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Mind the misalignment: The moderating role of daily social sleep lag in employees' recovery processes

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Summary

Circadian processes are important for employees and organizations yet have been relatively underexplored in recovery research. Thus, we embed the concept of circadian misalignment into the recovery literature by investigating the moderating role of employees' daily social sleep lag (i.e., a discrepancy between employees' actual and biologically preferred sleep–wake times) in their recovery processes. Building on the effort-recovery model and a circadian perspective on recovery, we propose that low relaxation and mastery experiences explain the relationship between workplace interpersonal conflicts and low next-morning vigor. Concerning circadian misalignment, we investigated whether daily social sleep lag impedes the occurrence and effectiveness of after-work recovery experiences (i.e., moderates the relationships with interpersonal conflicts and vigor, respectively). Results of a daily diary study with 274 employees (1926 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 best recover from work, highlighting the need to take circadian processes into account in recovery research.

KEYWORDS
circadian misalignment, interpersonal conflicts, recovery experiences, social sleep lag, vigor

1 | INTRODUCTION

Recovery after work lays a foundation for organizational behavior by enabling employees to maintain their psychological and physiological capital needed for work (Barnes et al., 2023). However, certain job stressors have the potential to spill over into after-work hours and impede crucial recovery processes (Steed et al., 2021). Specifically, workplace interpersonal conflicts are widespread, representing important job stressors that can result in stress reactions and decrease employees' energetic and self-regulatory resources (Baumeister et al., 2019). Because of their self-threatening nature, interpersonal conflicts are likely to spill over into the private domain (Pluut

Two changes in affiliation occurred since this research was conducted: Theresa J. S. Koch now works at the University of Vienna, Austria, and Monika Wiegelmann now works at the Boston Consulting Group.

et al., 2022) and might undermine recovery processes more strongly than other job stressors (Sonnentag, 2018). Accordingly, while recovery might generally help to downregulate and reverse strain reactions, recovery processes can be impaired when experiencing interpersonal conflicts at work (cf. effort-recovery model; Meijman & Mulder, 1998).

A variety of studies have focused on job stressors as antecedents and well-being states as outcomes of after-work recovery (Headrick et al., 2023; Steed et al., 2021). However, although recovery research has made substantial progress over the past two decades (Sonnentag et al., 2022), a crucial aspect has been overlooked. Specifically, previous research has implicitly assumed that the relationships between job stressors, after-work recovery, and well-being operate in an identical manner on any given day. Thereby, research has neglected important daily circumstances that might constrain or foster these recovery processes. In other words, we still know little about day-to-day circumstances that moderate when recovery experiences are particularly impaired after stressful workdays and when recovery experiences are particularly effective in improving employees' well-being (Sonnentag, 2018; Sonnentag & Fritz, 2015). Such insights are important to further refine prominent recovery models, contributing to a deeper knowledge of how recovery processes operate in employees' daily lives.

To better understand the underlying circumstances that moderate the occurrence and effectiveness of daily recovery experiences, we posit it is essential to consider employees' energetic and self-regulatory resources as they emerge during the day. Specifically, when adopting a circadian perspective, recovery has been described as a process that regulates arousal throughout the day (Zijlstra et al., 2014). Arousal thereby follows circadian rhythms that determine the peaks and troughs in self-regulatory and energetic resources during a 24-h cycle (Borbély, 1982; Borbély et al., 2016). Accordingly, because the upregulation and downregulation of arousal is essentially the core interest of recovery research (Zijlstra et al., 2014), research needs to integrate circadian processes and recovery from work. Still, despite the potential relevance of circadian processes for recovery, research has neglected their role in recovery after work (Völker et al., 2023) and instead focused on circadian processes *during* work (e.g., Kühnel et al., 2016).

In this study, we aim to advance recovery research and reinforce the circadian perspective on recovery by investigating the moderating role of circadian misalignment (i.e., daily social sleep lag) in employees' daily recovery processes. In daily life, employees' natural circadian preferences of when to be active and asleep during the day can conflict with their work schedules. This results in a circadian misalignment, which has also been referred to as social sleep lag (i.e., a discrepancy between actual and biologically preferred daily rhythms; Kühnel et al., 2016; Wittmann et al., 2006). On days with high social sleep lag, employees' work requires them to be aroused at times of the day they would not normally be when following their biological circadian preferences (Roenneberg et al., 2003; Wittmann et al., 2006). Consequently, employees need to invest additional effort to reach the arousal their work requires to fulfill their tasks (cf. Zijlstra et al., 2014). Because daily social sleep lag increases the discrepancy between actual (determined by circadian preferences) and required (determined by work) arousal levels, we propose that it changes daily recovery processes that focus on the upregulation and downregulation of arousal. Specifically, combining the effort-recovery model (Meijman & Mulder, 1998) and a circadian perspective on recovery (cf. Zijlstra et al., 2014), we suggest that daily social sleep lag impedes the occurrence (i.e., moderates the relationship with interpersonal conflicts) and the effectiveness (i.e., moderates the relationship with next-morning vigor) of after-work recovery experiences (i.e., relaxation and mastery). Figure 1 shows our conceptual model.

