprocal relations between work and nonwork, the results of my dissertation suggest the necessity of alleviating boundary transitions between work and nonwork domains. Concerning the transition from nonwork to work, improving boundary-transition experiences can help improve employees' well-being during the entire week. Specifically, employees might implement simple practices that can foster reattachment. For example, using just a few minutes to think about upcoming work tasks and goals can be an efficient reattachment intervention (Vogel et al., 2022). Furthermore, following morning routines might act as "transition rites" (Ashforth et al., 2000) that can facilitate boundary transitions and thereby benefit the work domain (McClean et al., 2021). One possible morning routine that can facilitate the transition between nonwork and work might be commuting to work (Jachimowicz et al., 2021; Pindek et al., 2023). At the same time, as reattachment seems to depend on energetic resources, improving sleep can help facilitate boundary-transition experiences. Simple interventions such as wearing blue-light filtering glasses before sleep (Guarana et al., 2021) or adhering to sleep hygiene practices (Barber et al., 2012) might help increase the quality and duration of employees' sleep and, thus, foster employees' transition to work.

Also concerning the transition from work to nonwork, simplifying employees' boundary transition should be the center of attention. Decreasing job stressors is an intuitive approach to facilitating role exit from the work role. For example, unfinished tasks could be reduced by making realistic goals in the morning or by distributing the workload among colleagues, while interpersonal conflicts might be reduced by focusing on common team goals (Hentschel et al., 2013; Hobman et al., 2003). However, as not all stressful situations at work might be preventable, it is essential that employees can still exit their work role such

that negative work experiences do not spill over into the private domain. Similar to morning routines (McClean et al., 2021), also after-work routines might act as "transition rites" (Ashforth et al., 2000), facilitating boundary transitions and, thus, subsequent recovery processes. Again, commuting from work to home might serve as such a transition rite (Jachimowicz et al., 2021; Pindek et al., 2023). Interventions including such boundary-crossing approaches (e.g., educating about transitions rites) have successfully improved recovery experiences (Hahn et al., 2011). Similarly, planning the upcoming workday before ending work might help to leave work behind and enter the private role after work (Smit, 2016). Considering the whole work-nonwork interface, planning the upcoming workday before ending work could, in turn, also facilitate re-entering the work domain in the next morning because goals for the upcoming day are already clear. Thus, employing such simple interventions could help employees transfer loss cycles into gain cycles (Halbesleben et al., 2014).

Conclusion

By integrating circadian processes in research on employees' work-nonwork interface, this dissertation underscores the relevance of circadian mismatches for employees' daily life. Specifically, in three empirical studies, I demonstrated that week-level (catch-up sleep; Study 1), day-level (social sleep lag; Study 2), and person-level (couples' chronotype match; Study 3) circadian mismatches matter directly or as boundary conditions for the transition from nonwork to work (Study 1) as well as the transition from work to nonwork (Study 2 and 3). At the same time, the studies uncover paradoxical relationships between work and nonwork – both at the transition from nonwork to work (i.e., reattachment paradox) as well as the transition from work to nonwork (i.e., recovery paradox; Sonnentag, 2018).

Zooming out of the individual studies, this dissertation moves research forward by suggesting an integration of the rather physiological assumptions that underly circadian

mismatches (Borbély, 1982; Borbély et al., 2016) into person-environment fit theory (Edwards et al., 1998) to explain why mismatches result in impaired recovery processes and well-being (Zijlstra et al., 2014). With this dissertation, I hope to inspire research and practice to take circadian processes more seriously when considering employees' work-nonwork interface. Acknowledging employees' circadian preferences is inevitable because constantly fighting against mismatched circadian rhythms has adverse implications for their well-being and recovery processes.

"The rhythm is gonna get you tonight
No way, you can fight it every day
But no matter what you say
You know it the rhythm is gonna get'cha"
(Gloria Estefan, 1987)

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