Author Accepted Manuscript

human relations

The Role of Regulatory-, Affective-, and Motivational Resources in the Spillover of Sleep in the Home Domain to Employee Effectiveness in the Work Domain

SCHOLARONE™
Manuscripts

Author Accepted Manuscript

The Role of Regulatory-, Affective-, and Motivational Resources in the adverse Spillover of

Sleep in the Home Domain to Employee Effectiveness in the Work Domain

Rivkin, Wladislaw - Trinity Business School - Trinity College Dublin,

Diestel, Stefan - University of Wuppertal

Stollberger, Jakob - School of Business and Economics - Vrije Universiteit Amsterdam

Sacramento, Claudia - Aston Business School - Aston University

Correspondence concerning this article should be addressed to:

 Wladislaw Rivkin, Trinity Business School – Trinity College Dublin, the University of

Dublin, Dublin 2, Ireland, UK. E-mail: rivkinw@tcd.ie

Abstract

How does sleep affect employee effectiveness and what can employees do to remain

effective on days with a lack of sleep? Drawing on the conservation of resources theory our

research expands on the cognitive (regulatory resources), affective (positive affect), and

motivational (subjective vitality) mechanisms that link sleep and employee effectiveness.

Furthermore, considering the crucial role of individuals' beliefs in the spillover of sleep to

work, we examine implicit theories about willpower – a mindset about the resource-draining

nature of self-regulation – as a moderator of the positive relationship between sleep duration

and employee effectiveness through regulatory resources availability. Two daily diary studies

with a combined sample of Ntotal=214 employees (Ntotal=1317 workdays) demonstrate the

predominant role of cognitive and affective resources in the day-specific relations between

sleep at home to engagement, in-, and extra-role performance at work. Moreover, the

spillover of sleep to employee effectiveness via cognitive resources is stronger for individuals

holding a limited as compared to a non-limited resource theory. This research not only

expands our theoretical understanding of the psychological mechanisms that link sleep to

employee effectiveness but also offers practical implications by highlighting the protective

role of holding a non-limited resource theory on days with a lack of sleep.

Keywords: Conservation of resource theory, In- and extra-role performance, Positive

affect, Self-regulation, Sleep, Subjective vitality, Theories about Willpower, Work

engagement

Sleep is a crucial recovery experience, which can make or break a workday (Barnes,

2012). Whereas good sleep can facilitate employee effectiveness, having slept poorly can be

highly detrimental to one's work (for reviews see Harrison & Horne, 2000; Henderson &

Horan, 2021; Litwiller et al., 2017; Pilcher & Huffcutt, 1996; Siegel, 2005). To understand

the role of sleep for employee effectiveness, scholars have predominantly sought out self-

regulation theory for explanations (Barnes, 2012; Muraven & Baumeister, 2000). This theory

suggests that self-regulation, which refers to controlling one's impulses, desires, and emotions

to achieve long-term goals relies on the availability of limited regulatory resources (Muraven &

Baumeister, 2000). Sleep restores regulatory resources (Barnes, 2012) and thereby facilitates

employee effectiveness (Lian et al., 2017). That is, good sleep allows employees to successfully

resist distractions and focus on their work tasks or to persist when work tasks become more

demanding (Schmidt & Neubach, 2007). However alternative psychological mechanisms have

been scarcely considered in the relation between sleep and work (Lian et al., 2017). This not

only prevents painting a more comprehensive picture of the relevant psychological mechanisms

that link sleep to employee effectiveness but also limits our understanding of the unique role of

self-regulation identified in previous studies (Henderson & Horan, 2021; Litwiller et al., 2017).

Furthermore, in light of a steep increase of sleep difficulties among the working

population (Kessler et al., 2011), and based on theoretical propositions and empirical findings

Author Accepted Manuscript

that self-regulation constitutes an important mechanism in the relation between sleep and

employee effectiveness (Barnes, 2012), scholars have explored individual and organizational

contingencies that can alleviate the harmful effects of a lack of sleep. Most studies, however,

have focused on relatively stable contingencies (i.e., self-control capacity, chronotype; job

control; Diestel et al., 2015; Kühnel et al., 2016; Lanaj et al., 2014), which are not very

malleable. Whereas some studies have identified more malleable protective factors such as

caffeine consumption (Welsh et al., 2014), having a sense of power, and contemplation (Welsh

et al., 2018), their beneficial role may be more relevant for some individuals compared to

others. For instance, consuming caffeinated beverages is less useful for individuals who do not

like such beverages or are concerned about the side effects of caffeine consumption (Pray et al.,

2014). Moreover, whereas a sense of power and contemplation can reduce unethical conduct

following a lower sleep duration (Welsh et al., 2018), their relevance for broader indicators of

employee effectiveness such as engagement and task performance remains unexplored. Thus, it

is important to identify additional malleable contingencies that can help employees to

successfully self-regulate at work and thereby protect their effectiveness from fluctuations in

sleep duration.

Considering that for the most part sleep occurs in the home domain, our research

introduces a spillover lens (i.e., experiences being transferred intact between domains;

Edwards & Rothbard, 2000) to examine the home-to-work spillover of sleep to employee

effectiveness. To fully explain this spillover we draw on the distinction between cognitive-,

affective- and motivational processes (Inzlicht & Schmeichel, 2012; Lazarus, 1991; O'Shea

et al., 2017) and hence test the mediating role of regulatory resource availability, positive

affect, and subjective vitality in the relation between sleep and employee effectiveness.

Furthermore, to identify a viable way to prevent the harmful consequences of a lack of sleep,

we examine theories about willpower as a malleable mindset that can attenuate the harmful spillover of sleep to employee effectiveness via self-regulation.

We delineate our conceptual model building on notions about sleep as a recovery process and the Conservation of Resources Theory (CoR; Hobfoll et al., 2018), which focuses on the role of resources, defined as "(…) anything perceived by the individual to help attain his or her goals" (Halbesleben et al., 2014, p. 1338), for individual functioning. More specifically, CoR theory suggests that the loss of resources triggers a defensive state to protect one's remaining resources and prevent further resource loss. This state is characterized by the aim to conserve and protect an individual's remaining resources for example by refraining from activities that may further drain one's resources. Based on this theoretical argument, we propose regulatory resource availability – an indicator of cognitive resources (Baumeister et al., 1998), positive affect – an indicator of affective resources, (Watson et al., 1988), and subjective vitality – an indicator of motivational resources (Ryan & Deci, 2008; Ryan & Frederick, 1997) as unique mediating mechanisms of the home-to-work spillover of sleep duration to employee effectiveness as these resources have been identified as crucial for employee effectiveness (Quinn et al., 2012). Furthermore, we propose theories about willpower – a mindset whether willpower relies on resources that are easily depleted and take time to recover (i.e., limited theory of willpower) or are *not* easily drained and can quickly refuel themselves (i.e., non-limited theory of willpower) – as a moderator of the relation between sleep and employee effectiveness. More specifically, we argue that individuals who hold a limited resource theory rely more strongly on sleep as a recovery process for successful self-regulation because these individuals are more sensitive to fluctuations in the availability of their regulatory resources (Job et al., 2013). As sleep and the examined psychological resources considerably fluctuate across days (Henderson & Horan, 2021; Litwiller et al., 2017), our hypothesized model is tested in two daily diary studies. As

Author Accepted Manuscript

outcomes, we focus on indicators of employee effectiveness, which have been strongly linked

to organizational effectiveness (Call & Ployhart, 2021; Christian et al., 2011). Besides work

engagement (i.e., a positive state characterized by feelings of vigor, dedication, and

absorption at work), we examine in- (i.e., the effective fulfillment of job duties), and extra-

role performance (i.e., discretionary acts that go beyond job duties) as indicators of employee

effectiveness (see Figure 1 for the depiction of our model).

- Insert Figure 1 here -

Our study offers several contributions to the literature on sleep and employee

effectiveness. First, beyond the well-established insights into the beneficial effects of sleep on

self-regulatory functioning, our research highlights the crucial but so far overlooked role of

positive affect and subjective vitality as alternative psychological mechanisms that link sleep

in the home domain to employee effectiveness in the work domain. This is crucial because

examining different processes that underlie the harmful effects of a lack of sleep for work can

help us to disentangle the unique role of each psychological process and thus allows us to

paint a more comprehensive picture of how sleep affects work. Second, we seek to expand

scholarly understanding of how sleep as a recovery process interacts with theories about

willpower as a mindset about self-regulation. More specifically, we examine whether holding

a limited resource theory makes employees' self-regulation and associated effectiveness more

dependent on sleep as a recovery experience. Identifying the moderating role of theories

about willpower also holds practical implications in the form of interventions to change one's

mindset towards a non-limited theory, which can alleviate the detrimental consequences of

day-to-day fluctuations in sleep duration. Finally, whereas research has strongly focused on

the work-to-home spillover of how work affects sleep as an indicator of well-being (Litwiller

et al., 2017), our research focuses on the mechanisms and contingencies of the home-to-work

spillover of sleep to employee effectiveness (ten Brummelhuis & Bakker, 2012). We do this

by addressing Litwiller et al.'s (2017) call to go beyond work engagement and unethical conduct as consequences of sleep and focus on in- and extra-role performance as behavioral indicators of employee effectiveness, which have been strongly linked to organizational effectiveness (Call & Ployhart, 2021).

The Cognitive, Affective, and Motivational Mechanisms of the Home-to-Work Spillover of Sleep to Employee Effectiveness

Sleep is a dynamic recovery process, which has received increasing attention from organizational scholars (Barnes, 2012; Barnes & Watson, 2019; Litwiller et al., 2017). Research on the relationship between sleep and work has foremost focused on two distinct conceptualizations of sleep (Harvey et al., 2008; Pilcher et al., 1997). Whereas sleep quality refers to a more experiential indicator of how people evaluate their sleep, sleep duration as the number of hours spent sleeping constitutes a more objective indicator (Pilcher et al., 1997). Departing from an initial interest in how work affects employees' sleep as an indicator of employee well-being, more recent research has emphasized that sleep is an important determinant of employee effectiveness (Litwiller et al., 2017). The dominant theoretical explanation for the work-related consequences of sleep is based on self-regulation theory (Muraven & Baumeister, 2000). More specifically, scholars have argued that maintaining a high work engagement or abstaining from unethical or counterproductive work behaviors requires self-regulation to control one's impulses, emotions, and desires, which relies on the availability of regulatory resources (Lian et al., 2017). Furthermore, sleep is a recovery process that restores regulatory resources (Barnes, 2012). By now several meta-analyses have provided convincing support for this theoretical proposition (Harrison & Horne, 2000; Henderson & Horan, 2021; Litwiller et al., 2017; Pilcher & Huffcutt, 1996; Siegel, 2005).

However, besides focusing on self-regulation research on the within-person psychological processes that link sleep to employee effectiveness has largely neglected

Author Accepted Manuscript

alternative mechanisms (Henderson & Horan, 2021; Litwiller et al., 2017). As sleep mostly

occurs in the home domain the present research adopts a home-to-work spillover lens

(Edwards & Rothbard, 2000) to investigate how sleep affects employee effectiveness.

Theoretically, we explain this spillover through CoR theory (Hobfoll et al., 2018), which is

based on the assumption that individuals strive to obtain, retain, foster, and protect their

resources defined as anything that facilitates goal attainment (Halbesleben et al., 2014). This

theory suggests that resource loss is a salient experience, which triggers the tendency to

conserve and protect one's remaining resources. Based on these theoretical arguments, we

propose regulatory resource availability – a specific resource for self-regulation (Baumeister

et al., 2000) –, positive affect – an affective resource reflected by pleasant states of high

activation (Watson et al., 1988) – and subjective vitality – a motivational resource reflected

by feelings of aliveness and energy (Ryan & Frederick, 1997) – as mediators of the relation

between sleep and employee effectiveness. Our decision to focus on these three resources is

based on the widely established distinction between cognitive-, affective-, and motivational

processes and their unique role for individual's states and behaviors (Inzlicht & Schmeichel,

2012; Lazarus, 1991; O'Shea et al., 2017). In addition to providing a comprehensive

understanding of the psychological mechanisms of the spillover of sleep to work, the

conceptual differences between the examined resources can also disentangle the unique role

of each resource and associated psychological mechanisms in linking sleep to employee

effectiveness. Despite some conceptual overlap given that all three resources represent forms

of human energy (Quinn et al., 2012), we draw on previous research suggesting that each of

the examined resources has unique characteristics (Gombert et al., 2020; Muraven et al.,

2008; Ryan & Frederick, 1997; Tice et al., 2007). Specifically, regulatory resource

availability represents a cognitive resource, which is solely required for acts of self-regulation

or willpower (Baumeister et al., 2000). It is distinct from positive affect because positive

affect is not inevitably tied to one's capacity for self-regulation as is the case with regulatory

resources availability. For example, after making a successful sale to a difficult customer a

salesperson may feel enthusiastic, excited, and proud but at the same time have fewer

regulatory resources because engaging with the customer required self-regulation . However,

if the customer interaction is not challenging in nature the salesperson is likely to still

experience positive affect without their regulatory resources having been taxed. In line with

this proposition, a meta-analysis of experimental research on self-regulation suggests that

there is no significant relationship between self-regulation and positive affect (Hagger et al.,

2010). We further argue that regulatory resource availability is distinct from subjective

vitality, which represents a "salient and functionally significant indicator of health and

motivation" (Ryan & Deci, 2008, p. 730). Accordingly, subjective vitality is proposed as a

comprehensive organismic state, which goes beyond regulatory resources availability (Ryan

& Deci, 2008). Furthermore, compared to regulatory resources, high subjective vitality

represents a surplus of energy, which facilitates the motivation to further expand one's

energy. Finally, positive affect and subjective vitality are also conceptually distinct because

positive affect incorporates states of low and high activation whereas subjective vitality only

reflects high activation (Ryan & Deci, 2008). In line with these theoretical arguments,

previous research demonstrates that the correlations between these resources range between r

= .36 - .64 suggesting that the proportions of variance shared between these constructs range

between 13% and 41% (Gombert et al., 2020; Ryan & Frederick, 1997).