Our study contributes to research in three important ways. First, we introduce circadian misalignment to the recovery literature. Even

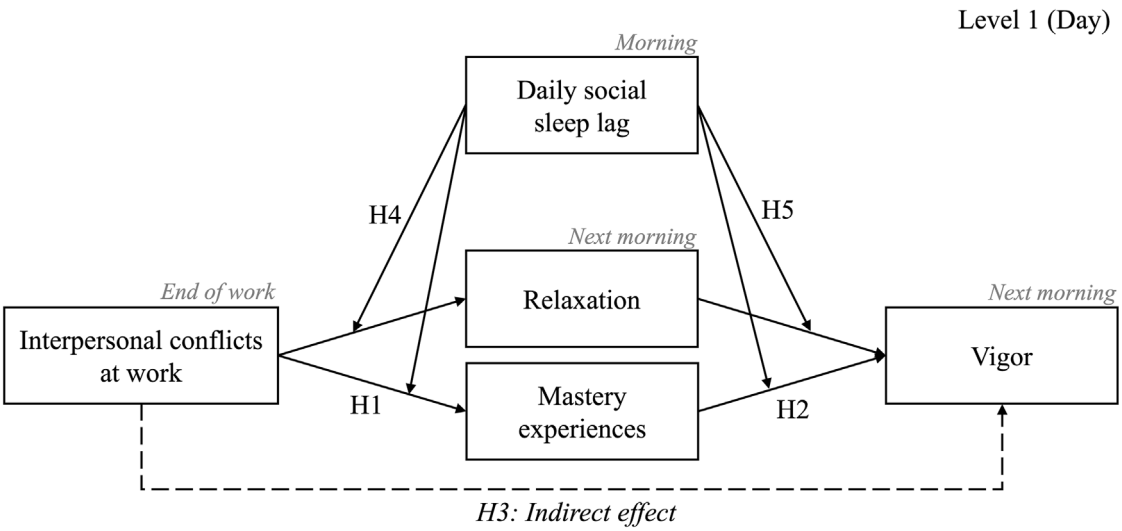

FIGURE 1 Conceptual model. *Note*: Dashed line: proposed indirect association between interpersonal conflicts and next-morning vigor via relaxation and mastery experiences.

though previous research has demonstrated that circadian misalignment matters for employees at work (Kühnel et al., 2016) and scholars have suggested circadian perspectives on recovery (Völker et al., 2023; Zijlstra et al., 2014), circadian processes and particularly circadian misalignment have not been studied in recovery research. This is an unfortunate oversight because circadian processes largely determine the peaks and troughs of employees' energetic and self-regulatory recourses throughout the day. These, in turn, are the core interest of recovery research that focuses on depletion and restoration of resources (Zijlstra et al., 2014). Investigating circadian misalignment (i.e., social sleep lag) as a day-level moderator provides the unique opportunity to identify which day-specific factors change the occurrence and effectiveness of after-work recovery processes and, hence, determine when and how employees best recover from work. Thereby, we simultaneously respond to calls to further investigate which factors change employees' daily recovery processes (e.g., Steed et al., 2021) and refine predominant recovery models neglecting such moderators (Meijman & Mulder, 1998).

Second, we focus on social sleep lag as an important but rarely examined circadian facet of sleep and introduce its *daily fluctuations* to organizational sleep research. To date, only a few empirical studies have examined the role of circadian misalignment for employees at work (e.g., Kühnel et al., 2016) and have considered social sleep lag to be a person-level construct. Interestingly, while the relevance of daily fluctuations in other aspects of sleep has already been demonstrated (e.g., sleep duration and quality; Liu et al., 2021), possible fluctuations in circadian misalignment have been neglected. However, similar to sleep quality and sleep duration, sleep timing might also change from day to day (Kühnel et al., 2018; Roenneberg et al., 2019). Accordingly, only investigating stable between-person differences in social sleep lag underestimates the dynamic nature of sleep and the circadian system during the workweek (Roenneberg et al., 2019). By considering day-level social sleep lag, we take these fluctuations into account and paint a more accurate picture of circadian misalignment and its consequences for employees. Thereby, the daily fluctuations in social sleep lag reflect the assumptions of the circadian perspective on recovery (Zijlstra et al., 2014) by representing daily deviations between the actual (determined by circadian preferences) and required (determined by work) arousal levels that can dynamically change the occurrence and effectiveness of recovery processes.

Third, we contribute to the job stress literature by investigating the interplay of interpersonal conflicts, recovery, and well-being. We draw on the effort-recovery model (Meijman & Mulder, 1998) to establish relaxation and mastery experiences as explanatory mechanisms in the relationship between interpersonal conflicts and next-morning vigor. While previous research has focused on psychological detachment from work (Sonnentag & Fritz, 2015), we argue that the core assumptions of the effort-recovery model (Meijman & Mulder, 1998) also apply to relaxation and mastery experiences. Focusing on relaxation and mastery experiences characterized by low and high arousal, respectively, can help us to better understand how recovery experiences might regulate employees' arousal when taking a circadian perspective (cf. Zijlstra et al., 2014). Thus, we add to previous job stress research that has largely focused on cognitive mechanisms (i.e., impaired psychological detachment; Wendsche & Lohmann-Haislah, 2017) by introducing an arousal-regulation perspective to explain the detrimental role of interpersonal conflicts for well-being.

1.1 | Interpersonal conflicts, recovery experiences, and next-morning vigor

Building on the effort-recovery model (Meijman & Mulder, 1998), we propose that daily job stressors are negatively related to employees' well-being via reduced recovery experiences after work. The effort-recovery model (Meijman & Mulder, 1998) suggests that work effort requires psychological resources to be invested and these depleted resources are recovered when work ends. However, if recovery does not take place, strain reactions accumulate, and well-being is impaired. Thus, a lack of recovery can explain the negative relationship between job stressors and subsequent well-being.

