# HOW NATURE CAN NURTURE: EXAMINING THE ROLE OF ENVIRONMENT NATURALNESS IN RECOVERY DURING WORK BREAKS

by

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A dissertation submitted to the faculty of
The University of North Carolina at Charlotte
in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in
Organizational Science

Charlotte

2023

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# ABSTRACT

KATHRYN ANN KAVANAGH. How Nature Can Nurture: Examining the Role of Environment Naturalness in Recovery During Work Breaks. (Under the direction of DR. LINDA R. SHANOCK)

Work stress recovery is critical to employee health, wellbeing, and engagement, but our understanding of how recovery unfolds during work breaks and in different environments is incomplete. Based on theories of recovery from occupational health psychology and environmental psychology, the current study examines the role of break environment naturalness in the recovery process during work breaks. Specifically, I use a within-person diary design to test whether environment naturalness relates to experiencing psychological detachment, relaxation, and enjoyment during breaks, as well as post-break recovery outcomes (recovery state and strain) and afternoon outcomes (performance capacity and positive affect). I further investigate the indirect effect of naturalness on post-break and afternoon outcomes via break experiences, as well the between-persons relationships between recovery outcomes and work engagement and burnout at the end of the two-week study period. Data were collected from 112 working adults who responded to three daily surveys across 10 workdays. Findings suggest break environment naturalness has a direct effect on relaxation and enjoyment during breaks, as well as post-break recovery state. Naturalness is also indirectly related to post-break recovery state and strain via break relaxation and enjoyment. Results support certain theories of recovery across disciplines, and provide evidence for the role of natural environments in promoting recovery during the workday.

# DEDICATION

To my parents, Mary Ellen and Kelly, for their continuous love, support, and encouragement for so many years. For the family trips growing up that instilled in me an appreciation for and desire to see the world, for teaching me to think critically for myself, and for always having confidence in me even when I didn't have it myself. Mom, I would not have made it through graduate school without our phone calls, visits, or celebratory excursions. I hope I continue to make you both proud.

# ACKNOWLEDGEMENTS

I am deeply grateful to my advisor and mentor, Dr. Linda Shanock. Graduate school is a unique and difficult journey, and I would not be where I am today without Dr. Shanock's continuous support, advice, patience, and lab meeting candy. Beyond being an exceptional and well-rounded professor and advisor, she is a gem of a human being, and working with her over the last several years has truly made me a better scholar, practitioner, and person. I would also like express my gratitude to my committee members for their discussions and suggestions that undoubtedly improved this project. Many thanks to Dr. Alyssa McGonagle for encouraging me as I found the research I am passionate about, Dr. Anita Blanchard for expanding how I think and write, and Dr. Lisa Walker for her insightful comments and feedback on my dissertation.

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| | |
|---|---|
| ART | Attention Restoration Theory |
| CFA | Confirmatory factor analysis |
| COR | Conservation of Resources |
| E-R | Effort-Recovery Model |
| ESM | Experience sampling methodology |
| EBPP | Event-based pre-/post-design |
| ICC | Intraclass correlation |
| MLM | Multilevel modeling |
| NA | Negative affect |
| OHP | Occupational Health Psychology |
| PA | Positive affect |
| SRT | Stress Reduction Theory |

# CHAPTER 1: INTRODUCTION

Recovering from everyday work stress is a critical component of employee health and wellbeing, motivation, and performance (Sonnentag et al., 2022). When employees face stressors or demands at work, they must use psychophysiological resources (e.g., energy, concentration) to respond adequately, which can lead to strain symptoms. When depleted, these resources need to be replenished in order for employees to use them again and to prevent longer-term adverse health effects (Hobfoll, 2001; Meijman & Mulder, 1998). Recovery is the psychophysiological unwinding process in which, after responding to work tasks has increased strain levels and depleted resources, psychophysiological resources are restored to baseline (i.e., pre-stressor) levels (Craig & Cooper, 1992; Sonnentag & Guerts, 2009). This study explores how employees unwind during their breaks at work, and whether spending those breaks in natural environments is especially helpful for recovering from work stress.

Recovery research has predominantly occurred within the field of occupational health psychology (OHP), which has demonstrated the importance of successful recovery for employee wellbeing, work engagement, and other important work outcomes like performance, productivity, and proactive behavior at work (Demerouti et al., 2009; Kinnunen et al., 2011; Sonnentag, 2003; Sonnentag et al., 2010; Sonnentag et al., 2012; Sonnentag et al., 2017). Thus far, recovery researchers have largely focused on questions of *what* and *how:* the activities (the *what)* and their associated psychological experiences (the *how,* or the mechanisms*)* that lead to recovery. This work has consistently demonstrated the importance of a few specific underlying psychological experiences (i.e., psychological detachment, relaxation, mastery, and control) that lead to recovery

(Sonnentag et al., 2007). When considering additional questions of *when* and *where* recovery occurs, gaps remain, and raise more questions regarding recovery in particular contexts, such as during the workday.

The current study seeks to add to our understanding of *when* (i.e., recovery during the workday), *where* (i.e., in natural environments), and *how* (i.e., additional recovery mechanisms) of recovery from work stress. In terms of *when,* recovery research has predominantly investigated recovery during nonwork time: during evenings, weekends, and vacations, when employees have more extended periods of time to recover (Sonnentag et al., 2017). But people spend a third or half of their day at work (or doing work) (Trougakos & Hideg, 2009), so understanding *how* employees can recover *when at work* is an important part of building a more comprehensive understanding of the recovery process. Employees' personal resources (e.g., cognitive, affective, energetic resources) become depleted over the workday, and thus employees may need recovery experiences during working hours, rather than waiting until the end of the day or for a weekend or vacation (Trougakos & Hideg, 2009). But *how* recovery happens during the workday on breaks may not be through the same mechanisms that lead to recovery during evenings or weekends. Indeed, existing studies of recovery at work have demonstrated that other experiences (beyond the four typical experiences mentioned above) are important to recovering at work, such as experiencing social relatedness and enjoyment (as well as relaxation and control) during lunch breaks (Bosch et al., 2018; Sianoja et al., 2018). However, the recovery potential of these and other recovery experiences needs further study. In their recent review of recovery research and fruitful future directions,

Sonnentag et al. (2022) list identifying "the underlying processes that make breaks from work successful" (p. 3) as a question future research should address to advance the field.

Another remaining gap is our understanding of how recovery unfolds in different environments (i.e., questions of both *where* and *how).* During the workday, employees likely have few options for physical locations to spend their breaks, such as a break room, their own desk or office, or going outside. Yet very few studies to date have actually studied the *where,* that is, the work break environments' role in recovery. OHP researchers have acknowledged that natural environments in particular (compared to nonnatural or built environments) are likely lead to better work recovery, based on theories and findings from environmental psychology research on restorative environments. For example, in their review of recovery research, Sonnentag et al. (2017) recognized natural environments as settings for recovery, and cited research and theory from environmental psychology supporting nature's potential to restore affective, energetic, and cognitive resources and improve health and wellbeing (Bowler et al., 2020; Bratman et al., 2012).

The authors also acknowledge that scant research has linked natural environments to the job stress recovery process (and experiences) proposed by OHP scholars. Linking the two would either strengthen the current propositions regarding those experiences or raise the possibility that our understanding of work recovery and its mechanisms should be expanded to include those specifically relevant to natural environments. The experiences in natural environments that lead to recovery (i.e., *how* recovery happens in natural environments) may not be the same *how* experiences OHP researchers have characteristically studied (i.e., psychological detachment, relaxation, control, and

mastery). In fact, the environmental psychology theories and empirical evidence suggest other factors and mechanisms make natural environments restorative (e.g., affective restoration, Hartig et al., 2014). There is also some conceptual overlap with recovery constructs from OHP, yet these have not been sufficiently incorporated into the work recovery framework.

The purpose of the current study is to explore how the naturalness of the environment in which work breaks are spent may be beneficial for employee recovery. I draw on theories from occupational health, positive, and environmental psychologies to argue that work breaks spent in highly natural environments (e.g., natural outdoor environments) may be particularly beneficial for employee recovery and wellbeing. This study integrates these various theories to broaden our understanding of how recovery unfolds, including mechanisms beyond the oft-studied psychological experiences of psychological detachment, relaxation, mastery, and control, and explore the role of enjoyment, work reflection, and problem-solving pondering as mechanisms of recovery during breaks. I suspect natural environments may facilitate recovery through the typically studied mechanisms as well as through the additional mechanisms of enjoyment and potentially positive work reflection or pondering because of the affective and cognitive outcomes of contact with nature proposed by environmental psychology theories. My general hypothesis is that spending work breaks in more natural outdoor environments will lead to better postbreak recovery and work-related wellbeing outcomes (compared to indoor or less natural environments).

First, I define what nature, natural environments, and contact with nature mean in the current study, and why they are beneficial to recovery and health more generally.

Then, I describe the concepts of work stress and recovery. I introduce the conservation of resources theory (COR; Hobfoll, 1989) as a guiding framework for understanding how work stress develops and the important role of resources to stress and wellbeing. I draw on the Effort-Recovery (E-R; Meijman & Mulder, 1989) model to explain why and how work breaks may help employees recover from their daily work stressors and replenish their internal resources.

Then, I categorize the proposed pathways (i.e., types of mechanisms) through which recovery during work breaks and in natural environments is thought to occur into affective and cognitive pathways. In addition to COR and the E-R model, the Stress Reduction Theory (SRT; Ulrich et al., 1991) of restorative environments and the broaden-and-build theory of positive emotions (Fredrickson, 1998, 2001) explain the affective pathways through which recovery during work breaks in natural environments may occur. The affective pathways to recovery include enjoyment and relaxation experienced during one's work break, which align with propositions from SRT, broaden-and-build theory, and the E-R model.

Cognitive pathways to recovery include psychologically detaching from work, feeling one has control over how they spend their break, positive reflecting on one's work, and problem-solving pondering. Attention Restoration Theory (ART) from environmental psychology, the stressor-detachment model from OHP, and broaden-and-build theory from positive psychology all help explain why these cognitive and affective experiences should result in successful recovery after breaks in natural environments (operationalized as recovery state, strain level, affect, and performance capacity).

One goal of the current study is to clarify the similarities between the two fields of study (OHP and environmental psychology) and incrementally shape a more comprehensive understanding of recovery. Therefore, I also consider the similarities and conceptual overlap between the various theories and constructs discussed to illustrate how OHP and environmental psychologists have essentially been studying the same phenomenon (recovery), but in different contexts and from different perspectives on the process. See Table 1 for an overview of each theory and the recovery mechanisms and outcomes each provides theoretical support for.

I also discuss findings from the literature that speak to the restorative benefits of natural environments and within-day work breaks as recovery opportunities. Together, these theories and findings cover the cognitive, affective, energetic, and other work-related benefits of a) successful recovery from work and b) restorative environments. This lays the groundwork for my research questions and hypotheses, which broadly propose that the higher the naturalness of the work break setting, the higher the recovery of affective, cognitive, and energetic resources, and therefore benefit to individual wellbeing. I also raise the question of whether positive work reflection or problem-solving pondering are involved in the recovery during work breaks spent in more highly natural environments.

I also explore how work-related wellbeing and resource levels each day at work may affect later employee engagement and burnout levels. Feeling engaged (i.e., vigorous, absorbed, dedicated; Schaufeli et al., 2002) with one's work or feeling burnt out (i.e., physically, mentally, and emotionally exhausted; Hobfoll & Shirom, 2000; Shirom, 2003) are both important for employee wellbeing and job performance (e.g.,

Christian et al., 2011; Carter et al., 2018, Taris, 2006). I propose that when employees take workday breaks, they will feel recovered and less strained, and experience restored levels of energy, concentration, and motivation (or performance capacity) and positive affect. These outcomes then prime employees for feeling vigorous, absorbed in, and dedicated to their work (i.e., more engaged) and less burned out.

The current study makes important contributions to the recovery literature by 1) examining how recovery happens during work breaks, 2) linking our understanding of restorative natural environments to recovery at work by exploring recovery experiences during work breaks in natural environments, and 3) drawing on multiple relevant disciplines and theories to integrate logic from OHP and environmental psychology. The current study seeks to learn more about the *when*, *where*, and *how* of employee recovery during work. Specifically, the current study will examine whether the level of natural of one's work break environment (*when* – during work, and *where* – naturalness of the break environment) evokes specific recovery experiences (*how*), and whether those experiences during work breaks lead to better recovery outcomes for employees (see Figure 1 for my full conceptual model).

To that end, I conducted a repeated-measures, daily diary within-subjects design. Over the course of two consecutive work weeks (10 workdays), participants were instructed to take a 15-minute afternoon work break each workday, either outdoors in a natural environment or indoors for one week each (all participants were instructed to experience both settings, but order was randomized). I conducted two waves of data collection. During both waves, participants were asked to complete one survey each morning measuring pre-break levels of outcome variables (recovery state, strain,

performance capacity, and affect), one survey right after their work break measuring break environment naturalness, break experiences (e.g., psychological detachment, relaxation, enjoyment), and post-break recovery and strain, and one survey before the end of each work day measuring afternoon outcome variables (performance capacity and affect). During the second wave of data collection, I also gathered measured participants' work engagement and burnout levels at the end of the two-week study period, so that I could connect participants' day-level break experiences to their levels of engagement and burnout by the end of the study period.

## Literature Review and Theoretical Background

### *Theoretical Background of Nature and Recovery*

Nature has been defined as the "physical features and processes of nonhuman origin that people ordinarily can perceive, including the 'living nature' of flora and fauna, together with still and running water, qualities of air and weather, and the landscapes that comprise these and show the influence of geological processes" (Hartig et al., 2014, p. 208). A natural environment is an environment that is seemingly undisturbed by human presence or interruption (Hartig et al., 2014). In research and in this study, "nature" and "natural environment" are used interchangeably. As the literature on nature as a restorative environment has grown, the understanding of nature and natural environments has broadened to also include environments with natural elements that have been built, altered, displayed by humans, such as urban parks, community gardens, street trees, and indoor plants (Hartig et al., 2014). Contact with nature represents any physical contact with nature or natural elements, including physically being in nature, viewing nature

while physically being indoors, or visually viewing nature or natural elements via photographs or even virtual reality.

The study of natural environments and their benefits to humans is a multidisciplinary one. Research from the fields of environmental psychology, urban planning, public health, and education has shown that human contact with and access to nature and natural elements has important health, developmental, and community outcomes (e.g., Hartig et al., 2014). There is now general consensus within the field of environmental psychology that natural environments and contact with nature benefit human health. Hartig et al. (2014) propose four pathways through which contact with nature is beneficial to individual and public health: air quality, physical activity, social cohesion, and stress reduction. Stress reduction is the predominant link between natural environments and recovery from work stress specifically. Research on the stress-reduction pathway between contact with nature and health and wellbeing has primarily come from environmental psychologists and focuses on the reduction of exposures to stressors, the procurement of coping resources, and affective, cognitive, and physiological restoration (Hartig et al., 2014).

Theories of recovery through contact with nature grew out of Wilson's (1984) biophilia hypothesis, which posits that humans' genetic and evolutionary history has led us to feel an inherent and universal connection to nature and a desire to spend time in it (Kellert & Wilson, 1993). According to the biophilia hypothesis, humans feel an affinity to nature because bodily systems developed in environments dominated by natural elements (e.g., plants, animals, sunlight, bodies of water, weather), so how humans feel, think, learn, and behave is closely linked to the natural world (Kellert & Wilson, 1993).

Environmental psychology research on the stress-reduction and health benefits of contact with nature is guided by two major theories, described in more detail later: Kaplan and Kaplan's (1989; Kaplan, 1992, 1993, 1995) ART, and Ulrich's (1983; Ulrich et al., 1991) SRT. The latter is a psychoevolutionary theory that focuses on patterns of affective and aesthetic (preference) responses to visual stimulus characteristics of an environment and their relationship with human health. ART, on the other hand, centers around voluntary and involuntary cognitive attentional resources. According to ART, restorative environments, which are often natural environments, capture our involuntary attention, allowing our directed attention (a neurocognitive resource that becomes depleted by everyday demands and work tasks, for example) to rest and recover. These two theories are often used in tandem and complement each other well to explain both the affective and cognitive pathways through which nature relates to stress recovery and wellbeing. See Table 1 for a brief description of the main tenet of each theory used in the current study and the mechanisms and outcomes they support.

### *Theoretical Background of Work Stress and Recovery*

**Conservation of Resources Model.** The COR theory (Hobfoll, 1989) is a popular framework for understanding how individuals' resources (and lack thereof) relate to their work stress and engagement. The main proposition of COR is that people try to gain, keep, protect, and build resources that they value (Hobfoll, 1989). Resources are defined within COR as personal characteristics, physical objects, conditions, and energy sources that are valued by an individual (Hobfoll, 1989). In their review of and proposed taxonomy of resources, Lee et al. (2020) categorize resources into five distinct categories: a) organizational, b) social, c) job, d) home, and e) personal resources. Resources within

these categories can range from job conditions to physical experiences, to psychological energies (Lee et al., 2020). Personal resources are most relevant to the current study of recovery, and refer to "one's cognitive, psychological, and physical abilities" (p.24; Lee et al., 2020). In previous studies, personal resources have been operationalized as levels of concentration, motivation, energy, and feeling recovered, to name a few (Kühnel et al., 2012; Ragsdale & Beehr, 2016; Lee et al., 2020; Venz & Sonnentag, 2015). Affect has also been conceptualized as a personal resource, such that positive emotions can help individuals direct their attention and effort and improve their personal attitudes and wellbeing (Fredrickson, 2001; Trougakos & Hideg, 2009). The current study examines whether work breaks in natural environments lead to recovery of such personal resources as feeling recovered (i.e., recovery state) concentration, energy, and motivation (i.e., performance capacity), and positive affect.

According to COR, stress develops when valued resources are perceived to be threatened, lost, or not gained after investing in them. At work, stress is very common (American Psychological Association, 2007; Hassard et al., 2018) and thus resources may regularly become depleted or threatened throughout the workday, especially during demanding or stressful situations, leading workers to try to restore their lost or threatened resources (e.g., by taking a break from their work; Demerouti et al., 2009). To recover from stress, one must restore their depleted resources or obtain new ones (Sonnentag & Fritz, 2007). The *what*, that is, activities such as walking outdoors during a work break and the *how*, that is, underlying experiences (e.g., psychological detachment, relaxation) involved with recovering from work stress, represent these efforts to restore resources. In the workday context, work breaks represent the primary opportunity for employees to

recover resources that have depleted during their work (Trougakos & Hideg, 2009). Recovering depleted cognitive, affective, and energetic resources during their break may make it easier for employees to invest these resources toward their work after the break. While COR is a good framework for understanding how work stress occurs and the role of resources in that process, complementing COR with other theories is useful for explaining the specifics of how work breaks are recovery opportunities, the underlying recovery mechanisms, and why natural environments may be particularly conducive to recovering during work breaks.

**Effort-Recovery Model.** The effort-recovery model (E-R; Meijman & Mulder, 1998) is a conceptual approach to understanding stress and recovery—or incomplete recovery—from stress, and how work stress can eventually lead to chronic health impairments. Conceptualized by Meijman & Mulder (1998), the core assumption of the E-R model is that responding to work demands requires expending effort, which is inherently associated with acute load reactions (e.g., strain), and if one does not sufficiently recover, those acute load reactions can become chronic and detrimental to one's health.

According to the E-R model, successfully recovering from work means one's psychophysiological systems that were activated during work return to and stabilize at baseline levels. Therefore, recovery is the process of psychophysiological systems unwinding and recuperating, the reverse process of the strain activation process during effort expenditure and stressful situations (Guerts & Sonnentag, 2006). At work, ideally, an employee can take a short break from the demands of the workday, during which they are no longer exposed to work stressor(s), and their activated psychophysiological

systems can then return to normal and stabilize. However, if that recovery period is unsuccessful or insufficient, the employees' psychophysiological stress systems stay activated, stress hormones are still present, strain levels remain high, and the employee must return to work with depleted personal resources (e.g., energy, motivation) to draw on. To prevent cumulative downward spirals of resource loss and load reactions into more chronic health issues, it is important for employees to fully recover from their work at the day level as much as possible.

In addition to the aforementioned chronic health issues that can develop after consistent insufficient recovery, more immediate indicators of poor recovery after stressful work include high levels of strain and fatigue, poor quality sleep, and not feeling recovered (Guerts & Sonnentag, 2006), which can all lead to development of burnout (Toker & Melamed, 2017). On the other hand, shorter-term positive indicators of successful recovery include feeling recovered, low levels of exhaustion, fatigue, physical health complaints, and need for recovery, as well as high levels of vigor, job and life satisfaction, sleep quality, and positive affect (Sonnentag et al., 2017). Successful recovery is also beneficial for day-level work engagement and performance (Kühnel et al. 2012, Sonnentag 2003). Thus, understanding recovery *at* work is an important undertaking to understand how successfully recovering during breaks may have beneficial employee health and wellbeing outcomes, both at the day level and over time.

While COR theory and the E-R model differ in how they view personal resources and resource depletion or replenishment, they are similar in that they share the notion that doing things that require effort (e.g., work tasks, reacting to stressors) drains our personal resources. Recovery can happen when stressors are no longer present, or when we are no

longer doing things that require effort. COR theory introduces the salience of resources in the stress process, and the E-R model provides an explanation for how work breaks can be opportunities for recovery of such resources. Both theories discuss "resources" rather generally and are vague on how exactly resources can be recovered. Therefore, I incorporate the broaden-and-build theory of positive emotion, and two environmental theories of natural or restorative environments described below, to explain specifically why and how I expect work breaks spent in natural environments may be particularly helpful for employees' resource recovery. I briefly discuss the stressor-detachment model (Sonnentag, 2010), because this is a commonly cited theory for explaining the important role of experiencing psychological detachment in the recovery process. However, given I am also introducing alternative experiences that may aid recovery in the work break and environmental context beyond psychological detachment, I keep the discussion of this model brief before moving on to the theories mentioned above that will be more relevant to the goals of the current study.

Integrating these various multidisciplinary theories should help build a fuller picture of the recovery process during work, and the role natural environments may play in recovery. Environmental psychology's stress reduction theory (SRT; Ulrich, 1983) provides a rationale for why natural environments restore individuals' affective resources. The broaden-and-build theory (Fredrickson, 1998) then explains how emotions can affect individuals' thoughts and behaviors, during and after their work breaks. Attention Restoration Theory (ART; Kaplan, 1992), established in environmental psychology, provides the foundation for how natural environments recover our cognitive and attentional resources, which can then be drawn upon following work breaks spent in

natural environments. Propositions from broaden-and-build theory and ART also both inform the incorporation of additional potential recovery mechanisms that I suggest may be facilitated during work breaks in natural environments: positive work reflection and problem-solving pondering.

### *Affective Pathways to Recovery*

Recovery may occur through positive changes in our emotions (one type of affect) in response to settings or activities, such as natural environments or breaks from work. According to one of the dominant theories of restoration from environmental psychology, SRT, many natural environments are restorative because they increase our positive emotions, which can undo detrimental effects of negative emotions and allows for internal stress systems to recover. The broaden-and-build theory of positive emotions posits that positive emotions play an important role in our individual wellbeing and flourishing.