In line with our goal to disentangle the roles of cognitive-, affective-, and

motivational resources, we focus on sleep duration rather than sleep quality as sleep duration

should be less confounded by momentary states (Henderson & Horan, 2021; Litwiller et al.,

2017). Whereas states of high regulatory resource availability, positive affect, or subjective

vitality in the morning may affect how employees retrospectively evaluate their sleep quality,

Author Accepted Manuscript

this is less likely to be the case for sleep duration (Bower et al., 2010). This proposition is also supported by the higher correlations between self-reported and objectively measured indicators of sleep duration as compared to sleep quality (Litwiller et al., 2017). Besides methodological considerations, our focus on sleep duration is also guided by practical considerations because employees have more influence on the duration rather than the quality of their sleep for example, by going to bed earlier (Sayre et al., 2021). Rather than examining it as a focal predictor, we control for sleep quality which also allows us to disentangle the unique effects of sleep duration for employee effectiveness. In the following, we will elaborate on each spillover mechanism that links sleep duration to employee effectiveness.

Starting with the role of self-regulation, we propose that regulatory resources mediate the positive relationship between sleep duration and employee effectiveness. Drawing on previous research, which suggests that sleep affects neurobiological processes involving the prefrontal cortex – an area of the brain that has been identified as relevant for self-regulation (Gruber & Cassoff, 2014; Mullins et al., 2014; Schnyer et al., 2009) – we argue that on days with a lower sleep duration employees experience internal signs of lower availability of regulatory resources, such as feeling tired and not being able to concentrate, and being more irritable or impulsive. These feelings are also associated with the desire for more sleep, which needs to be suppressed to achieve one's daily goals (Kotabe & Hofmann, 2015). To illustrate, imagine the sound of your wake-up alarm on a day where you have slept regular hours and compare that with a day where you have slept less. Getting out of bed and ready for work on the latter day is likely to require more willpower to overcome the urge to stay in bed and to sleep longer, which consumes regulatory resources. In support of this proposition an experience sampling study of daily desires demonstrates that the desire for sleep on workdays is more prevalent than on non-workdays (Hofmann et al., 2012). The authors explain this finding by suggesting that on workdays employees' sleep duration is much more constrained.

In contrast, on days with more sleep employees are less likely to experience any cues that may indicate a lack of regulatory resources and the associated desire for more sleep, which in turn reduces the self-regulation requirements when engaging in morning activities. Based on these arguments we propose that sleep duration is positively related to employees' regulatory resources availability in the morning.

Consistent with CoR theory we further argue that after experiencing a lower daily availability of regulatory resources due to a lack of sleep employees enter a defensive state, during which they try to refrain from further self-regulation to protect their remaining regulatory resources. This is because for reasons of self-preservation individuals conserve at least some of their regulatory resources for more important situations, which may require self-regulation and may result in major aversive consequences if individuals are unable to self-regulate. For example, due to the lower availability of regulatory resources an individual may be caught speeding when commuting home after work (Clinton et al., 2021). If the individual then does not self-regulate and insults the police officer this will result in an even more severe punishment than the speeding ticket. This defensive state in turn spills over to the work domain and reduces employee effectiveness (Chong et al., 2020; Gerpott et al., 2021). In the present study, we focus on work engagement, as well as in- and extra-role performance as work behaviors, which contribute to organizational effectiveness (Goodman & Svyantek, 1999). In line with previous research, we argue that sleep in the home domain spills over to these indicators of effectiveness in the work domain through a lower availability of regulatory resources due to their essential role for self-regulation at work. That is, maintaining a high level of work engagement, which involves being vigorous, dedicated, and absorbed at work requires self-regulation and associated regulatory resources (Diestel et al., 2015; Lanaj et al., 2014). More specifically, vigor at work most likely emerges during challenging tasks that require basic cognitive functions such as reasoning and problem

Author Accepted Manuscript

solving, which rely on self-regulation (Stjernfelt, 2021). Moreover, dedication and absorption

are also dependent on one's regulatory resource availability as both require individuals to

remain focused on a particular work task for extended periods and overcome difficulties

when working (Schmidt & Neubach, 2007).

In addition to this, to effectively complete work tasks (i.e., in-role performance)

employees must invest regulatory resources to resist distractions and stay focused even when

working on potentially uninteresting tasks (Gerpott et al., 2021). Finally, engaging in extra-

role performance requires regulatory resources to suppress the desire to be selfish and instead

support a co-worker (DeWall et al., 2008; Lanaj et al., 2016).

Hypothesis 1: Regulatory resources availability mediates the day-specific positive

relation between sleep duration and a) work engagement, and b) in-, and c) extra-role

performance.

Notwithstanding evidence for the association between sleep and employees' positive

affect (Bower et al., 2010; Pilcher & Huffcutt, 1996; Scott & Judge, 2006; Sonnentag et al.,

2008; Totterdell et al., 1994) as well as the role of positive affect for employee effectiveness

(Kaplan et al., 2009; Shockley et al., 2012) to our knowledge only one study directly tested

the mediating role of positive affect in this relationship, and the findings were inconclusive

(Sayre et al., 2021). To further elucidate the role of affective processes in linking sleep to

employee effectiveness, we examine positive affect as an alternative mechanism underlying

this relationship. Based on evidence that sleep is associated with overall brain activity (Ma et

al., 2015), we argue that sleep duration is positively related to positive affect. More

specifically, given that positive affect reflects a state of positive activation (Watson et al.,

1988), a reduction in brain activity due to a lack of sleep should be associated with a lower

overall level of activation, which manifests in lower levels of positive affect. Moreover,

because employees anticipate difficulties in attaining their daily goals due to reductions in

sleep duration, they will have to invest more effort to adequately fulfill their work and non-work duties, which should also reduce positive affect (Scott & Judge, 2006; Sonnentag et al., 2008).

In turn, and consistent with CoR theory, we argue that morning positive affect will be positively associated with daily effectiveness as it focuses employees' attention on positive outcomes, which reduces tendencies to protect and conserve affective resources and instead facilitates the investment of these resources when engaging in work tasks (Bledow et al., 2013; Ilies & Judge, 2005). Accordingly, experiencing high morning positive affect makes it more likely that employees tackle challenging work tasks, which not only increases work engagement but also in-role performance due to investing more effort at work. Moreover, morning positive affect also improves extra-role performance because it increases the likelihood to approach rather than avoid others at work (Spector & Fox, 2002). Furthermore, in line with the proposition that to gain resources employees must invest resources (Hobfoll et al., 2018) we argue that when in states of high positive affect employees are more willing to invest their resources to help others, which can help to maintain and further enhance their affective resources through the positive experience of helping others (Koopman et al., 2016).

Hypothesis 2: Positive affect mediates the day-specific positive relation between sleep duration and a) work engagement, and b) in-, and c) extra-role performance.

Akin to affective processes, our literature review also indicates only one study that examined subjective vitality as a motivational resource of the home-to-work spillover of sleep to employee effectiveness (Schmitt et al., 2017). The results of this study support the mediating effect of subjective vitality in the relation between sleep quality and proactivity contingent on employees' self-efficacy. However, this same mediating effect was not observed for sleep duration. To further extend these initial findings, we examine subjective vitality as a motivational mechanism that links sleep duration to employee effectiveness.

Author Accepted Manuscript

SLEEP AND EMPLOYEE EFFECTIVENESS 13

Subjective vitality reflects a motivational resource that is more likely to emerge "when basic

bodily functions are robust and able to be effectively exercised" (Ryan & Frederick, 1997, p.

531). We thus propose that sleep duration as a somatic factor is positively associated with

subjective vitality. This is because on days with a lack of sleep employees become more

constrained by experienced aversive somatic states such as having a headache, irritable bowel

syndrome, limb pain (Schlarb et al., 2017), which should reduce their feelings of subjective

vitality because individuals realize their limitations due to aversive somatic states (Liu et al.,

2020; Schmitt et al., 2017).

　　　　We further argue that lower levels of subjective vitality due to a lower daily sleep

duration will impair employee effectiveness. This proposition corresponds with CoR, in that

employees will withhold their motivation to invest resources at work on days with lower as

compared to higher levels of subjective vitality as they try to conserve their remaining

resources. This in turn will inhibit employees' work engagement, which requires mustering

the initial motivation to engage in a work task (Bakker & Oerlemans, 2019). Lower

subjective vitality will also inhibit in-role performance because employees will not be

motivated to invest any more energy than the bare minimum to complete work tasks. Finally,

on days with lower subjective vitality employees will be less motivated to invest their

remaining energy in supporting their colleagues, which should manifest in lower extra-role

behaviors (Lanaj et al., 2016).

　　　　Hypothesis 3: Subjective vitality mediates the day-specific positive relation between

sleep duration and a) work engagement, and b) in-, and c) extra-role performance.

Theories about Willpower and the Regulatory Resources Spillover of Sleep to Employee

Effectiveness

　　　　Research on implicit theories about willpower has offered novel perspectives on how

mindsets can affect self-regulation processes (Francis & Job, 2018; Job, 2016) by

demonstrating that having a mindset that regulatory resources are scarce and easily depleted, which is referred to as holding a limited resource theory, compared to a mindset that regulatory resources are abundant and cannot be easily drained (i.e., holding a non-limited resource theory), can impair one's ability to self-regulate (Job et al., 2010). Drawing on these findings a growing body of research has demonstrated that holding a limited resource theory is negatively associated with various positive outcomes associated with self-regulation such as well-being (Bernecker et al., 2017; Job et al., 2010) and psychological adjustment (Bernecker & Job, 2015). Furthermore, considering the crucial role of self-regulation at work (Lian et al., 2017), an initial study (Konze et al., 2019) demonstrated that holding a limited resource theory strengthens the adverse effects of emotional dissonance – a work demand which requires self-regulation to display emotions, which are not genuinely felt.

Going beyond these relevant findings, initial research on theories about willpower has also contributed to our understanding of how physiological processes can facilitate successful self-regulation (Gailliot et al., 2007). Based on studies on the role of glucose for successful self-regulation, scholars have proposed that glucose represents the physiological manifestation of regulatory resources availability (Gailliot et al., 2007). Job et al. (2013) have questioned this proposition and suggested that rather than through the physiological process of regulatory resource recovery, the benefits of glucose for self-regulation can be accounted for by psychological mechanisms, which are determined by the extent to which the availability of resources for self-regulation is of concern for individuals. Accordingly, these authors propose that the intake of glucose will be more likely to support self-regulation for individuals holding a limited resource theory and thus believe that regulatory resources are easily consumed. This is because believing that regulatory resources are limited makes individuals more sensitive to internal cues associated with the availability of regulatory resources. In contrast, individuals who hold a non-limited resource theory are less sensitive to

Author Accepted Manuscript

internal cues associated with regulatory resource availability and thus should be less likely affected by the consumption of glucose for successful self-regulation. Three experiments support this proposition by demonstrating that after a self-regulation task the consumption of a sugar drink as compared to a sugar substitute drink improves subsequent self-regulation only for those participants who believed or were led to believe in a limited as compared to a non-limited resource theory (Job et al., 2013).

The present study aims to extend these initial findings by examining whether theories about willpower moderate the self-regulatory consequences of sleep duration as another recovery process relevant for self-regulatory functioning (Barnes, 2012). More specifically, we integrate theories about willpower and CoR theory to propose that holding a limited resource theory strengthens the relation between sleep duration and employees' regulatory resource availability because to successfully self-regulate these individuals rely more strongly on sleep as a recovery process. Drawing on the proposition that individuals who hold a limited resource theory are more sensitive to internal cues associated with one's availability of regulatory resources (Job et al., 2013), we argue that this sensitivity strengthens the tendency to conserve and protect regulatory resources associated with daily fluctuations in sleep duration. This is because daily fluctuations in sleep duration trigger internal cues, such as feeling refreshed and recovered when sleep duration is high or tired and more irritable when sleep duration is low, which are more likely to be felt by individuals holding a limited as compared to a non-limited resource theory. The heightened awareness of these internal cues triggers the tendency to conserve and protect one's regulatory resources and thus makes individuals who hold a limited resource theory more dependent on daily sleep duration for successful self-regulation. Furthermore, for individuals holding a limited resource theory this psychological process occurs even on days with minor fluctuations in sleep duration as their heightened sensitivity allows them to perceive internal cues associated with even minor daily

changes in sleep, which are less likely to be noticed by individuals holding a non-limited resource theory. In turn, we argue that on days with a lower sleep duration those holding a limited resource theory will experience a lower regulatory resource availability than individuals who hold a non-limited resource theory. This is because individuals with a limited resource theory tend to conserve and protect their remaining resources after a night with a lower sleep duration. This tendency becomes manifest in high inner motivational resistances, when engaging in morning activities, thereby requiring additional self-regulation." In contrast, on days with a higher sleep duration we do not expect major differences in regulatory resource availability between individuals holding a limited- and a non-limited resource theory because on those days individuals do not experience any tendencies to conserve and protect their regulatory resources.