Following this theoretical perspective (Meijman & Mulder, 1998), we investigate recovery experiences as underlying psychological aspects of the recovery process. While different experiences can matter for recovery (e.g., detachment, relaxation, mastery, and control; Sonnentag & Fritz, 2007), previous research has mainly focused on psychological detachment (i.e., mentally leaving work behind; Sonnentag & Fritz, 2015). However, building on our circadian perspective on recovery, we argue that relaxation (i.e., experiencing low physiological arousal) and mastery (i.e., experiencing competence due to overcoming challenges; Sonnentag & Fritz, 2007) 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 arousal, respectively, and thus may have opposing implications for the recovery process (Sonnentag & Fritz, 2007). Specifically, while relaxation is associated with low-aroused states, mastery is associated with high-aroused states (Ouyang et al., 2019; Sonnentag et al., 2008). Detachment, instead, focuses more on cognitive aspects of recovery and less on underlying energetic arousal processes (Sonnentag & Fritz, 2007). Thus, mastery and relaxation experiences are uniquely suited to investigate circadian aspects of recovery that focus on arousal regulation.

With respect to job stressors within the effort-recovery model framework, we focus on interpersonal conflicts at work (e.g., disagreements or experiences of mistreatment; Spector & Jex, 1998). Specifically, we focus on relationship conflicts with coworkers and supervisors (e.g., personal tensions arising from diverging personal beliefs) as opposed to purely work-related task conflicts (Giebels & Janssen, 2005). As relatedness is a basic human need (Deci et al., 2017), maintaining good relationships and not experiencing conflicts with others is desirable for most people—which is also the case at work as important life domain (US 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) and constitute a relevant job stressor with far-reaching negative consequences (Gerhardt et al., 2021; van Woerkom & van Engen, 2009). Importantly, the adverse effects of interpersonal conflicts likely spill over to the private domain (Pluut et al., 2022). This should especially be the case for relationship conflicts that refer to employees' private lives (e.g., personal beliefs)—as opposed to task conflicts or quantitative job stressors that relate purely to work tasks and might not strongly interfere with their private lives (Giebels & Janssen, 2005; Meier et al., 2013; Sonnentag, 2018).

Regarding the relationship between job stressors and recovery, interpersonal conflicts at work should impede relaxation and mastery experiences after work. When employees experience interpersonal conflicts at work, their energetic and self-regulatory resources can be impaired (Baumeister et al., 2019) because these conflicts represent a threat to employees and trigger 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 downregulate themselves (Meijman & Mulder, 1998; Zijlstra et al., 2014). Interpersonal conflicts thus make it harder for employees to downregulate due to ongoing negative arousal and limited energetic and self-regulatory resources (Baumeister et al., 2019; Meier et al., 2013). Thereby, interpersonal conflicts decrease the likelihood that employees can relax after work—as a state characterized by low physiological arousal. Similarly, encountering conflicts at work should decrease energetic and self-regulatory resources needed for mastering challenges because these resources are occupied with dealing with the physiological stress reaction (Baumeister et al., 2019; Nixon et al., 2011). After experiencing interpersonal conflicts, it is thus harder for employees to regulate their arousal and the likelihood that employees naturally experience mastery after work decreases (Zijlstra et al., 2014). Hence, we conclude that workplace interpersonal conflicts should be negatively related to relaxation and mastery experiences after work.

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

Recovery experiences, in turn, should translate to higher next-morning well-being. Specifically, we focus on employees' next-morning vigor as a well-being state. By incorporating positive and activated affect (Russell, 1980; Shirom, 2011), vigor represents a core aspect of employees' well-being (Diener et al., 1999). When employees feel vigorous, they feel, for example, "lively" or "full of pep" (McNair et al., 1971). Morning vigor is considered an important outcome as vigorous states matter for subsequent behavior (Venz et al., 2018) and performance (Binnewies et al., 2009) at work. Therefore, we see vigor as an indicator of how recovery serves to maintain the human capital needed for work (Barnes et al., 2023).

Following the effort-recovery model (Meijman & Mulder, 1998), we propose that relaxation and mastery experiences boost employees' next-morning vigor. Feeling relaxed in combination with low physiological arousal and low tension should reduce the load from work (Meijman & Mulder, 1998; Sonnentag & Fritz, 2007). This means that when work-related demands are no longer present, energetic resources can be restored during the evening (Meijman & Mulder, 1998). Accordingly, employees downregulate their arousal and recover their energetic and self-regulatory resources (Zijlstra et al., 2014). Thus, relaxation after work should increase employees' next-morning vigor. In contrast, mastery experiences arise from more challenging activities (e.g., physical or creative activities; Alameer et al., 2023) and give employees a feeling of competency. Thus, experiencing mastery can feel energizing and uplifting (van Hooff & De Pater, 2019; Vandercammen et al., 2014). Accordingly, 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). Previous empirical results support our assumptions by suggesting that relaxation and mastery experiences are indeed positively related to vigorous states (Bennett et al., 2018; Headrick et al., 2023).

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

By synthesizing the previous hypotheses within the effort-recovery model framework (Meijman & Mulder, 1998), relaxation and mastery should explain why interpersonal conflicts at work are negatively related to next-morning vigor. When facing interpersonal conflicts at work, employees struggle to regulate their arousal and lack the energetic as well as 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 to restore energetic and self-regulatory resources, interpersonal conflicts hamper relaxation and mastery in the first place. This, in turn, results 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.

1.2 | The moderating role of daily social sleep lag

We propose that daily social sleep lag moderates the relationship between interpersonal conflicts and recovery experiences, as well as between recovery experiences and next-morning 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 employees' circadian preferences) with the required level (determined by work). Building on this idea, we now explain why circadian misalignment indicated by social sleep lag should impede the occurrence and effectiveness of recovery experiences.

In humans, the biological clock causes various physiological functions to follow circadian rhythms with a cycle that lasts approximately 1 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 spent 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 chronotypes (Roenneberg et al., 2003) such that earlier chronotypes have an earlier sleep gate and reach their peak energy level earlier in the day than later chronotypes (Wiegelmann et al., 2023).