It is important to note that affect and emotions researchers have long debated the definition and structure of affect and emotions (Harmon-Jones et al., 2017). "Affect" has been used to describe anything emotional (e.g., Davidson et al., 2003), or as feelings that accompany emotions such as anger, sadness, happiness (e.g., Panksepp, 1998). Scholars hold varying views of whether emotions are dimensional across valence and arousal (positive to negative) (e.g., Barrett et al., 2007; Russell, 1980, Watson & Tellegen, 1985), or as discrete entities (e.g., Ekman, 1994; Izard, 2007)—and often use the terms affect, emotion, and mood interchangeably. In the current study, I differentiate between trait affect, state affect, and emotion. Affect is a broad construct referring to "consciously accessible feelings" (Fredrickson, 2001, p. 218) or any mental state that can be described

as pleasant or unpleasant, with some degree of arousal (Barrett & Bliss-Moreau, 2009; Russell & Barrett, 1999). Emotions and mood (i.e., state affect) are subsumed within the concept of "affect." Both state affect and discrete emotions are transient, affective states, and categorized as positive or negative, but differ in their intensity, duration, and origin. State affect (or mood) tends to be longer lasting and not tied to specific event or origin, while emotions are typically more intense, shorter, vary more within-persons, and are tied to a specific cause (e.g., person, event or, object) (Fisher, 2000; Frijda, 1993; Jacobson et al., 2021). Trait affect is generally stable positive or negative disposition between persons (Jacobson, 2021; Watson & Tellegen, 1985; Watson, 2005). In the current study I use "affect" to refer to state affect, unless otherwise specified (e.g., trait affect as a control variable).

In the recovery and restoration literature described throughout this section, researchers often use "affect" and "emotion" interchangeably or refer broadly to "positive affective states." SRT aligns most with the emotions literature, but restoration research based on SRT often state "positive affect" as the primary restorative outcome of natural environments. This confusion and lack of conceptual specificity is typical of psychological research of affect in general (e.g., Quigley et al., 2014). I use the terms originally used by the authors in the works referenced below but recognize that the definitions and measures of affect vs. emotion used may not directly align with the various affect frameworks and conceptualizations (e.g., referring to emotional changes but using measures of affect, or using both terms interchangeably, etc.). In terms of emotion and affect measured in the current. study, I categorize *enjoyment* of one's break as an emotion, because it is an affective state tied to the individual's work break

experience. Enjoyment has also been conceptualized as a common emotion (e.g., Ekman et al., 1990; Izard, 1997). A likely outcome of experiencing enjoyment is positive affect (or mood; Smith et al., 2014), therefore positive affect is considered a potential outcome of an enjoyed work break.

**Stress Reduction Theory.** SRT is a psychoevolutionary framework that explains the restorative effects of nature through the affective changes experiencing nature inherently elicits. Ulrich (1983) posits that humans are biologically predisposed to respond positively to nature (i.e., positive affective reactions to nature), and this increased positive affective response can buffer against negative stress responses. According to Ulrich (1983, 1991), stress is the process of responding to a situation that one perceives as demanding or threatening to their wellbeing. Restoration from stress occurs through physiological relaxation and increased positive affect, which happens when a natural scene or environment invokes feelings of mild to moderate interest, pleasantness, and calmness. The positive emotions can replace negative emotions and hold one's interest while physiological arousal declines (Hartig, 2004).

A few assumptions underlie SRT's propositions: a) our emotions or affect have adaptive functions, b) affect is central to our conscious experience and behaviors, and c) emotions are separate from and precede cognitions (Ulrich, 1983). Ulrich argues that there is agreement in the emotions literature that our emotions have adaptive functions because in our evolutionary past, emotions were important for our survival and general wellbeing. Over our evolution as a species, humans have become biologically wired to quickly respond with positive emotions (e.g., calmness, enjoyment) toward natural,

vegetative environments because they signal resources (e.g., food, water, shelter) and therefore safety and health (Joye & Dewitte, 2018; Ulrich, 1983; Ulrich et al., 1991).

According to SRT, the immediate (positive) affective responses to nature facilitate stress recovery. The positive affect elicited by certain environmental qualities can in turn protect against or reduce the negative thoughts, emotions, and physiological activation indicative of psychophysiological stress (Ulrich, 1983). The visual and spatial qualities of an environment that should elicit "liking" of the environment and positive affect include a) being moderately complex and including a focal point, b) having moderate depth, c) being conducive to moving around in the environment, d) being absent of any perceived threat, and e) containing vegetation and/or water elements (Hartig, 2004; Ulrich, 1983). If someone is in an environment with these characteristics, they will quickly experience a preference or "liking" of the environment, pleasurable feelings, and associated neurophysiological activity (e.g., parasympathetic or sympathetic activation). These feelings elicited by the environment then motivate one's thoughts and actions (e.g., approach/explore further, continue activity, or deal with a perceived threat). Thus, SRT views the immediate affective responses to natural stimuli to be adaptive, such that they are linked to approach-avoidance behaviors or impulses and can sustain one's ability to continue an activity (Ulrich, 1983). Ulrich (1983) gives the example of a fatigued hiker who stops to take in a view and experiences a positive feeling of exhilaration from what they see, which results in physiological activity that can help them continue their trek. Similarly, many people can probably relate to feeling refreshed or invigorated after going for a walk or even simply stepping outside for a few breaths after feeling stressed or depleted from working or focusing for a while.

The affective and stress reduction benefits of contact with nature purported by SRT have received consistent empirical support, particularly when comparing natural environments to urban or built environments (e.g., Berto et al., 2014; McMahan & Estes, 2015). Participants exposed to natural environments experience lower levels of physiological arousal and negative affect and higher positive affect levels compared to participants exposed to urban or built environments (e.g., Hartig et al., 2003; Lee et al., 2011; Park et al., 2007). These effects have been replicated when participants are both physically in nature and when they view simulations of nature (e.g., viewing photographs or videos of natural environments) though meta-analytic evidence suggests the positive effects appear to be stronger in "real" nature as opposed to simulated or laboratory settings (McMahan & Estes, 2015).

Meta-analytic evidence also supports the link between natural environments and affect—across studies, brief contact with natural environments is moderately associated with increases in positive affect and decreases in negative affect (the latter association being smaller but consistent) compared to nonnatural environments (McMahan & Estes, 2015). Reviews and meta-analyses of the affective effects of natural environments suggest that contact with nature leads to stress restoration particularly through the resulting increase in positive affect, rather than the smaller influence of negative affect reduction (e.g., Berto, 2014; McMahan & Estes, 2015).

**Broaden and Build Theory of Positive Emotions.** As the name suggests, the broaden-and-build theory of positive emotion (Fredrickson, 1998, 2001) theorizes on the role positive emotions play in individuals' wellbeing. It provides rationale for why, if work breaks in natural environments elicit positive emotions, this may promote

experiences such as positive work reflection and problem-solving pondering during breaks, and post-break recovery outcomes such as enhanced performance capacity. The broaden-and-build theory of positive emotion (Fredrickson, 1998, 2001) is a theory based in positive psychology and supports the notion that, because emotions influence thoughts and behavior, individuals' emotions and affective states may serve as personal resources. A core proposition of broaden-and-build theory is that certain positive emotions are able to "broaden people's momentary thought-action repertoires and build their enduring personal resources" (Fredrickson, 2001, p. 219). In other words, positive emotions expand our individual scopes of attention, thoughts, and behaviors, and therefore enable us to draw on a range of new possible cognitions and behaviors. Positive emotions can allow individuals to be more curious, experimental, creative, and consequently build new physical, social, and cognitive resources. Breaks employees take during their workday are a work event with accompanying positive (e.g., enjoyment) or negative emotions, which can subsequently affect employees' attitudes and behaviors (Trougakos & Hideg, 2009).

Another tenet of broaden-and-build theory is that experiencing positive emotions promotes approach behavior, which motivates people to engage in their environment and activities (Trougakos & Hideg, 2009). When employees take breaks from work and experience positive emotions, such as joy, contentment, or interest (all of which natural environments are theorized to elicit), those positive affective states can then be used to help employees redirect their focus, effort, and attitude toward their work (Trougakos & Hideg, 2009). In a recent study particularly relevant to the current study, Sianoja et al. (2018) found that lunchtime park walks were related to better concentration and less fatigue in the afternoon, through the experience of enjoyment during their walk (and

notably, not through psychological detachment). The current study extends the Sianoja et al. (2018) study by using a within-persons approach to understanding recovery in different break environments, including additional break recovery experiences or mechanisms (beyond just psychological detachment and enjoyment), and connecting daily outcomes to broader work-related outcomes of employee engagement and burnout.

Positive emotions also relate to our individual wellbeing. Fredrickson and colleagues (Fredrickson & Levenson, 1998; Fredrickson et al., 2000) have demonstrated that positive emotions can have an "undoing" effect, such that they can reduce the physiological effects of negative emotions—similar to Ulrich's (1983) theorizing of natural environments eliciting positive emotions that can undo effects of negative emotions. Positive emotions have been found to not generate cardiovascular reactivity themselves, but rather reduce any cardiovascular reactivity caused by negative emotions (Fredrickson et al., 2001). Thus, positive emotions experienced during a work break should help employees recover from adverse effects of any negative emotions they experience at work prior to their breaks and provide the opportunity for building additional resources.

### *Cognitive Pathways to Recovery*

In addition to affective pathways to recovery, there are also cognitive mechanisms through which recovery may occur. The stressor-detachment model from OHP and ART from environmental psychology explain how our thoughts and cognitive processes during work breaks and in natural environments can facilitate recovery from stress.

**Stressor-Detachment Model**. Work recovery research generally recognizes that it is not the activities employees do p*er se* that lead to recovery, but the psychological

*experiences* during various activities that are important to recovery. In addition to the affective pathways mentioned above, the majority of research on job stress recovery has focused on four recovery experiences: psychological detachment, relaxation, mastery, and control (Sonnentag et al., 2017). The stressor-detachment model (Sonnentag & Fritz, 2010) is an oft-used model in studies of recovery that focuses on psychological detachment from work, and posits that psychological detachment is both a mediator and a moderator in the stressor-strain relationship. Psychological detachment is a recovery experience (or mechanism) and refers to mentally disengaging from work during non-work time (Sonnentag & Bayer, 2005). This model is similar to the effort-recovery model (Meijman & Mulder, 1998) in that it asserts that the acute stress reactions that occur when one faces a stressor are not necessarily harmful, but rather it is the sustained activation of our psychophysiological systems even *after* the stressor is no longer present that can be detrimental to our wellbeing. According to the stressor-detachment model, job stressors increase negative activation of our stress response systems, which then make it harder to psychologically detach from work. Lack of psychological detachment, in turn, impairs our affective states and wellbeing. On the other hand, individuals who experience higher levels of psychological detachment are more likely to enjoy improved short- and long-term wellbeing outcomes, including lower levels of emotional exhaustion, fatigue, health complaints, negative affect, need for recovery, and burnout (Sonnentag & Bayer, 2005; Sonnentag & Fritz, 2007, 2010; Sonnentag et al., 2008), and higher levels of positive affect, vigor, life satisfaction, and work engagement (Sonnentag & Bayer, 2005; Sonnentag & Fritz, 2007; ten Brummelhuis & Bakker, 2012).

However, the notion that not thinking about work is essential for recovery may be too simplistic when applied to the work break (within a workday, or even post-workday) context. Even studies of recovery and work-related thought during non-work time have added nuance to our understanding of thinking about work when not at work, such that the quality and valence of work-related thoughts (i.e., positive vs. negative valence) may have differential effects. Thinking about the good sides of one work has been positively associated with improvements to affective wellbeing (Meier et al., 2016) and work engagement (Daniel & Sonnentag, 2014), and has even been proposed as a recovery process that builds psychological and affective personal resources (Meier et al. 2016). On the other hand, affective rumination (recurring, negative thoughts about work) has been shown to be negatively related to off-job recovery, while problem-solving pondering (reflecting and using strategies to work through problems) has not (Vahle-Hinz et al., 2017). Work breaks could be a time when workers take a step back and reflect on their day at work rather than completely mentally disengaging. In addition, natural environments may be relevant to such affective recovery mechanisms given natural environments have been theorized to increase positive emotions and promote reflection (Kaplan & Kaplan, 1989). So, work breaks taken in natural outdoor environments may promote experiences such as positive work reflection and problem-solving pondering (i.e., potential cognitive pathways), which could then facilitate recovery and prompt more positive feelings and thoughts towards one's work.

**Attention Restoration Theory**. In addition to affective effects of contact with nature, natural environments are also theorized to have cognitive restorative benefits. ART (Kaplan, 1992, 1995) is a theory of stress restoration that focuses on cognitive

pathways of restoration, specifically environmental cognition, environmental preferences, and psychological benefits of experiences in nature (Hartig, 2004). ART speaks to the potential of natural environments to restore depleted attentional resources, or our directed attention capacity. According to Kaplan (1992, 1993), performing daily tasks and functioning requires directing or focusing our attention (and ignoring other distracting stimuli), and that ability to direct attention and focus is a limited resource. When our directed attention capacity is depleted, mental fatigue occurs, which can manifest in work-related problems such as negative emotions, more errors on tasks, worsened performance, and increased susceptibility to stress (Kaplan, 1993, 1995). Restoration is possible when our directed attention is allowed to rest, which the restorative qualities of natural environments facilitate. The restoration process can happen through multiple stages, from simply being able to clear one's thoughts, to renewing directed attention resources, to ultimately reflecting on things important to the individual (Hartig, 2004).

According to Kaplan (1992, 1995), restorative environments have four properties that elicit restorative experiences: 1) "soft" fascination or involuntary attention, 2) "being away," 3) extent, and 4) compatibility. Soft fascination or involuntary attention is a type of fascination assumed to be involuntary, effortless, and with limitless capacity (in contrast to directed attention, which requires effort and is a finite resource) (Hartig, 2004). When one's involuntary, effortless attention is captured, the demands on their directed attention capacity are reduced, and that capacity can therefore be restored. The feeling of "being away" refers to being in a different conceptual (or physical) place away from one's usual demands and stressors. Extent, the third property of restorative environments, refers to the feeling that the setting is part of a larger whole or place, that it

is large enough to explore, and that it is coherent enough that one can make sense of what is happening around them and relate it to a larger frame of reference (Hartig et al., 1991; Kaplan, 1995). Finally, compatibility means that the environment and one's reason for being there are well suited.

Restorative environments are not inherently natural environments, but natural environments often possess these restorative qualities (Kaplan, 1992, 1995). For example, visiting a museum could capture one's involuntary attention, provide them a sense of being away, feel part of a larger interconnected whole, and match their purpose for being there. But visiting a museum, and other nonnatural setting, likely also entail interacting with others, navigating, or avoiding other distractions, which all require directed attention. While restorative environments may not always be natural environments, natural environments are much more likely to possess restorative qualities, as well as fewer reminders of work demands, fewer people with whom one may need to interact with, and are often rich with aesthetically pleasing features (e.g., scenic views, flowers, vegetation water elements) that evoke our involuntary attention and allow for reflection. Further, environments perceived to more natural are also more cognitively and emotionally restorative than environments perceived as urban or artificial (e.g., Berto, 2005; Berto et al., 2008; Hartig et al., 2003). Natural settings and experiences can range from small and simple, like a window view of trees, to vast and wild, like backpacking through the wilderness. Any of these natural environments are arguably all fascinating in some way to the eye or mind, are often purposeful "get-aways" for rest and restoration, and can easily feel like part of a larger world or ecosystem (Kaplan, 1995).

The restorative effects of nature on cognitive attentional resources, such as directed attention and concentration, have also received empirical support (Bratman et al., 2012). Being exposed to natural stimuli has been shown to lead to cognitive performance improvements, such as greater attention and memory capacity, compared to exposure to urban or built environments (e.g., Berman et al., 2008, Bratman et al., 2015; Hartig et al., 2003; Kuo & Sullivan, 2001). For example, compared to walking in urban settings or passive relaxation, walking through a park has been shown to improve attention and memory (Berto, 2005) as well as self-reported concentration at work (Sianoja et al., 2018).

Overall, environmental psychologists have not yet reached consensus over how "directed attention" should be operationally defined, and thus there is uncertainty about which specific aspects of attention are affected by natural environment exposure (Ohly et al., 2016). However, there is growing agreement within the field that exposure to more natural environments has resulting cognitive benefits—the underlying mechanisms just require more clarification (Schertz & Berman, 2019). The current study could help inform whether time spent in natural environments during the workday improves cognitive resources related to attention needed to perform optimally at work: concentration, energy, and motivation.

### *Branches of the Same Tree: Theoretical Overlap and Recovery Mechanism Synergies*

Though I have categorized mechanisms to recovery as either cognitive or affective (or general, as in the case of COR theory), that is not to say that these pathways necessarily work independently or separately in time. The current study integrates mechanisms proposed by theories from OHP, environmental psychology, and positive

psychology to come to a broader understanding of recovery at work and the role of natural environments in that process. Findings from this study may suggest it is not solely the psychological experiences, nor the affective changes, nor the cognitive attentional resources from work breaks in natural environments that results in employees' stress recovery, but a combination of these interrelated mechanisms. The emotions, cognitions, and experiences during work breaks may all play important roles in how employees feel and approach the rest of their workday, and their related health and wellbeing. Table 1 provides a brief description of each theory and the recovery mechanisms associated with each theory's propositions.

Studies of the stress-reducing benefits of natural environments typically draw on both SRT and ART, as the corresponding proposed pathways of affective restoration and cognitive restoration complement each other well. Empirical and meta-analytic findings suggest that in response to natural environments, both affective and cognitive mechanisms appear to be present, act independently, and produce restorative effects of nature (Bratman et al., 2012; Schertz & Berman, 2019; Valtchanov & Ellard, 2015). This conclusion is largely based on findings from multiple studies that cognitive improvements from contact with nature are not correlated with the affective changes, suggesting that changes in mood do not drive the cognitive benefits (contradictory to a tenet of SRT; Ulrich, 1983) (Bratman et al., 2012; Stenfors et al., 2019). However, the distinction between affective and attentional mechanisms, and the finding that both cognitive and affective benefits do appear, suggests they may work together synergistically and result in greater restoration when both mechanisms are present.

Perhaps these potentially synergistic mechanisms explain why people consistently *prefer* natural environments for the purpose of relaxing and recovering, compared to built or urban environments (e.g., McMahan & Estes, 2015; Menardo et al., 2021; Ryan et al., 2010; Twedt et al., 2019; Tyrväinen et al., 2014). Empirical and meta-analytic evidence demonstrates the more "natural" participants perceive the environment to be (e.g., more trees and natural elements, fewer indicators of human interference such as built structures), the higher their ratings of the environment's restorative potential. Participants consistently report feeling restored after being exposed to natural scenes, and even show longer visual fixation to natural scenes, compared to nonnatural (e.g., Korpela et al., 2017; Pals et al., 2014; Tyrväinen et al., 2014; Valtchanov & Ellard, 2015). In addition to instructing individuals to take breaks in natural environments one week, and indoors another week, the current study includes participants' ratings of the level of naturalness of their break environments as the predictor of break recovery outcomes, which will allow for a test of the notion that one's perception of an environment's naturalness can facilitate recovery.

**Nature and Work**

While the current study makes novel contributions to the recovery and restoration literatures, prior research has also already identified benefits nature can have for employees and organizations. Researchers have investigated the effects of natural window views, presence of plants in offices, biophilic building design (aspects of a building that allow employees in contact with nature), and park walks in employee wellbeing and organizational outcomes (e.g., Bringslimark et al., 2007; Dijkstra et al., 2008; Sianoja et al., 2918).

Within the management literature, Klotz and Bolino (2021) called out the discipline's lack of consideration of nature at as a substantial oversight. The authors argue that the organizational science's understanding of work conditions should be expanded to include biophilic work conditions (aspect of job that allow employees in contact with nature) as a part of physical work conditions. They categorize four types of potential contact with nature at work: outdoor breaks (e.g., in organization campuses with natural spaces), outdoors brought indoors (e.g., indoor plants, plant walls), nature via physical barrier (e.g., window, roofs), and representations of nature (e.g., reclaimed materials, blue and green colors). Outdoor work breaks represent the most direct contact, because all human senses are engaged, and should thus provide the most benefit to workers (Klotz & Bolino, 2021). The authors focus on the energetic benefits of contact with nature at work and propose that the four restorative qualities originally proposed by Kaplan (1992) should each uniquely recover employees' cognitive, emotional, prosocial, and physical energy. The current study is thus a timely investigation into the cognitive and affective benefits of contact with nature during breaks from work that involve varying degrees of environment naturalness, including outdoor work breaks.

### *Work Breaks as Recovery Opportunities*

The need to take a break from work to recover is central to the concept of recovery and a widely accepted notion within the literature (e.g., Sonnentag, 2001; Sonnentag & Zijlstra, 2006; Steed et al., 2019; Trougakos & Hideg, 2009), whether those breaks take place during the workday, in the evenings after work, over the weekends, or during vacations (Trougakos & Hideg, 2009). Within-day work breaks are time periods during the workday when work tasks are not expected or required (Trougakos et al.,

2008) and are the primary opportunity for employees to recover during the workday (Zhu et al., 2019). Consistent with the resource-based theories of stress and recovery described, in order for work breaks to be effective in recovering from work stress, they should be spent doing activities that do not tax one's resources further, and should be enjoyable (Trougakos & Hideg, 2009).

Studies of recovery during the workday (as opposed to during non-work time, such as evenings or weekends) have increased over the last decade or so, with most within-day work break studies focusing on the lunch break or shorter, informal breaks called microbreaks (Sonnentag et al., 2017). In general, within-day work recovery research shows engaging in activities (whether during lunch or microbreaks throughout the day) that one prefers and/or that are relaxing seem to facilitate resource recovery, leading to improvements in wellbeing and performance (e.g., lower fatigue and emotional exhaustion, improved mood, vigor, and attention) (Bennett et al., 2019; Hunter & Wu, 2016; Trougakos et al., 2008; Zhu et al., 2019).

In their review of recovery research, Sonnentag et al. (2017) state that evidence about the recovery potential of experiences during within-day work breaks is still limited. The four main recovery experiences may be more difficult to fully experience, given the time and space constraints of the workplace (e.g., fully relaxing or mastering a new skill during the workday), and may not even be as beneficial during work as they are after work (e.g., if one fully detaches from work during a break, re-attaching after the break may require even more effort and therefore be more fatiguing or stress-inducing) (Sonnentag et al., 2017). Therefore, researchers need to expand how we think about recovering during work and the experiences that facilitate successful recovery. If

employees cannot fully detach from their work during breaks, what other mechanisms are at play when they take breaks to restore their energy and focus? And how does the environment in which one takes their break affect the mechanisms through which they feel recovered after? If employees can feel better after their breaks, and if their surrounding environment is important for their subsequent health and performance, it behooves researchers and organizations to understand what about those breaks and experiences is beneficial to employees, to inform the development of future studies, interventions, and workplace practices.

While the relatively nascent field of recovery research on within-day work breaks has primarily examined lunch breaks and informal microbreaks, employees are usually supposed to take 15-20-minute breaks from work during the day, which are considered paid work time under federal law (U.S. Department of Labor, n.d.). These types of breaks are shorter than 30-minute lunch breaks, but longer than microbreaks, and are not as regulated as the 30-minute lunch break. States differ in whether they require companies to provide rest breaks and meal breaks, but companies often provide these to their employees regardless (U.S. Department of Labor, n.d.). While the field of OHP is still trying to understand how recovery from stress during the workday unfolds, researchers have largely neglected this type of break and the recovery potential of what one does and experiences during them. These breaks require more study, as they provide opportunities for employees to intentionally step away from their work demands and engage in recovery-promoting behaviors, beyond their morning coffee break or occasional phone scroll session. Theoretically, the absence of work demands during work breaks allows for recovery and replenishment of depleted resources (e.g., energy, mood), as well as the

opportunity to engage in activities and experiences that further promote recovery and build additional resources to be used post-break. Recovery during work breaks should be associated with benefits to employees' work-related health, as well as their capacity to perform on the job (e.g., attentional capacity, feeling focused, energized, and motivated to work) (Fritz et al., 2013).