Hypothesis 4: Implicit theories about willpower moderate the positive day-specific relation of sleep duration and regulatory resource availability. The relation will be stronger for individuals holding a limited- as compared to non-limited resource theory.

Integrating Hypothesis 1 that regulatory resources mediate the relation between sleep duration and employee effectiveness and the moderating effect of theories about willpower proposed in Hypothesis 4, we argue that implicit theories about willpower will moderate the indirect effect of sleep duration on employee effectiveness through regulatory resources.

Hypothesis 5: Implicit theories about willpower moderate the indirect effects of sleep duration on a) work engagement, b) in-, and c) extra-role performance via regulatory resource availability. The indirect effects will be stronger for individuals holding a limited- as compared to a non-limited resource theory.

To demonstrate the unique moderating role of theories about willpower in the relation between sleep duration end employee effectiveness through regulatory resources we also control for self-control capacity as a crucial individual factor for successful self-regulation

Author Accepted Manuscript

SLEEP AND EMPLOYEE EFFECTIVENESS   17

(de Ridder et al., 2012). Self-control capacity reflects an interindividual difference in the

ability to volitionally regulate behavior, emotions, and motivational tendencies (Tangney et

al., 2004). Previous research has suggested that the beneficial role of self-control capacity for

self-regulation results from individuals having, on the one hand, generally higher availability

of regulatory resources (Hagger et al., 2010) and on the other hand more effective strategies

for self-regulation (de Ridder & Gillebaart, 2017). Thus, to strengthen the evidence for our

theoretical proposition that the moderating effect of theories about willpower is due to an

increased sensitivity to cues associated with the availability of regulatory resources, which

are affected by daily sleep duration rather than an individual's overall capability for self-

regulation, we thoroughly test alternative explanations by considering direct and moderating

effects of self-control capacity when examining theories about willpower as a moderator.

It should be noted that although most research has focused on between-person

differences in theories about willpower (Francis & Job, 2018), there is amounting evidence

supporting the malleability of such theories (Francis & Job, 2018). This malleability derives

from the notion that individuals' theories about willpower are influenced by previous

experiences of effort exertion associated with willpower (Klinger et al., 2018) and external

information such as cultural views on willpower (Savani & Job, 2017). As both one's

experienced effort when exerting willpower, as well as external information about willpower

(i.e., cultural beliefs) can change, we argue that theories about willpower are malleable.

Whereas we acknowledge that individuals will not actively challenge their theories about

willpower on a daily basis, previous evidence suggests that providing external information

can reliably change an individual's theories about willpower (Job et al., 2010, 2013). Such

malleability in turn ascribes important practical value to this moderator.

Studies

We examine the proposed hypotheses in two studies. In Study 1, we test a moderated

mediation model in which regulatory resource availability mediates the day-specific relations

of sleep duration on work engagement and this indirect effect is moderated by theories about

willpower. In Study 2, we replicate and extend Study 1's findings by a) examining positive

affect, and subjective vitality as additional mechanisms that link sleep duration to employee

effectiveness, b) going beyond work engagement by testing in-, and extra-role performance

as outcomes, and c) controlling for self-control capacity to substantiate evidence for the

proposed mechanisms underlying the moderating role of theories about willpower.

Study 1

Method

Participants

The data for Study 1was collected through snowball sampling involving students

taking a methods module at a university in Germany. Each student was asked to recruit three

participants from their networks. To take part in the study participants had to be in

employment on a full-time contract. Once consent was given, each participant received a pre-

survey, which measured demographic characteristics as well as stable variables such as

theories about willpower. After that participants indicated two consecutive weeks (10

workdays) during the following month to receive daily surveys. Subsequently, for each

workday (Monday-Friday) during the selected period, participants indicated their estimated

time at which they finished work. Each participant received three surveys per day: A morning

survey at 8 am, an afternoon survey one hour before the end of work, and an evening survey

two hours after the end of work. As the data collection was part of a larger project, the

present study only focuses on the first and last daily measurements. If participants did not

respond within the first hour after receiving a survey a reminder was sent. The surveys were

Author Accepted Manuscript

automatically deactivated if participants did not respond within four hours after they received a survey. There was no compensation awarded for participation.

The initial sample of participants who completed the pre-survey consisted of N=67 individuals. After that, we excluded participants who did not complete any daily surveys, which resulted in a sample of *N*=58 (person-level response rate: 87%) who completed 428 daily surveys (day-level response rate: 74%). These person- and day-level response rates are in line with previously published daily diary studies (Fisher & To, 2012). The average completion times for daily surveys were 10:49 am, and 6:17 pm. Participants were employed in different sectors (19% teaching and education, 12% health, 10% public administration, 9% finance and insurance, 5% manufacturing, 5% hospitality, and 40% in other sectors), their age ranged from 20 to 60 years (*M* = 40.31; *SD* = 12.57), and the rate of female participants was 55%. Out of all participants, 41% indicated that they had flexible time arrangements and that their main tasks at work were interacting with customers (indicated by 48%), followed by knowledge work (indicated by 33%), and manual labor (indicated by 12%; selection of more than one activity was possible).

Measures

In the pre-survey, we assessed *theories about willpower* with five items of the strenuous mental activity scale developed by Job et al., (2010). The scale was introduced by the following statement: "The following questions investigate your ideas about willpower. Willpower is what you use to resist temptations, stick to your intentions, and remain vigilant during strenuous mental activities. There are no right or wrong answers. We are interested in your ideas. Please indicate how much you agree or disagree with each of the following statements." A sample item is: "When you have been working on a strenuous mental task, you feel energized and you are able to immediately start with another demanding activity" (1 = "strongly disagree" - 6 = "strongly agree"). While the original scale consists of six items

our MCFAs indicated a high correlation ($r = .78$, $p < .01$) between two items of this scale,

which negatively affected the overall fit of the measurement model. Therefore, we removed

the item "Strenuous mental activities exhaust resources, which need to be refueled afterward

(e.g., through taking breaks, doing nothing, watching television)." Theories about willpower

were coded so that high levels indicate the agreement with a non-limited rather than a limited

resource theory.

In the morning we measured *sleep duration* with the following item from the

Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989) 'During the last night, how many

hours of actual sleep did you get?'. This measure is widely used to assess sleep duration in

organizational research (Guarana et al., 2021; Liu et al., 2020; Sayre et al., 2021). *Regulatory*

resources availability was also assessed in the morning with five items (Bertrams et al.,

2011) related to the participant's current experiences (e.g., 'Right now, I have no mental

energy left.'; 1 = 'not at all' to 4 = 'a great deal'). We reversed the items so that higher values

represent higher perceived regulatory resource availability (see also Yam et al., 2016).

In the evening we assessed day-specific *work engagement* with the nine-item version

of the Utrecht Work Engagement Scale (Breevaart et al., 2012; Schaufeli et al., 2006), which

involves three facets: vigor (e.g., 'Today, I felt strong and vigorous at work.'), dedication

(e.g., 'Today, I was enthusiastic about my work.'), and absorption (e.g., 'Today, I was

immersed in my work.'; 1 = 'strongly disagree' to 7 = 'strongly agree').

Data Analysis

Because of the nested structure of our data (Level 1: Sleep duration, regulatory

resource availability, and work engagement; Level 2: Theories about willpower), we used

multilevel structure equation modeling (MSEM) to examine our hypotheses. This method

allows for analyses on multiple levels and has advantages compared to traditional approaches

to multilevel mediation analysis (e.g., multilevel modeling; Preacher, Zyphur, & Zhang,

Author Accepted Manuscript

2010). The analyses were conducted with Mplus 8.2 (Muthén & Muthén, 1997-2017) using maximum likelihood estimation with robust standard errors.

We test the proposed hypotheses by specifying a 1-1-1 moderated-mediation mediation model (Preacher et al., 2010). In this model on the within-person level, we specified the relation between sleep duration and perceived regulatory resource availability as a random slope. To examine the cross-level moderator, in the between-person level part of our model implicit theories about willpower predicted this random slope as well as the mediator regulatory resource availability. Finally, on the within-person level sleep duration was specified to predict work engagement. Following the suggestions of Ohly et al. (2010), we centered all exogenous day-level variables around each person's mean ('group-mean centering') and grand-mean-centered implicit theories about willpower.

Because the conventional bootstrapping method of re-sampling cannot be applied to multilevel analyses (Preacher & Selig, 2012), we utilized a Monte Carlo approach of re-sampling to estimate the confidence intervals for the moderated mediation model (Preacher & Selig, 2012). Specifically, we computed bias-corrected 95% confidence intervals (CIs) for the indirect effects based on 20,000 re-samples using the software provided by Selig and Preacher (2008). For testing moderated indirect effects, we followed Hayes and Preacher's (2010) recommendation and computed conditional indirect effects, at lower ($-$ 1 SD), and higher (+1 SD) levels of our moderators. Moreover, following Koopman et al. (2016) we also computed 95% CIs to test whether the indirect effects differ between high and low levels of theories about willpower. An indirect effect or a difference in indirect effects is indicated by the respective 95% CI, not including zero (Preacher, Rucker, & Hayes, 2007).

Measurement Models

We conducted multilevel confirmatory factor analyses (MCFAs) to assess the psychometrical distinctiveness of our day-level measures. In line with our research model, we

Author Accepted Manuscript

SLEEP AND EMPLOYEE EFFECTIVENESS   22

specified a model with implicit theories about willpower on the between- and perceived

regulatory resource availability and work engagement on the within- person-level.

Accordingly, a 1-Factor model on the between- and a 2-Factor model on the within-person

level provided an acceptable data fit: $\chi 2$ (81) = 233.06, p < .01, root mean square error of

approximation (RMSEA) = .066, confirmatory fit index (CFI) = .937, standardized root mean

square residual within-person/between-person (SRMRw/b) = .048/.042. A 1-Factor model on

the between- and a 1-Factor model on the within-person level that integrated perceived

regulatory resource availability and work engagement into one factor performed worse ($\chi 2$

[82] = 1262.59, p < .01, RMSEA = .183, CFI = .731, SRMRw/b = .156/.042; S-B [Satorra-

Bentler] scaled $\Delta\chi 2$ (1) = 102.34, p < .01).

Results

The high proportions of within-person variance of sleep duration: 68%, perceived

regulatory resource availability: 54%, and work engagement: 33% justify the application of

multilevel modeling. Table 1 provides an overview of the descriptive statistics, internal

consistencies, and correlations.

- Insert Table 1 here -

In support of Hypothesis 1, which predicts that perceived regulatory resource

availability mediates the relation between sleep duration and work engagement, we found

direct relations of sleep duration and perceived regulatory resource availability as well as

between perceived regulatory resource availability and work engagement with signs

corresponding to expectations. Furthermore, there was an indirect effect of sleep duration on

work engagement via perceived regulatory resource availability (95% CI = 0.022 - 0.096).

Hypothesis 2 predicts a moderating (strengthening) effect of holding a limited

resource theory on the relation between sleep duration and regulatory resource availability.

The significant effect of implicit theories about willpower on the random slope between sleep

Author Accepted Manuscript

duration and perceived regulatory resource availability ($\gamma = -.11$, $p = .012$) supports this

hypothesis. We plotted the relationship between sleep duration and perceived regulatory

resource availability at conditional values of implicit theories about willpower (+1 SD: non-

limited resource theory and –1 SD: limited resource theory; Cohen, Cohen, West, & Aiken,

2003). In line with our predictions, Figure 2 demonstrates that for individuals holding a

limited resource theory, the positive relation between sleep duration and perceived regulatory

resource availability was stronger than for individuals holding a non-limited resource theory.

Hypothesis 3 proposes that person-specific implicit theories about willpower

moderate the indirect relation between sleep duration and work engagement via perceived

regulatory resource availability. Our results support the proposition that the indirect effect of

sleep duration on work engagement via regulatory resource availability is weaker for

individuals holding a non-limited as compared to a limited resource theory, which is

indicated by the 95% CI of the difference in indirect effects between individuals holding a

limited and a non-limited resource theory not including zero (95% CI = -0.007 – -0.107; cf.

Table 2). This implies that the indirect effect of sleep duration on work engagement through

regulatory resource availability is considerably stronger for individuals holding a limited as

compared to a non-limited resource theory.

- Insert Table 2 here -

Finally, we calculated the amounts of variance in our endogenous variables explained

by the proposed predictors. As traditional R^2 values are not available for MSEM, we followed

recommendations by Snijders and Bosker (2011) and computed pseudo R^2 values for all

endogenous variables (see also LaHuis et al., 2014). For perceived regulatory resource

availability and work engagement, the amounts of explained variance were 11.1% and 18.1%

respectively. These proportions of explained variance do not only support the theoretical, but

also practical relevance of our findings.

Study 2

Method

Participants

Data for Study 2 was collected by students of a university in the UK. Each student was asked to recruit 20 participants as part of their master dissertation project. The recruitment criteria were that employees were English speakers and employed on a full-time contract. The design of this study was similar to Study 1. We adapted the times of measurement to account for participant's work schedules. More specifically, in the pre-survey, we asked participants when they start and finish work. The first daily survey was distributed two hours after the start of work whereas the second survey was sent one hour before the end of work. A timeframe of 4 hours was given to complete each survey after which the surveys were automatically deactivated.