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 overrule 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 stable person-level characteristic. For example, employees might experience higher social sleep lag on days when they are forced to get up unusually early to attend an early-morning meeting. While they might still sleep sufficiently long by going to bed earlier, sleeping outside their biological sleep gate (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 with 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 (e.g., being attentive during early-morning meetings). In the evening, on the contrary, downregulation might be needed as employees' arousal levels are still too high to sleep.

Therefore, we propose that daily social sleep lag impedes daily recovery processes (i.e., if and how employees recover after stressful workdays). Specifically, the relationship between job stressors and recovery experiences can be exacerbated, for example, by 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. On these days, employees need to continuously regulate themselves to overcome the discrepancy between required and actual arousal levels, resulting in fewer remaining energetic and self-regulatory resources at the end of the workday (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 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 because energetic and self-regulatory resources 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 available energetic resources 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 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 in combination with low physiological activation, mastery experiences can increase arousal after work by mastering challenges (Ouyang et al., 2019; Sonnentag et al., 2008; Sonnentag & Fritz, 2007).

First, the benefits of experiencing relaxation should be especially evident on days with high social sleep lag. 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. As no additional energetic activation is required (Sonnentag & Fritz, 2007), experiencing relaxation helps downregulate arousal after work and, thus, aligns the actual arousal

level with 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, which is reflected in higher next-morning energetic states (Meijman & Mulder, 1998). Taking the above into account, we propose that relaxation is more strongly associated with higher next-morning vigor on days when social sleep lag is higher (vs. lower).

Second, the potential benefits of mastery experiences should be hampered on days with higher social sleep lag. Experiencing mastery can be accompanied by elevated arousal levels (Sonnentag & Fritz, 2007). When experiencing mastery on days with high social sleep lag, employees feel activated even though they should downregulate their arousal levels to sleep. Thereby, mastery experiences could increase arousal before sleep, resulting in an actual arousal level that deviates even more from the required level and, hence, energetic and self-regulatory resources are less likely to be restored overnight (Zijlstra et al., 2014). Consequently, we suggest that on days when social sleep lag is high (vs. low), mastery experiences are less effective in increasing next-morning vigor (i.e., weaker relationship).

> **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).

2 | METHOD

2.1 | Study design and sample

To test our hypotheses, we conducted a daily diary study within a larger research project on promoting health behavior at work (Koch et al., 2023) that received ethics approval by the institutional review board. We collected data between May 2020 and December 2021 in Germany while Germany was still partly affected by the COVID-19 pandemic. Even though data collection largely took place during the later phases of the pandemic, some participants might have still been forced to work from home. We later describe how we accounted for these special circumstances in the analyses (see Section 2.2.5). Participants were employees working at least 30 h 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 €1200 each. Participants received invitations to all online surveys via e-mail. After answering a general questionnaire, participants responded to daily surveys during two workweeks (Monday to Friday). While the greater research project included three daily surveys (morning, noon, and after-work surveys), we only used two daily surveys for this study (morning and after-work survey). The morning surveys were available from 5 AM to 10 AM (participants were instructed to answer the survey before work), and the after-work surveys were available from 3 PM to 10 PM (participants were instructed to answer the survey right after work).[1]

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: 2946 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 Monday to Thursday and 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 2 h 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 1926 days (1789 morning, 1748 after-work, and 1750 next-morning surveys). Participants in the final sample were predominantly female (82%), and their mean age was $M = 39.7$ ($SD = 11.0$) years. They mostly worked between 30 and 40 h (45%) or more than 40 h (47%) per week in various occupations (most frequent: office and administrative occupations: 45.6%; health, social, and educational occupations: 25.5). Despite data collection during the later phases of the COVID-19 pandemic, participants worked in person most of the days (77%), with 61 participants working only in person and 16 participants working only remotely during the data collection phase. 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, χ^2 (1) $= 0.847$, $p = .357$, education, $t(379.31) = -0.049$, $p = .961$, or living with others in the same household, χ^2 (1) $= 1.31$, $p = .252$.

2.2 | 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

[1] 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 with the aim 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 a 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.

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 when necessary. Two-level Cronbach's alphas (Geldhof et al., 2014) of all scales are presented in Table 1.

2.2.1 | 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 and 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 2-h difference between the respective employee's daily midpoint of sleep and the biologically preferred midpoint of sleep.

2.2.2 | Interpersonal conflicts at work

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" were answered on a 5-point Likert scale ranging from 1 = *not at all true* to 5 = *absolutely true*.

2.2.3 | Relaxation and mastery

We assessed relaxation and mastery using three items each from the Recovery Experience Questionnaire (Sonnentag & Fritz, 2007). 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*.

2.2.4 | Vigor

We assessed employees' momentary vigor using four items from the Profile of Mood States (McNair et al., 1971, German version: Bullinger et al., 1990). Employees indicated whether they currently felt

TABLE 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: Correlations below the diagonal are person-level correlations ($N = 274$). Correlations above the diagonal are day-level correlations ($n = 1926$).
Abbreviations: 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).
[a]In decimal hours.
*$p < .05$, **$p < .01$, and ***$p < .001$.

"vigorous," "lively," "active," and "full of pep" on a 5-point Likert scale ranging from 1 = *not at all* to 5 = *very much*.

2.2.5 | Control variables

To increase the robustness of our results, we included 3 day-level control variables because of the day-level focus of our research model. 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 et al., 2018; Roenneberg et al., 2019) and well-being might change from the beginning to the end of the week (Weigelt et al., 2021). Second, we controlled for participants' work location while answering the surveys (0 = *not working from home*, 1 = *working from home*) because we collected data during the COVID-19 pandemic, which forced some of the participants to work from home. Working from home might have impacted some of our primary constructs, for example, reduced interpersonal conflicts at work due to a lack of in-person contact or altered recovery processes due to blurred boundaries between one's work and private life (Cho, 2020). Third, we controlled for affective tendencies in our self-report data to rule out that employees' experiences were altered by positive affective biases (cf. Rothbard & Wilk, 2011). Specifically, we measured low-aroused positive affect (i.e., 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).