## Break Environment Naturalness and Recovery Mechanisms

### *Psychological Detachment, Relaxation, and Enjoyment*

Recovery research generally acknowledges that it is not the activities *per se* that lead to recovery, but the psychological *experiences* during various activities that are important to recovery. The majority of research on job stress recovery that has actually assessed potential recovery experiences (pathways that are not just general theoretical statements about recovery but are mechanisms through which breaks lead to good recovery outcomes) has focused on four recovery experiences: psychological detachment, relaxation, mastery, and control, all of which can be considered cognitive pathways from Table 1 above (Sonnentag et al., 2017). In the current study, I include two of the typical recovery experiences (psychological detachment and relaxation) to examine whether they are also mediators in the break environment naturalness—recovery relationships. I exclude mastery, in line with other studies of recovery at work (e.g., Bosch et al., 2018; Trougakos et al., 2014), under the assumption that these relatively short breaks from work are likely not long enough for employees to master a new skill or do new, challenging things, which mastery entails. I also exclude control as a recovery experience in natural environments because there is little theoretical support for a notion that nature or natural environments facilitate an individual feeling they have control over their time

or what they do. Additionally, I include another potential recovery mechanism that is an affective pathway: enjoyment. Doing activities one prefers and experiencing enjoyment during work breaks has been proposed to be particularly relevant to recovery during the workday, instead of experiences like psychological detachment or mastery that individuals can enjoy during longer time periods during evenings, weekends, or vacations (Trougakos & Hideg, 2009).

Given one of the main restorative benefits of natural environments is purported to be its ability to engage our involuntary attention, allowing our directed attention (including actively thinking about work), natural environments may help employees psychologically detach from their work. Evidence from environmental psychology studies has also demonstrated that contact with nature has physiologically restorative benefits, such as reductions in stress markers like heart rate and cortisol levels (Gladwell et al., 2012; Laumann et al., 2003; Tyrväinen et al., 2014), which would promote feeling relaxed. SRT and empirical evidence suggests natural environments may be particularly enjoyable for many individuals (Ulrich, 1992); the more "natural" an environment is perceived to be, the stronger the affective responses and wellbeing outcomes (Ulrich et al., 1983; Barton & Pretty, 2010). Based on COR theory, the E-R model, SRT, and empirical findings about the role of natural environments in recovery, I hypothesize:

> *Hypothesis 1: Break environment naturalness will positively relate to experiencing (a) psychological detachment, (b) relaxation, and (c) enjoyment during work breaks, above and beyond control variables.*

## Post-Break Recovery Outcomes

### *State of Being Recovered*

The outcome of a successful recovery period is often referred to or measured as one's state of being recovered or recovery state, which refers to one's psychological or physiological state reached after a recovery period, such as a work break (Sonnentag et al., 2017). One's state of being recovered is the result of a previous recovery period (e.g., a work break, sleep) as well as the starting point for one's subsequent actions and performance (Binnewies et al., 2009). As theories of recovery suggest, feeling recovered is necessary to restore depleted resources and reduce job strain (Sonnentag et al., 2017). Feeling highly recovered indicates a high amount of resources is available for work, while low levels of feeling recovered imply scarce or lacking resources for performing at work (Binnewies et al., 2009; Fritz & Sonnentag, 2005).

In a prime example of conceptual overlap across disciplines, environmental psychologists often include psychological restoration or "feeling restored" as an outcome of experiences in nature. Like work recovery, psychological restoration involves renewing functional resources that become depleted in response to everyday cognitive demands (Hartig & Staats, 2003) and is usually operationalized as restoration of positive affective states and wellbeing, as well as cognitive functioning and performance (Bowler et al., 2010; Bratman et al., 2012; Sonnentag et al., 2017). Given the definitional overlap between recovery and restoration, the current study uses "state of being recovered" as an outcome of work breaks that encompasses one's general feeling of replenished psychological or physiological resources.

Being outdoors in natural environments provides employees a change of scenery and has restorative benefits on its own (Berto, 2014; Hartig et al., 2014; Kaplan, 1995; Ulrich et al., 1991). And theoretically and empirically, the more natural an environment is or is perceived to be, the more conducive it is to recovery (Korpela et al., 2017; Pals et al., 2014; Tyrväinen et al., 2014; Valtchanov & Ellard, 2015). I expect that the "naturalness" of their work break environments will be positively related to post-break recovery levels.

*Hypothesis 2a: Break environment naturalness will positively relate to post-break recovery state, above and beyond control variables and morning recovery levels.*

Meta-analytic evidence suggests recovery activities, experiences, and recovery state are each discrete aspects of the overall recovery process, such that recovery activities and experiences are associated with subsequent feelings of recovery (Steed et al., 2019). And employees enjoy greater well-being and stress reduction when they have more recovery experiences. Specifically, psychological detachment and relaxation experiences have demonstrated the strongest and most consistent evidence for their benefits to wellbeing (e.g., Sonnentag et al., 2017), such as lower levels of psychological strain, exhaustion, and need for recovery (2015; Fritz et al., 2010; Moreno-Jimenez et al., 2009; Park & Fritz, 2015. Psychologically detaching from work during nonwork time has been shown to be associated with lower levels of psychological strain and physical complaints, exhaustion, and need for recovery (e.g., Molino et al., 2015; Fritz et al., 2010; Moreno-Jimenez et al., 2009; Park & Fritz, 2015). Additionally, enjoyment during nonwork time and work breaks is important for successful recovery (Oerlemans et al., 2014; van Hooff et al., 2011). Thus, I anticipate recovery experiences during breaks will

be positively related to post-break recovery state. I also expect the relationship between break environment naturalness and recovery state will occur partly via break recovery experiences (psychological detachment, relaxation, and enjoyment).

*Hypothesis 2b: Recovery experiences during work breaks (psychological detachment, relaxation, and enjoyment) will be positively related to post-break recovery state above and beyond controls and morning recovery state.*

*Hypothesis 2c: The effect of break environment naturalness on post-break recovery state will occur partly via psychological detachment, relaxation, and enjoyment during work breaks.*

***Strain***

Strain refers to an individual's short-term psychophysiological responses to stressors (Ganster & Rosen, 2013; Griffin & Clarke, 2011). Exposure to work demands or stressors and their associated psychological experiences has both short-term (i.e., strains) and long-term detrimental effects (Ganster & Rosen, 2013). If employees do not sufficiently recover from the strain reactions experienced at work, they are likely to experience detrimental wellbeing outcomes, including chronic health issues or development of burnout (Ganster & Rosen, 2013; Guerts & Sonnentag, 2006; McEwen, 1998). Recovery is the unwinding process of reducing or eliminating strain that has resulted from responding to work stressors (Sonnentag et al., 2017). As COR and E-R models would suggest, work breaks provide momentary respites from work demands, which provides opportunity for resource replenishment and strain reduction.

In addition to taking work breaks on their own, natural environments may also effectively reduce strain. Given strain is a reaction characterized by high arousal state and

negative affect, being in an environment that reduces one's arousal and induces positive affect should reduce strain levels. Natural environments, in comparison urban or indoor environments, are visually less complex and have fewer arousal-increasing features (e.g., low noises), which allows for the reduction of strain and tension (Berto, 2014). Further, natural environments are thought to increase positive affect and decrease negative affect, the latter being an emotional strain indicator. Indeed, exposure to nature, such as through park walks during lunch breaks, has been linked to strain reduction (Bowler et al., 2010; Sianoja et al., 2018). Therefore, I expect that the more natural a break environment is, the less strain is experienced post-break.

Research on employee recovery has centered on the activities and experiences that lead to strain reduction and resource replenishment (Sonnentag & Guerts, 2009; Bennett et al., 2018). If employees engage in activities and have experiences that promote recovery, successful recovery will manifest as lower strain levels. Indeed, there is consistent evidence that recovery experiences reduce strain and act as mediators between stressors and strain indicators (Safstrom & Hartig, 2013; Sonnentag & Fritz, 2015). I therefore anticipate that recovery experiences during work breaks will be negatively related to post-break strain levels, and that the effect of break environment naturalness on strain will be partially mediated by the break experiences.

*Hypothesis 3a: Break environment naturalness will negatively relate to post-break strain levels, above and beyond control variables and morning strain levels.*

*Hypothesis 3b: Recovery experiences during work breaks (psychological detachment, relaxation, and enjoyment) will be negatively related to post-break strain above and beyond controls and morning strain levels.*

*Hypothesis 3c: The effect of break environment naturalness on post-break strain will occur partly via psychological detachment, relaxation, and enjoyment during work breaks.*

## Afternoon Recovery Outcomes

### *Performance Capacity*

Performance capacity refers to an employee's feelings of being focused, energized, and motivated to work (Fritz et al., 2013). Performance capacity represents having the cognitive, attentional, and energetic resources required to optimally perform one's work. Recovery experiences during work breaks should positively predict employees' performance capacity following their work breaks. Taking break time to not think about work, relax, and feeling enjoyment during work breaks would allow employees to return with more focus, energy and motivation (i.e., performance capacity) toward their work. Indeed, engaging in preferred activities during breaks has been found to predict improved post-break performance capacity (Hunter & Wu, 2016). And lack of psychological detachment from work over a weekend can result in lower performance capacity the following work week (Fritz et al., 2013). Therefore, I hypothesize that recovery experiences during work breaks will predict afternoon performance capacity measured before the end of the workday.

*Hypothesis 4a: Recovery experiences during work breaks will predict afternoon performance capacity, above and beyond controls and morning performance capacity.*

The link between nature and attentional or cognitive resources has received some empirical support as well. Walking through natural settings versus urban settings, viewing pictures of natural versus urban scenery, and even residing in building with natural views versus built views have all been found to relate to better directed attention capacity (Berman et al., 2008; Berto, 2005; Tennessen and Cimprich, 1995). In their meta-analysis of studies investigating the attentional restoration potential of natural environment exposure, Ohly et al. (2016) reported significant evidence that participants exposed to natural environments showed better attention scores than participants exposed to nonnatural settings. As it relates to the current study, purposefully directing one's attention is subsumed in the measurement of performance capacity.

In terms of nature at work, employees in offices with greenery or natural elements have shown to perform better on cognitive tasks and report greater concentration than employees without natural elements (Nieuwenhuis et al., 2014; Raanaas et al., 2011 Additionally, employees who went on park walks during their lunch break experienced better concentration in the afternoon via enjoyment, compared to participants who did relaxation exercises (Sianoja et al., 2018). Thus, I anticipate that work break environment naturalness will have an effect on afternoon performance capacity, via break recovery experiences.

*Hypothesis 4b: Break environment naturalness will relate to afternoon performance capacity via psychological detachment, relaxation, and enjoyment during work breaks.*

### *Affect*

Affective states are a type of personal resource that can be recovered during work breaks (Fredrickson, 1998; Trougakos & Hideg, 2009). While longer-lasting than discrete emotions, affective states are momentary, and a resource likely to be impacted by work breaks, given the momentary processes of within-day work breaks (Trougakos et al., 2008; Trougakos & Hideg, 2009). When employees feel recovered and have sufficient resources, this induces a positive-motivational state, or high-activation positive affect (Schaufeli et al., 2002).

The theoretical premise of SRT is that natural environments are restorative because they elicit positive affective states. This relationship has received considerable empirical support (Berto et al., 2014; McMahan & Estes, 2015). A few prior studies are relevant to the current proposed study. In one study of a "green exercise" workplace intervention, employees who exercised in a green or natural environment reported greater positive affect compared to employees who exercised indoors (Calogiuri et al., 2016). In another study comparing walking in nature, walking inside, and passively viewing nature scenes, only participants who walked in nature showed significant increases in positive affect post-walk (Olafsdottir et al., 2020). Meta-analytic evidence corroborates the relationships between natural environments and affect; across studies, even brief contact with natural environments is moderately correlated with increases in positive affect and

decreases in negative affect compared to nonnatural environments (McMahan & Estes, 2015).

Affective wellbeing is also an established outcome of recovery from work. Relaxation and psychological detachment during nonwork time is related to more positive affective states, (Feuerhahn et al., 2014; Fritz et al., 2010) Positive work reflection at the end of the workday has also been shown to positively relate to positive affect states that evening and the next morning (Meier et al., 2016). Additionally, Trougakos and colleagues (2008, 2014) have found that when workers engage in relaxing break activities and preferred or enjoyable break activities, they experience more positive emotions and affect post-break. I hypothesize that break recovery experiences will predict afternoon positive affect, and that naturalness of break environments will have an effect on afternoon positive affect via the break experiences.

*Hypothesis 5a: Recovery experiences during work breaks will predict afternoon positive affect, above and beyond controls and morning affect.*

*Hypothesis 5b: Break environment naturalness will relate to afternoon performance capacity via psychological detachment, relaxation, and enjoyment during work breaks.*

**End-of-Study Recovery Outcomes**

In addition to wellbeing and work-related recovery outcomes at the post-break and day levels, I measured week-level work engagement and burnout as recovery outcomes at the end of the second week of the two-week study period. As COR (Hobfoll, 1998) postulates, having energetic resources available after successful recovery makes it easier to immerse oneself and feel engaged with their work (Sonnentag et al., 2022).

Further, as employees gain resources at the day level, they are more likely to continue to build resources, potentially invoking a gain cycle and the building of work engagement throughout the week (Hobfoll et al., 2018). As employees take daily work breaks and enjoy the potential short-term benefits of feeling recovered, less strained, and better able to perform, they will also likely feel and experience their work more positively over the week. Recovery experiences and outcomes have been empirically shown to be important for employees' work-related wellbeing, including employee engagement (e.g., Sonnentag, 2003; Sonnentag et al., 2012; ten Brummelhuis & Bakker, 2012) and burnout (e.g., Oerlemans & Bakker, 2014; Sonnentag & Fritz, 2007; 2014). By measuring employees' work engagement and burnout at the end of two work weeks, I make an initial attempt to understand the role of daily work breaks in natural environments at work in the longer-term work-related wellbeing outcomes of engagement and burnout.

***Engagement***

Employee engagement refers to how employees feel while at work and feel about their work. Being highly engaged is characterized by high levels of vigor, absorption, and dedication in one's work (Schaufeli & Bakker, 2004). Vigor, an energy resource, refers to experiencing high energy levels, and a willingness to exert effort and persist in the face of challenges. Absorption is characterized by bring highly concentrated and immersed in one's job tasks. Finally, dedication involves experiencing enthusiasm, meaning, and inspiration by one's tasks (Schaufeli & Bakker, 2004). Work engagement has been shown to fluctuate within persons (Sonnentag, 2003), which is important for one's daily work performance and wellbeing (cite).

There is consistent evidence linking feeling recovered to work engagement. For example, studies have repeatedly shown that feeling recovered in the mornings predicts work engagement during the day (e.g., Sonnentag, 2003; Kühnel et al. 2012; Sonnentag et al., 2012; ten Brummelhuis & Bakker, 2012), while low recovery level during the morning is negatively associated with engagement (Lanaj et al., 2014). In their study of recovery experiences during lunch breaks, Bosch et al. (2018) found that employees' state of being recovered after their lunch break positively predicted afternoon work engagement and negatively predicted afternoon exhaustion (both measured at the end of their workday). If employees feel higher levels of recovery after their breaks throughout the week, they will also likely feel more highly engaged in their work over the week.

*Hypothesis 6: Employees' daily levels of being recovered (aggregated across the study period) will positively relate to their week-level work engagement, above and beyond control variables.*

Energy and resources are needed to experience engagement (Bakker et al., 2014). One's state of being recovered is an indicator of having successfully recovered resources and being able to invest resources in future acts. Further, the cognitive resources or performance capacity measured as post-break resources in the current study (concentration, attention, and energy) align directly with the willingness to exert effort, persist, concentrate, and immerse oneself in work, all characteristic of employee engagement (Schaufeli & Bakker, 2004). COR theory (Hobfoll, 1989) suggests that one's state of being recovered and levels of attentional resources allows them to invest the resources necessary to concentrate, immerse in tasks, and persist through difficulties (Hobfoll et al., 2018). I therefore propose employees' aggregate levels of performance

capacity (i.e., concentration, attention, and energy levels) will be related to their work engagement captured at the end of the second work week.

*Hypothesis 7: Employees' daily levels of performance capacity (aggregated across the study period) will positively relate to their work engagement, above and beyond control variables.*

Work engagement is characterized by investing oneself into their work and the presence of positive work-related feelings (Kahn, 1990; Rich et al., 2010), and is therefore closely linked to and dependent on affect (Bledow, 2011). Schaufeli et al. (2002) conceptualize work engagement as an affective-motivational construct comprised of attitudinal, energetic, and self-investment components. Broaden-and-build theory of positive emotions (e.g., Fredrickson, 2001) proposes that experiencing positive emotions or affect broadens our momentary thought-action repertoires and leads to a distinctive work engagement mindset that allows one to become absorbed in an activity and experience vigor and dedication to an ongoing task (Bledow, 2011). Positive emotions or positive affect can therefore serve as a person resource that predicts work engagement. serve as a personal resource and increase work engagement (Sonnentag et al., 2010). State positive emotions have been found to predict day-level work engagement (e.g., Bledow et al., 2008; Xanthopoulou et al., 2009), and Sonnentag et al. (2010) even proposed a model of "state work engagement" in which day-level personal resources included positive affect and energy predict work engagement. I hypothesize that employees' aggregate levels of afternoon positive affect will positively relate with their engagement at the end of the second week.

*Hypothesis 8: Employees' levels of positive affect (aggregated across the study period) will positively relate to their work engagement, above and beyond control variables.*

***Burnout***

Burnout has been conceptualized a few different ways over the course of its study. On the basis of COR, burnout has been defined as an affective state of resource depletion, consisting of physical, emotional, and cognitive exhaustion that develops because of cumulative, chronic exposure to work stress (Hobfoll & Shirom, 2000; Shirom, 2003). The first dimension of burnout, physical fatigue, refers to consistently feeling tired and lacking energy. Emotional exhaustion involves a lack of energy to empathize with others at work. The third dimension, cognitive weariness, refers to feeling one has reduced mental agility (Toker & Melamed, 2017). Within the broader study of work and burnout, the relationship between job demands and resources to employee burnout has been extensively studied and supported (e.g., Bakker et al., 2005; Crawford et al., 2010). For example, meta-analytic evidence corroborates the link between job stressors (and particularly hindrance stressors) with strain and burnout (e.g., Crawford et al., 2010; Lee & Ashforth, 1996; Nixon et al., 2011). On the other hand, job resources can buffer the detrimental effects of job stressors on strain and burnout (Bakker et al., 2005; Winwood et al., 2007).

In the same vein as job resources buffering the stressor—burnout relationship, recovery can also play a buffering role in this relationship (Toker & Melamed, 2017). In COR terms, recovery processes (e.g., recovery experiences) allow energetic resources to be replenished, resource loss to stop, and resources to develop. Empirical evidence

supports this proposition—as engaging in weekend recovery activities leads to reduced burnout and higher work engagement (e.g., Fritz & Sonnentag, 2005; Kühnel et al., 2012; Ragsdale & Beehr, 2016). Beyond activities on their own, the role of psychological experiences elicited by engaging in certain activities (i.e., recovery experiences) play an important role in reducing strain and burnout (Ragsdale et al., 2011; Ragsdale & Beehr, 2016). For example, longitudinal evidence shows that lack of psychological detachment during nonwork time predicts increased emotional exhaustion one year later, regardless of job demand level (Sonnentag et al., 2010). Intervention studies have found that improving recovery experiences (Siu et al., 2014) and practicing recovery activities and relaxation techniques (Almen et al., 2020) led to reduced burnout symptoms over time. In the first study testing actual resource replenishment, Ragsdale & Beehr (2016) found that replenishing cognitive, affective, and motivational resources (specifically, self-regulatory capacity and state optimism) over a weekend negatively predicted burnout.

One's feeling of being recovered represents their resource replenishment following a recovery process. As evidence described above corroborates, one's state of feeling recovered following daily work breaks should negatively relate to their burnout at the end of the workweek. If employees have more recovery-promoting experiences during their work breaks, they will likely feel more highly recovered postbreak. As employees feel more highly recovered after their work breaks, they should theoretically possess physical, emotional, and cognitive energy to protect against potential burnout. Thus, I hypothesize that the higher employees' aggregate recovery levels, the less likely they will be to report burnout symptoms measured at the end of the second week.

Additionally, I hypothesize that employees' aggregate levels of being recovered will mediate the relationship between their break recovery experiences and burnout levels.

*Hypothesis 9a: Recovery state (aggregated across the study period) will be negatively associated with burnout measured at the end of the study period.*

*Hypothesis 9b: Break recovery experiences (aggregated across the study period) will relate to burnout via recovery state.*

After a successful recovery period, individuals will feel recovered and less strained. However, incomplete recovery can lead to sustained sympathetic and neuroendocrine activation and energetic resource depletion, meaning that strain indicators are not reduced. When strain reactions, or feeling tense and stressed, accumulate and are not sufficiently recovered, burnout and other long-term negative effects can develop (Guerts & Sonnentag, 2006; McEwen, 1998; Meijman & Mulder, 1998; Toker & Melamed, 2017). The current study measures strain with the item "I feel stressed and tense" (from Sianoja et al., 2018). Feeling stressed and tense over time would interfere with one's physical, emotional, and cognitive energy, or the aspects of burnout as conceptualized by Shirom and colleagues (Hobfoll & Shirom, 2000; Shirom, 2003). In the current study of recovery, low levels of strain indicate successful recovery, and are predicted to negatively relate with burnout measured at the end of the second workweek.

*Hypothesis 10: Strain (aggregated across the study period) will be negatively associated with burnout measured at the end of the study period.*

## Exploratory Research Questions

### *Positive Work Reflection*

In addition to hypothesizing psychological detachment, relaxation, and control as break recovery mechanisms, I pose research questions about the potential role of two additional cognitive pathways, positive work reflection and problem-solving pondering, in recovery during breaks in natural environments. Positive work reflection refers to thinking about the good sides of one's work and what one likes about their job (Binnewies et al., 2009; Fritz & Sonnentag, 2005), and has been proposed as a (cognitive) recovery experience that builds psychological and affective personal resources (Meier et al., 2016). Given positively reflecting on one's work inherently means thinking about one's work, positive work reflection as a recovery experience is clearly in direct contrast with psychological detachment, the experience with the most research attention and support (e.g., Sonnentag et al., 2017, 2022). However, researchers have also proposed that thinking about one's work during nonwork may not always be detrimental—but rather *how* one thinks about work may determine whether work-related thoughts are beneficial or detrimental (Cropley et al., 2012). Further, it is possible that breaks taken during the workday may be too short to fully psychologically detach (Trougakos & Hideg, 2009). Work-related thoughts such as positive work reflection and problem-solving pondering may be more likely to occur during work breaks, and may be beneficial for recovery and wellbeing in the absence of psychological detachment.

Indeed, positive work reflection has been found to be related to wellbeing outcomes. For example, positive work reflection during leisure time is associated with improvements in affective wellbeing (i.e., increases in positive mood and decreases in

negative mood) (Meier et al., 2016). Thinking about the positive aspects of one's work has been found to predict work engagement and vitality (Daniel & Sonnentag, 2014; Weigelt et al., 2019) and lower exhaustion and disengagement (Fritz & Sonnentag, 2005).

While many of the affective and cognitive benefits of contact with natural environments have received empirical support, one proposed outcome of successful restoration remains surprisingly unexplored: the notion that being in restorative natural environments provide opportunities for personal reflection. According to ART (Herzog et al., 1997; Kaplan & Kaplan, 1989), in addition to attentional recovery, another cognitive benefit of restorative environments is that they provide the opportunity for one to reflect—on immediate personal issues as well as broader ideas like one's priorities and goals. According to ART (Kaplan, 1993), it is the involuntary attention elicited by natural settings that provides the opportunity for reflection. When one's involuntary attention is captured in a natural setting, they are relieved of the need to focus and resist distractions. That freedom can then allow the mind to wander effortlessly, and perhaps provides opportunities to reflect on one's work in a less stress-inducing or emotionally reactive way.

According to Kaplan (1992), vegetation (e.g., trees and grass, flowers, gardens) are especially aesthetic and pleasurable to view, and in the context of this pleasing natural scenery, people can reflect on things that might be too confusing or difficult to think about under other circumstances. The pleasurable experience in an environment that elicits "soft" effortless fascination can offset any negative emotions that may be associated with personal reflection (Herzog et al., 1997). On the other hand, urban, built, or work settings are associated with activities that demand our directed attention, or may

evoke “hard” fascination, whereby our attention is captured, and we must deliberately focus, but in response to demanding stimuli (e.g., social activities, work tasks, errands, etc.), therefore inhibiting the potential to restore our attentional resources or reflect (Herzog et al., 1997). Reflection is considered to be a deeper, more profound benefit of restorative environments beyond recovery to baseline.