The initial sample of participants who completed the pre-survey consisted of N=224 individuals. Again, we excluded participants who did not complete any daily survey throughout the study period, which resulted in a sample of $N = 156$ (person-level response rate 70%) who completed 889 daily surveys (daily response rate 57%). While both person- and day-level response rates are lower than in Study 1, the sample size on the person- and day-level conforms with recommendations for daily diary studies (Gabriel et al., 2019). The average completion times for each daily survey were 12:09 pm – first survey –, and 6:10 pm – second survey. Participants worked in different countries: 63% in the UK, 13% in Italy, 12% in Saudi Arabia, and 12% in other countries. They were employed in different sectors (30% health, 8% energy and water supply, 6% education, 6% retail and wholesale, 6% finance and insurance, 6% IT and communications, and 38% in other sectors), their age ranged from 20 to 65 years ($M = 32.16$; $SD = 10.15$), and the rate of female participants was 56%. Out of all participants, 37% indicated that they had flexible time arrangements and that

their main tasks at work involve interacting with customers (indicated by 72%), followed by

knowledge work (indicated by 69%) and manual labor (indicated by 12%).

Measures

We used the same measures as in Study 1 for implicit theories about willpower (pre-

survey), sleep duration, regulatory resources availability (morning; changed to a 5-point

scale), and work engagement (afternoon).

In the morning we assessed *positive affect* – a state of high positive activation – with

six items (see Sonnentag et al., 2008) that were based on the Positive and Negative Affect

Schedule (Watson et al., 1988; i.e., 'Right now, I feel strong; 1 = 'very slightly/not at all'; 5 =

'extremely'). Moreover, s*ubjective vitality*, which reflects feelings of energy and aliveness

was measured in the morning with four items from the subjective vitality scale (Rivkin et al.,

2018; Ryan & Frederick, 1997; i.e., 'Right now, I have energy and spirit.'; 1 = 'strongly

disagree'; 5 = 'strongly agree').

In the afternoon we measured day-specific *in-role performance* with two items

(Demerouti et al., 2015; Goodman & Svyantek, 1999 i.e., 'Today, I performed tasks that were

expected of me.'; 1 = 'not at all' to 7 = 'a great deal') and *extra-role performance* (i.e.,

individual-focused organizational citizenship behavior) with four items (Lee & Allen, 2002;

i.e., 'Today, I willingly gave my time to help others who had work-related problems.'; 1 =

'not at all' to 7 = 'a great deal').

Control Variables. We included several control variables to substantiate the

robustness of our findings. First, because sleep quality is considered a determinant of sleep

duration (Barnes et al., 2011), we controlled for its influence. *Sleep quality* was assessed with

the following item from the PSQI (Buysse et al., 1989): 'How would you rate the quality of

your previous night's sleep?'; 0 = 'very bad' to 3 = 'very good').

We also controlled for the direct and moderating effects of *self-control capacity* when

examining the moderating effect of theories about willpower. Self-control capacity was

measured in the pre-survey with a 17-item scale (Tangney et al., 2004; i.e., 'I am good at

resisting temptations.'; 1 = 'strongly disagree'; 5 = 'strongly agree')

Data Analysis

Based on the model specified in Study 1, we added in-, and extra-role performance as

additional endogenous variables. Moreover, we extended our model by adding random slopes

for the relation between sleep duration and positive affect as well as subjective vitality. Both

alternative mechanisms were also specified to predict all outcomes. In the between-person

part of our model, all random slopes, as well as each mediator (perceived regulatory resource

availability, subjective vitality, and positive affect), were predicted by theories about

willpower as well as self-control capacity to account for the proposed moderating effects. As

in Study 1, all exogenous day-level variables were person-mean centered whereas exogenous

person-level variables were group mean-centered.

Measurement Models

As in Study 1, we assessed the psychometrical distinctiveness of our day-level

measures through MCFAs. We specified a model with the Level 2 variables – implicit

theories about willpower and self-control capacity - on the between- and the Level 1 variables

- perceived regulatory resource availability, subjective vitality, positive affect, work

engagement, in-, and extra-role performance on the within- person-level. Accordingly, a 2-

Factor model on the between- and a 6-Factor model on the within-person level provided a

good data fit: $\chi 2$ (607) = 1812.30 p < .01, RMSEA = .047, CFI = .927, SRMRw/b

= .052/.080. A 2-Factor model on the between- and a 4-Factor model that integrated

perceived regulatory resource availability, positive affect, and subjective vitality into a single

factor performed worse ($\chi 2$ [616] = 4649.27, p < .01, RMSEA = .085, CFI = .756, SRMRw/b

Author Accepted Manuscript

SLEEP AND EMPLOYEE EFFECTIVENESS 27

= .137/.080) compared to the theoretically proposed factor model (S-B scaled $\Delta\chi2$ (9) =

3594.79, p < .01). Finally, a 2-Factor model on the between and a 4-Factor model on the

within level that integrated all outcomes into a single factor also performed worse ($\chi2$ [616] =

4451.95, p < .01, RMSEA = .083, CFI = .768, SRMRw/b = .088/.080) compared to the

theoretically proposed model (S-B [Satorra-Bentler] scaled $\Delta\chi2$ (9) = 1745.05, p < .01). Thus,

MCFAs support the proposed factor structure of our variables in Study 2.

Results

As in Study 1, our day-level variables exhibited a high proportion of within-person

variation: sleep duration: 57%, sleep quality: 67%, regulatory resource availability: 62%,

positive affect 50%, subjective vitality: 60%, work engagement: 54%, in-: 53%, and extra-

role performance: 54%. The descriptive statistics, internal consistencies, and correlations

among all study variables are presented in Table 3.

- Insert Table 3 here -

Hypothesis 1 (a-c) proposes that regulatory resource availability mediates the

relations between sleep duration and a) work engagement, b) in-, and c) extra-role

performance. Our results support this hypothesis as the corresponding 95% CIs for the

indirect effects of sleep duration on work engagement, in-, and extra-role performance do not

include zero (cf. Table 4) at average levels of theories about willpower. Hypothesis 2 (a-c)

predicts positive affect as a mediator of the relation between sleep duration and employee

effectiveness. Our data lend support for this hypothesis as the 95% CIs for the indirect effects

of sleep duration on work engagement, in-, and extra-role performance via positive affect did

not include zero (cf. Table 4). Hypothesis 3 (a-c) suggests that subjective vitality also

mediates the relation between sleep duration and employee effectiveness. The proposed

mediating role of subjective vitality linking sleep duration to work engagement (3a) was

supported by our data. However, the indirect effects on in- (3b) and extra-role (3c)

performance were not supported (cf., Table 4).

Hypothesis 4 proposes that person-level theories about willpower moderate the

relation between sleep duration and regulatory resource availability. As indicated by the

significant effect of theories about willpower on the random slope linking sleep duration and

perceived regulatory resource availability (i.e., the interaction term in Table 4), our data

supports a moderating effect of theories about willpower. Corresponding with our hypothesis

and Study 1's findings, the plot of the interaction effect suggests that the relation between

sleep duration and perceived regulatory resource availability is weaker for individuals

holding a non-limited- as compared to a limited resource theory (cf., Figure 2). Moreover,

simple slope tests indicate that for individuals holding a non-limited resource theory

relationship between sleep duration and regulatory resource availability is non-significant

whereas this relationship is significant for individuals holding a limited resource theory.

- Insert Figure 2 here -

Hypothesis 5 suggests that person-specific implicit theories about willpower moderate

the indirect relation between sleep duration and all indicators of employee effectiveness via

perceived regulatory resource availability. Our data support the proposed moderated

mediation model, as the indirect effects of sleep duration on a) work engagement (95% CI =

0.034 - 0.103), b) in- (95% CI = 0.022 - 0.071)., and c) extra-role performance (95% CI =

0.006 - 0.080) via perceived regulatory resource availability were only present for individuals

holding a limited resource theory. In contrast, the 95% CIs these indirect effects were not

present for individuals holding a non-limited resource theory (work engagement: 95% CI = -

0.013 - 0.039), in-: 95% CI = -0.009 - 0.028, and extra-role performance: 95% CI = -0.009 -

0.029). Accordingly, comparisons of the indirect effects reveal a significant difference

between the indirect effects for individuals holding a limited as compared to a non-limited

Author Accepted Manuscript

resource theory on work engagement (95% CI = -0.103 - -0.011), in- (95% CI = -0.069 - -

0.007), and extra-role performance (95% CI = -0.079 - -0.002). These results indicate that

regulatory resource availability mediates the relation between sleep duration and employee

effectiveness for individuals holding a limited resource theory, whereas our data suggests no

such mediating effect for individuals holding a non-limited resource theory.

Another interesting finding was that theories about willpower also moderate the

relation between sleep duration and subjective vitality as indicated by the significant effect of

theories about willpower on the sleep duration-subjective vitality random slope (represented

by the interaction term in Table 4). The interaction plots and simple slope tests indicate a

similar pattern of the interaction as for regulatory resources availability (cf. Figure 2c). More

specifically sleep duration significantly affects subjective vitality only for those individuals

who hold a limited as compared to a non-limited resource theory.

- Insert Table 4 here –

The amounts of explained variance for our endogenous variables were: 18.4% - sleep

duration; 18.3% - perceived regulatory resource availability; 7.3% - positive affect; 10.9% -

subjective vitality; 29.6% - work engagement; 17.5% - in-, and 6.5% - extra-role performance

These proportions of explained variance again support the practical relevance of our results.

Finally, our results suggest that self-control capacity neither moderated the link

between sleep duration and perceived regulatory resource availability nor the relations

between sleep duration and alternative mediating pathways. Also, controlling for self-control

capacity did not affect the moderating effect of theories about willpower on the relation

between sleep duration and perceived regulatory resource availability (cf., Table 4).

Discussion

To provide a more comprehensive understanding of the psychological mechanisms

that underlie the home-to-work spillover of sleep to employee effectiveness, our research

examined regulatory resource availability, positive affect, and subjective vitality as mediators of the daily relation between sleep duration and employee effectiveness. Furthermore, to identify an additional malleable factor that can prevent the harmful consequences of less sleep for employee effectiveness, we tested the moderating role of theories about willpower in the relation between sleep duration and employee effectiveness through self-regulation. The results of two daily diary studies support most of the hypothesized relations. First, our research affirms the relevance of all three examined psychological mechanisms in linking sleep to employee effectiveness. Our studies support the substantial role of regulatory resources in linking sleep duration to work engagement, in-, and extra-role performance. Moreover, our data suggest that positive affect also constitutes a relevant psychological mechanism, which links sleep duration to employee effectiveness. Finally, subjective vitality only mediated the relation between sleep duration and work engagement. Furthermore, both studies consistently demonstrate that holding a limited as compared to a non-limited resource theory strengthens the relation between sleep duration and regulatory resource availability. In addition, we found preliminary evidence suggesting that theories about willpower also moderate the relation between sleep duration and subjective vitality.

The present research offers several contributions to research on the work-to-home spillover of sleep to employee effectiveness. First, by integrating sleep as a recovery experience with CoR our study expands on the cognitive, affective, and motivational mechanisms that underly the spillover of sleep to employee effectiveness. More specifically, our study suggests that regulatory resource availability, positive affect, and subjective vitality each represent distinct cognitive-, affective-, and motivational resources, which exhibit unique relationships with employee effectiveness. On the one hand, our findings complement previous research showing that self-regulation links sleep to indicators of employee effectiveness such as unethical conduct and work engagement (Barnes, 2012; Litwiller et al.,

Author Accepted Manuscript

2017) by demonstrating the relevance of regulatory resource availability for the link between

sleep and employees' daily in- and extra-role performance. On the other hand, our research

sheds light on the role of affective- and motivational resources that link sleep and employee

effectiveness. More specifically, by highlighting positive affect as an important mechanism

that explains how sleep relates to work outcomes, our study identifies the crucial but so far

largely neglected role of affective processes in linking sleep duration to employee

effectiveness. Moreover, beyond cognitive and affective processes, our results suggest that

subjective vitality as a motivational resource represents yet another linchpin that connects

sleep to work engagement. Taken together, our research supports the theoretical propositions

for the unique role of cognitive, affective, and motivational mechanisms in the relation

between sleep and employee effectiveness. That is, whereas the mediating role of regulatory

resources implies that sleep duration affects employee effectiveness through employees'

ability to control impulses, emotions, and desires, the mediating role of positive affect

indicates that sleep duration spills over to employee effectiveness through a more positive

outlook towards task completion. Last but not least the mediating role of subjective vitality

suggests that sleep duration also facilitates employee effectiveness through increasing

employees' motivation to invest their energetic resources at work. It is also noteworthy that

the results of Study 1 indicate a positive relationship between sleep duration and work

engagement even after controlling for the mediating effect of regulatory resource availability.

This highlights the added value of examining the proposed additional mechanisms in Study 2

as there we do not find a positive relationship between sleep duration and employee

effectiveness after including all mediators. Taken together results of both studies imply that

the examined mechanisms comprehensively explain the positive relation between sleep

duration and employee effectiveness.