2.3 | Analytic strategy

To account for the two-level structure of our data (days nested within persons), we used two-level path analyses 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 an imputation model, including the assumed interaction terms (Enders et al., 2014; Grund et al., 2018; Lüdtke et al., 2017).

To test 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 control variables (day of the week, working from home, serenity) 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 ($-1SD$) and high ($+1SD$) values of social sleep lag (Aiken et al., 1991; Preacher et al., 2016).

2.4 | Preliminary analyses

Descriptive statistics, variance decomposition, and correlations of all variables are displayed in Table 1. All variables exhibited considerable day-level variance (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 h, with a mean of $M = 1.3$ ($SD = 0.9$) hours. Thus, on average, participants experienced a 1 h and 18 min discrepancy between their biologically preferred mid-sleep point and their actual mid-sleep point on workdays. With a maximum of 6 h and 48 min, the respective employee experienced a daily social sleep lag larger than time zone differences when traveling from Paris, France, to New York City, United States.

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, χ^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 S1).

3 | RESULTS

3.1 | Hypotheses testing

To test Hypotheses 1 to 3, we first relied on the path model with main effects only (see Section 2.3). Results of this two-level path model are displayed in Table 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 after work. Supporting Hypothesis 1b, but not 1a, interpersonal conflicts at work were negatively related to mastery ($\gamma = -0.082$, $SE = 0.037$, $p = .026$), but not relaxation ($\gamma = -0.026$, $SE = 0.040$, $p = .511$) after work. Hypothesis 2 suggested that (a) relaxation and (b) mastery experiences are positively related to next-morning vigor. Indeed, both relaxation ($\gamma = 0.066$, $SE = 0.021$, $p = .002$) and mastery ($\gamma = 0.047$, $SE = 0.021$, $p = .022$) positively predicted next-morning vigor, supporting Hypothesis 2a,b. 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 3a, mastery (estimate indirect effect = −0.004, $SE = 0.002$, 95% CI [−0.010;-0.001]) but not relaxation (estimate indirect effect = −0.001, $SE = 0.003$, 95% CI [−0.007;0.004]) explained why 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. 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 were significant (predicting relaxation: $\gamma = 0.055$, $SE = 0.107$, $p = .611$; predicting mastery: $\gamma = 0.106$, $SE = 0.086$, $p = .220$), resulting in Hypothesis 4a,b 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 ($\gamma = 0.053$, $SE = 0.048$, $p = .268$), failing to support Hypothesis 5a. However, in line with Hypothesis 5b, social sleep lag moderated the relationship between mastery experiences and next-morning vigor ($\gamma = -0.126$, $SE = 0.050$, $p = .011$). 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*, $\gamma = 0.099$, $SE = 0.029$, $p = .001$) and not significant on days with higher social sleep lag (+1*SD*, $\gamma = -0.012$, $SE = 0.030$, $p = .702$). The interaction effect is displayed in Figure 2.

Conditional indirect effects (see Table 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 2 Results of two-level path analysis: Model with main effects only.

	Social sleep lag		Interpersonal conflicts		Relaxation		Mastery		Vigor (next morning)	
	γ	SE	γ	SE	γ	SE	γ	SE	γ	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: Day of the week, working from home, and serenity (next morning) were included as control variables. $N = 274$ employees providing data on 1926 days.

[a]Coded 0 = *Monday* to 3 = *Thursday*.

[b]Coded 1 = *working from home* and 0 = *not working from home*.

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

TABLE 3 Results of two-level path analysis: Model with within-person interaction effects.

	Social sleep lag		Interpersonal conflicts		Relaxation		Mastery		Vigor (next morning)	
	γ	SE	γ	SE	γ	SE	γ	SE	γ	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: Day of the week, working from home, and serenity (next morning) were included as control variables. $N = 274$ employees providing data on 1926 days.

[a]Coded 0 = *Monday* to 3 = *Thursday*.

[b]Coded 1 = *working from home* and 0 = *not working from home*.

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

With respect to our control variables, the results displayed in Table 2 showed that day of the week was positively related to daily social sleep lag ($\gamma = 0.035$, $SE = 0.011$, $p = .001$), indicating an increase from Monday to Thursday.[2] In addition, participants reported a lower daily social sleep lag ($\gamma = -0.158$, $SE = 0.040$ $p < .001$) and fewer workplace interpersonal conflicts ($\gamma = -0.087$, $SE = 0.036$, $p = .016$) when working from home (vs. not working from home). Next-morning serenity was significantly related to all variables (relaxation: $\gamma = 0.169$, $SE = 0.038$, $p < .001$; mastery: $\gamma = 0.098$, $SE = 0.039$, $p = .008$; vigor: $\gamma = 0.474$, $SE = 0.034$, $p < .001$).[3,4]

3.2 | 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 (cf. Hypothesis 4 and 5). The results (see Table S2) 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 (previously tested in Hypothesis 5b), even when the interaction effects of sleep duration and sleep quality, respectively, were taken into account. Thus, we conclude that daily social sleep lag is as a relevant moderator for how employees' mastery experiences boost next-morning vigor, over and above other sleep characteristics.

[2]We also tested day of study participation (coded 1 = *first Monday* to 8 = *last Thursday*) as well as cyclical effects of day of the week (sine and cosine functions) as day-level control variables. Day of study participation did not relate to any of the variables. Only daily social sleep lag was significantly and positively predicted by its cosine function. Including day of study participation or cyclical effects of day of the week 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.