To my knowledge, there has not been an empirical study linking natural or restorative environments with reflection since Herzog’s (1997) vignette study in which participants rated ordinary natural environments most conducive for reflecting on their lives compared to sports/entertainment and urban environments. Therefore, the current study contributes to the literature by questioning an understudied theoretical notion of ART: that natural environments are restorative, in part, because they can provide opportunities for reflection. The current study includes reflection related to work specifically, as the naturalness of the work break environment at hand is situated within the workday, given that participants will be taking a short break from their work. Thus, I raise the question of whether natural break environments relate to positive work reflection during the break, and whether that reflection is a mechanism for recovery outcomes post-break.

The current study is an initial effort to evaluate whether work break environments affect *how* we think about work, whether those positive or negative thoughts affect our resource level and wellbeing. In the context of breaks taken at work, it is plausible that employees may reflect on their work during or after these breaks. If employees experience improvements in mood and “soft” fascination in natural environments, their reflective thoughts should be more positive, rather than ruminative. And the more natural

an environment is perceived to be, the more likely it may be to invoke positive work reflection, as more highly natural environments are associated with more improvements in mood and affect (Berto et al., 2014; McMahan & Estes, 2015). Therefore, I pose the following research question:

*Research Question: Does break environment naturalness relate to positive work reflection during breaks?*

Broaden-and-build theory also suggests that the positive emotions and mood states elicited by natural environments broaden our thought-action repertoires and build personal resources, allowing us to engage in various thoughts and behaviors (Fredrickson, 2001). One of these types of thoughts may be positive work reflection, or thinking about the good sides of one's work (Fritz & Sonnentag, 2005). COR (Hobfoll, 2001) also lends support to the notion that positive mood during a work break will be associated with positive work reflection, which will then be related to afternoon work-related wellbeing. The positive affect elicited during an outdoor work break may be related to positive thoughts about one's work, which could trigger a resource gain cycle, allowing employees to continue to build resources after their break, potentially leading to improved engagement in their work.

Conversely, in their longitudinal study of the effects of recovery on burnout and engagement, Sonnentag et al. (2010) found no bivariate relationship between psychological detachment and work engagement, contrary to their expectations. The authors suggest the zero-net effect of detachment on engagement may be a result of two mechanisms: a) thinking and ruminating about job demands during off-job time may decrease engagement because doing so depletes energetic sources, and b) reflecting

positively about one's job may actually increase work engagement, because doing so may increase one's willingness to continue their work with dedication and absorption (Sonnentag et al., 2010). Following this line of reasoning, positive work reflection and problem-solving pondering may also increase engagement, as one may feel more motivated or energized to be dedicated and absorbed in their work after thinking about the positive aspects of their job and potential solutions to work-related issues.

> *Research Question: Does positive work reflection during work breaks relate to post-break (i.e., recovery state), end-of-day (performance capacity, positive affect), or end-of-study (engagement, burnout) recovery outcomes?*

***Problem-Solving Pondering***

In addition to reflecting on the positive sides of one's job, problem-solving pondering is another type of work-related thinking. Problem-solving pondering is a constructive cognitive reflection about work-related problems and refers to reconsidering work-related issues during free time (Cropley et al., 2012). It differs from negative types of reflection, such as affective rumination and negative work reflection, in that it does not involve a negatively valanced emotional process that maintains arousal. Rather, while problem-solving pondering does involve thinking about work issues, those thoughts are more constructive rather than reactionary and emotion laden. Researchers suggest that being "switched-on" to work, and therefore not psychologically detaching, may not always be problematic if their thoughts help them solve issues and if they find thinking about work interesting (Cropley & Zijlstra, 2011). Indeed, problem solving pondering has demonstrated a negative relationship with both chronic and acute work-related fatigue (Querstet & Cropley, 2012). Problem-solving pondering has also been shown to be

indirectly related to wellbeing via state of being recovered, for employees higher in trait self-regulation (Firoozabadi et al., 2018). Additionally, positive work reflection and problem-solving pondering were shown to predict positive energetic states, including work engagement and vitality (Weigelt et al., 2019).

The same theoretical rationale for positive work reflection as a potential recovery mechanism also suggests problem-solving pondering may also be promoted by natural environments and related to recovery outcomes. The momentary positive emotions and cognitive restoration experienced during a break from work may allow employees to mentally reframe their work issues, and reflect on them from a different perspective. However, there is not yet much specific theorizing or empirical evidence directly linking this specific type of work-related thinking to recovery during work breaks or natural environments. Rather, it seems a plausible reaction to spending work breaks in natural environments, given the cognitive and affective pathways to recovery already theorized to occur. Therefore, I raise the questions of how problem-solving pondering might relate to natural environments and recovery outcomes.

*Research Question: Does break environment naturalness relate to problem-solving pondering during breaks?*

As a potential recovery mechanism, problem-solving pondering during work breaks may also be related to post-break recovery and performance capacity. According to COR (Hobfoll, 1998, 2001), if investing one's resources leads to gaining resources over time, one can experience stress reduction and positive emotion induction. In the current context, thinking about a work-related issue and how to solve it during one's break represents resource investment, and being able to solve the problem and better

detach from work later represents resource gain across time (Vahle-Hinz et al., 2017). Previous empirical evidence has demonstrated health and work-related benefits of constructively reflecting on work issues. For example, problem-solving pondering has been shown to be negatively related with both acute and chronic work-related fatigue (Querstet & Cropley, 2012), and to predict recovery state (Firoozabadi et al., 2018). Further, problem-solving pondering has been suggested as a recovery experience promoting work engagement (Bennett et al., 2016; Kinnunen et al., 2017), though more research is needed to support this proposition (Kinnunen et al., 2019).

*Research Question: Does problem-solving pondering during breaks relate to post-break (i.e., recovery state), end-of-day (performance capacity, positive affect), or end-of-week- (engagement, burnout) recovery outcomes?*

# CHAPTER 2: METHOD

The current study is a multilevel daily diary study, in which Level 1 is the within-person level of analysis and Level 2 is between-persons. Over the course of two workweeks, participants were asked to take a daily 15-minute work break in environments with varying degrees of naturalness, and to respond to three surveys a day: one in the morning before their break, one right after their break, and one in the afternoon before ending their workday. The goal of this design was to capture participants' morning levels of post-break and afternoon outcome variables, then the within-person effects of break environment naturalness on participants' experiences during their breaks, right after their breaks, and in the afternoons following their breaks. I used multilevel modeling (MLM) to analyze the repeated measures data and explore the effects of participants' work breaks on their break experiences and outcomes. I also examined the effects of the naturalness and recovery experiences of two weeks' worth of breaks on engagement and burnout at the end of the two-week study period.

## Pilot Study

Prior to the main study, I first conducted a pilot study to 1) obtain base-rate information on employee work breaks and typical break environments and 2) gather evidence of reliability and validity of measures to be used in the main study. I wanted to first understand whether employees typically work breaks, how they experience their work breaks, and whether employees typically spend work breaks in natural environments. This information would help me know whether the work break intervention I would be asking participants to complete would be a proper manipulation of their typical break habits. It was also necessary to gather evidence of

reliability/validity of my main study measures, particularly because I was adapting and shortening several measures to best accommodate the daily diary study design. Adapted measures need to be investigated to determine they still show content validity and capture the construct of interest (Heggestad et al., 2019).

### *Pilot Study Participants*

I used the Prolific online survey participant panel to recruit participants to complete a one-time Qualtrics survey containing all the measures included in the main survey, which was estimated to take about 15 minutes. People were eligible to participate in the pilot if they were over 18 and worked full-time in the U.S. I received responses from 208 participants, but five were rejected for failing multiple attention check items/insufficient effort responding, and three people timed out of the survey. A total of 200 complete survey responses were used in the analysis. On average, the survey took participants about 11 minutes to complete, and participants were paid $3.93 for their time. In the study information posted to Prolific, I also asked participants to take the survey after a work break of about 15 minutes.

The majority of Prolific participants were white (82%), were about split between men (48.5%) and women (50.5%), and most participants had completed either a 4-year degree (43%) or some collect (19%), and the average age was 36. Participants worked in a variety of industries—15% worked in Professional, Scientific, and Technical Services and Health Care and Social Assistance (14.5%), about 10% in Information, 8% in Retail Trade, and 7% in Educational Services. On average, participants' role tenure was about 5 years. Participants had a variety of work arrangements—43% reported working fully in-person, 31% fully remote, and 26% hybrid.

### *Typical Employee Break Findings*

The first goal of the pilot study was to understand how often employees typically take breaks, where they go, what they do, and how restorative they perceive their breaks to be. The majority of the pilot study participants reported taking breaks regularly; 34% reported they take breaks once a day and 40% reported taking breaks very frequently (i.e., more than once a day). On average, participants' breaks were about 16 minutes long. In terms of where employees typically spend breaks, the majority (53%) of pilot participants reported they rarely or never spend breaks in natural environments. Eighteen percent reported spending breaks in natural environments two to three times per week or once a day (17.5%), and 12% more than once a day. However, when asked to describe where they typically spend their breaks, 41% said outdoors. Forty-four percent described their typical break setting as indoors but not at their work desk, and 25% said their work desk. When asked to describe what they typically do during their work breaks, over half (53%) reported going on their phone or using the internet, 22% eat a snack or drink a beverage, 19% walk, and 14% rest or relax. I also asked pilot participants to describe where they would ideally like to spend their work breaks, and 64% reported somewhere outdoors, including at the beach/ocean, in a shaded spot, at a park, or just around nature. Sixteen percent said their ideal break location is inside, including at home or away from their desk.

To understand how restorative participants perceive their breaks and break environments to be, I asked pilot participants to think about their most recent work break (of about 15 minutes, excluding lunch) when responding to survey items. Sixty-two percent of participants had taken their most recent break within the past three hours of

taking the survey. I measured the restorativeness of participants' recent work break environment with the Perceived Restorativeness Scale (PRS; Pasini et al., 2014), and break recovery experiences with the Recovery Experience Questionnaire (REQ; Sonnentag & Fritz, 2007).

Results indicated that pilot participants found their recent break to be fairly restorative—the average PRS (rated on a 1-5 Likert-type scale) score of fascination elicited by their break environment 2.87 (*SD* = 1.06), being away was 3.24 (*SD* = 1.07), coherence was 3.49 (*SD* = 0.83), and scope was 2.94 (*SD* = 1.14). The break recovery experiences I measured were psychological detachment (M = 3.45, SD = 0.88), relaxation (M = 3.74, SD = 0.89), control (M = 3.80, SD = 0.72), and enjoyment (M = 4.05, SD = 0.79). Participants also reported whether they engaged in positive work reflection (M = 2.57, SD = 1.03), negative work reflection (M = 2.49, SD = 1.07), and problem-solving pondering (M = 2.60, SD = 1.07). Reliability coefficients for the pilot study measures are displayed in Table 2.

Overall, the first goal of the Prolific pilot study was achieved. Taking breaks does indeed appear to be a regular occurrence for employees, and employees rated their most recent breaks as fairly restorative. However, taking breaks in natural environments is not common, and suggests the main study procedure could be a novel enough break protocol to produce significant differences in terms of recovery experiences and outcomes when employees spend breaks in environments with varying degrees of naturalness.

***Reliability and Validity of Study Measures***

The second goal of conducting the pilot study was to assess the reliability and/or validity of the measures I use in the main study. Due to the daily diary design of my

study, several of my included measures needed to be adapted and shortened. The types of adaptations include changing the time referent, shortening scales, and slightly modifying the response scale. Heggestad et al. (2019) provide recommendations for making these types of adaptations and strategies for determining the validity of adapted scales. For the types of adaptations I planned to make, recommendations include conducting confirmatory factor analyses (CFAs) to make sure the factor structure is consistent with the conceptualization of the construct and prior scale development findings, and calculating part-whole correlations to determine if using a singular item or shortened version in place of the full scale still shows good convergent validity, content validity, and reliability with the full scale.

To run the CFAs for my adapted measures, I used the "lavaan" package and maximum likelihood estimate in R (version 3.6.2). To determine the fit of the models, I used the comparative fit index (CFI), Tucker-Lewis Index (TLI), root-mean-square-error-of-approximation (RMSEA), and the chi-square value. A well-fitted model must result in a CFI or TLI value at or above the recommended cut-offs of .90, and the RMSEA value must be below the .10 cutoff (Hu & Bentler, 1999; Tabachnick & Fidell, 2013). I also examined the changes in chi-square values across different models to see whether similar constructs load better as one factor or as a more differentiated model (e.g., one-factor model compared to two-or-more factor model). The results of the CFAs for the adapted scales described below are shown in Table 3.

### *Time-Referent Changes*

I changed the time-referent of the recovery experiences, enjoyment, positive and negative work reflection, problem-solving pondering, state of being recovered,

engagement, and burnout scales. Specifically, the original Recovery Experience Questionnaire (REQ; Sonnentag & Fritz, 2007), positive and negative work reflection items (Binnewies et al., 2009; Fritz & Sonnentag, 2006), and problem-solving pondering items (Cropley et al. 2012) all originally referred to respondents' experiences during their time after work or leisure time, and in the current study I adapted the instructions/statements for these scales to refer to respondents' experiences during their work breaks. Additionally, the REQ and problem-solving pondering items were changed from present tense to past tense. For example, an original REQ item including the referent statement is "During my time after work, I forget about work." The adapted item in my study is "During my break, I forgot about work." When adapting scale time referents, Heggestad et al. (2019) recommend conducting a CFA of the adapted measures and comparing the number of factors and loadings of items on factors between the adapted and original scales.

**Recovery Experiences Measures.** I began by running a CFA on the measures of respondents' experiences during work breaks. These include the psychological detachment, relaxation, and control experiences captured in the REQ (Sonnentag & Fritz), positive and negative work reflection (Binnewies et al., 2009; Fritz & Sonnentag, 2006), and problem-solving pondering items (Cropley et al. 2012). The break enjoyment item ("I enjoyed my break) was only slightly adapted from a previous study which included the one item (I enjoyed my lunch break) to measure enjoyment, and thus CFA was not possible. I first ran a one-factor model containing all the psychological detachment, relaxation, and control items from the original REQ, and then a three-factor model with the items for each of these three sets of experience loading on their own

factor. The one-factor model did not fit the data well, as the CFI and TLI values were below the .90 cutoff and the RMSEA value was above the .10 cutoff. The three-factor model (which aligns with the conceptualization of the REQ) fit much better, with CFI and TLI values above .90 and an RMSEA value below .10. The chi-square value for the three-factor model was also significantly lower than the one-factor model, providing further support for the three-factor model as a superior model to the one-factor model. I also compared the factor loadings of the adapted scale to the original scale. While the loadings themselves differed from the original scale loadings, the pattern of magnitude of the loadings was aligned with the original model. Taken together, these findings suggest the adapted scale is operating similarly to the original scale, and thus is a valid measure of recovery experiences during work breaks.

**Positive and Negative Work Reflection and Problem-Solving Pondering**. The items included for positive work reflection and negative work reflection are from the scales developed by Fritz and Sonnentag (2006), and the additional item added to each scale by Binnewies et al. (2009). The original positive and negative work reflection items from Fritz and Sonnentag (2006) referred to respondents' time during vacation (e.g., "During vacation, I realized what I like about my job"). The positive and negative work reflection items used by Binnewies et al. (2009) referred respondents to their leisure time experience (e.g., "During leisure time, I think about the good sides of my work"). In the current study, I changed the time frame referent to participants' break experiences (e.g., During my break, I realized what I like about my job"). Similarly, the problem-solving pondering items developed by Cropley et al. (2012) reference participants' free time in the present tense (I find solutions to work-related problems), while the current study

references participants' break that just occurred (i.e., past tense) and with slight wording change from "I find solutions" to "I thought about solutions" (e.g., During my break I thought about solutions to work-related problems"). I slightly modified this wording with the assumption that 15-minute breaks may be too short to fully find solutions, but may be sufficient to think about solutions. Additionally, "think about" more closely matches the "pondering" component of problem-solving pondering.

Again, these context and referent changes should be validated by conducting CFAs and comparing the number of factors and loadings with their original scale development findings (Heggestad et al., 2019). However, only Cronbach's alpha values for the work reflection scales were provided in both articles, so there are not CFA results to compare the adapted scales to. However, Cronbach's alpha for positive work reflection (.89) and negative work reflection (.88) from the pilot study data are higher than the Cronbach's alpha values provided for the scales in both Binnewies et al. (2009) and Fritz and Sonnentag (2006).

I conducted CFAs with the positive work reflection, negative work reflection, and problem-solving pondering items to test whether the items loaded on three respective factors as expected.). I first ran a one-factor model with all positive and negative work reflection and problem-solving pondering items, resulting in a poor-fitting model. I then ran two-factor model with all work reflection items loaded on one factor, and the problem-solving pondering items on the other. This resulted in an improved but still poor-fitting model. I then ran a three-factor model, with the items from each scale loading on their own factor. This resulted in a well-fitting model (Chi-square = 33.82, CFI = .98, TLI = .97, RMSEA = .07). The items also loaded as expected on their respective factors

and all with loadings of at least .80, except for two items with standardized loadings of .78 and .77. These results suggest that the items measuring positive work reflection, negative work reflection, and problem-solving pondering are acting as expected and the items capture the factors appropriately.

**State of being Recovered**. One's state of being recovered was originally measured by Sonnentag (2003), asking participants' whether they feel recovered, relaxed, and in a good mood, after the referent "because of the leisure activities pursued yesterday, ..." In the current study I am measuring how participants currently feel after returning from their break, so changed that time referent to "Right now, ..." Cronbach's alpha for this scale with this adaptation in the Prolific pilot was .86, indicating strong reliability for these three items. I conducted a CFA with these items as well, which resulted in a just-identified model (*df* = 0; Chi-square = 1.00, CFI = .00, RMSEA = 0.00), so model parameters could not be identified and thus fit cannot be assessed. Three indicators is the minimum amount needed to run a single-factor CFA, and doing so is sufficient if all the indicators or items are uni-factorial and their error terms are uncorrelated—which is likely the case here (e.g., the indicators are too highly correlated with each other), in addition to relatively small sample size for running CFAs. [1]

**Work Engagement**. In the original version of the 9-item job engagement scale (Schaufeli et al., 2006), the instructions ask participants to rate how often they have felt each statement about their job (i.e., no specific time referent given). In my study, I adapt

[1] I ran a CFA using the three-item performance capacity measure as well, which also resulted in a saturated mode without interpretable fit statistics.l

the instructions to ask participants to rate how often they have felt each statement about their job that week. The job engagement scale is also made up of three factors: vigor, dedication, and absorption. I ran a CFA with the pilot data, first loading all items onto one engagement factor, which resulted in a well-fitting model. I then ran another CFA with each item loading onto its respective subscale (3 items to each factor), which resulted in a slightly better fitting model that aligns with the theoretical conceptualization of job engagement. This slight difference in model fit estimates between the one-factor and three-factor models was similar to the original short-form scale development paper (Schaufeli e al., 2006), which found only slightly better fit with the three-factor model. The authors note the three subscales are highly interrelated, though the one- and three-factor models were not invariant. The model fit parameters are shown in Table 3. These findings suggest that this scale is acting reliably and as expected with the adapted time referent.

**Burnout**. Finally, the burnout measure I use in the current study is the shortened 6-item version (Almén & Jansson, 2021) of the Shirom-Melamed Burnout Measures (SMBM; Shirom & Melamed, 2006). The SMBM asks respondents to refer to the past month when rating how often they felt each statement listed, whereas in the current study I ask participants to refer to the past *week*. I also modified the response scale for the burnout scale to be consistent with the engagement response options (e.g., "almost never" and "almost always" changed to "never" and "always" to match engagement options). Heggestad et al. (2019) state this type of change is minor enough and do not provide specific statistical recommendations to assess the scale. To validate the time referent change, I did run CFAs on the burnout items. The one-factor model did not show great

fit, while the three-factor model (expected model) fit the data very well. Parameter estimates are shown in Table 3. Therefore, this set of items is sufficiently reliable and shows evidence of construct and content validity, supporting the use of the scale in the current study.

***Shortened Scales***

Scales that are to be shortened (mostly to item per scale or subscale) in the main study include recovery experiences, positive and negative work reflection, and problem-solving pondering. When shortening scales, Heggestad et al. (2019) recommend choosing items from the original scale with both empirical evidence and a conceptual understanding of the construct—trying to optimize content validity, construct validity, and reliability. To determine the validity of the adapted scale, Heggestad et al. (2019) recommend calculating part-whole correlations between the original and adapted scales.

Heeding Heggestad et al.'s (2019) recommendation, I calculated part-whole correlations (i.e., correlation of an item with the whole scale except for that item) which each of the scales to be shortened in the main study. After computing part-whole correlations for the REQ subscales, (four questions per subscale) the item mostly highly correlated with the psychological detachment scale was the first item ("I forgot about work;" coefficient = .72), which also had the highest item loading on the psychological detachment factor from the CFA analyses. Additionally, the item with the highest correlation ("I forgot about work;" coefficient = .81) with the relaxation subscale was also the highest loading item for the relaxation subscale in the CFA findings. Therefore, these items appear to have good content and construct validity, as well as strong reliability.

I also ran part-whole correlations for positive and negative work reflection, respectively. The positive work reflection item "I considered the positive points of my job" had the largest part-whole correlation with the whole 3-item scale (coefficient = .79), as well as the highest loading on the positive work reflection factor in the CFA. The negative work reflection item ("I thought about sides of my work) had the highest part-whole correlation at .80. Due to these high part-whole correlations and corresponding high factor loadings indicating the items' validity and reliability for representing the work reflection constructs, these two items will each be used to capture positive and negative work reflection in the main study. The problem-solving pondering scale was made of only two items, so the part-whole correlations were the exact same for each item. The higher loading item "I thought about solutions to work-related problems" will be used in the main study. Together, the part-whole correlation findings, in conjunction with evidence from the CFAs I ran for the study, have provided good evidence for the reliability, content validity, and construct validity for the single items I am using for the constructs discussed above in the daily surveys of the main study.

I could not run the type of reliability and validity analyses described above for the naturalness rating item included in the main study. This item, which asks respondents to rate how natural they would rate the environment in which they spent their break on a scale from 1-7, is included in my study to capture whether participants were in more or less natural environments for their breaks. However, I cannot provide the same reliability or validity statistics as the other scales because a rating of naturalness is not in the same construct space as previously used scales (e.g., the Perceived Restorativeness Scale; Pasini et al., 2017). In many previous studies, the level of an environment's naturalness

was often pre-determined by the study investigator, rather than rated by participants themselves. Thus, this item is based on a study item previously described by van den Berg et al. (2014).

**Main Study Participants**

Participants for the main study were U.S. employees of a global manufacturing company. Participants were recruited through articles posted on the company's intranet site, in which a short article and flyer described the study, eligibility requirements, and included a Qualtrics sign-up link. To be eligible, participants had to be at least 18 years old, full-time salaried workers, and able to spend daily 15-minute work breaks in multiple environments (i.e., indoors and outdoors). I recruited participants in two waves: the first at the end of September 2022, then again at the end of October 2022. I recruited the second wave of participants in order to reach my final sample size goal. Following recommendations and norms for ESM studies in high-ranking journals (Gabriel et al., 2019; Ohly et al., 2010) and in line with other within-person diary studies on work break recovery (e.g., Bosch et al., 2018; Hunter & Wu, 2016), my goal was to collect data from at least 100 participants.