Second, by examining the interplay between sleep duration and theories about willpower in predicting regulatory resource availability and associated effectiveness, we not only expand our understanding of sleep and theories about willpower as determinants of self-regulation but also identify an important malleable moderator, which can protect employee effectiveness from daily fluctuations in sleep duration. Akin to being more reliant on consuming glucose drinks for self-regulation, we find that holding a limited resource theory also makes individuals more dependent on sleep duration for successful self-regulation. Accordingly, our findings support Job et al.'s (2013) proposition that employees' current ability to self-regulate is at least partially influenced by theories about willpower, which determines the extent to which employees are sensitive to internal cues associated with the availability of regulatory resources. While we do not argue that holding a non-limited resource theory makes employees immune to sleep deprivation, our findings indicate that believing that regulatory resources are abundant can stabilize employee effectiveness on days with a lack of sleep. Furthermore, demonstrating that the moderating effect of theories about willpower remains stable even when controlling for self-control capacity, supports the theoretical propositions that the beneficial effects of self-control capacity, which reflects the general ability to self-regulate, and theories about willpower, which represent a mindset about the nature of self-regulation, rely on distinct psychological mechanisms. Last but not least, replicating the moderating effect of theories about willpower across two samples from different cultural contexts further supports the relevance of this moderator.

Finally, we also expand the literature on spillover effects between the home and the work domain (Edwards & Rothbard, 2000). More specifically, we go beyond the previous focus on work engagement and unethical conduct (Harrison & Horne, 2000; Litwiller et al., 2017) by examining in- and extra-role performance as behavioral indicators of work effectiveness. Interestingly, whereas our findings highlight the relevance of all three

Author Accepted Manuscript

psychological mechanisms in the relation between sleep duration and work engagement,

regulatory resources availability and positive affect constitute the most relevant mediators in

the relation of sleep duration to in- and extra-role performance. This indicates that after

accounting for cognitive and affective mechanisms, there is no significant relation of

motivational resources in the form of subjective vitality to in- and extra-role performance.

One reason for this finding may be that subjective vitality reflects a surplus of motivational

energy (Ryan & Deci, 2008). However, as in-role performance constitutes the core part of

one's work, it still has to be delivered even if employees feel less motivated. In sum, our

research highlights the relevance of different psychological mechanisms for linking sleep to

different indicators of employee effectiveness.

Practical Implications

Our research also offers some practical implications on how to prevent the adverse

consequences of a lack of sleep. First, in line with previous research (Barnes et al., 2011;

Lanaj et al., 2014) our studies further highlight the importance of day-specific sleep for

employee effectiveness. Accordingly, interventions to improve day-to-day sleep at home can

facilitate employee effectiveness at work. For example, Hülsheger et al. (2015) demonstrate

that a guided mindfulness meditation combined with informal mindfulness exercises can

improve sleep duration. Moreover, by identifying different mechanisms that link sleep to

employee effectiveness practitioners may focus on these psychological mechanisms to

alleviate the aversive consequences of a lack of sleep. Organizations may for example offer

employees the autonomy to engage in micro-breaks, which can replenish regulatory resources

(Kim et al., 2021). Furthermore, to improve employees' positive affect on days with poor

sleep interventions such as watching a humorous video, picture, or text may serve to alleviate

negative sleep-related consequences (Ferrer et al., 2015). Also, to enhance subjective vitality

managers may focus on employees' basic needs satisfaction (van den Broeck et al., 2016).

Furthermore, considering the crucial role of self-regulation in linking sleep to employee effectiveness, our findings highlight that holding a non-limited as compared to a limited resource theory attenuates the adverse spillover effects of a lack of sleep on regulatory resource availability and in turn stabilizes employees' effectiveness in the work domain. As such theories can be malleable (Job et al., 2010; Klinger et al., 2018; Sieber et al., 2019), individuals could adapt their implicit theories about willpower towards holding a non-limited resource theory. This may in turn help overcoming the adverse consequences of short-term fluctuations in sleep duration and stabilize their effectiveness. Furthermore, organizational interventions informing individuals about the role of malleable mindsets when engaging in self-regulation may also support employee effectiveness (Dweck, 2017)

Limitations and Suggestions for Future Research

Despite positive contributions, our work also has some limitations that should be discussed. First, while previous research suggests that implicit theories about willpower are malleable and can be affected through manipulations as well as recent experiences of self-regulation (Job et al., 2010; Klinger et al., 2018; Sieber et al., 2019), the malleability of such theories in everyday contexts needs to be further explored (Francis & Job, 2018). In light of the beneficial impact of holding a non-limited resource theory on self-regulation processes and associated outcomes, future studies could integrate an experimental manipulation with an experience sampling study to examine the impact of an intervention to change employees' implicit theories about willpower towards adapting a non-limited resource theory.

Second, alligned with previous research our measure for theories about willpower focused on engaging in strenuous mental activities as a form of self-regulation (Job, 2016). Considering that self-regulation can occur in different domains such as resisting temptations, controlling impulses, or regulating emotions (Diestel & Schmidt, 2011), domain-specific theories about willpower could be even more effective in facilitating domain-specific self-

Author Accepted Manuscript

SLEEP AND EMPLOYEE EFFECTIVENESS   35

regulation. Accordingly, future research may explore differences between general and

domain-specific theories about willpower. In addition, the indicated role of theories about

willpower in the relation between sleep duration and subjective vitality provides initial

evidence that theories about willpower also affect motivational processes, which could be

further explored in the future.

Third, while our research provides initial evidence on the unique role of different

psychological resources there may be further mechanisms that are relevant in the spillover of

sleep to employee effectiveness. For example, the conceptual differences and similarities

between perceived regulatory resources availability and fatigue are not yet well understood

(Baumeister et al., 2006; Evans et al., 2016; Lian et al., 2017). Accordingly, shedding light on

the similarities and differences of fatigue and regulatory resources availability could help to

expand our understanding of the role of self-regulation in the relation of sleep and work.

Fourth, our studies were based on self-reported data, which are susceptible to

common method bias (Podsakoff et al., 2003). However, the occurrence of moderating effects

of theories about willpower in both studies as well as the differential mediating effects of

different psychological processes in Study 2 is highly unlikely under the assumption of

common method bias. Also, while external performance assessments may increase the

validity of our research, they may also be deficient in experience sampling studies because

supervisors and colleagues may not be comprehensively aware of an employees' day-specific

in- and extra-role performance (Gabriel et al., 2019). Accordingly, future research may use

more objective assessments of sleep (Lauderdale et al., 2008) or collect more objective

assessments of employee effectiveness to validate the findings of our research.

Conclusion

In sum, our studies highlight the relevance of cognitive, affective, and motivational

processes in the daily home-to-work spillover of sleep duration to employee effectiveness.

Furthermore, we identify that holding a limited resources theory makes employees' self-regulation and associated effectiveness more dependent on sleep duration as a process of regulatory resource recovery.

References

Bakker, A. B., & Oerlemans, W. G. M. (2019). Daily job crafting and momentary work engagement: A self-determination and self-regulation perspective. *Journal of Vocational Behavior*, *112*(January 2018), 417–430. https://doi.org/10.1016/j.jvb.2018.12.005

Barnes, C. M. (2012). Working in our sleep. *Organizational Psychology Review*, *2*(3), 234–257. https://doi.org/10.1177/2041386612450181

Barnes, C. M., Schaubroeck, J., Huth, M., & Ghumman, S. (2011). Lack of sleep and unethical conduct. *Organizational Behavior and Human Decision Processes*, *115*(2), 169–180. https://doi.org/10.1016/j.obhdp.2011.01.009

Barnes, C. M., & Watson, N. F. (2019). Why healthy sleep is good for business. *Sleep Medicine Reviews*, *47*, 112–118. https://doi.org/10.1016/j.smrv.2019.07.005

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology*, *74*(5), 1252–1265. https://doi.org/10.1037/0022-3514.74.5.1252

Author Accepted Manuscript

Baumeister, R. F., Gailliot, M., DeWall, C. N., & Oaten, M. (2006). Self-regulation and

personality: How interventions increase regulatory success, and how depletion

moderates the effects of traits on behavior. *Journal of Personality*.

https://doi.org/10.1111/j.1467-6494.2006.00428.x

Baumeister, R. F., Muraven, M., & Tice, D. M. (2000). Ego depletion: A resource model of

volition, self-regulation, and controlled processing. *Social Cognition*.

https://doi.org/10.1521/soco.2000.18.2.130

Bernecker, K., Herrmann, M., Brandstätter, V., & Job, V. (2017). Implicit Theories About

Willpower Predict Subjective Well-Being. *Journal of Personality*, *85*(2), 136–150.

https://doi.org/10.1111/jopy.12225

Bernecker, K., & Job, V. (2015). Beliefs About Willpower Are Related to Therapy

Adherence and Psychological Adjustment in Patients With Type 2 Diabetes. *Basic and

Applied Social Psychology*, *37*(3), 188–195.

https://doi.org/10.1080/01973533.2015.1049348

Bertrams, A., Unger und, A., & Dickhäuser, O. (2011). Momentan verfügbare

selbstkontrollkraft - Vorstellung eines Messinstruments und erste Befunde aus

pädagogischpsychologischen Kontexten (Momentary Available Self-Control Strength -

Introduction of a Measurement Instrument and First Evidence from Paedagogical

Contexts). *Zeitschrift Für Pädagogische Psychologie (Journal of Paedagogical

Psychology)*, *25*(3), 185–196. https://doi.org/10.1024/1010-0652/a000042

Bledow, R., Rosing, K., & Frese, M. (2013). A Dynamic Perspective on Affect and

Creativity. *Academy of Management Journal*, *56*(2), 432–450.

https://doi.org/10.5465/amj.2010.0894

Bower, B., Bylsma, L. M., Morris, B. H., & Rottenberg, J. (2010). Poor reported sleep quality

predicts low positive affect in daily life among healthy and mood-disordered persons.

Journal of Sleep Research, *19*(2), 323–332. https://doi.org/10.1111/j.1365-

2869.2009.00816.x

Breevaart, K., Bakker, A. B., Demerouti, E., & Hetland, J. (2012). The Measurement of State

Work Engagement. *European Journal of Psychological Assessment*, *28*(4), 305–312.

https://doi.org/10.1027/1015-5759/a000111

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The

Pittsburgh sleep quality index: A new instrument for psychiatric practice and research.

In *Psychiatry Research* (Vol. 28, Issue 2, pp. 193–213). https://doi.org/10.1016/0165-

1781(89)90047-4

Call, M. L., & Ployhart, R. E. (2021). A Theory of Firm Value Capture from Employee Job

Performance: A Multidisciplinary Perspective. *Academy of Management Review*, *46*(3),

572–590. https://doi.org/10.5465/amr.2018.0103

Chong, S., Huang, Y., & Chang, C.-H. (Daisy). (2020). Supporting interdependent telework

employees: A moderated-mediation model linking daily COVID-19 task setbacks to

next-day work withdrawal. *Journal of Applied Psychology*, *105*(12), 1408–1422.

https://doi.org/10.1037/apl0000843

Christian, M. S., Garza, A. S., & Slaughter, J. E. (2011). Work Engagement: A Quantitative

Review and Test of its Relations with Task and Contextual Performance. *Personnel

Psychology*, *64*(1), 89–136. https://doi.org/10.1111/j.1744-6570.2010.01203.x

Clinton, M. E., Hewett, R., Conway, N., & Poulter, D. (2021). Lost Control Driving Home: A

Dual-Pathway Model of Self-Control Work Demands and Commuter Driving. *Journal

of Management*. https://doi.org/10.1177/0149206321997912

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple

regression/correlation analysis for the behavioral sciences (3rd ed.)*. Erlbaum.

de Ridder, D. T. D., & Gillebaart, M. (2017). Lessons learned from trait self-control in well-

Author Accepted Manuscript

being: making the case for routines and initiation as important components of trait self-

control. *Health Psychology Review*, *11*(1), 89–99.

https://doi.org/10.1080/17437199.2016.1266275

de Ridder, D. T. D., Lensvelt-Mulders, G., Finkenauer, C., Stok, F. M., & Baumeister, R. F.

(2012). Taking Stock of Self-Control. *Personality and Social Psychology Review*, *16*(1),

76–99. https://doi.org/10.1177/1088868311418749

Demerouti, E., Bakker, A. B., & Halbesleben, J. R. B. (2015). Productive and

counterproductive job crafting: A daily diary study. *Journal of Occupational Health

Psychology*, *20*(4), 457–469. https://doi.org/10.1037/a0039002

DeWall, C. N., Baumeister, R. F., Gailliot, M. T., & Maner, J. K. (2008). Depletion makes

the heart grow less helpful: Helping as a function of self-regulatory energy and genetic

relatedness. *Personality and Social Psychology Bulletin*, *34*(12), 1653–1662.

https://doi.org/10.1177/0146167208323981

Diestel, S., Rivkin, W., & Schmidt, K.-H. (2015). Sleep quality and self-control capacity as

protective resources in the daily emotional labor process: Results from two diary studies.

Journal of Applied Psychology, 100(3), 809–827. https://doi.org/10.1037/a0038373

Diestel, S., & Schmidt, K.-H. (2011). Costs of simultaneous coping with emotional

dissonance and self-control demands at work: Results from two German samples.