[3]We also tested daily household/childcare activities (day level) as well as age, gender, living with children in the same household, and job type (person level) as additional covariates in all models. Including these additional control variables did not change any of our results.

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

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 mid-sleep point 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, predicting these random slopes by person-level social sleep lag. The results (see Table S3) 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 moderator in day-level recovery processes.

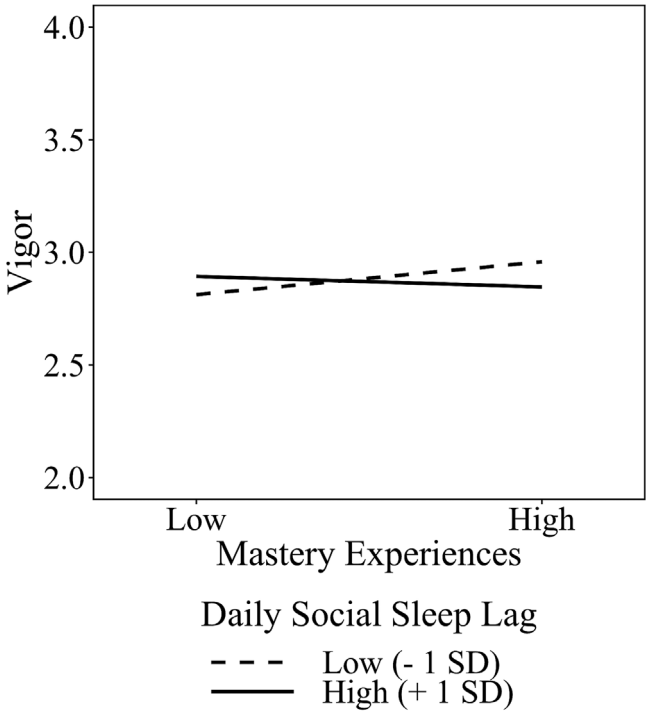

FIGURE 2 Interaction plot of significant within-person moderation effect of social sleep lag on the association between mastery and next-morning vigor. *Note*: The *y* axis was rescaled for better visibility of the slopes. Vigor was assessed using a 5-point Likert scale ranging from 1 to 5.

Third, we included the day of the week (previously used as control variable) as an additional moderator in our model. 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. The results (see Table S4) 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 ($\gamma = -0.148$, $SE = 0.070$, $p = .035$; see Figure 3). On Mondays, interpersonal conflicts at work were negatively related to mastery experiences when daily social sleep lag was lower ($-1SD$, $\gamma = -0.352$, $SE = 0.096$, $p < .001$) but not when social sleep lag was higher ($+1SD$, $\gamma = -0.042$, $SE = 0.098$, $p = .670$). On Thursdays, the relationship between interpersonal conflicts at work and mastery experiences was not significant at any level of social sleep lag ($-1SD$: $\gamma = 0.078$, $SE = 0.082$, $p = .345$; $+1SD$: $\gamma = -0.002$, $SE = 0.079$, $p = .981$). 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 sleep.

4 | DISCUSSION

With this daily diary study, we embedded the concept of circadian misalignment into recovery research by investigating the moderating role of daily social sleep lag in employees' recovery processes. Building on the effort-recovery model (Meijman & Mulder, 1998), we proposed that low levels of after-work relaxation and mastery experiences explain the relationship between interpersonal conflicts and low next-morning vigor. Integrating a circadian perspective on recovery (Zijlstra et al., 2014), we argued 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 relaxation, explained the negative association between interpersonal conflicts and next-morning vigor. Additionally,

TABLE 4 Day-level (conditional) indirect effects depending on the moderator social sleep lag.

Day-level indirect effect	Moderator: social sleep lag	Estimate	SE	95% CI
Interpersonal conflicts at work → relaxation → vigor	-1*SD*	−0.002	0.004	[−0.011; 0.005]
	Main effect only	−0.001	0.003	[−0.007; 0.004]
	+1*SD*	0.000	0.005	[−0.011; 0.011]
Interpersonal conflicts at work → mastery → vigor	**−1*SD***	**−0.013**	**0.006**	**[−0.027; −0.002]**
	Main effect only	**−0.004**	**0.002**	**[−0.010; −0.001]**
	+1*SD*	0.000	0.002	[−0.002; 0.008]

Note: Bold means confidence interval does not include zero. Unstandardized estimates were 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).
Abbreviation: CI, confidence interval.

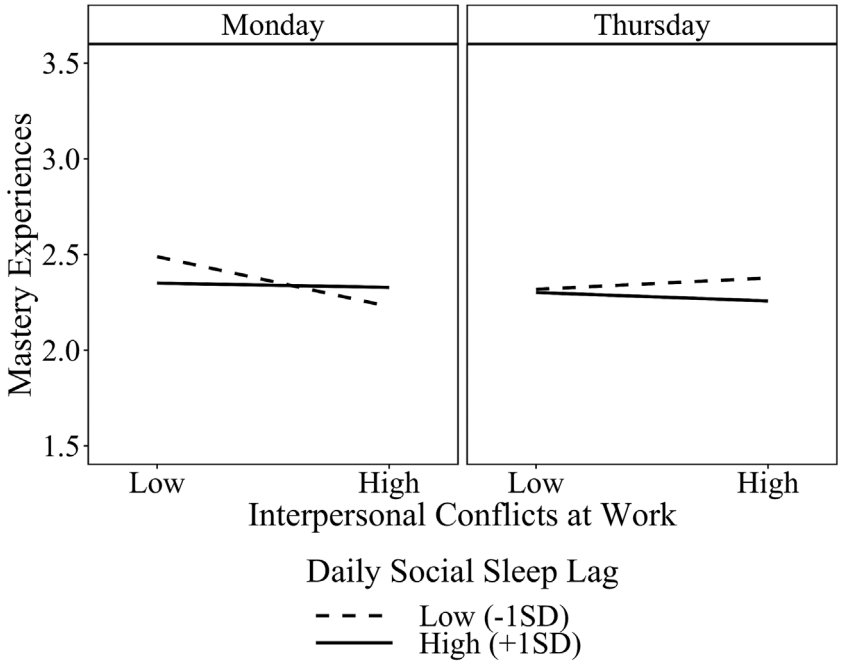

FIGURE 3 Interaction plot of significant within-person moderation of social sleep lag and day of the week on the relationship between interpersonal conflicts and mastery (three-way interaction). *Note*: The *y* axis was rescaled for better visibility of the slopes. Mastery experiences were assessed using a 5-point Likert scale ranging from 1 to 5.