To incentivize complete participation in the study, participants who provided complete data (i.e., at least three days of three complete survey) during the first week were sent a $10 Amazon gift card. During the first wave of data collection, participants who provided complete data during their second week were gifted an item of company-branded merchandise (e.g., mug). I was more limited in terms of monetary funding available for participant incentives during the subsequent wave of data collection, so I modified the incentive structure for the second week of the second recruitment wave.

Participants who provided complete data during the second week of the second wave were entered into a random drawing for one of three higher-value items of company-branded merchandise (e.g., insulated cooler).

Given the differences between the two recruitment waves in second week incentive structure and week-level measure timing, I checked for any significant differences between the two waves of recruited participants to make sure combining their data was justified. I examined demographic and job level measures, baseline levels of main study variables, and day (Level 1)- and person-level (Level 2) differences in predictors and outcome variables. The only significant difference in baseline measures was in typical natural/green space visit frequency—participants in the first wave were more likely to report more frequent nature visits than the second wave (e.g., 30% of the 64 wave 1 participants reported visiting natural spaces every day, compared to 4% of the 48 wave 2 participants). And across study days, participants in the first recruitment wave reported slightly higher afternoon capacity ($M = 3.59$) than the second wave ($M = 3.41$). Because the nature visit frequency measure was included as basic demographic/background information and not a main study variable, and there was a practically minimal difference in the differences in afternoon performance capacity, I proceeded with combining the two datasets from each wave.

Across the two waves of data collection, 303 employees indicated their interest in participating and provided their names and emails for future surveys. Those employees were then sent a baseline survey to complete. This survey began with an Informed Consent form followed by demographic, individual trait, and job characteristics measures. Two-hundred forty-nine (249) employees consented to participate. One person

was excluded for only answering the first several questions of the baseline survey, and three people from the second recruitment wave were excluded because they had already participated in the first wave.

I also reviewed the data for insufficient effort responding (IER), such as not following survey instructions or providing inaccurate responses (Huang et al., 2015). I excluded four participants for IER, all of whom incorrectly answered at least one of the three attention check items (included in baseline and Friday surveys) and gave responses with *SD* = 0 across multiple scales and surveys (i.e., selected the same response across an entire scale or survey) (Meade & Craig, 2012). I also excluded surveys that were noncompliant with timing requirements (e.g., morning survey completed after break survey, afternoon survey completed the next morning)—110 surveys were excluded across both waves for survey timing noncompliance. Then, I excluded incomplete data; I considered data to be complete if a participant had at least three days of three completed surveys each (or 60% complete data for at least one of the two study period weeks). This 60% cutoff for completeness would mean I have at least three day-level measurements per person, and is a similar to other response rate cutoffs used in other ESM design studies (Gabriel et al., 2019). After removing insufficient effort responders and incomplete data, the final dataset across both waves was comprised of 112 participants, representing a 45% retention rate of the 249 who consented.

The sample was majority women (59%, 37% men, 2% non-binary/gender-nonconforming, 2% did not disclose), mostly white (79%; 9% Hispanic, 4% black, 3 Asian, 4% bi- or multi-racial, and 3% did not disclose), and the average age was 42.06 (*SD* = 10.54). The majority of the sample had at least a 4-year degree (52% had a 4-year

degree, 20% a Master's degree, and 2% a professional degree), while 12% completed some college and 4% graduated high school or received a GED. Participants represented a variety of job functions within the organization: 19% were in Engineering, 12% in Administration, 11% in Project Management, 10% in Sales, 10% in Global Integrated Supply Chain, and 13 other functions (e.g., Customer Service, Finance, IT) representing less than 10% of the sample each. In terms of job level, 11% were Entry-level, 24% Analysts Associates/Individual Contributors, 29% were Senior Analysts/Senior Associates/Individual Contributors, 22% were Managers, and higher levels were represented at less than 8% each. Half of the sample had a hybrid work arrangement, while the rest were fully remote (27%) or full in-person (23%). Overall, the sample was majority women and largely white and well educated, while representative of a variety of job functions and levels.

**Procedure**

To best answer the question of whether the naturalness of work break environments is related to recovery experiences and outcomes, I used a within-person design in which participants were instructed to take a 15-minute break from their work every day for two weeks and answer three surveys every workday. The goal of my data collection strategy was to capture the psychological mechanisms proposed to occur during work breaks to determine if and how post-break recovery occurs (Level 1), and to assess whether the degree of naturalness of work break environments affects recovery outcomes post-break and by the end of their workday (Level 1) and end of the two-week study period (Level 2). The diary survey design allows researchers to capture dynamic within-person experiences or phenomena in real time and circumvent problems

associated with retrospective accounts that rely on memory and recall (Beal, 2015; Fisher & To, 2012). A diary design is also most suited to capturing the episodic nature of work breaks and the recovery process as it is theorized—a reduction in strain and replenishment of resources—by measuring pre-break and post-break levels of strain and resources (e.g., performance capacity, positive affect) (Meijman & Mulder, 1998; Zhu et al., 2019).

After providing informed consent and completing a baseline survey, participants were randomly assigned into one of two conditions with alternating break locations: 1) one group was instructed to spend the first week of breaks indoors away from their work desk, and then instructed to spend the second week of breaks in an outdoor natural environment; 2) the other group was instructed the same in reverse order (first week of breaks in an outdoor natural environment, then second week indoors away from their desk). My goal with counter-balancing the order in which participants spent their breaks was to eliminate any potential bias from participant dropout effects or any order effects. The instructions for the natural environment week stated, "'Natural environment' can mean anywhere with as many natural elements (e.g., trees, greenery, water) you can access." Participants were also encouraged to take their breaks when they felt depleted, to be present during the break (i.e., not spend time scrolling on their phone), and to spend their breaks solo. As far as timing of breaks, participants were also instructed to take their 15-minute work break at some point after working for two hours and up to two hours before their workday ended. The baseline survey participants completed after giving informed consent asked their typical work hours, and I used their answers to schedule the Qualtrics surveys accordingly: morning surveys were sent one hour into their workday,

break surveys were sent two hours into their workday, and afternoon surveys two hours before their workday ended.

The following Monday, the main study period began. Participants received their instructions for the week and received their three surveys each day: one survey to complete in the morning and before their work break, one survey to complete right after their work break, and one survey to complete in the afternoon before the end of their workday. Morning surveys measured participants' current performance capacity, affect, recovery state, and strain levels (which served as control variables in predictive models of each respective outcome later in the day). Post-break surveys measured participants' break experiences and their post-break outcomes; specifically, post-break surveys asked about participants' experiences during their breaks (relaxation, detachment, control, positive work reflection, problem-solving pondering), where they went, what they did, how natural the environment was, and their current recovery state and strain levels. The afternoon survey measured afternoon recovery outcomes of current performance capacity and affect. During the first wave recruitment wave, the final survey of the study period (i.e., second Friday afternoon) included engagement and burnout scales in addition to the normal afternoon survey questions. By that final survey, there was decent attrition (65%; 94 responses to the Friday afternoon survey compared to 143 responses to the first Monday survey). In an effort to get more responses during the second wave, I decided to

move the engagement and burnout measures to the morning survey of the second Friday for the second wave[2].

## Measures

### *Level 2 Variables (Between-Person Level)*

**Demographic and Job Variables**. The baseline survey included questions about participants' demographic information, such as age, gender, race, as we as job measures such as job title, function, and work arrangement (fully remote, fully in-person, or hybrid). This information was collected largely for descriptive or exploratory purposes. I hoped the work arrangement question would provide some understanding of where participants might be able to take their work breaks during the study period (e.g., at the organization's headquarters, near their home, etc.). However, I since learned the vast majority of the organization's U.S. employees' work arrangement selections do not align where they actually end up spending their days (e.g., over 2/3 of hybrid employees come to campus less than once a week, many fully remote employees work onsite, etc.), so I did not consider the work arrangement a reliable indicator of where participants likely were for their breaks.

**Trait Affect**. I included trait affect as a control variable because previous findings suggest that negative and positive affectivity can influence individuals' reactions to or experiences of different events. For example, individuals higher in trait negative

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[2] In the first recruitment wave, engagement and burnout were only measured at the end of week 2. In the second recruitment wave, engagement and burnout were measured at the end of both weeks. The engagement and burnout data from the second week of each wave are included in the current analysis after merging the datasets.

affectivity have a more dispositional tendency to experience negative emotions or react more negatively to stressors than individuals higher in trait positive affectivity (e.g., Watson, 2005; Watson & Tellegen, 1985). Trait affect was measured at baseline with the PANAS (Watson et al., 1988), a 20-item scale in which respondent indicate the extent to which they feel 10 positive and 10 negative emotions on a typical day on a 5-point Likert-type scale ranging from very slightly to not at all (1) to extremely (5). Example emotion words include "interested," "excited," "distressed," and "upset." Baseline internal reliabilities were strong for each subscale were strong (positive affect = .93, negative affect = .84).

**Trait Connection to Nature.** How connected or related individuals feel to the natural world has been shown to relate to how they perceive the restorativeness of environments and how they act in the natural world (Mayer et al., 2009). I therefore controlled for individuals' connection to nature to determine whether any beneficial effects of nature occur after accounting for how connected individuals already feel to it. Connection to nature was measured at baseline using the Nature Connection Index (NCI; Hunt et al., 2017). This 6-item measure captures individuals' affective and experiential relationship with nature. Respondents rate their level of agreement on a 7-point Likert-type scale, to items including "Being in nature makes me very happy," and "Spending time in nature is very important to me" (Hunt et al., 2017). The scale showed strong internal reliability at baseline (.90).

**Job Demands**. To determine how work breaks in natural environments relate to recovery above and beyond employees' typical job demands, I included a workload measure as a control variable. Workload may influence how employees feel before and

after their work breaks, and whether they are able to experience recovery mechanisms during their breaks. I used the five-item Quantitative Workload Inventory (QWI; Spector & Jex, 1998) to measure participants' typical job demands. Example items include "My job requires me to work very hard" and "My job leaves me little time to get things done," to which participants rate their agreement on a 5-point Likert-type scale. The QWI demonstrated good internal reliability at baseline (coefficient alpha = 0.88).

***Level 1 Measures (Within-Person Level)***

Because I was surveying participants multiple times a day over multiple days and measuring multiple constructs at each measurement occasion, I used mostly single-item measures to minimize survey fatigue and participant dropout and collect as many responses as possible. The use of single-item measures is also consistent with previous studies of within-day work recovery using diary designs (e.g., Hunter & Wu, 2016; Sianoja et al., 2018) and single-item measures have previously been shown to be valid replacements for multi-item measures (Elo et al., 2003; Fisher et al., 2016).

**Naturalness of Break Environment.** In the post-break surveys, I asked participants who indicated they took a break to rate the naturalness of their break environment. The question asked, "How natural (i.e., containing natural elements such as trees, plants, water; limited manmade, built structures and human interference) would you rate the physical environment in which you spent your most recent work break?". Response options ranged from completely manmade (1) to completely natural (7). This item was based on previous studies describing single-item measures of perceived naturalness of environments (e.g., Gilchrist et al., 2015; Marselle et al., 2016; van den Berg et al., 2003, 2014).

**Break Recovery Experiences**. Break psychological detachment and relaxation were assessed using a single item each from the REQ (Sonnentag & Fritz, 2007). Psychological detachment was measured using "I forgot about work," and relaxation with "I used the time to relax." In the pilot study analysis, each of these items had the highest factor loading and the highest part-whole correlations with their respective subscales. Baseline Cronbach's alpha values were strong for each subscale (psychological detachment = .81, relaxation = .89). Break enjoyment was measured with the item "I enjoyed my break," adapted from the item "I enjoyed my lunch break" from Sianoja et al. (2018). All break experience items (including work reflection and problem-solving pondering, below) asked participants to rate their agreement with each statement about the work break they just took, on a 5-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5).

**Break Positive and Negative Work Reflection**. Work reflection during breaks was measured with the items "I thought about the positive aspects of my job," and "I thought about the negative sides of my work," adapted from Fritz & Sonnentag (2006). Each of these items was the highest loading on its respective factor (positive and negative work reflection subscales). Cronbach's alpha values for the full subscales at baseline were high (.86 and .86).

**Break Problem-Solving Pondering**. I measured problem-solving pondering during breaks with an item adapted from a two-question set by Cropley et al. (2012): "I thought about solutions to work-related problems". The two-item scale had poor reliability at baseline (Cronbach's alpha = .67), but has previously shown good reliability

across daily measurements (e.g., Cronbach's alpha ranging from .86 to .88; Firoozabadi et al., 2018)

**Recovery State.** Participants' current state of feeling recovered was assessed with the item "I feel recovered" from Sonnentag (2003) and Oerlemans & Bakker (2014). Participants rated their level of agreement on a 5-point Likert-type scale. Morning, post-break, and afternoon surveys all included the recovery state item, allowing me to account for morning recovery when predicting post-break recovery. I could not assess fit using CFA during the pilot analysis, likely due to uni-factorial items, correlated error terms, or small sample size, but Cronbach's alpha for the original three-item scale was high during the pilot analysis (.86).

**Strain**. I measured strain in the morning, post-break, and afternoon surveys, with the item "I feel stressed and tense." This item was previously used in another study of the effects of contact with nature at work with recovery (Sianoja et al., 2018; adapted from Elo et al., 2003). Participants rated their agreement on a 5-point Likert-type scale.

**Performance Capacity**. The current study operationalizes performance capacity as employees' perceived levels of energy, concentration, and motivation. I assessed performance capacity in the morning and the afternoon surveys, in the morning with the item, "What is your current level of energy/concentration/motivation?" and in the afternoon with the item, "This afternoon after your work break, what has been your level of energy/concentration/motivation?" from Hunter & Wu (2016). Participants respond on a 5-point Likert-type scale ranging from 1 (very low) to 5 (very high). These items were not included in the baseline survey, but Cronbach's alpha was high during pilot testing (.87).

**Affect**. State affect was measured using the 8-item scale from Yoon et al. (2021), which includes four items each for positive and negative affect, representing both and low levels of activation (Barrett & Russell, 1998). Participants' state affect was measured in the morning and afternoon surveys. Example items include "happy," "content," "nervous," and "sad," and participants rate their level of agreement with each on a 5-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5). State affect was not included in the baseline survey, but during pilot testing items loaded as expected and a two-factor model fit was the best fit, and Cronbach's alpha was good for each subscale (positive = .81, negative - .82).

**Engagement**. On the last day of the study period, participants were asked about their work engagement and burnout. Engagement was measured using the 9-item Utrecht Work Engagement Scale (UWES-9; Schaufeli et al., 2006). This measure captures the three theorized factors of engagement: vigor (e.g., "I felt bursting with energy at work," dedication (e.g., "I was enthusiastic about my job"), and absorption (e.g., "I got carried away when I was working"), and instructions asked participants to rate how often they felt each way that week. Responses were on a Likert-type scale ranging from never (1) to always (7). The scale showed strong internal reliability at baseline (Cronbach's alpha = .89).

**Burnout**. Burnout at the end of the study period was measured using the newer six-item version of the Shirom-Melamed Burnout Inventory (SMBM; Almen & Jansson, 2021; Shirom & Melamed, 2006). This two-factor measure of burnout captures the emotional and physical exhaustion and cognitive weariness dimensions of burnout. From its development study, this brief 6-item measure, based on the 12-item version, showed

evidence of good composite reliability, convergent validity, excellent model fit, and the composite score strongly correlated with the composite scores from other measures included in the validation study (Almen & Jansson, 2021). The authors suggest this shorter measure may be appropriate for studies using repeated measures and thus need shorter scales. Example items include “I felt physically exhausted” and “I felt I was not thinking clearly.” Internal reliability was strong at baseline (Cronbach’s alpha = .87).

# CHAPTER 3: RESULTS

## Analytic Approach

Given the hierarchical, nested nature of the data (multiple daily surveys nested within individuals), I tested my model (Figure 1) using multilevel path analysis. Each participant (Level 2, between-person) has a maximum of 30 possible data points (three daily surveys over 10 workdays; Level 1, within-person). Repeated measurements from the same individual cannot be assumed to be independent, and thus violate the assumption of independent residuals required for other analysis techniques such as ordinary least squares (OLS) regression. Multilevel modeling (MLM) analyses does not assume independence of residuals and includes equations across both levels that integrate non-independence appropriately, making it the most appropriate analysis technique for handling the study's nested data structure (Beal, 2015; Ohly et al., 2010). Multilevel path analysis also separates variance into Level 1 (within-person) and Level 2 (between-person) variances. In the current study, Level 1 (within-person) variance includes the variance in the repeated measures that participants complete over the course of the study (e.g., performance capacity, break recovery experiences), and Level 2 (between-person) variance component is comprised of the variance in those repeated measures variables that is common to the person across the study (person-level mean) and the variance in the individual-level variables measured at baseline (e.g., trait affect, connection to nature). I conducted multilevel path modeling to test my hypotheses in R using the multilevel and nlme packages in R (Bliese, 2022).

Before proceeding with any multilevel modeling, it is necessary to first determine whether analyzing the study data at multiple levels is appropriate, by investigating

whether systematic within-person and between-person variance on the focal outcome variables (e.g., performance capacity, strain) exists. To determine how much variation in outcome variables was due to between-person differences vs. within-person differences, I estimated null models and calculated the intraclass correlation (ICC) for each endogenous variable (Hofmann, 1997). The ICC(1) values indicate how much variance in the outcome variables is within-person (e.g., Level 1) and how much variance is between-persons (e.g., Level 2). There should be both within- and between-person variance in the outcome variables to justify multilevel path analysis (Bliese, 2000). Substantial within-person variance in each of the outcome variables would provide evidence that the variables indeed vary within individuals across the daily surveys, and therefore proceeding with the within-person predictors is appropriate (Bliese, 2000). And between-person variance in the outcome variables would indicate they vary across individuals in the sample, so using the between-persons variables (e.g., control variables) to try to predict that variance is appropriate.

The ICC(1) values for post-break recovery state and strain were .48 and .50 respectively, indicating that 48% of variance in post-break recovery is due to between-person variation (and 52% due to within-person variation), and ½ of the variance in post-break strain is between-persons variation, (and ½ within-persons). The ICC(1) values for afternoon performance capacity and positive affect were .30 and .53, meaning 30% of the explained variation in afternoon performance capacity was due to between-person variance, and 53% of variation in afternoon positive affect was due to between-person variance. The ICC(1) values for break recovery experiences suggest that 24% of psychological detachment, 33% of relaxation, and 31% of break enjoyment variance is

between-person variance (thus the majority of the variance is level-1, within-person variance). For positive work reflection, negative work reflection, and problem-solving pondering, ICC(1) values were .49, .49, and .37, respectively. Together, ICC(1) values of endogenous variables ranged from .25 to .53, meaning that 25 to 53% of the overall variance is between-persons, and thus there is substantial variation that also exists at the within-person level, consistent with the main focus of my model, and continuing with multilevel modeling is appropriate.

The hypothesized relationships in my model focus on Level 1 (within-person) variables and relationships, and any other Level 2 predictors are included only as controls. Given the within-person focus, I person-mean centered the Level 1 predictors and mediators, which disentangles the between-person variance in these variables and provides unbiased estimates of the within-person (Level 1) relationships (Enders & Tofighi, 2007; Hofmann & Gavin, 1998). In models predicting post-break and afternoon outcomes, I included the morning levels of the respective outcome as Level 1 control variables. Means, standard deviations, and intercorrelations for within and between study variables from Wave 1 are presented in Table 3.

**Final Model**

The model I originally proposed prior to data collection modeled a slightly different set of relationships than the model I ended up testing in the final version of the current study. I originally modeled “work breaks” (took one or not) predicting the break recovery experiences, moderated by break environment naturalness. However, after collecting and during cleaning my study data, I realized that almost all participants took breaks (e.g., 90% of surveys reported taking a break that day). This was a positive finding

from a compliance perspective, but also meant that whether participants took a break or not could not be a predictor because there was almost no variance in break-taking behavior. On the other hand, during data collection I instructed participants to take their breaks in indoors or outdoors environments each week. After data collection I also learned that a substantial percentage of participants did not adhere to the break location they were assigned to for a respective week (e.g., participants assigned to an indoor or outdoor break location each spent about 25%-35% of breaks in the opposite location). Participants were still spending breaks both indoors and outdoors, but the condition they were assigned to was not an accurate representation of where they actually spent their breaks. Overall, the data I collected did not exactly match how I presented my original model. Thus, the model that appears in Figure 1 is my revised model in which I changed break environment naturalness to the exogenous predictor variable. This model preserves my original intent and research questions I had for the study, and is a model I could actually test with the study design and data. See Figure 1 for the final hypothesized model.

I also originally planned to measure participants' work engagement and burnout at the end of each of the two workweeks of the study period. However, I mistakenly excluded these scales during the first week of the first wave of recruitment/data collection. The final model thus includes engagement and burnout as end-of-week-two outcomes, instead of week-level outcomes. Ultimately, the switch to using naturalness as the exogenous predictor rather than condition removed the reliance on the week level as an indication of break location, so I accordingly felt including of engagement and burnout measured at the end of the study was acceptable enough to proceed.

**Hypothesis Testing**

The results of the hypothesized model are illustrated in Figure 2 and also reported in Tables 3-6. Hypothesis 1 purported break environment naturalness would positively relate to experiencing (a) psychological detachment, (b) relaxation, and (c) enjoyment during breaks. To test these relationships, I regressed each of the break experiences onto person-mean centered break naturalness, controlling for Level 2 variables (trait connection to nature, positive and negative affect, and job demands). The only control variable significantly related to any of the break recovery experiences was trait negative affect with psychological detachment ($b$ = -.45, p < .01). Break environment naturalness was significantly positively related to break relaxation ($b$ = .05, $p$ < .001) and enjoyment ($b$ = .05, $p$ < .001), but not psychological detachment ($b$ = .03, $p$ = .13). Thus, Hypothesis 1b and 1c were supported. I calculated the pseudo-R-squared ($R^2$) values for each of these models (relaxation $R^2$ = .10, enjoyment $R^2$ = .06), which indicates that break naturalness accounted for 10% of the explained variance in break relaxation, and 6% of the explained variance in break enjoyment (LaHuis et al., 2014; Snijders & Bosker, 1994).

Hypotheses 2a and 3a posited that break environment naturalness would relate to post-break recovery state (2a) and strain (3a). To test these hypotheses, I regressed each of the person-mean centered post-break outcomes onto break naturalness, including the Level 2 controls as well as person-mean centered morning levels of recovery state or strain as a Level 1 control. I found support for Hypothesis 2a, as naturalness was significantly related to post-break recovery state ($b$ = .03, $p$ < .01). Morning recovery state was also significantly related to post-break recovery ($b$ = .09, $p$ < .01). The pseudo

$R^2$ value was .13, meaning 13% of the explained variance in post-break recovery was due to the within-person variables of break environmental naturalness and morning recovery. Naturalness did not significantly relate to post-break strain ($b$ = -.01, $p$ = .26), so Hypothesis 3a was not supported. The control variables job demands ($b$ = .11, $p$ < .05), trait negative affect ($b$ = .26, $p$ < .01), and morning strain levels ($b$ = .43, $p$ < .001) were significantly related to post-break strain.

Hypotheses 2b and 3b predicted break recovery experiences would significantly relate to post-break recovery state and strain. I regressed each of these outcomes onto the three person-mean centered break experiences, including Level 2 and Level 1 (person-mean centered morning levels of each outcome) controls. Psychological detachment ($b$ = .05, p <.05), relaxation ($b$ = .15, $p$ < .001), and enjoyment ($b$ = .24, $p$ < .001) were all significantly related to post-break recovery state, and no controls variables were significant. The pseudo $R^2$ value was .22, indicating the break experiences account for 22% of the variance explained in post-break recovery. As for break experiences and post-break strain, relaxation and enjoyment were significantly related ($b$ =-.09, $p$ < .05; $b$ = -.35, $p$ < .001, respectively) to strain, though psychological detachment was not ($b$ = -.05, $p$ = .07). Job demands, trait positive and negative affect, and morning strain levels were also significantly related to post-break strain. The pseudo $R^2$ value for the strain model was .35, with Level 1 (break relaxation and enjoyment, morning strain) and Level 2 variables (job demands and trait affect) accounting for 35% of the variance explained in post-break strain. Thus, Hypotheses 2b was fully supported and 3b received partial support.