Journal of Applied Psychology, *96*(3), 643–653. https://doi.org/10.1037/a0022134

Dweck, C. S. (2017). From needs to goals and representations: Foundations for a unified

theory of motivation, personality, and development. *Psychological Review*, *124*(6), 689–

719. https://doi.org/10.1037/rev0000082

Edwards, J. R., & Rothbard, N. P. (2000). Mechanisms linking work and family: Clarifying

the relationship between work and family constructs. *Academy of Management Review*,

25(1). https://doi.org/10.5465/amr.2000.2791609

Evans, D. R., Boggero, I. A., & Segerstrom, S. C. (2016). The Nature of Self-Regulatory

Fatigue and "Ego Depletion." *Personality and Social Psychology Review*, *20*(4), 291–

310. https://doi.org/10.1177/1088868315597841

Ferrer, R. A., Grenen, E. G., & Taber, J. M. (2015). Effectiveness of internet-based affect

induction procedures: A systematic review and meta-analysis. *Emotion*, *15*(6), 752–762.

https://doi.org/10.1037/emo0000035

Fisher, C. D., & To, M. L. (2012). Using experience sampling methodology in organizational

behavior. *Journal of Organizational Behavior*, *33*(7), 865–877.

https://doi.org/10.1002/job.1803

Francis, Z., & Job, V. (2018). Lay theories of willpower. *Social and Personality Psychology

Compass*, *12*(4). https://doi.org/10.1111/spc3.12381

Gabriel, A. S., Podsakoff, N. P., Beal, D. J., Scott, B. A., Sonnentag, S., Trougakos, J. P., &

Butts, M. M. (2019). Experience Sampling Methods: A Discussion of Critical Trends

and Considerations for Scholarly Advancement. *Organizational Research Methods*,

22(4), 969–1006. https://doi.org/10.1177/1094428118802626

Gailliot, M. T., Baumeister, R. F., DeWall, C. N., Maner, J. K., Plant, E. A., Tice, D. M.,

Brewer, L. E., & Schmeichel, B. J. (2007). Self-control relies on glucose as a limited

energy source: Willpower is more than a metaphor. *Journal of Personality and Social

Psychology*, *92*(2), 325–336. https://doi.org/10.1037/0022-3514.92.2.325

Gerpott, F. H., Rivkin, W., & Unger, D. (2021). Stop and go, where is my flow? How and

when daily aversive morning commutes are negatively related to employees'

motivational states and behavior at work. *Journal of Applied Psychology*.

https://doi.org/10.1037/apl0000899

Gombert, L., Rivkin, W., & Schmidt, K.-H. (2020). Indirect Effects of Daily Self-Control

Demands on Subjective Vitality via Ego Depletion: How Daily Psychological

Author Accepted Manuscript

Detachment Pays Off. *Applied Psychology*, *69*(2), 325–350.

https://doi.org/10.1111/apps.12172

Goodman, S. A., & Svyantek, D. J. (1999). Person–Organization Fit and Contextual

Performance: Do Shared Values Matter. *Journal of Vocational Behavior*, *55*(2), 254–

275. https://doi.org/10.1006/jvbe.1998.1682

Gruber, R., & Cassoff, J. (2014). The Interplay Between Sleep and Emotion Regulation:

Conceptual Framework Empirical Evidence and Future Directions. *Current Psychiatry*

Reports, *16*(11), 500. https://doi.org/10.1007/s11920-014-0500-x

Guarana, C. L., Barnes, C. M., & Ong, W. J. (2021). The effects of blue-light filtration on

sleep and work outcomes. *Journal of Applied Psychology*, *106*(5), 784–796.

https://doi.org/10.1037/apl0000806

Hagger, M. S., Wood, C., Stiff, C., & Chatzisarantis, N. L. D. (2010). Ego depletion and the

strength model of self-control: A meta-analysis. *Psychological Bulletin*, *136*(4), 495–

525. https://doi.org/10.1037/a0019486

Halbesleben, J. R. B., Neveu, J.-P., Paustian-Underdahl, S. C., & Westman, M. (2014).

Getting to the "COR": Understanding the Role of Resources in Conservation of

Resources Theory. *Journal of Management*, *40*(5), 1334–1364.

https://doi.org/10.1177/0149206314527130

Harrison, Y., & Horne, J. A. (2000). The impact of sleep deprivation on decision making: A

review. *Journal of Experimental Psychology: Applied*, *6*(3), 236–249.

https://doi.org/10.1037/1076-898X.6.3.236

Harvey, A. G., Stinson, K., Whitaker, K. L., Moskovitz, D., & Virk, H. (2008). The

Subjective Meaning of Sleep Quality: A Comparison of Individuals with and without

Insomnia. *Sleep*, *31*(3), 383–393. https://doi.org/10.1093/sleep/31.3.383

Hayes, A. F., & Preacher, K. J. (2010). Quantifying and Testing Indirect Effects in Simple

Mediation Models When the Constituent Paths Are Nonlinear. *Multivariate Behavioral Research*, *45*(4), 627–660. https://doi.org/10.1080/00273171.2010.498290

Henderson, A. A., & Horan, K. A. (2021). A meta-analysis of sleep and work performance: An examination of moderators and mediators. *Journal of Organizational Behavior*, *42*(1), 1–19. https://doi.org/10.1002/job.2486

Hobfoll, S. E., Halbesleben, J., Neveu, J.-P., & Westman, M. (2018). Conservation of Resources in the Organizational Context: The Reality of Resources and Their Consequences. *Annual Review of Organizational Psychology and Organizational Behavior*, *5*(1), 103–128. https://doi.org/10.1146/annurev-orgpsych-032117-104640

Hofmann, W., Baumeister, R. F., Förster, G., & Vohs, K. D. (2012). Everyday temptations: An experience sampling study of desire, conflict, and self-control. *Journal of Personality and Social Psychology*, *102*(6), 1318–1335. https://doi.org/10.1037/a0026545

Hülsheger, U. R., Feinholdt, A., & Nübold, A. (2015). A low-dose mindfulness intervention and recovery from work: Effects on psychological detachment, sleep quality, and sleep duration. *Journal of Occupational and Organizational Psychology*, *88*(3), 464–489. https://doi.org/10.1111/joop.12115

Ilies, R., & Judge, T. A. (2005). Goal Regulation Across Time: The Effects of Feedback and Affect. *Journal of Applied Psychology*, *90*(3), 453–467. https://doi.org/10.1037/0021-9010.90.3.453

Inzlicht, M., & Schmeichel, B. J. (2012). What Is Ego Depletion? Toward a Mechanistic Revision of the Resource Model of Self-Control. *Perspectives on Psychological Science*, *7*(5), 450–463. https://doi.org/10.1177/1745691612454134

Job, V. (2016). Implicit Theories About Willpower. In *Self-Regulation and Ego Control* (pp. 203–225). Elsevier. https://doi.org/10.1016/B978-0-12-801850-7.00011-1

Author Accepted Manuscript

SLEEP AND EMPLOYEE EFFECTIVENESS 43

Job, V., Dweck, C. S., & Walton, G. M. (2010). Ego Depletion—Is It All in Your Head?

Psychological Science, *21*(11), 1686–1693. https://doi.org/10.1177/0956797610384745

Job, V., Walton, G. M., Bernecker, K., & Dweck, C. S. (2013). Beliefs about willpower

determine the impact of glucose on self-control. *Proceedings of the National Academy*

of Sciences of the United States of America, *110*(37), 14837–14842.

https://doi.org/10.1073/pnas.1313475110

Kaplan, S., Bradley, J. C., Luchman, J. N., & Haynes, D. (2009). On the role of positive and

negative affectivity in job performance: A meta-analytic investigation. *Journal of*

Applied Psychology, *94*(1), 162–176. https://doi.org/10.1037/a0013115

Kessler, R. C., Berglund, P. A., Coulouvrat, C., Hajak, G., Roth, T., Shahly, V., Shillington,

A. C., Stephenson, J. J., & Walsh, J. K. (2011). Insomnia and the Performance of US

Workers: Results from the America Insomnia Survey. *Sleep*, *34*(9), 1161–1171.

https://doi.org/10.5665/SLEEP.1230

Kim, S., Cho, S., & Park, Y. (2021). Daily microbreaks in a self-regulatory resources lens:

Perceived health climate as a contextual moderator via microbreak autonomy. *Journal of*

Applied Psychology. https://doi.org/10.1037/apl0000891

Klinger, J. A., Scholer, A. A., Hui, C. M., & Molden, D. C. (2018). Effortful experiences of

self-control foster lay theories that self-control is limited. *Journal of Experimental*

Social Psychology, *78*(March), 1–13. https://doi.org/10.1016/j.jesp.2018.04.006

Konze, A.-K., Rivkin, W., & Schmidt, K.-H. (2019). Can faith move mountains? How

implicit theories about willpower moderate the adverse effect of daily emotional

dissonance on ego-depletion at work and its spillover to the home-domain. *European*

Journal of Work and Organizational Psychology, *28*(2), 137–149.

https://doi.org/10.1080/1359432X.2018.1560269

Koopman, J., Lanaj, K., & Scott, B. A. (2016). Integrating the bright and dark sides of OCB:

A daily investigation of the benefits and costs of helping others. *Academy of Management Journal*, *59*(2), 414–435. https://doi.org/10.5465/amj.2014.0262

Kotabe, H. P., & Hofmann, W. (2015). On Integrating the Components of Self-Control. *Perspectives on Psychological Science*, *10*(5), 618–638. https://doi.org/10.1177/1745691615593382

Kühnel, J., Bledow, R., & Feuerhahn, N. (2016). When do you procrastinate? Sleep quality and social sleep lag jointly predict self-regulatory failure at work. *Journal of Organizational Behavior*, *37*(7), 983–1002. https://doi.org/10.1002/job.2084

LaHuis, D. M., Hartman, M. J., Hakoyama, S., & Clark, P. C. (2014). Explained Variance Measures for Multilevel Models. *Organizational Research Methods*, *17*(4), 433–451. https://doi.org/10.1177/1094428114541701

Lanaj, K., Johnson, R. E., & Barnes, C. M. (2014). Beginning the workday yet already depleted? Consequences of late-night smartphone use and sleep. *Organizational Behavior and Human Decision Processes*, *124*(1), 11–23. https://doi.org/10.1016/j.obhdp.2014.01.001

Lanaj, K., Johnson, R. E., & Wang, M. (2016). When lending a hand depletes the will: The daily costs and benefits of helping. *Journal of Applied Psychology*, *101*(8), 1097–1110. https://doi.org/10.1037/apl0000118

Lauderdale, D. S., Knutson, K. L., Yan, L. L., Liu, K., & Rathouz, P. J. (2008). Self-Reported and Measured Sleep Duration. *Epidemiology*, *19*(6), 838–845. https://doi.org/10.1097/EDE.0b013e318187a7b0

Lazarus, R. S. (1991). Cognition and motivation in emotion. *American Psychologist*, *46*(4), 352–367. https://doi.org/10.1037/0003-066X.46.4.352

Lee, K., & Allen, N. J. (2002). Organizational citizenship behavior and workplace deviance: The role of affect and cognitions. *Journal of Applied Psychology*, *87*(1), 131–142.

Author Accepted Manuscript

https://doi.org/10.1037//0021-9010.87.1.131

Lian, H., Yam, K. C., Ferris, D. L., & Brown, D. (2017). Self-Control at Work. *Academy of Management Annals*, *11*(2), 703–732. https://doi.org/10.5465/annals.2015.0126

Litwiller, B., Snyder, L. A., Taylor, W. D., & Steele, L. M. (2017). The relationship between sleep and work: A meta-analysis. *Journal of Applied Psychology*, *102*(4), 682–699. https://doi.org/10.1037/apl0000169

Liu, H., Ji, Y., & Dust, S. B. (2020). "Fully recharged" evenings? The effect of evening cyber leisure on next-day vitality and performance through sleep quantity and quality, bedtime procrastination, and psychological detachment, and the moderating role of mindfulness. *Journal of Applied Psychology*. https://doi.org/10.1037/apl0000818

Ma, N., Dinges, D. F., Basner, M., & Rao, H. (2015). How Acute Total Sleep Loss Affects the Attending Brain: A Meta-Analysis of Neuroimaging Studies. *Sleep*, *38*(2), 233–240. https://doi.org/10.5665/sleep.4404

Mullins, H. M., Cortina, J. M., Drake, C. L., & Dalal, R. S. (2014). Sleepiness at work: A review and framework of how the physiology of sleepiness impacts the workplace. *Journal of Applied Psychology, 99*(6), 1096–1112. https://doi.org/10.1037/a0037885

Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin, 126*(2), 247–259. https://doi.org/10.1037//0033-2909.126.2.247

Muraven, M., Gagné, M., & Rosman, H. (2008). Helpful self-control: Autonomy support, vitality, and depletion. *Journal of Experimental Social Psychology*, *44*(3), 573–585. https://doi.org/10.1016/j.jesp.2007.10.008

Muthén, L. K., & Muthén, B. O. (1997-2017). *Mplus User's Guide. Eighth Edition.* (Muthén & Muthén (eds.)).