in terms of their next-morning vigor, employees benefited less from mastery experiences on days with higher (vs. lower) social sleep lag.

4.1 | Theoretical implications

Our study bridges the gap between research on recovery from work and circadian misalignment, yielding several theoretical implications. First, our study advances the recovery literature by highlighting the relevance of circadian misalignment. Specifically, 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 effort-recovery model (Meijman & Mulder, 1998) and a circadian perspective on recovery (cf. Zijlstra et al., 2014), employees' mastery experiences translated not 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 fewer energetic and self-regulatory resources being restored overnight (Zijlstra et al., 2014). Moreover, it is important to note that social sleep lag moderated 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. These results emphasize 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 has already been applied to other fields of organizational behavior (e.g., leadership; Volk et al., 2023), it has rarely found its way into empirical recovery research (Völker et al., 2023). Neglecting this circadian perspective is a crucial oversight because circadian processes determine employees' peaks and troughs as well as upregulation and downregulation of energetic and cognitive resources during the day. Because recovery research essentially centers around the depletion and restoration of these energetic and cognitive resources, it is necessary to incorporate how circadian processes change recovery processes. As our findings on the role of social sleep lag demonstrate, one may arrive at incorrect conclusions about the benefits of certain recovery experiences when ignoring circadian processes. We hope that our results inspire future research by demonstrating that certain recovery processes are ineffective on days with higher circadian misalignment. Building on these results, we further encourage scholars to link employees' circadian and recovery processes in theoretical and empirical work. By doing so, recovery research could provide more precise insights into the dynamic resource regulation processes that employees undergo during a day.

Likewise, these results also advance the recovery literature by suggesting 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 has suggested that recovery processes are equally effective every day (Sonnentag et al., 2017). However, our results demonstrate that day-level factors make mastery experiences less effective in restoring employees' energetic resources under certain circumstances (i.e., on days with a higher social sleep lag). Even though this effect was rather small,[5] which is not unusual in daily diary studies (Gabriel et al., 2019),

[5]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 0.4% of day-level variance in vigor.

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, 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; Alameer et al., 2023) depend more on energetic and self-regulatory resources and, thus, social sleep lag plays a greater role. All in all, considering moderators of recovery processes is crucial to gain a deeper understanding of how and when employees most benefit from *which* recovery experiences. Thereby, we advance theoretical perspectives on recovery that have largely neglected moderating circumstances (Meijman & Mulder, 1998) and instead suggest that recovery experiences are beneficial on any given day (Sonnentag & Fritz, 2007). Accordingly, our study indicates that recovery processes are more complex than previously assumed and can be subject to important daily circumstances that limit and expand their potential in improving employees' well-being.

Second, our study contributes to organizational sleep research by demonstrating that taking a day-level perspective on social sleep lag can be beneficial. Specifically, our results revealed that social sleep lag exhibited a notable amount of within-person variance, and day-level—not person-level—social sleep lag changed 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 worthwhile to consider within-person fluctuations in social sleep lag. Neglecting within-person fluctuations and only considering person-level circadian misalignment might lead to the dynamic nature of sleep and the circadian system during the week being underestimated (Roenneberg et al., 2019). Similar to other sleep characteristics, such as sleep quality (e.g., Liu et al., 2021), future research might benefit from studying circadian misalignment on the 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 a moderator 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) did daily social sleep lag moderate 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 et al., 2018). Thus, considering the day of the week can be crucial in painting a more accurate picture of how circadian processes change as the week goes by. Taken together, our study underpins that it is necessary to account for circadian processes and their daily fluctuations to account for the complex regulation of the human sleep–wake rhythm. While this daily perspective is suited for adopting a circadian perspective on recovery (Zijlstra et al., 2014), it also translates to investigating other day-level consequences of circadian misalignment (e.g., adverse work-related consequences of expending compensatory effort during the workday).

Third, our study advances the job stress literature by highlighting that the adverse link between workplace interpersonal conflicts and employees' next-morning well-being can be explained by low mastery experiences. Accordingly, interpersonal conflicts seem to have the power to adversely affect employees' evening and, in turn, their next workday as morning vigorous states can be a prerequisite for behavior and performance (Binnewies et al., 2009; Venz et al., 2018). However, interpersonal conflicts were not related to lower levels of relaxation after work. These results underline that dealing with the physiological stress reaction following interpersonal conflicts limits employees' energetic and self-regulatory resources, which are subsequently not available for mastering challenges (Baumeister et al., 2019; Nixon et al., 2011). Considering the diverging results for mastery and relaxation, recent research has demonstrated that different recovery activities underly relaxation and mastery experiences (Alameer et al., 2023). Thus, one might speculate that interpersonal conflicts negatively affect effortful recovery activities (e.g., physical or creative activities) that typically lead to mastery experiences but not to relaxation. While previous research on the recovery-undermining effects of job stressors has often focused on impaired psychological detachment (Sonnentag & Fritz, 2015), we thus demonstrate that the core assumptions of the effort-recovery model (Meijman & Mulder, 1998) also translate to mastery experiences. Thereby, we identify an additional pathway of why workplace interpersonal conflicts spill over into the private domain. Specifically, these interpersonal conflicts might not only impede psychological detachment (Wendsche & Lohmann-Haislah, 2017) but also constrain employees' opportunities for growth in the private domain (i.e., mastery experiences) and thereby undermine well-being. These results can inspire future job stress research to investigate the explanatory mechanisms of these spillover processes besides cognitive aspects linked with psychological detachment.