Hypotheses 3c and 4c posited that the relationships between (3c) naturalness and post-break recovery state and (4c) naturalness and post-break strain would be partially mediated by break psychological detachment, relaxation, and enjoyment. To test the indirect effects in my model, I used the mediation package in R, which provides quasi-Bayesian bootstrapped confidence intervals (simulation = 1,000). I included workload, trait connection to nature and trait affect as Level 2 controls, and person-mean centered morning levels of recovery or strain as Level 1 controls. The mediation results indicate relaxation and enjoyment had significant indirect effects on recovery: relaxation indirect effect = .01 (95% CIs [0.00, 0.02], $p < .001$), and enjoyment indirect effect = .02 (95% CIs [0.01, 0.02], $p < .001$). These results provide partial support for Hypothesis 3c, such that break environment naturalness has significant indirect effects on post-break recovery state via break relaxation and enjoyment. The mediation results show similar results for strain: naturalness had significant indirect effects on post-break strain via relaxation (indirect effect = -.02, 95% CIs [-0.03, -0.01], $p < .01$) and enjoyment (indirect effect = -.02, 95% CIs [-0.03, -0.01], $p < .001$). Hypothesis 4c is therefore partially supported; break relaxation and enjoyment mediate the naturalness—strain relationship. There is little agreement over how to estimate effect sizes of mediating effects (especially for multilevel mediation), which technique is best, or whether effect sizes of indirect effects are even necessary (e.g., Preacher & Kelley, 2011; Rungtusanatham et al., 2014; Wen & Fan, 2015). Kenny (2021) proposes that, because the indirect effect is a product of two effects (IV to mediator, mediator to DV), squared values of the typical Cohen (1988) effect size guidelines (.1 is small, .3 is medium, .5 is large) could represent small, medium, and large effect sizes. In that case, an indirect effect of .01 would be considered

small, .09 medium, and .25 would be large. Using these guidelines, the indirect effects of relaxation and enjoyment on post-break recovery and strain (ranging from -.02 to 02) are effectively small, and their practical significance may be minimal.

Hypotheses 4 and 5 purported that break recovery experiences would predict (4a) afternoon performance capacity and (5a) afternoon positive affect, and that naturalness would have an indirect effect on (4b) performance capacity and (5b) positive affect via break experiences. None of the break experiences were related to afternoon performance capacity or positive affect, so I could not test for mediating effects from naturalness onto these afternoon outcomes. Hypotheses 4a-b and 5a-b were not supported. Some Level 1 and Level 2 control variables did significantly predict afternoon outcomes: trait positive affect ($b$ = .21, $p$ < .001), negative affect ($b$ = -.18, $p$ < .05) morning performance capacity ($b$ =.10, $p$ <.05) were related to afternoon performance capacity, and trait positive affect ($b$ =.30, $p$ < .001), negative affect ($b$ = -.24, $p$ < .05), and morning positive affect ($b$ = .13, $p$ < .01) were related to afternoon positive affect.

To test my hypotheses involving engagement and burnout, I conducted single-level linear path modeling. Engagement and burnout were each measured at the end of the study period, so were not nested measurements within individuals (Level 1) and were instead Level 2, or between-person, variables (see Figure 3). I therefore regressed engagement or burnout onto aggregated daily measures of my hypothesized predictors of engagement or burnout, so all variables were at the same between-persons level. I included job demands and trait positive and negative affect as between-person control variables as in prior models, but excluded connection to nature because it was not a theoretically relevant correlate with job engagement or burnout.

Hypothesis 6 predicted daily post-break recovery levels (aggregated to the study level) would positively relate to work engagement at the end of the second week. I found support for Hypothesis 6, as post-break recovery significantly predicted work engagement ($b = .28$, $p < .01$), above and beyond Level 2 controls and baseline engagement levels. I regressed engagement onto performance capacity to test Hypothesis 7. Performance capacity was not significantly related to engagement, so Hypothesis 7 was not supported ($b = .16$, $p = .29$). Hypothesis 8 purported employees' afternoon positive affect would predict engagement measured at the end of the second week, and this hypothesis was supported ($b = .42$, $p < .01$). So, the hypothesized relationships between employees' work engagement and average post-break recovery state and average afternoon positive affect received support, while average afternoon performance capacity and engagement did not. Baseline engagement was a statistically significant predictor of engagement across models, and trait positive affect was significantly related to engagement in the performance capacity—engagement model.

The rest of my hypotheses involved relationships with burnout measured at the end of week two of the study. Hypothesis 9a purported aggregated post-break recovery state would be negatively related to burnout, and Hypothesis 9b proposed break recovery experiences would indirectly relate to burnout via recovery state. Post-break recovery state did significantly relate to burnout ($b = -.35$, $p < .01$), over and above Level 2 controls, lending support to Hypothesis 9a. I added the break recovery experiences as additional predictors to the recovery state—burnout model, but none were significant, while break recovery remained a significant predictor ($b = -.57$, $p < .001$), therefore refuting the notion that there would be a proposed mediating effect, as stated in

Hypothesis 9b. Further, aggregate post-break strain levels did not significantly predict burnout ($b$ = .23, p = .07), so Hypothesis 10 was not supported. Baseline burnout level was the only control variable significantly related to burnout across all models.

**Exploratory Research Questions**

I posed research questions about the role of positive work reflection, negative work reflection, and problem-solving pondering during breaks and in relation to recovery outcomes. I tested whether break naturalness predicted each experience during breaks, and then whether the experiences were significant predictors of post-break strain and recovery and afternoon performance capacity and positive affect, when predicted in full models with psychological detachment, relaxation, and enjoyment. Break naturalness did not significantly predict positive work reflection, negative work reflection, or problem-solving pondering. When running full models with psychological detachment, relaxation, and enjoyment (and work reflection and pondering) predicting post-break and afternoon outcomes, models would not converge. This issue of nonconvergence is likely due to the model being overparametrized, with a complex random effects structure that cannot properly fit the data (Bates et al., 2015) (each break experience and morning recovery/strain were all included in the random effects structure, i.e., their intercepts were allowed to vary). I therefore took a piecemeal approach to simplifying the random effects structure, first removing psychological detachment, after which the models converged. Only negative work reflection was related to post-break strain (b = .12, p < .05). Neither positive or negative or work reflection nor problem-solving pondering were related to afternoon performance capacity or positive affect.

# CHAPTER 4: DISCUSSION

In the current study, I sought to explore the *when*, *where*, and *how* of recovery from work stress—specifically, recovery during work breaks in natural environments over a two-week period. To that end, this study adds to our understanding of how the naturalness of work break environments contributes to work stress recovery and wellbeing outcomes using a within-persons approach. Taken together, this study's findings illustrate that the level of break environment naturalness affects employees' experiences during their breaks and recovery outcomes right after breaks. The more natural the environments in which employees spent their work breaks, the more relaxation and enjoyment they reported experiencing, which in turn increased how recovered they felt and decreased their strain right after their breaks. In addition to the indirect effects break environment naturalness had on recovery state and strain via relaxation and enjoyment, naturalness also has a direct positive effect on post-break recovery state. While findings from this study suggest break environment naturalness has positive short-term effects post-break, break experiences did not predict day-level afternoon performance capacity or positive affect. Overall, the naturalness of work break environments plays a role in successful recovery, particularly through the relaxation and enjoyment natural environments elicit.

The study results also illuminate the between-persons relationships between employees' recovery outcomes and work engagement and burnout. Participants who experienced, on average, more recovery after their breaks across both weeks or higher performance capacity in the afternoon across both weeks were more likely to experience higher work engagement by the end of their second week of taking breaks. Additionally,

average post-break recovery state predicted lower levels of burnout, and post-break strain predicted higher levels of burnout at the end of the two weeks. These findings underscore the importance of recovering from work, even during short breaks during the day, on longer-spanning work-related wellbeing.

## Theoretical Implications

### *Mechanisms to Recovery*

The current study contributes to the literature in various ways. First, it answers a recent call to identify the underlying processes or mechanisms that make recovery during work breaks successful (Sonnentag et al., 2022). I examined affective mechanisms (relaxation, enjoyment) and cognitive mechanisms (psychological detachment, positive work reflection, and problem-solving pondering) to recovery. I found that relaxation and enjoyment are key mechanisms through which recovery occurs during breaks while at work. These findings support the E-R model (Meijman & Mulder, 1998), which suggests that taking a break from effort in response to a stressor allows our stress responses to recuperate and our strain levels to return to baseline. Work breaks represent pausing one's effort at work, and the significant relationship between relaxation and enjoyment experienced during breaks and post-break strain (above and beyond any morning strain) provides support for the notion that internal stress systems and resources have been able to successfully restore.

Additionally, the evidence from this study deviates from the oft-cited and support stressor-detachment model (Sonnentag, 2010), which proposes psychological detachment as mediator in the stress—recovery relationship. In this study, psychological detachment was not a significant predictor of post-break strain, and was the weakest predictor of

post-break recovery state in comparison to relaxation and enjoyment. Participants also reported less psychological detachment, on average, than relaxation or enjoyment during breaks. Participants were instructed to take 15-minute work breaks; it may be that work breaks do not provide sufficient time to fully detach from work, so while an important mechanism for recovery during evenings, weekends, and vacations (e.g., Sonnentag et al., 2022), psychological detachment may not be the primary recovery mechanisms during the workday. Relaxation and enjoyment are positively valanced experiences and are more related to affective experiences than psychological detachment, which is simply a lack of work-related thoughts. Work breaks are short pauses accounting for just a small fraction of a full workday, and perhaps relaxation and enjoyment are more easily achieved affective responses in short amounts of time than psychological detachment, and therefore the most impactful during breaks.

Further, I incorporated additional experiences during breaks as potential recovery mechanisms, in an attempt to capture experiences beyond the ones included in most all studies of work recovery (i.e., psychological detachment, relaxation, mastery, and control). I excluded mastery and control from the current study, because 1) they are not theoretically related to environment naturalness, 2) mastery has been excluded from prior studies of work breaks under the notion that work breaks are likely too short to fully engage in mastery of new skills or learning (e.g., Bosch et al., 2017). Instead, I added, as exploratory research questions, positive work reflection and problem-solving pondering as potential mechanisms to recovery during work breaks because a main focus of the current study was on naturalness of the break environment. I thought more highly natural break environments may make it more likely that participants would positively reflect on

their job or ponder work problems, based on ART's notion that natural environments allow for deeper reflection. But naturalness was not related to either experience, and problem-solving pondering was actually negatively related to post-break recovery and strain, as well as afternoon positive affect. This suggests that thinking through work-related problems, even if not necessarily negatively, may not be beneficial for recovering. Additionally, participants reported less work reflection and problem-solving pondering, on average, than psychological detachment, relaxation, and enjoyment. This is perhaps not surprising because I instructed participants to be present and detach during their breaks, so they were not explicitly thinking about work. Or it is possible that participants do not want to spend their short amount of time away from work spending more time thinking about it. While natural environments theoretically might elicit deeper reflection, it may be the case that longer times spent in nature or more time away from a stressor are needed, or that any reflection is more likely on another subject—more personal instead of work-related, or more external beyond oneself or role.

The nonsignificant findings between break experiences and afternoon performance capacity and affect were surprising. Interestingly, the patterns of relationship between some of the recovery experiences differ across within- and between-person correlations (see Table 4). The person-centered correlational results show significant positive relationships between break environment relaxation and enjoyment with afternoon performance capacity and positive affect. However, at the aggregate, between-person level, enjoyment and performance capacity are no longer significantly related.

Various between-persons job characteristics or individual differences may influence whether any improvements in recovery or strain post-break linger or dissipate more quickly, or how likely one is to experience performance capacity or affective benefits later in the afternoon following a relatively short break. For example, job characteristics like time pressure, poor social interactions, emotional labor or individual variables like sleep quality and trait affect could all affect the break—recovery—outcome relationships. Indeed, in the current study, job demands and trait negative affect were positively related to post-break strain, and negatively related to recovery and afternoon performance capacity and positive affect (between-persons). Trait positive affect was also related to strain, performance capacity, and afternoon state positive affect. These findings suggest that individuals' stable affective dispositions influence how they experience recovery outcomes—those who are already higher in trait positive affect are more likely to experience higher state positive affect at the within-person, day level, while individuals higher in trait negative affect are less likely to experience such positive affective states. Additionally, individuals with higher job demands at their baseline level are less likely to experience as much recovery from breaks, indicating that between-persons factors like workload influences the extent to which individuals benefit (or not) from their work breaks.

***Environment Naturalness and Recovery***

Another aim of the current study was to fill a gap in the recovery literature around how recovery unfolds in different environments. This study was one of the first to include an examination of the relationship between degree of environment naturalness and work stress recovery. Existing recovery studies largely focus on the nonwork time (e.g.,

evenings, weekends) and the activities or experiences, while ignoring the actual physical environment or context in which recovery happens. While previous studies have incorporated activities in nature in specific fixed environments (e.g., park walking vs. indoor office relaxation exercises; Sianoja et al., 2018), participants in the current study experienced breaks in a variety of settings across a variety of levels of perceived naturalness. This allowed me to discover that how natural we perceive an environment to be actually has an effect on our workdays and how successful work breaks can be for recovery—through relaxation and enjoyment and directly on recovery itself. The higher the naturalness, the better the recovery experiences of relaxation and enjoyment.

These results around the role of environment naturalness in recovery offer mixed support for the mechanisms purported by environmental psychologists. SRT (Ulrich, 1991) proposes that seeing natural elements promotes positive affect or emotions (i.e., affective pathways to recovery), which then buffer against detrimental effects of psychophysiological effects (e.g., strain). In the current study, break naturalness had an indirect negative effect on strain via break enjoyment (my proposed affective recovery mechanism), which directly supports the affective restoration claims of SRT.

Instead of an affective pathway to recovery, ART (Kaplan, 1993) purports a cognitive pathway to recovery, such that recovery occurs when one's exhausted directed attention is allowed to rest (and indirect attention is captured by restorative qualities of nature). While I did not incorporate a measure of directed attention itself, psychological detachment is the closest proxy for directed attention at rest, and afternoon performance capacity (energy, motivation, and concentration; controlling for morning performance capacity) can approximate the restoration of directed attention. In terms of the current

study, ART might suggest that natural environments should allow directed attention toward work to rest by not thinking about work (i.e., psychological detachment), and a prediction of performance capacity via psychological detachment would provide support for this proposition. But naturalness did not predict psychological detachment during breaks, and psychological detachment did not predict afternoon performance capacity, therefore not offering support for ART using these approximated conceptualizations of directed attention. However, prior studies testing ART conceptualization and test a more immediate cognitive effect of nature, and use more objective measures of directed attention immediately before and after nature exposure (e.g., Berman et al., 2009; Schertz & Berman, 2019). I may not have found longer-term effects of work break naturalness on performance capacity measured later in the afternoon if any benefits of nature exposure do not carry over into employees' self-perceived performance capacity later in the workday. Regardless, findings from the current study seem to favor the affective recovery pathways of natural environments purported by SRT (Ulrich, 1991).

Beyond the cognitive or affective recovery pathways nature may facilitate, future research should further investigate potential dose-response relationships between natural environments and work recovery. Nature dose can be measured by three components: intensity of exposure, frequency of exposure, and duration of exposure (Shanahan et a., 2015). Outside of the work context, previous work has found dose relationships between nature and psychological and physical health benefits in terms of amount of time spent exercising in green environments (Barton & Pretty, 2010), number of bird and plant species in an area (Dallimer et al., 2012, Fuller et al., 2007), and tree cover density (Jiang et al., 2016). In the context of recovery during the workday, there may be important dose

relationships between the richness or diversity of outdoor environments accessible to employees (intensity), how frequently employees experience natural environments during work (frequency), and the amount of time spent in natural environments (duration). The current study is an initial exploration of the intensity of nature of exposure, though on a natural vs. manmade spectrum as opposed to quantified biodiversity. Potentially, more intense or longer contact with nature during breaks could have longer-lasting benefits than found in the current study. Future research could include more measures of the intensity, frequency, and duration of contact with nature at work (or after work) and how they relate to wellbeing outcomes. Additionally, different types of work or job characteristics may moderate relationships between nature dose and wellbeing. For example, workers without any natural views from their immediate workspace may benefit more from taking breaks in rich or diverse natural environments or more frequent outdoor breaks in general than workers with natural views from their workspace. Examining different aspects of nature dose at work would make meaningful theoretical and practical contributions to understanding work recovery and employee wellbeing generally.

### *Theoretical Clarity and Comprehensiveness*

Finally, I sought to highlight the similarities across theories of recovery from both OHP and environmental psychology. Environmental psychology theories of restoration are similar to OHP theories of recovery, the two disciplines just view the process from different perspectives—OHP within the work context, environmental psychology from the natural environment context. But both sets of theories agree that humans have internal, personal resources that, if depleted, must be recovered for optimal functioning. The E-R model (Meijman & Mulder, 1998) posits that breaks from effortful tasks allow

for resources to replenish and recovery to occur, and the Stressor-Detachment Model says psychologically detaching from work is beneficial for recovery; ART (Kaplan, 1993) argues that breaks or detachment from directed attention allows this type of attentional resource to recover. Broaden-and-build theory of positive emotions (Fredrickson, 2001) states that positive emotions facilitate approach behaviors, and positive emotions beget more positive thoughts and outcomes; SRT (Ulrich, 1991) posits that natural elements elicit approach behaviors and positive emotions, which reduce psychophysiological stress.

In addition to theoretical overlap, outside of the current study, there is a larger body of evidence supporting the restorative benefits of natural environments. There is room for nuance to be incorporated into OHP theories of recovery to include the ways in which physical environments, particularly natural environments, can add employees' recovery from work stress. By incorporating findings and theorizing from environmental psychology, researchers can create a more comprehensive understanding of work stress recovery, to continue to empirically examine not just what individuals do, but where they do it that enhances their wellbeing. For example, we know that the activities and experiences during the evenings and on weekends is important for wellbeing, but perhaps engaging in those activities outdoors in natural environments is even more beneficial. Additionally, during the workday, workers are already limited in the time they can take to recover when their resource become depleted. As the current study suggests, spending their limited time away from work during breaks in more natural environments may be one way for employees to experience as much recovery as they can. Perhaps even short

doses of these types of environments are beneficial to employees when they are not able to break from work for extended periods of time.

**Practical Implications**

The current study offers some practical implications for employees and organizations to consider in terms of employee wellbeing. As employees become depleted during the workday, taking breaks is their primary way of recovering and returning to work with refreshed resources. Current findings suggest that taking these breaks in more natural environments can be especially beneficial for employees in terms of feeling recovered and less strained upon their return to work. And across persons in the study, feeling recovered and less strained after was related to higher performance capacity and positive affect in the afternoon. On average (between-persons; predictors aggregated to study-level), feeling like one has the capacity to perform at work and experiencing positive affect in the afternoon was also relatively highly related to engagement and burnout levels at the end of the study period (two weeks). Taking these findings together, it would behoove organizations and managers to encourage employees to take breaks at work, so they can return to work for the better.

Even better, organizations could ensure employees have access to natural outdoor spaces for breaks. Technology and other large companies have appeared to realize the benefits to current employees and attractiveness to potential future employees of offering access to nature and opportunities for contact with nature at work (Klotz & Bolino, 2021). Other organizations should consider investing in providing outdoor natural spaces on their campuses or offices. Buildings can also be made more natural by incorporating natural elements and principles of biophilic design (e.g., Sanchel et al., 2018).

Individually, employees should also make concerted efforts to actually take breaks during their workday. Current findings suggest they might experience even more benefit if they take those breaks, even if just 15 minutes, in as natural an environment as they can. In doing so, employees are more likely to feel relaxed and enjoy their breaks, and return to work feeling more recovered and less stressed and tense. On average, the more relaxation and enjoyment employees experience during their breaks, the higher capacity to perform and higher positive affect they will enjoy, thereby benefiting their work-related and person wellbeing.

**Limitations and Future Research**

The present study is not without limitations. First, I hypothesized a mediated model, which implies causal relationships between study variables. However, the design of my study was quasi-experimental and the initial randomization of break environment order did not work, so I cannot rule out other explanations for the relationships between the study variables. Even if participants strictly adhered to spending their work breaks in their assigned environment type each week, their break environments would still vary given this was not a laboratory experiment and I could not control for environmental or any other potentially related variables. Future research should use experimental designs to explore the study relationships and provide stronger evidence for causal inferences for the relationships examined in the current study.

I originally planned to quasi-experimentally manipulate the environments in which participants spent their work breaks each week. Participants were instructed to spend one week of breaks in outdoor natural environments, and the other week indoors away from their desk (condition order counter-balanced). However, the type of

environment they were instructed to spend their breaks in did not align with their actual environment for a substantial portion of the sample, so I could not use their randomly assigned condition as a grouping variable. Compliance is an inevitable issue across any ESM study involving real-world employees as opposed to research participants in a controlled lab setting. Future studies could take steps to standardize the break environment or reduce potential conflating variables throughout an intervention study. For example, an employee sample from one office or location with designated outdoor break area(s) would provide more uniformity in terms of the break environments experienced by participants. Future research could also use even more controlled environments for participants to take breaks in, where naturalness level could be manipulated and controlled to vary across levels of naturalness. Experimental studies, though lacking in the ecological generalizability using real-world employees as participants offers, would offer more control in the variables and experiences and allow for more direct testing of the effect of varying levels of environment naturalness.

The study sample was also not particularly diverse, so generalizability of results may be a concern. Participants were salaried employees from one organization, and were mostly white, female, over 40, and well-educated. This is not outside of the norm as recovery research thus far has largely used samples of professionals, administrative workers, and other white-collar jobs with relatively low physical job demands (Sonnenntag et al., 2022). The lack of research on recovery across other occupational groups is a critical gap in the literature that future research should address. For example, shiftwork jobs or other highly physically demanding jobs or cognitively demanding jobs in which safety is a concern (e.g., air-traffic controllers) likely need to be recovered the

most to safely and effectively work, and potentially face the most detrimental effects of inadequate recovery at work (Sonnentag et al., 2022). Job types and characteristics may also differ in terms of employees' break experiences. For example, workers who experience high levels of time pressure may be less likely to fully detach or relax during their breaks, while more physical or less knowledge-based workers may be more likely to do so. The activities, experiences, and environments that promote recovery for different types of workers is an important area ripe for future research exploration.

The current study may be limited by measurement issues. Given the diary design of the study, I used mainly single-item measures for the daily surveys. Single-item measures can be sufficient for capturing discrete or narrow constructs and ask a participant about their current or very recent experience (Fisher & To, 2012), which the daily survey measures did. Single-item measures should also have face validity, content validity, and correlate with other measures as expected (suggesting construct validity), which I did gather evidence for in the pilot study and the main study's correlational results support. However, an issue with single-item measures is they may not always fully capture each construct. One such construct I believe could be an issue in the current study in regard to content validity is recovery state. Sonnentag's (2003) original three-item measurement of recovery state asked respondents if they 1) feel recovered, 2) feel relaxed, and 3) are in a good mood. In the daily surveys, the current study used only the item asking if respondents feel recovered. Respondents' interpretations of "feeling recovered" may vary and may not necessarily include their feeling of being relaxed or in a good mood. One suggestion for future research would be to present a short definition of

recovery to respondents ahead of the single item, or use the three items to capture recovery state.

Another suggested practice for using single-item measures is to include more response options (e.g., 7-point Likert-type scales instead of 5-point). In the daily surveys, I only used a 7-point Likert-type scale for the naturalness rating item, the other daily measures were on 5-point Likert-type scales. Providing more response options on a single item allows for more distinction and variation between respondents, similar, theoretically, to how including more items captures more information across a construct and allows for more detailed distinctions (Dawes, 2008). I used the scales' original response options, but researchers could consider using a larger number of response options to increase variance (Fisher & To, 2012).