O'Shea, D., Buckley, F., & Halbesleben, J. (2017). Self-regulation in entrepreneurs:

Integrating action, cognition, motivation, and emotions. *Organizational Psychology Review*, *7*(3), 250–278. https://doi.org/10.1177/2041386617705434

Ohly, S., Sonnentag, S., Niessen, C., & Zapf, D. (2010). Diary Studies in Organizational Research. *Journal of Personnel Psychology*, *9*(2), 79–93. https://doi.org/10.1027/1866-5888/a000009

Pilcher, J. J., Ginter, D. R., & Sadowsky, B. (1997). Sleep quality versus sleep quantity: Relationships between sleep and measures of health, well-being and sleepiness in college students. *Journal of Psychosomatic Research*, *42*(6), 583–596. https://doi.org/10.1016/S0022-3999(97)00004-4

Pilcher, J. J., & Huffcutt, A. I. (1996). Effects of Sleep Deprivation on Performance: A Meta-Analysis. *Sleep*, *19*(4), 318–326. https://doi.org/10.1093/sleep/19.4.318

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Pray, L., Yaktine, A. L., & Pankevich, D. (2014). *Caffeine in Food and Dietary Supplements: Examining Safety: Workshop Summary*. National Academies Press (US). http://www.nap.edu/catalog.php?record_id=18607

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing Moderated Mediation Hypotheses: Theory, Methods, and Prescriptions. *Multivariate Behavioral Research*, *42*(1), 185–227. https://doi.org/10.1080/00273170701341316

Preacher, K. J., & Selig, J. P. (2012). Advantages of Monte Carlo Confidence Intervals for Indirect Effects. *Communication Methods and Measures*, *6*(2), 77–98. https://doi.org/10.1080/19312458.2012.679848

Preacher, K. J., Zyphur, M. J., & Zhang, Z. (2010). A general multilevel SEM framework for

Author Accepted Manuscript

assessing multilevel mediation. *Psychological Methods*, *15*(3), 209–233.

https://doi.org/10.1037/a0020141

Quinn, R. W., Spreitzer, G. M., & Lam, C. F. (2012). Building a Sustainable Model of

Human Energy in Organizations: Exploring the Critical Role of Resources. *The*

Academy of Management Annals, *6*(1), 337–396.

https://doi.org/10.1080/19416520.2012.676762

Rivkin, W., Diestel, S., & Schmidt, K.-H. (2018). Which daily experiences can foster well-

being at work? A diary study on the interplay between flow experiences, affective

commitment, and self-control demands. *Journal of Occupational Health Psychology*,

23(1), 99–111. https://doi.org/10.1037/ocp0000039

Ryan, R. M., & Deci, E. L. (2008). From Ego Depletion to Vitality: Theory and Findings

Concerning the Facilitation of Energy Available to the Self. *Social and Personality*

Psychology Compass, *2*(2), 702–717. https://doi.org/10.1111/j.1751-9004.2008.00098.x

Ryan, R. M., & Frederick, C. (1997). On Energy, Personality, and Health: Subjective Vitality

as a Dynamic Reflection of Well-Being. *Journal of Personality*, *65*(3), 529–565.

https://doi.org/10.1111/j.1467-6494.1997.tb00326.x

Savani, K., & Job, V. (2017). Reverse ego-depletion: Acts of self-control can improve

subsequent performance in Indian cultural contexts. *Journal of Personality and Social*

Psychology, *113*(4), 589–607. https://doi.org/10.1037/pspi0000099

Sayre, G. M., Grandey, A. A., & Almeida, D. M. (2021). Does sleep help or harm managers'

perceived productivity? Trade-offs between affect and time as resources. *Journal of*

Occupational Health Psychology, *26*(2), 127–141. https://doi.org/10.1037/ocp0000192

Schaufeli, W. B., Bakker, A. B., & Salanova, M. (2006). The Measurement of Work

Engagement with a Short Questionnaire: A Cross-National Study. *Educational and*

Psychological Measurement, *66*(4), 701–716.

https://doi.org/10.1177/0013164405282471

Schlarb, A., Claßen, M., Hellmann, S., Vögele, C., & Gulewitsch, M. D. (2017). Sleep and

somatic complaints in university students. *Journal of Pain Research*, *Volume 10*, 1189–

1199. https://doi.org/10.2147/JPR.S125421

Schmidt, K.-H., & Neubach, B. (2007). Self-control demands: A source of stress at work.

International Journal of Stress Management, *14*(4), 398–416.

https://doi.org/10.1037/1072-5245.14.4.398

Schmitt, A., Belschak, F. D., & Den Hartog, D. N. (2017). Feeling vital after a good night's

sleep: The interplay of energetic resources and self-efficacy for daily proactivity.

Journal of Occupational Health Psychology, *22*(4), 443–454.

https://doi.org/10.1037/ocp0000041

Schnyer, D. M., Zeithamova, D., & Williams, V. (2009). Decision-Making Under Conditions

of Sleep Deprivation: Cognitive and Neural Consequences. *Military Psychology*,

21(sup1), S36–S45. https://doi.org/10.1080/08995600802554607

Scott, B. A., & Judge, T. A. (2006). Insomnia, Emotions, and Job Satisfaction: A Multilevel

Study. *Journal of Management*, *32*(5), 622–645.

https://doi.org/10.1177/0149206306289762

Selig, J. P., & Preacher, K. J. (2008). *Monte Carlo method for assessing mediation: An*

interactive tool for creating confidence intervals for indirect effects [Computer

software].

Shockley, K. M., Ispas, D., Rossi, M. E., & Levine, E. L. (2012). A Meta-Analytic

Investigation of the Relationship Between State Affect, Discrete Emotions, and Job

Performance. *Human Performance*, *25*(5), 377–411.

https://doi.org/10.1080/08959285.2012.721832

Sieber, V., Flückiger, L., Mata, J., Bernecker, K., & Job, V. (2019). Autonomous Goal

Author Accepted Manuscript

Striving Promotes a Nonlimited Theory About Willpower. *Personality and Social Psychology Bulletin*, *45*(8), 1295–1307. https://doi.org/10.1177/0146167218820921

Siegel, J. M. (2005). Clues to the functions of mammalian sleep. *Nature*, *437*(7063), 1264–1271. https://doi.org/10.1038/nature04285

Snijders, T. A. B., & Bosker, R. J. (2011). *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling*. SAGE Publications. https://books.google.co.uk/books?id=N1BQvcomDdQC

Sonnentag, S., Binnewies, C., & Mojza, E. J. (2008). "Did you have a nice evening?" A day-level study on recovery experiences, sleep, and affect. *Journal of Applied Psychology*, *93*(3), 674–684. https://doi.org/10.1037/0021-9010.93.3.674

Spector, P. E., & Fox, S. (2002). An emotion-centered model of voluntary work behavior. *Human Resource Management Review*, *12*(2), 269–292. https://doi.org/10.1016/S1053-4822(02)00049-9

Stjernfelt, F. (2021). Conscious self-control as criterion for reasoning. *Cognitive Semiotics*, *14*(1), 71–99. https://doi.org/10.1515/cogsem-2021-2039

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High Self-Control Predicts Good Adjustment, Less Pathology, Better Grades, and Interpersonal Success. *Journal of Personality*, *72*(2), 271–324. https://doi.org/10.1111/j.0022-3506.2004.00263.x

ten Brummelhuis, L. L., & Bakker, A. B. (2012). A resource perspective on the work–home interface: The work–home resources model. *American Psychologist*, *67*(7), 545–556. https://doi.org/10.1037/a0027974

Tice, D. M., Baumeister, R. F., Shmueli, D., & Muraven, M. (2007). Restoring the self: Positive affect helps improve self-regulation following ego depletion. *Journal of Experimental Social Psychology*, *43*(3), 379–384. https://doi.org/10.1016/j.jesp.2006.05.007

Totterdell, P., Reynolds, S., Parkinson, B., & Briner, R. B. (1994). Associations of Sleep

With Everyday Mood, Minor Symptoms and Social Interaction Experience. *Sleep*, *17*(5),

466–475. https://doi.org/10.1093/sleep/17.5.466

van den Broeck, A., Ferris, D. L., Chang, C.-H., & Rosen, C. C. (2016). A Review of Self-

Determination Theory's Basic Psychological Needs at Work. *Journal of Management*,

42(5), 1195–1229. https://doi.org/10.1177/0149206316632058

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief

measures of positive and negative affect: The PANAS scales. *Journal of Personality and*

Social Psychology, *54*(6), 1063–1070. https://doi.org/10.1037/0022-3514.54.6.1063

Welsh, D. T., Ellis, A. P. J., Christian, M. S., & Mai, K. M. (2014). Building a self-regulatory

model of sleep deprivation and deception: The role of caffeine and social influence.

Journal of Applied Psychology, *99*(6), 1268–1277. https://doi.org/10.1037/a0036202

Welsh, D. T., Mai, K. M., Ellis, A. P. J., & Christian, M. S. (2018). Overcoming the effects

of sleep deprivation on unethical behavior: An extension of integrated self-control

theory. *Journal of Experimental Social Psychology*, *76*(January), 142–154.

https://doi.org/10.1016/j.jesp.2018.01.007

Yam, K. C., Fehr, R., Keng-Highberger, F. T., Klotz, A. C., & Reynolds, S. J. (2016). Out of

control: A self-control perspective on the link between surface acting and abusive

supervision. *Journal of Applied Psychology*, *101*(2), 292–301.

https://doi.org/10.1037/apl0000043

Biographies

Wladislaw (Wlad) Rivkin is an Associate Professor in Organizational Behavior at Trinity
Business School - Trinity College Dublin. His research focuses on how self-regulation affects
employees' mental health, well-being, and effectiveness. It has been published in high-impact

Author Accepted Manuscript

academic journals such as the Journal of Applied Psychology, and the Journal of

Occupational Health Psychology. [Email: rivkinw@tcd.ie]

Stefan Diestel is a Professor in Work, Organizational and Business Psychology at the

Schumpeter School of Business and Economics - University of Wuppertal. His research

interests center around the impact of personality on self-regulation, well-being and

motivation at work. [Email: diestel@wiwi.uni-wuppertal.de]]]

Jakob Stollberger is an Associate Professor in Organizational Behavior at the School of

Business and Economics - Vrije Universiteit Amsterdam. His research examines topics such

as leadership and innovation, the intersection between work and family, as well as well-

being. It has been published in journals such as the Journal of Organizational Behavior, and

the Journal of Vocational Behavior. [Email: j.stollberger@vu.nl]

Claudia Sacramento is a Reader in Organizational Behavior at the Department of Work and

Organisations Aston Business School, UK. Her areas of research interests include individual

and organisational creativity, group processes, team effectiveness, leadership and motivation.

She has published her]work in outlets such as Organizational Behavior and Human Decision

Processes, Academy of Management Journal, Journal of Management and Journal of

Organizational Behavior.]

Tables

Table 1
Means, standard deviations, internal consistencies (Cronbach's Alpha), and intercorrelations (Study 1)

Variable	1	2	3	4	5	6
1. Sleep duration - morning	-	**0.30**	**0.25**			
2. Regulatory resources availability - morning	0.26	*.92 - .96*	**0.24**			
3. Work engagement - evening	0.26	**0.71**	*.96 - .98*			
4. *Implicit theories about willpower*	-0.03	**0.27**	0.22	*.71*		
5. *Age*	-0.14	0.25	**0.31**	-0.16	-	
6. *Gender*	-0.05	0.12	0.06	0.23	0.05	-
M	6.35	3.26	4.04	2.84	40.31	1.45
SD	1.10	0.75	1.44	0.79	12.57	0.50

Note. Cronbach's alpha for day-level variables represents the lowest and highest values across all measurement days. Correlations below the diagonal are person-level correlations (N=58). Correlations above the diagonal are day-level correlations (N=428). Numbers in bold $p < .05$. Between-person level variables in italic.

Author Accepted Manuscript

Table 2

Unstandardized coefficients from an MSEM predicting perceived regulatory resource availability, work engagement, and conditional indirect effects. (Study 1)

	Regulatory resources availability - morning				Work engagement - evening			
	Estimate	SE	z		Estimate	SE	z	
Between-level								
Intercept	3.286	0.072	45.910	**	4.319	0.166	26.062	**
Implicit theories about willpower	0.174	0.099	1.764	+				
Residual variance	0.247	0.052	4.718	*				
Residual variance of RS[a]	0.024	0.014	1.742	+				
Within-level								
Sleep duration - morning[a]	0.193	0.037	5.284	**	0.164	0.084	1.965	*
Regulatory resources availability - morning					0.292	0.088	3.328	**
Sleep duration x Implicit theories about willpower[a]	-0.098	0.041	-2.365	*				
Residual variance	0.253	0.034	7.401	**	0.645	0.099	6.490	**

Indirect Effects

Moderator: Implicit theories about willpower	95% CI indirect effect:		Difference of the conditional indirect effect to low theories about willpower	
	LL 95% CI	UL 95% CI	LL 95% CI	UL 95% CI
High (non-limited resource theory)	**0.006**	**0.073**	**-0.098**	**-0.006**
Low (limited resource theory)	**0.030**	**0.135**		

Note. *p < .05. **p < .01. [a]Estimates refer to the random slope (RS) of sleep duration and regulatory resource availability, which was specified at the between-level part of the statistical model and predicted by theories about willpower to test the cross-level interaction. All Estimates are unstandardized, resulting from one overall analysis including the prediction of all outcomes and RS in one model. CI = Confidence Interval. LL = Lower limit. UL = Upper limit. Confidence intervals, which do not include zero in bold. Controlling for previous day endogenous variables, as well as a linear and a quadratic trend across days, did not affect the results.