4.2 | Directions for future research

Going beyond the theoretical implications, our study offers specific avenues for future empirical research. First, scholars could investigate the temporal processes underlying the circadian perspective on recovery in greater detail. Our results highlight that mastery experiences translated not to next-morning vigor on days when social sleep lag was higher (vs. lower). While we referred to mastery experiences during the entire evening, future studies could focus on more complex temporal patterns such as trajectories of recovery experiences during the evening (Arnold et al., 2023). For example, mastery experiences right after work might translate to next-morning vigor, but mastery experiences shortly before sleep would 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 moderator in this relationship between mastery experiences, time, and next-morning vigor (i.e., a three-way interaction) such

that increasing mastery trajectories during the evening would 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, future research could investigate the relevance of daily circadian misalignment for other recovery opportunities during the day. 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 that social sleep lag acts as a moderator for the effectiveness of employees' recovery processes after work. However, recovery might also occur at work (Chan et al., 2022). Thus, future research could build on our results and investigate the interplay of daily circadian misalignment with other recovery opportunities, for example, breaks during the workday (Chan et al., 2022).

Third, future research could identify mechanisms through 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 to experience mastery (Sonnentag, 2018). Future studies could directly address these mechanisms, for example, by testing energetic resource depletion as an underlying process between interpersonal conflicts at work and mastery experiences. At the same time, researchers could investigate how additional conflicts at home factor into these relationships. For example, interpersonal conflicts at work might result in employees also experiencing more conflicts at home (Pluut et al., 2022; Sanz-Vergel et al., 2015), leading to even stronger impairments of recovery processes. These insights can then help in designing interventions to improve experiencing mastery even after encountering interpersonal conflicts at work.

4.3 | Limitations

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 (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, and 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 reports from colleagues of interpersonal conflicts or objectively assessed sleep times (e.g., using actigraphy, Kühnel et al., 2021), to reduce concerns about common-method bias further. At the same time, the effort-recovery model also largely focuses on physiological load reactions (Meijman & Mulder, 1998), which we could not portray when solely relying on self-report measures. Accordingly, future research could extend our research by assessing physiological recovery or strain indicators as a consequence of encountering interpersonal conflicts at work (e.g., cortisol levels; Sommovigo et al., 2023).

Second, we measured some of our constructs in the next morning. On the one hand, to decrease the burden on participants, we retrospectively assessed employees' recovery experiences in the next morning instead of 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 the next morning has the advantage of being able to refer to the whole evening and not only the time until participants answered the last questionnaire before bedtime. On the other hand, the study 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 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, the generalizability of our results might be limited. On the one hand, we collected data during the COVID-19 pandemic with accompanying restrictions and lockdowns. In particular, working-from-home mandates could have been accompanied by changes in employees' work situation and recovery processes. A shift to digital communication practices also occurred at this time (McGloin et al., 2022; Nguyen et al., 2020), which might have impacted the frequency and type of interpersonal conflicts with coworkers and supervisors. Unfortunately, however, we did not collect information on how often and which communication tool employees used to interact with coworkers and supervisors. Still, we observed that interpersonal conflicts were lower when working from home, suggesting that working-from-home mandates indeed mattered for the absolute levels of conflict. At the same time, employees' sleep times as well as recovery opportunities could have been different because the ongoing pandemic control measures during data collection might have limited leisure opportunities. Indeed, our results demonstrated that social sleep lag was lower when working from home, resembling results that employees were better able to follow their circadian preferences during the pandemic (Blume et al., 2020; Korman et al., 2020). Additionally, working-from-home mandates might have led to a stronger blurring of one's work and private life (Cho, 2020), even though in our data, levels of recovery experiences and well-being did not differ when working from home (vs. not working from home). On the other hand, we collected our data in Germany, which possibly limits the generalizability to other countries and cultures. Even though research on cross-cultural differences is scarce, recovery processes might

potentially differ between cultures and countries, for example, due to differences in legal work time regulations or the subjective importance of specific recovery activities (Sonnentag et al., 2022). Specifically, relationships between recovery and well-being might be stronger in European than in non-European samples (Headrick et al., 2023). Taken together, further replicating our findings in different samples could help increase their generalizability.

4.4 | 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. In our study, employees did not benefit 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 that offer mastery experiences (e.g., physical or creative activities; Alameer et al., 2023) 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 is needed for employees to make informed decisions and, hence, 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 to new working-from-home regulations (Ker et al., 2021), and studies observed a decrease in 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. In fact, employees would also prefer to work from home about 2 days per week (Entgelmeier & Tisch, 2022). 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 the detrimental impact of interpersonal conflicts on employees' recovery and well-being. On the one hand, organizations could reduce interpersonal conflicts, for example, by promoting positive tones in team-based communication 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 the interpersonal conflicts they do encounter. 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 negate adverse effects on employees' well-being.

5 | CONCLUSION

By demonstrating the moderating role of daily social sleep lag in 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 best recover from work, highlighting the need to take circadian processes into account in recovery research.

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CONFLICT OF INTEREST STATEMENT

There is no conflict of interest in conducting or reporting this research, and it is compliant with APA ethical standards.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

This research received ethics approval by the institutional review board.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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