Common method variance (CMV), or systematic error variance due to the measurement method (Conway & Lance, 2010), and the associated potential for common method bias (CMB; Podsakoff et al., 2003) are concerns. To avoid issues associated with CMB, best practices include separating measures predictor and outcome variables in time, using different rating sources, and randomizing the order of survey items. In the current study, the break naturalness, experiences, and post-break recovery and strain were all measured in the same post-break survey. Ideally, any CMV introduced by measured these three sets of variables together would be mitigated by be measuring them separately across time, or using other sources to measure naturalness. I did take steps to limit concerns of CMV, such as temporally separating sets of predictors and outcomes (i.e., recovery, strain, performance capacity, and positive affect all measured in the morning, recovery state and strain post-break, and performance capacity and positive affect in the

afternoon), controlling for morning levels of outcome variables, randomizing the order of survey items within scales, and using different response scales for break naturalness than experiences and outcomes (Jakobsen & Jensen, 2015; Podsakoff et al., 2012).

The reliance on self-report measures is also a potential concern for CMB. These types of measures make it difficult to distinguish the effect of study variables on participant perception versus actual outcomes (Sonnentag et al., 2017). Though, in the current study I was interested in individuals' personal experiences and outcomes, which can only be assessed via their own reports. And regarding CMB, person-mean centering the Level 1 variables addresses largely addresses this concern. Between-person are often identified as potential sources of CMB (Podsakoff et al., 2003), but when predictors are centered within each person, their mean on the predictor is zero and therefore there is no between-persons variance. All between-persons differences are effectively accounted for because they cannot correlate with person-mean centered predictors (Gabriel et al., 2019). In addition to addressing concerns of potential between-persons sources of CMB, I also made efforts to address concerns over state-based sources of CMB by controlling for morning state affect (and morning levels of all post-break and afternoon outcome variables) (Podsakoff et al., 2012). Nevertheless, future studies should consider using more objective measures of psychophysiological recovery (e.g., blood pressure, cortisol levels), environment naturalness, or multiple measurement sources (e.g., coworker ratings).

Regarding the environment naturalness rating, I attempted to provide some reference for what "naturalness" meant. The directions sent to participants during the week they were assigned to spend their breaks in an outdoor natural environment read,

"'Natural environment' can mean anywhere with as many natural elements (e.g., trees, greenery, water) you can access." The naturalness rating item also included some detail: "How **natural** (i.e., containing natural elements such as trees, plants, water; limited manmade, built structures and human interference) would you rate the **physical environment** in which you spent your most recent work break?" and response options ranged from "completely manmade" to "completely natural." Still, individuals were bound to vary in their perceptions of their environments and naturalness.

An additional measurement-related limitation of the current study includes using engagement and burnout measured at the end of the second week only. I originally planned to include the engagement and burnout measures in the Friday surveys across both data collection waves, but mistakenly did not include the measures in the first week of the first wave. This meant I could include the first week of engagement and burnout measures from the second wave when combining the two datasets, and subsequently limiting my ability to measure within-persons differences across the two weeks. The engagement and burnout measures refer respondents to the last week when responding to each item, so the measures of engagement and burnout I have are only representative of each wave's second week of participation. Although in the analyses relating the day-level variables to engagement and burnout, day-level variables were aggregated across both weeks anyway, so the predictors were ultimately between-persons and reflective of both weeks of data combined at the person level.

**Conclusion**

The current study used a within-persons, diary design approach to investigate the role of natural work break environments in work stress recovery. This study incorporated

break environment naturalness as a potential variable in predicting break recovery experiences and outcomes. The study also incorporated positive work reflection and problem-solving pondering as potential recovery mechanisms via environment naturalness. Findings suggest that break environment naturalness is related to break relaxation and enjoyment, and this relationship has an indirect effect on post-break recovery state and strain. Positive work reflection and problem-solving pondering were not found to be mechanisms to recovery as relaxation and enjoyment were. At the between-person level, post-break recovery state and strain and afternoon performance capacity and positive affect were significantly related to week-level work engagement burnout. These findings highlight the role of relaxation and enjoyment in the relationship between break environment naturalness and recovery, and the between-person aggregate benefits of recovery outcomes on work engagement and burnout.

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*Table 1.* Overview of Theories of Recovery: Central Tenets, Mechanisms, and Outcomes

| **Theory** | **Central Tenet(s)** | **Recovery Pathways/Mechanisms** (General/Affective/Cognitive) | **Recovery Outcomes** |
|---|---|---|---|
| Conservation of Resources (COR) Theory | People try to obtain, retain, build, and protect resources valuable to them. | **General:**<br>• Work breaks provide opportunities to recover and build personal resources | Day-level:<br>• State of being recovered<br>• Strain<br>• Performance capacity<br>• Affect<br>Week-level:<br>• Burnout<br>• Engagement |
| Effort-Recovery (E-R) Model | Expending effort at work leads to psychophysiological load reactions, which deplete energy resources. Temporarily removing work demands allows resource recovery to occur. | **General:**<br>• Work breaks remove work demands and therefore allow recovery to occur<br>**Affective and Cognitive:**<br>• Psychological detachment<br>• Relaxation<br>• Control<br>• Enjoyment | Day-level:<br>• State of being recovered<br>• Strain<br>• Performance capacity<br>• Affect<br>Week-level:<br>• N/A |
| Broaden and Build Theory | Discrete positive emotions can broaden people's momentary thoughts and behaviors and build their personal resources (e.g., help direct attention and effort, improve attitudes and personal wellbeing) | **Affective and Cognitive:**<br>• Enjoyment<br>• Relaxation<br>• Control<br>• Positive work reflection<br>• Problem-solving pondering | Day-level:<br>• Performance capacity<br>• Affect<br>Week-level:<br>• Engagement |
| Stress Reduction Theory (SRT) | Humans are predisposed to display positive affect or emotions in response to environments with natural and vegetative elements, because they signal resources and thus safety and health. | **Affective:**<br>• Enjoyment | Day-level:<br>• State of being recovered<br>• Strain<br>• Affect<br>Week-level:<br>• N/A |

| | | | |
|---|---|---|---|
| | The positive affect resulting from exposure to natural elements can buffer against negative effects of psychophysiological stress. | | |
| Attention Restoration Theory (ART) | Directed attention is a limited resource, and exhausting it leads to mental fatigue. When voluntary directed attention is allowed to rest, restoration (recovery) can occur. Natural environments have restorative qualities that facilitate restoration by allowing directed attention to rest. | **Cognitive:**<br>• Psychological detachment<br>• Positive work reflection<br>• Problem-solving pondering | Day-level:<br>• State of being recovered<br>• Performance capacity<br>Week-level:<br>• N/A |

*Table 2.* Pilot Study Scale Reliabilities

| | # items | N | Cronbach's alpha |
|---|---|---|---|
| Trait PA | 10 | 199 | 0.93 |
| Trait NA | 10 | 200 | 0.90 |
| QWI | 5 | 200 | 0.85 |
| Job Control | 3 | 200 | 0.95 |
| Trait Connection to Nature | 5 | 201 | 0.91 |
| PRS | 11 | 198 | 0.87 |
| REQ | 12 | 198 | 0.88 |
| Psychological Detachment (REQ) | 4 | 199 | 0.80 |
| Relaxation (REQ) | 4 | 199 | 0.88 |
| Control (REQ) | 4 | 199 | 0.75 |
| State of Recovery | 3 | 198 | 0.86 |
| Performance Capacity | 3 | 198 | 0.87 |
| State PA | 4 | 199 | 0.81 |
| State NA | 4 | 198 | 0.82 |
| Vigor (Engagement) | 3 | 198 | 0.89 |
| Dedication (Engagement) | 3 | 199 | 0.89 |
| Absorption (Engagement) | 3 | 199 | 0.79 |
| Emotional & physical exhaustion (Burnout) | 3 | 199 | 0.88 |
| Cognitive weariness (Burnout) | 3 | 199 | 0.85 |

*Note:* PA = positive affect, NA = negative affect, QWI = Quantitative Workload Inventory, PRS = Perceived Restorativeness Scale, REQ = Recovery Experience Questionnaire

*Table 3.* Pilot Study Confirmatory Factor Analysis Results

| Variable | # of Items | Model | *N* | CFI | TLI | $\chi^2$ | *df* | Difference | RMSEA |
|---|---|---|---|---|---|---|---|---|---|
| Trait Affect | 20 | One-factor (all PANAS items) | 195 | .493 | .433 | 1468.70*** | 170 | | .198 |
| Trait Affect (Positive and Negative) | 20 | Two-factor (Factor 1 = PA Factor 2 = NA) | 195 | .799 | .774 | 683.37*** | 169 | 785.34*** | .125 |
| Break Recovery Experiences | 12 | One-factor | 194 | .756 | .702 | 319.87*** | 54 | | .159 |
| Break Recovery Experiences | 12 | Three-factor (Factor 1 = Psych. Detach. Factor 2 = Relaxation Factor 3 = Control) | 194 | .930 | .909 | 127.82*** | 51 | 192.05*** | .088 |
| Work Reflection & Pondering | 8 | One-factor (all work reflection and problem-solving pondering items) | 198 | .550 | .370 | 415.50*** | 20 | | .316 |
| Work Reflection & Pondering | 8 | Three-factor (Factor 1 = positive work reflection Factor 2 = negative work reflection Factor 3 = problem-solving pondering) | 198 | .981 | .968 | 33.82** | 17 | 337.00*** | .071 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| State Affect | 8 | One-factor (all affect items) | 197 | .782 | .695 | 162.59*** | 20 | | .190 |
| State Affect (Positive and Negative) | 8 | Two-factor (Factor 1 = PA Factor 2 = NA) | 197 | .918 | .879 | 73.03*** | 19 | 89.56*** | .120 |
| Work Engagement | 9 | One-factor (all UWES-9 items) | 195 | .970 | .960 | 70.06*** | 27 | | .090 |
| Work Engagement | 9 | Three-factor (Factor 1 = vigor Factor 2 = dedication Factor 3 = absorption) | 195 | .973 | .959 | 63.12*** | 24 | 6.95 | .091 |
| Burnout | 6 | One-factor (all SMBM-6 items) | 196 | .836 | .727 | 122.80*** | 9 | | .254 |
| Burnout | 6 | Two-factor (Factor 1 = emotional & physical exhaustion Factor 2 = cognitive weariness) | 196 | .998 | .996 | 9.471 | 8 | 113.33*** | .031 |

*Note*: ***$p < .001$. Difference reflects the change in chi-square from a one-factor model to a two- or three-factor model for each measure. Each shaded block reflects the model with the expected number of factors for each scale based on previous literature.

*Table 4.* Means, Standard Deviations, and Intercorrelations of Study Variables

| **Level 1 Variables** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Morning Survey* | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Perf. Cap. | -- | .73*** | -.53*** | .66*** | -.47*** | -.14 | .22* | .30** | .14 | .00 | -.34** | -.04 | .42*** | -.42*** | .39*** | .49*** | .61*** | -.34** | .16 | -.02 | .55*** | -.13 | .53*** | -.40*** |
| 2. PA | .47*** | -- | -.61*** | .78*** | -.61*** | .03 | .32** | .40*** | .17 | .16 | -.39*** | -.04 | .57*** | -.58*** | .53*** | .81*** | .56*** | -.44*** | .14 | -.21* | .59*** | -.29** | .55*** | -.51*** |
| 3. NA | -.49*** | -.43 | -- | -.47*** | .78*** | -.04 | -.33** | -.38*** | -.34** | .21** | .57*** | .36*** | -.36*** | .73*** | -.32** | -.47*** | -.34** | .32** | -.20 | .23* | -.36*** | .37*** | -.31** | .45*** |
| 4. Recovered | .44*** | .43*** | -.31*** | -- | -.44*** | -.12 | .27* | .30** | .06 | -.02 | -.29** | -.06 | .57*** | -.41*** | .31** | .53*** | .34** | -.39*** | .09 | -.22* | .39*** | -.22* | .28** | -.37*** |
| 5. Strain | -.26*** | -.38*** | .53*** | -.19*** | -- | .02 | -.48*** | -.44*** | -.25* | .07 | .56*** | .33** | -.44*** | .88*** | -.36*** | -.55*** | -.33** | .46*** | -.08 | .43*** | -.36*** | .49*** | -.33** | .55*** |
| *Break Survey* | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. Naturalness | .05 | .04 | -.04 | .13** | -.07 | -- | .08 | .11 | .09 | .10 | .03 | .05 | .01 | -.05 | .03 | .03 | -.09 | .14 | .06 | .03 | -.12 | -.05 | -.01 | .09 |
| 7. Psych. Det. | .03 | .02 | .02 | .00 | -.02 | .06 | -- | .50*** | .37*** | -.20 | -.54*** | -.52*** | .55*** | -.51*** | 0.17 | .35*** | .18 | -.23* | .09 | -.25* | .10 | -.44*** | .11 | -.33** |
| 8. Relaxation | .10* | .17*** | -.08 | .11* | -.11* | .14*** | .3*** | -- | .72*** | -0.11 | -.33** | -.34** | .54*** | -.56*** | .22* | .38*** | .21 | -.12 | -.05 | -.07 | .16 | -.10 | .12 | -.20 |
| 9. Enjoyment | .11** | .15*** | -.04 | .12** | -.14*** | .16*** | .32*** | .54*** | -- | -0.14 | -.37*** | -.42*** | .51*** | -.41*** | .13 | .24* | .22* | -0.13 | .04 | .01 | .05 | -03 | .04 | -.11 |
| 10. PWR | .01 | .03 | -.03 | .02 | .02 | .06 | -.22*** | -.03 | -.02 | -- | .36*** | .69*** | 0.09 | .06 | .13 | .28** | .18 | -.09 | .10 | -.12 | .19 | .00 | .23* | -.08 |
| 11. NWR | -.20*** | -.22*** | .11** | -.06 | .16*** | -.08* | -.40*** | -.28*** | -.34*** | .25*** | -- | .68*** | -.40*** | .66*** | -.34** | -.42*** | -.42*** | .42*** | -.05 | .34** | -.18 | .37*** | -.26* | .40*** |
| 12. PSP | -.11** | -.04 | .01 | .00 | .14** | -.03 | -.52*** | -.20*** | -.15*** | .45*** | .47*** | -- | -0.18 | .38*** | -.07 | -.03 | .00 | .11 | -.03 | .14 | .09 | .26* | .07 | .13 |
| 13. Recovered | .2*** | .11** | -.14** | .10* | -.11** | .12** | .20*** | .33*** | .38*** | -0.03 | -.20*** | -.18*** | -- | -.60*** | .49*** | .66*** | .40*** | -.53*** | .09 | -.32** | .29** | -.36*** | .28** | -.51*** |
| 14. Strain | -.14** | -.2*** | .15*** | -.09* | .27*** | -.09* | -.22*** | -.37*** | -.40*** | -0.04 | .25*** | .11** | -.33*** | -- | -.47*** | -.64*** | -.38*** | .54*** | -.12 | .46*** | -.32** | .49*** | -.33*** | .57*** |
| *Afternoon Survey* | | | | | | | | | | | | | | | | | | | | | | | | |
| 15. Perf. Cap. | .12** | .11** | -.07 | .07 | -.05 | .07 | .05 | .10* | .13** | -.01 | -.06 | -.03 | .19*** | -.13** | -- | .72*** | .42*** | -.54*** | .17 | -.31** | .34** | -.27** | .45*** | -.54*** |
| 16. PA | .10* | .17*** | -.05 | .02 | -.10* | -.04 | .08* | .10** | .14** | .00 | -.13** | -.09* | .17*** | -.17*** | .48*** | -- | .57*** | -.63*** | .19 | -.31** | .54*** | -.39*** | .51*** | -.64*** |
| **Level 2 Variables** | | | | | | | | | | | | | | | | | | | | | | | | |
| *Friday Week 2 Survey* | | | | | | | | | | | | | | | | | | | | | | | | |
| 17. Eng. | | | | | | | | | | | | | | | | | -- | -.50*** | .21 | -.09 | .64*** | -.16 | .77*** | -.49*** |
| 18. Burnout | | | | | | | | | | | | | | | | | | -- | -.15 | .40*** | -.37*** | .55*** | -.46*** | .78*** |
| *Baseline Survey* | | | | | | | | | | | | | | | | | | | | | | | | |
| 19. CNS | | | | | | | | | | | | | | | | | | | -- | .06 | .18 | -.11 | .00 | -.09 |
| 20. QWI | | | | | | | | | | | | | | | | | | | | -- | .08 | .49*** | -.07 | .47*** |
| 21 Trait PA | | | | | | | | | | | | | | | | | | | | | -- | -.04 | .69*** | -.53*** |
| 22. Trait NA | | | | | | | | | | | | | | | | | | | | | | -- | -.27* | .67*** |
| 23. Eng. | | | | | | | | | | | | | | | | | | | | | | | -- | -.58*** |
| 24. Burnout | | | | | | | | | | | | | | | | | | | | | | | | -- |
| *M* | 3.53 | 3.34 | 1.93 | 3.03 | 2.28 | 3.52 | 3.28 | 3.82 | 4.11 | 2.57 | 2.09 | 2.44 | 3.45 | 2.2 | 3.51 | 3.37 | 4.62 | 3.27 | 5.92 | 3.51 | 3.34 | 1.6 | 4.45 | 3.47 |
| *SD* | 0.54 | 0.52 | 0.52 | 0.67 | 0.82 | 1.41 | 0.75 | 0.59 | 0.46 | 0.76 | 0.73 | 0.75 | 0.65 | 0.74 | 0.48 | 0.49 | 0.82 | 1.02 | 1.56 | 0.71 | 1.2 | 0.85 | 0.87 | 1.07 |

*Note.* Perf. Cap. = performance capacity, PA = positive affect, NA = negative affect, Psych. Detach. = psychological detachment, PWR = positive work reflection, NWR = negative work reflection, PSP = problem-solving pondering, Eng. = Engagement, CNS = connection to nature, QWI = job demands. Level 1 $n$ = 568. Level 2 $n$ = 80. Correlations below the diagonal reflect within-person centered correlations; correlations above the diagonal reflect between-person correlations. Level 1(uncentered) variables were aggregated to Level 2 to calculate the correlations with Level 2 variables. * indicates $p < .05$. ** indicates $p < .01$. *** indicates $p < .001$.

*Table 5.* Relationships between Break Environment Naturalness on Break Recovery Experiences (Hypothesis 1)

| | Psych. Detachment | Relaxation | Enjoyment | Pos. Work Reflection | Problem Solving Pondering |
|---|---|---|---|---|---|
| (Intercept) | 4.23*** (.54) | 4.07*** (.44) | 3.97*** (.35) | 1.61* (.64) | 1.47* (.59) |
| Naturalness | .03 (.02) | .05** (.01) | .05*** (.01) | .00 (.01) | -.01 (.02) |
| CNS[a] | .02 (.07) | -.01 (.06) | .02 (.04) | .06 (.08) | -.02 (.07) |
| QWI[a] | -.05 (.07) | -.01 (.06) | -.00 (.04) | -.11 (.08) | .02 (.07) |
| Trait PA[a] | -.03 (.09) | .04 (.07) | .03 (.06) | .21* (.11) | .11 (.10) |
| Trait NA[a] | -.45** (.14) | -.15 (.11) | -.04 (.09) | .17 (.16) | .37* (.15) |

*Note.* NWR = Negative Work Reflection. CNS = Connection to Nature Scale. QWI = Qualitative Workload Inventory. PA = positive affect. NA = negative affect. Level 2 $N$ = 110. Level 1 $N$ = 769-770. Estimates are unstandardized. Standard errors are in parentheses. Naturalness predictor is person-mean centered, which removes between-person variation and provides a pure estimate of the within-person relationship. [a] = control variable; all control variables are person-level (Level 2) variables. * $p < .05$. ** $p < .01$. *** $p < .001$.

*Table 5*. Relationships between Break Recovery Experiences and Post-Break Recovery State and Strain (Hypotheses 2b and 2c)

| | Recovery State | Strain |
|---|---|---|
| (Intercept) | 3.68 (.49)*** | 1.80 (.50)*** |
| Psychological Detachment | .05 (.02)* | -.05 (.03) |
| Relaxation | .15 (.04)*** | -.09 (.04)* |
| Enjoyment | .24 (.05)*** | -.35 (.05)* |
| Positive Work Reflection | .06 (.04) | -.02 (.04) |
| Negative Work Reflection | -.02 (.04) | .12 (.05)* |
| Problem-Solving Pondering | -.06 (.03) | -.04 (.04) |
| AM Recovery State[a] | .04 (.03) | -- |
| AM Strain[a] | -- | .26 (.05)*** |
| QWI[a] | -.11 (.06) | .21 (.06)** |
| Trait PA[a] | .10 (.08) | -.25 (.08)** |
| Trait NA[a] | -.20 (.12) | .47 (.12)*** |

*Note.* QWI = Qualitative Workload Inventory. PA = positive affect. NA = negative affect. Level 2 $N$ = 110. Level 1 $N$ = 765-770. Estimates are unstandardized. Standard errors are in parentheses. Level 1 predictor variables were person-mean centered, which removes between-person variation and provides a pure estimate of the within-person relationship. [a] = control variable; all variables below the line are person-level (Level 2) variables. * $p < .05$. ** $p < .01$. *** $p < .001$.

*Table 6.* Relationships between Break Recovery Experiences and Afternoon Performance Capacity and Positive Affect (Hypotheses 4a and 5a)

| | Performance Capacity | Positive Affect |
|---|---|---|
| (Intercept) | 3.14 (.36)*** | 2.72 (.33)*** |
| Psychological Detachment | .03 (.03) | .03 (.02) |
| Relaxation | .07 (.05) | .02 (.03) |
| Enjoyment | .05 (.06) | .06 (.04) |
| Positive Work Reflection | .00 (.04) | .04 (.03) |
| Negative Work Reflection | -.05 (04) | -.05 (.03) |
| Problem-Solving Pondering | .02 (.04) | -.04 (.03) |
| AM Performance Capacity[a] | .10 (.04)* | -- |
| AM Positive Affect[a] | -- | .12 (.04)** |
| QWI[a] | -.09 (.05)* | -.09 (.03)* |
| Trait PA[a] | .21 (.09)*** | .31 (.05)*** |
| Trait NA[a] | -.17 (.09) | -.22 (.08)* |

*Note.* QWI = Qualitative Workload Inventory. PA = positive affect. NA = negative affect. Level 2 $N$ = 110. Level 1 $N$ = 740-770. Estimates are unstandardized. Standard errors are in parentheses. Level 1 predictor variables were person-mean centered, which removes between-person variation and provides a pure estimate of the within-person relationship. [a] = control variable; all variables below the line are person-level (Level 2) variables. * $p < .05$. ** $p < .01$. *** $p < .001$.

*Table 7.* Mediation Analysis for the Effect of Naturalness on Post-Break Recovery State and Strain through Break Recovery Experiences (Hypotheses 3c and 4c)

| | MX | YM | Direct Effect | Indirect Effects | Est 95% CI Lower | Est 95% CI Upper |
|---|---|---|---|---|---|---|
| **Recovery State** | | | | | | |
| Psychological Detachment | .03 | .05* | .00** | .00 | -.00 | .01 |
| Relaxation | .05*** | .15*** | .02* | .01*** | .00 | .04 |
| Enjoyment | .05*** | .24*** | .02* | .02*** | .01 | .02 |
| **Strain** | | | | | | |
| Relaxation | .05*** | -.09* | -.01 | -.02** | -.03 | -.01 |
| Enjoyment | .05*** | -.35*** | -.01 | -.02*** | -.03 | -.00 |

*Note.* Level 1 $N$ = 513-764; Est. MX = estimate of path break naturalness to mediators; YM = estimate of path from mediators to outcome measures. Connection to nature, job demands, and trait affect were included as controls (Level 2). Estimated Confidence Intervals computed from 1,000 Monte Carlo bootstrap samples. * $p$ <. 05, ** $p$ < .01, *** $p$ < .001.