SLEEP AND EMPLOYEE EFFECTIVENESS   54

Table 3
Means, standard deviations, internal consistencies (Cronbach's Alpha), and intercorrelations (Study 2)

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Sleep duration - morning	-	**0.34**	**0.27**	**0.28**	0.03	0.00	-0.04	**0.41**				
2. Regulatory resources availability - morning	0.01	*.94 - .97*	**0.51**	**0.58**	**0.35**	**0.27**	**0.11**	**0.45**				
3. Positive affect - morning	0.13	**0.39**	*.86 - .93*	**0.70**	**0.32**	**0.27**	**0.12**	**0.38**				
4. Subjective vitality - morning	**0.21**	**0.48**	**0.81**	*.84 - .91*	**0.33**	**0.26**	**0.10**	**0.41**				
5. Work engagement - afternoon	0.09	**0.45**	**0.60**	**0.59**	*.93 - .96*	**0.67**	**0.50**	**0.14**				
6. In-role performance - afternoon	**0.16**	**0.49**	**0.30**	**0.39**	**0.67**	*.87 - .96*	**0.46**	**0.13**				
7. Extra-role performance - afternoon	-0.06	**0.16**	**0.36**	**0.33**	**0.54**	**0.50**	*.89 - .97*	0.02				
8. Sleep quality - morning	**0.35**	**0.30**	**0.40**	**0.43**	**0.18**	0.15	0.11	-				
9. *Implicit theories about willpower*	0.03	0.08	0.15	0.05	0.08	-0.01	0.02	0.02	*.81*			
10. *Trait self-control*	0.03	**0.30**	0.12	0.13	**0.16**	**0.23**	0.01	0.07	0.01	*.75*		
11. *Age*	0.08	0.13	0.06	-0.03	-0.08	-0.11	-0.01	0.04	0.08	0.14	-	
12. *Gender*	-0.15	0.07	0.07	0.08	0.07	-0.08	0.03	0.00	-0.08	**-0.18**	-0.13	-
M	6.70	3.90	3.19	3.13	3.72	3.85	4.32	2.07	3.04	3.37	32.16	1.44
SD	1.29	0.88	0.74	0.78	0.96	0.86	1.35	0.75	0.77	0.48	10.15	0.50

Note. Cronbach's alpha for day-level variables represents the lowest and highest values across all measurement days. Correlations below the

diagonal are person-level correlations (N=156). Correlations above the diagonal are day-level correlations (N=889). Numbers in bold p < .05.

Between-person level variables in italic.

Author Accepted Manuscript

Table 4

Unstandardized coefficients of an MSEM predicting sleep duration perceived regulatory resource availability, -subjective vitality, and -positive affect, work engagement, and in-role performance, and indirect effects. (Study 2)

	Sleep duration - morning			Regulatory resources availability - morning			Positive affect - morning			Subjective vitality - morning			Work engagement - afternoon			In-role performance - afternoon			Extra-role performance - afternoon		
	Estimate	SE	z	Estimate	SE	z	Estimate	SE	z	Estimate	SE	z	Estimate	SE	z	Estimate	SE	z	Estimate	SE	z
Between-level																					
Intercept				3.919	0.049	79.573**	3.164	0.050	62.721**	3.128	0.048	64.941**	3.647	0.065	56.175**	3.755	0.060	62.579**	4.127	0.096	42.865**
Implicit theories about willpower				0.044	0.058	0.760	0.111	0.066	1.677+	0.023	0.058	0.402									
Self-control capacity				0.425	0.109	3.900**	0.123	0.110	1.116	0.154	0.104	1.475									
Residual variance				0.247	0.042	5.944**	0.289	0.047	6.110**	0.239	0.037	6.450**	0.311	0.062	4.981**	0.294	0.045	6.586**	0.876	0.143	6.108**
Residual variance RS[a]				0.002	0.008	0.318	0.001	0.003	0.389	0.009	0.010	0.904									
Within-level																					
Sleep quality - morning	0.662	0.071	9.295**	0.425	0.049	8.669**	0.292	0.037	7.910**	0.371	0.046	8.013**	-0.066	0.054	-1.229	-0.009	0.052	-0.178	-0.100	0.085	-1.176
Sleep duration[a] - morning				0.130	0.031	4.228**	0.080	0.024	3.309**	0.080	0.030	2.656*	-0.103	0.037	-2.779*	-0.102	0.035	-2.896**	-0.109	0.063	-1.744+
Regulatory resources availability - morning													0.308	0.059	5.209**	0.207	0.047	4.392**	0.200	0.088	2.282*
Positive affect - morning													0.224	0.085	2.634*	0.208	0.080	2.614*	0.244	0.116	2.098*
Subjective vitality - morning													0.175	0.077	2.269*	0.109	0.063	1.734+	0.042	0.115	0.367
Sleep duration x Implicit theories about willpower[a]				-0.084	0.034	-2.517*	-0.012	0.026	-0.445	-0.085	0.028	-2.982**									
Sleep duration x Self-control capacity[a]				-0.029	0.060	-0.475	0.004	0.047	0.074	-0.004	0.052	-0.072									
Residual variance	0.711	0.079	9.045**	0.417	0.038	11.109**	0.288	0.023	12.448**	0.346	0.027	12.896**	0.518	0.058	9.004**	0.459	0.043	10.743**	1.363	0.137	9.957**

Indirect effects

Outcome:	Mediator	95% CI indirect effect:	
		LL 95% CI	UL 95% CI
	Regualtory resources availability	0.021	0.061
Work engagement	Positive affect	0.003	0.039
	Subjective vitality	0.001	0.033
	Regualtory resources availability	0.013	0.042
In-role performance	Positive affect	0.003	0.037
	Subjective vitality	-0.001	0.023
	Regualtory resources availability	0.004	0.047
Extra-role performance	Positive affect	0.001	0.048
	Subjective vitality	-0.016	0.024

Note. *p < .05. **p < .01 [a]Estimates refer to random slopes (RS) of sleep duration and each mediator (regulatory resource availability, positive affect, and subjective vitality), which were specified at the between-level part of the statistical model and predicted by theories about willpower and self-control capacity to test the cross-level interactions. Estimates are unstandardized, resulting from one overall analysis including the prediction of all outcomes and RSs in one model. CI = Confidence Interval. LL = Lower limit. UL = Upper limit. Controlling for previous day endogenous variables, as well as a linear and a quadratic trend across days, did affect the results. The effect of positive affect on extra-role performance became marginally significant (p = .068).
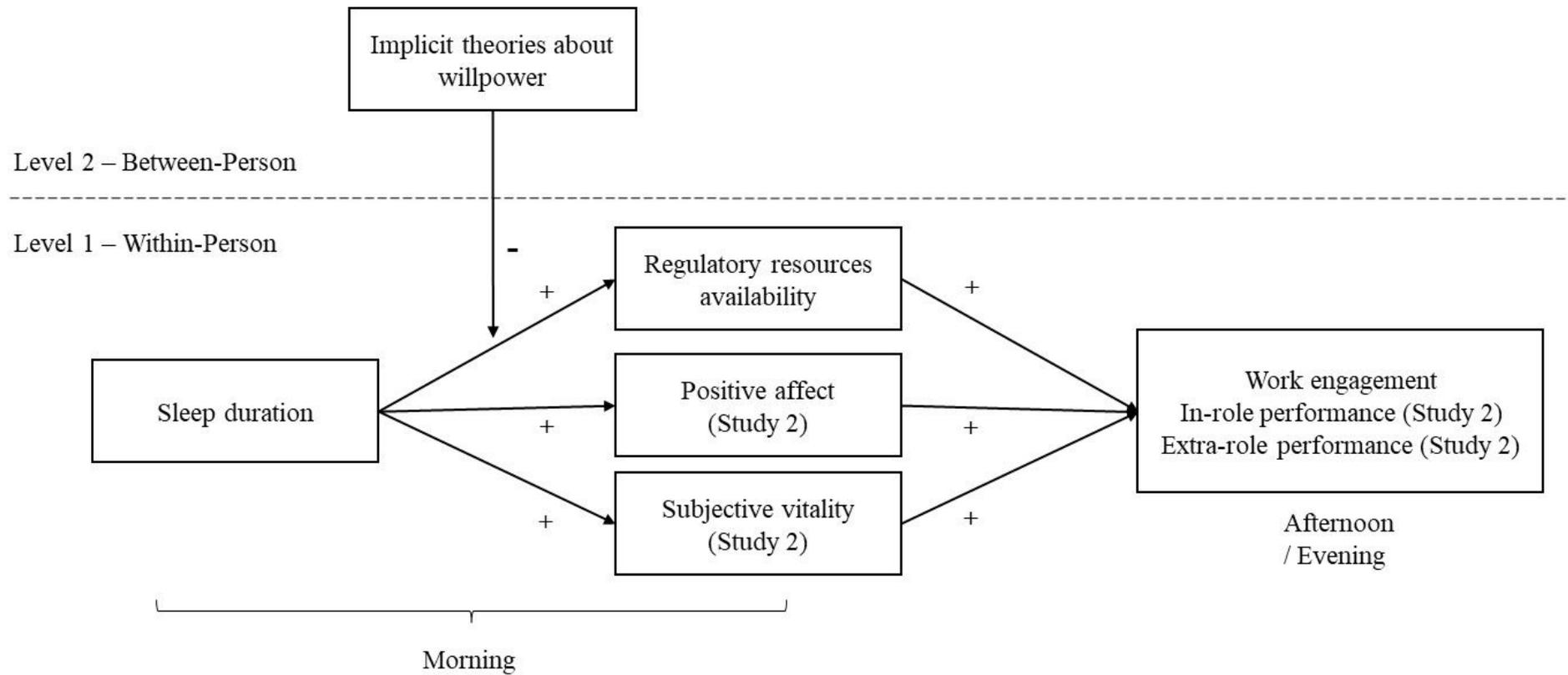
Figures

Figure 1. Theoretical model

Note. Control variables were omitted for clarity.
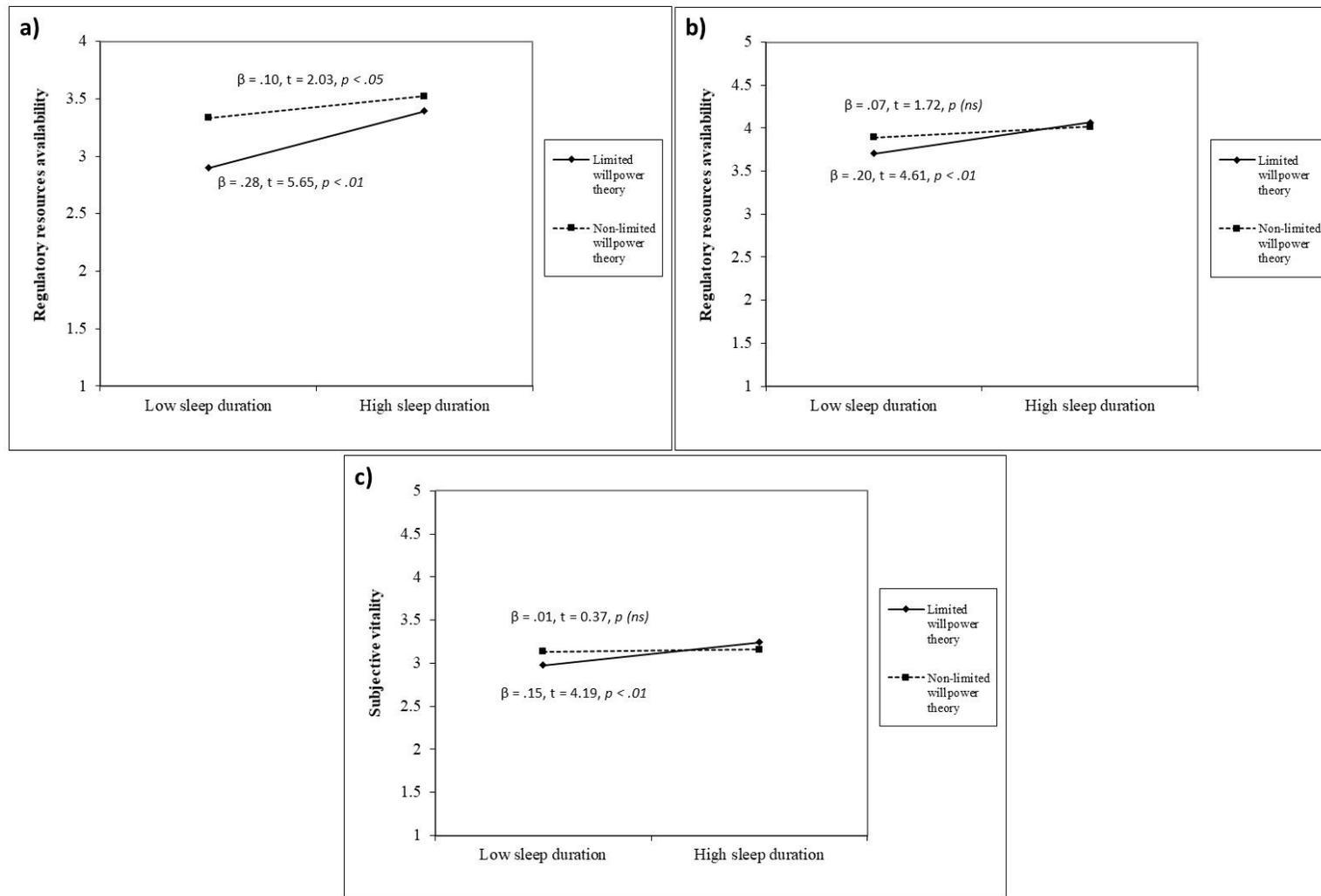
Author Accepted Manuscript

Figure 2. Cross-level moderating effect of implicit theories about willpower on the relations between sleep duration and a) perceived regulatory

resources availability – Study 1, b) perceived regulatory resources availability – Study 2, and c) subjective vitality – Study 2.