*Figure 1.* Full Hypothesized Model

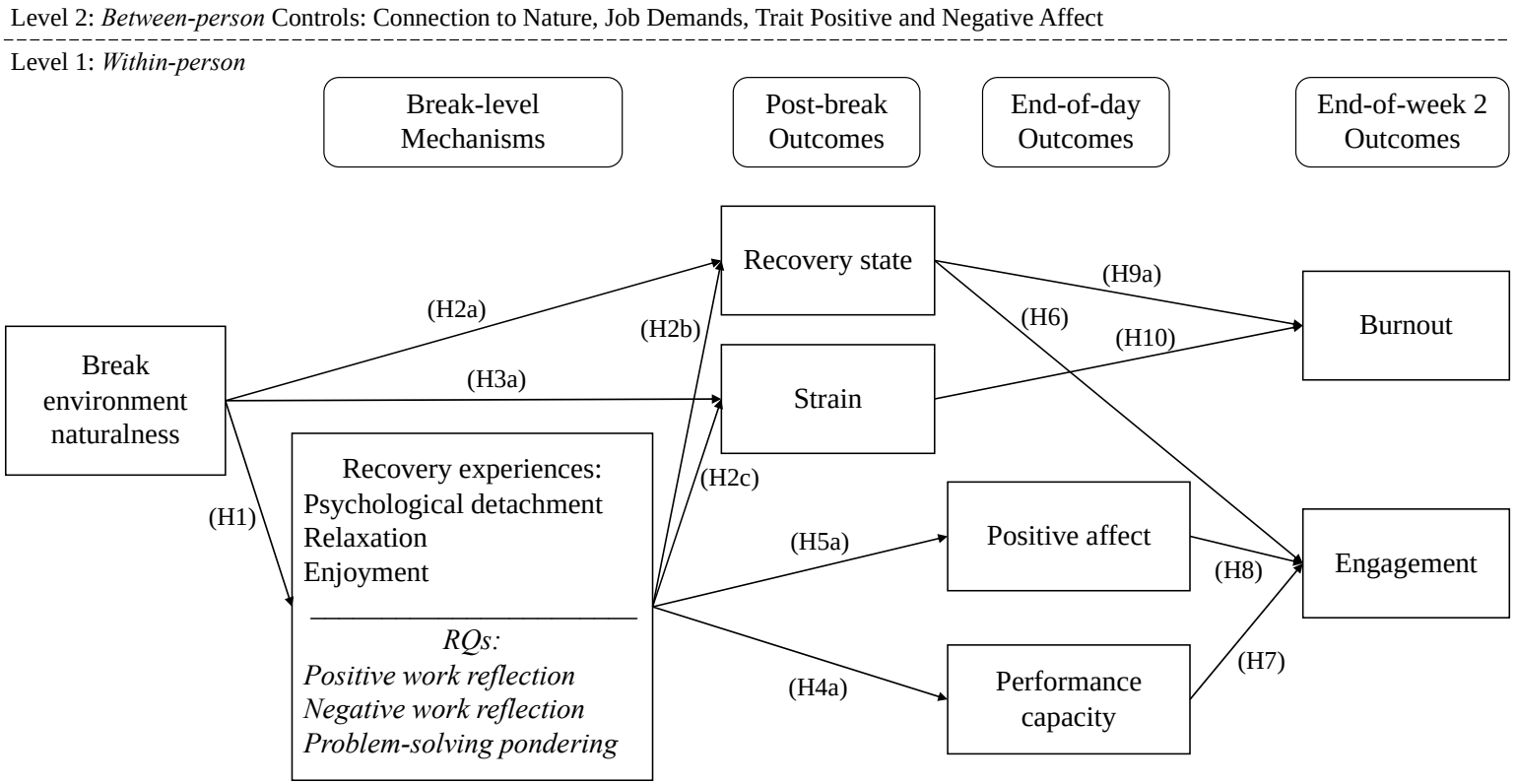
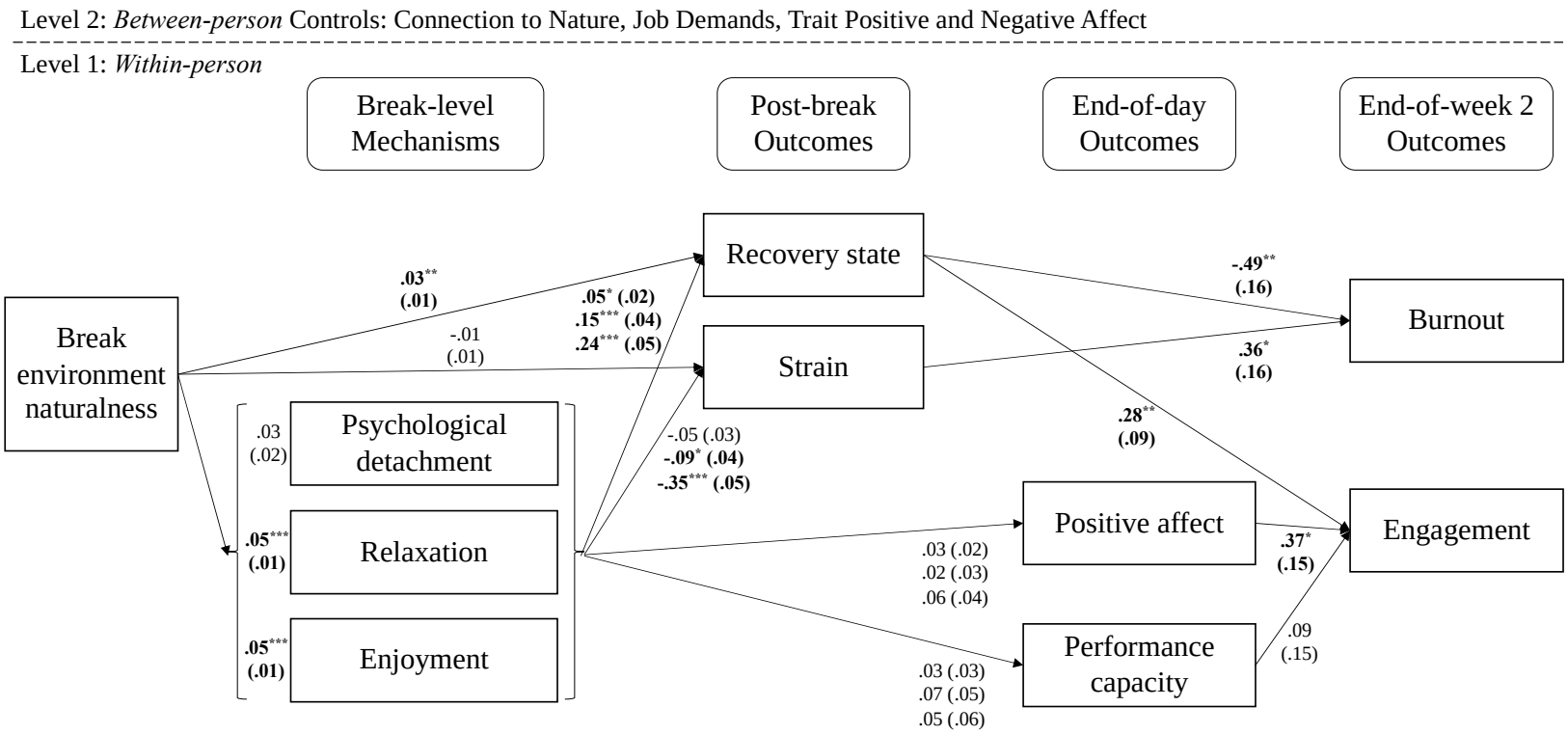


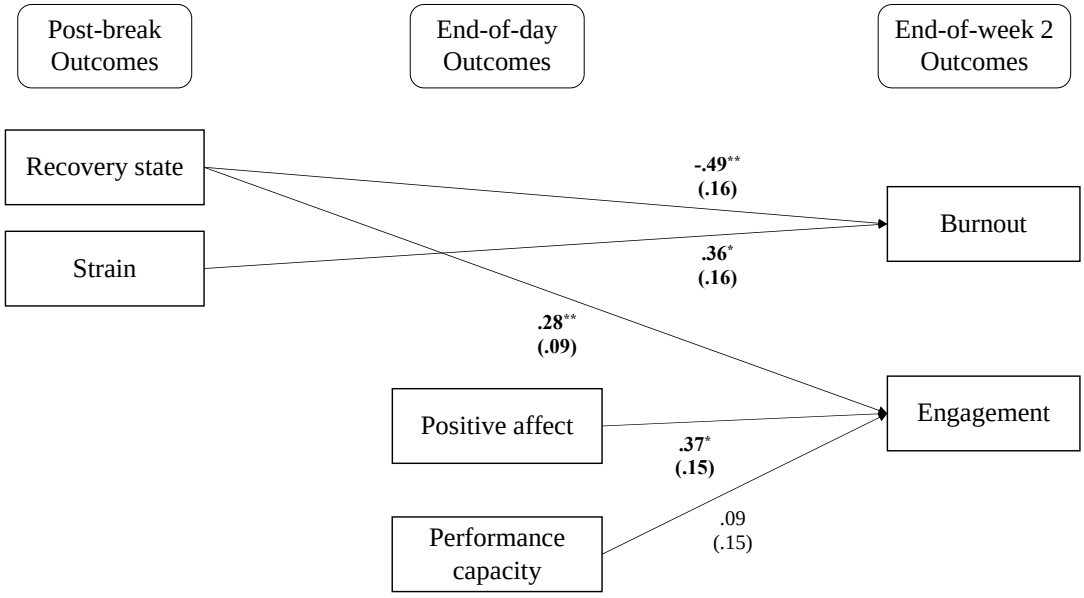
*Figure 2.* Results of Hypothesized Model




*Note.* Level 2 $N = 110$, Level 2 $N$ (engagement and burnout models only) = 74-79. Level 1 $N = 740$-770. Estimates are unstandardized. $^{*}$ $p < 05$, $^{**}$ $p < .01$, $^{***}$ $p < .001$. Level 1 predictor variables were person-mean centered, which removes between-person variation and provides a pure estimate of the within-person relationship. Level 2 controls listed were included as predictors of endogenous variables at the Level 1 level of analysis. At the Level 2 level of analysis (i.e., models predicting end-of-second week engagement and burnout),

job demands and trait affect were included as controls/predictors, while connection to nature was excluded because it was not theoretically relevant as a correlate of work engagement or burnout.

*Figure 3.* Results of Hypothesized Relationships with Engagement and Burnout




*Note.* $N = 79$. Post-break and end-of-day variables are aggregated across two weeks, so modeled relationships are all between-persons. Estimates are unstandardized. Standard errors are in parentheses. $^{*}$ $p < 05$, $^{**}$ $p < .01$, $^{***}$ $p < .001$

# APPENDIX A: PILOT STUDY SURVEY ITEMS

## Screening

Age

1. Are you at least 18 years old?
    - Yes (1)
    - No (2)
        - Screened out if selected

Full time

2. Are you a full-time employee (30+ hours per week)?
    - Yes (1)
    - No (2)
        - Screened out if selected

Residence

3. Do you currently reside in the U.S.?
    a. Yes (1)
    b. No (2)
        i. Screened out if selected

If screened out, survey will end and the following message will appear:

To be eligible for participation in this study, participants must have certain characteristics, and unfortunately you do not meet the criteria for participation in this study. Thank you so much for your time and interest in this study.

## Demographics

Gender

1. Please indicate your gender:
    - Male (1)
    - Female (2)
    - Non-binary/gender non-conforming (3)
    - Prefer to self-describe: _____ (4)
    - Prefer not to say (5)

Age

2. What is your age (in years)?
    - _____

Race/Ethnicity

3. Please indicate your race or ethnicity (select all that apply):
    - American Indian or Alaskan Native (1)
    - Asian or Asian American (2)

- Black or African American (3)
- Hispanic, Latinx, or Spanish origin (4)
- Middle Eastern or North African (5)
- Native Hawaiian or Other Pacific Islander (6)
- White/Not Hispanic (7)
- Other race or ethnicity not listed: _____ (8)
- Prefer not to answer (9)

Education Level

4. What is the highest level of education you have completed?
    - Less than high school (1)
    - High school/GED (2)
    - Some college (3)
    - 2 year degree (4)
    - 4 year degree (5)
    - Master's degree (6)
    - Professional degree (PhD, JD, MD) (7)
    - Prefer not to say (8)

Job Title

5. Which of the following most closely matches your job title?
    - Intern (1)
    - Entry level (2)
    - ADP (3)
    - Analyst/Associate (4)
    - Senior Analyst/Associate (5)
    - Manager (6)
    - Senior Manager (7)
    - Director (8)
    - Vice President (9)
    - Senior Vice President (10)
    - C-level Executive (CIO, CTO, COO, CMO, etc.) (11)
    - President or CEO (12)
    - Prefer not to say (13)

Job Function

6. Which of the following best describes your job function?
    - Finance/Accounting (1)
    - Human Resources (2)
    - Information Technology/MIS (3)
    - Administration (4)
    - Sales (5)
    - Marketing (6)
    - Research and/or Development (7)

- Manufacturing (8)
- Engineering (9)
- Other: _____ (10) _
- Prefer not to say (11)

Role Tenure

7. How many years have you worked in your current role?
   - _____

FOW

8. Are you currently working remotely or in-person?
   - Fully remote (1)
   - Hybrid (2)
   - Fully in-person (3)

**Typical Work Breaks**

Typical Break Frequency

1. How often do you take work breaks (excluding lunch) during your typical workweek? (For the current study, work breaks are defined as time periods of about 15 minutes where you are not working on work-related tasks, nor are you expected to).
   - Rarely or never (1)
   - Occasionally (1-3 times a week) (2)
   - Regularly (4-5 times per week) (3)
   - Very often (over 5 times per week) (4)

Typical Break Length

1. How long are your work breaks (excluding lunch) on average?
   - _____ minutes

Typical Break Setting

1. Please describe the setting/environment in which you **typically** spend your work breaks.
   - _____

Ideal Break Setting

1. Please describe the setting/environment in which you would **ideally** spend your work breaks.
   - _____

Naturalness of Work Break Environment

Based on item description from:

Van den Berg, A. E., Jorgensen, A., & Wilson, E. R. (2014). Evaluating restoration in urban green spaces: Does setting type make a difference?. *Landscape and Urban Planning*, *127*, 173-181.

Response scale:
1 = not at all natural, 7 = very natural

1. How natural (i.e., containing natural elements such as trees, plants, water) would you rate the environment in which you spent your break?

Typical Break in Nature Frequency

1. How often do you spend your work breaks (excluding lunch) in outdoor, natural environments?
    - Rarely or never (1)
    - Occasionally (1-3 times a week) (2)
    - Regularly (4-5 times per week) (3)
    - Very often (over 5 times per week) (4)

Perceived Restorativeness of Typical Break Environment

Pasini, M., Berto, R., Brondino, M., Hall, R., & Ortner, C. (2014). How to measure the restorative quality of environments: The PRS-11. *Procedia-Social and Behavioral Sciences*, *159*, 293-297.

| | **Original** | **Adapted** |
|---|---|---|
| | We are interested in how you experience this environment. To help us understand your experience, we have provided the following statements for you to respond to. Please read carefully, then ask yourself: "how much does this statements apply to my experience there?". To indicate your answer, circle only one numbers on the rating scale beside the statement. A sample of the rating scale is given below and at the top of each subsequent page. So, for example, if you think that the statement does not at all apply to your experience of the environment, then you would circle "0" (not at all), if you think it applies rather much, then you would circle "6" (rather much), but if you think that it apply very much, you would circle 10 (very much). | Think about the ***environment*** in which you typically spend your work breaks. Please read each of the following statements and rate the extent to which it applies to **your typical experience in your work break environment.** |

| | 0 (not at all), 6 (rather much), 10 (very much) | (not adapted) |
|---|---|---|
| 1 | Places like that are fascinating. *(fascination)* | (not adapted) |
| 2 | In places like this my attention is drawn to many interesting things. *(fascination)* | (not adapted) |
| 3 | In places like this it is hard to be bored. *(fascination)* | (not adapted) |
| 4 | Places like that are a refuge from nuisances. (*being away)* | (not adapted) |
| 5 | To get away from things that usually demand my attention I like to go to places like this. (*being away)* | (not adapted) |
| 6 | To stop thinking about the things that I must get done I like to go to places like this. (*being away)* | (not adapted) |
| 7 | There is a clear order in the physical arrangement of places like this. *(coherence)* | (not adapted) |
| 8 | In places like this it is easy to see how things are organized. *(coherence)* | (not adapted) |
| 9 | In places like this everything seems to have its proper place. *(coherence)* | (not adapted) |
| 10 | That place is large enough to allow exploration in many directions. *(scope)* | (not adapted) |
| 11 | In places like that there are few boundaries to limit my possibility for moving about. *(scope)* | (not adapted) |

Typical Work Break Activities

1. What do you typically do during your work breaks?

   _____

Work Break Recovery Experiences

*Psychological detachment, relaxation, control:*

Sonnentag, S., & Fritz, C. (2007). The Recovery Experience Questionnaire: development and validation of a measure for assessing recuperation and unwinding from work. *Journal of Occupational Health Psychology*, *12*(3), 204.

*Enjoyment:*
Sianoja, M., Syrek, C. J., de Bloom, J., Korpela, K., & Kinnunen, U. (2018). Enhancing daily well-being at work through lunchtime park walks and relaxation exercises: Recovery experiences as mediators. *Journal of Occupational Health Psychology*, *23*(3), 428.

| | **Original** | **Adapted** |
|---|---|---|
| | No instructions provided | Think about your typical work breaks. Please rate your level of agreement with the following statements about **how you typically feel during your work breaks**. |
| | During time after work, ... | During my breaks, ... |
| | 1 (I do not agree at all) to 5 (I fully agree) | 1 (Strongly disagree) to 5 (Strongly agree) |
| 1 | I forget about work. | (not adapted) |
| 2 | I don't think about work at all. | (not adapted) |
| 3 | I distance myself from my work. | (not adapted) |
| 4 | I get a break from the demands of work. | (not adapted) |
| 5 | I kick back and relax. | (not adapted) |
| 6 | I do relaxing things. | (not adapted) |
| 7 | I use the time to relax. | (not adapted) |
| 8 | I take time for leisure | (not adapted) |
| 9 | I feel like I can decide for myself what to do. | (not adapted) |
| 10 | I decide my own schedule. | (not adapted) |
| 11 | I determine for myself how I will spend my time. | (not adapted) |
| 12 | I take care of things the way that I want them done. | (not adapted) |
| 13 | I enjoyed my lunch break. | I enjoy my break. |

Positive and Negative Work Reflection

Binnewies, C., Sonnentag, S., & Mojza, E. J. (2009). Feeling recovered and thinking about the good sides of one's work. *Journal of Occupational Health Psychology, 14*(3), 243-256.

Fritz, C., & Sonnentag, S. (2006). Recovery, well-being, and performance-related outcomes: the role of workload and vacation experiences. *Journal of Applied Psychology*, *91*(4), 936.

| | **Original** | **Adapted** |
|---|---|---|
| | During vacation/during leisure time, ... | During my typical work break, ... |
| | 1 (not true at all) to 5 (totally true) | 1 (strongly disagree) to 5 (strongly agree) |
| 1 | I realized what I like about my job. | (excluded) |
| 2 | I thought about the positive points of my job. | I think about the positive aspects of my job. |
| 3 | I considered the positive aspects of my job. | I consider the positive aspects of my job. |
| 4 | I realized what I did not like about my job. | I realize what I do not like about my job. |
| 5 | I considered the negative aspects of my job. | I think about the negative sides of my work. |
| 6 | I noticed what is negative about my work | I notice what is negative about my work |

Problem-Solving Pondering

Cropley, M., Michalianou, G., Pravettoni, G., & Millward, L. J. (2012). The relation of post-work ruminative thinking with eating behaviour. *Stress and Health, 28*(1), 23-30.

| | **Original** | **Adapted** |
|---|---|---|
| | No instructions provided | During my typical work break, ... |
| | 1 (very seldom or never), 2 = seldom, 3 = sometimes, 4 = often and 5 = very often or always | 1 (strongly disagree) to 5 (strongly agree) |
| 1 | In my free time I find myself re-evaluating something I have done at work. | I find myself re-evaluating something I have done at work. |
| 2 | I find solutions to work-related problems in my free time. | I think about solutions to work-related problems. |

**Main Study Outcomes**

State of Being Recovered

Sonnentag, S. (2003). Recovery, work engagement, and proactive behavior: a new look at the interface between nonwork and work. *Journal of Applied Psychology*, *88*(3), 518.

| | **Original** | **Adapted** |
|---|---|---|
| | No instructions provided | Please rate your level of agreement with the following statements about how you feel **right now**. |
| | Because of the leisure activities pursued yesterday, ... | Right now, ... |
| | 1 (not true at all) to 5 (totally true) | 1 (strongly disagree) to 5 (strongly agree) |
| 1 | I feel recovered. | (not adapted) |
| | I feel relaxed. | (not adapted) |
| | I am in a good mood. | (not adapted) |

Strain

Sianoja, M., Syrek, C. J., de Bloom, J., Korpela, K., & Kinnunen, U. (2018). Enhancing daily well-being at work through lunchtime park walks and relaxation exercises: Recovery experiences as mediators. *Journal of Occupational Health Psychology*, *23*(3), 428.

| | **Original** | **Adapted** |
|---|---|---|
| | No referent provided | Right now, ... |
| | 1 (strongly disagree) to 7 (strongly agree) | 1 (strongly disagree) to 5 (strongly agree) |
| 1 | I feel stressed and tense. | (not adapted) |

Performance Capacity

Hunter, E. M., & Wu, C. (2016). Give me a better break: Choosing workday break activities to maximize resource recovery. *Journal of Applied Psychology*, *101*(2), 302.

Response scale: 1 (very low) to 5 (very high)

1. What is your current level of energy?
2. What is your current level of concentration?
3. What is your current level of motivation?

Affect (not adapted)

Yoon, D. J., Bono, J. E., Yang, T., Lee, K., Glomb, T. M., & Duffy, M. K. (2021). The balance between positive and negative affect in employee well-being. *Journal of Organizational Behavior*, 1-20.

Response scale:
1 (strongly disagree) to 5 (strongly agree)

Instructions: Please indicate how you are feeling right now.

1. Happy
2. Excited
3. Content
4. Relaxed
5. Nervous
6. Angry
7. Sad
8. Fatigued

**Week-level Work Engagement and Burnout**
Engagement

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.

| | **Original** | **Adapted** |
|---|---|---|
| | The following 9 statements are about how you feel at work. Please read each statement carefully and decide if you ever feel this way about your job. If you have never had this feeling, cross the "0" (zero) in the space after the statement. If you have had this feeling, indicate how often you felt it by crossing the number (from 1 to 6) that best describes how frequently you feel that way. | The following 9 statements are about how you feel at work. Please read each statement carefully and decide if you have felt this way about your job **this week**. Indicate how often by selecting the response option that best describes how often you felt this way **this week**. |
| | 0 (never), 1 (almost never), 2 (rarely), 3 (sometimes), 4 (often), 5 (very often), 6 (always) | 0 (never), 1 (almost never), 2 (rarely), 3 (sometimes), 4 (often), 5 (very often), 6 (always) |

| | | |
|---|---|---|
| 1 | At my work, I feel bursting with energy. | At my work, I felt bursting with energy. |
| 2 | At my job, I feel strong and vigorous. | At my job, I felt strong and vigorous. |
| 3 | I am enthusiastic about my job. | I was enthusiastic about my job. |
| 4 | My job inspires me. | My job inspired me. |
| 5 | When I get up in the morning, I feel like going to work. | When I get up in the morning, I felt like going to work. |
| 6 | I feel happy when I am working intensely. | I felt happy when I was working intensely. |
| 7 | I am proud of the work that I do. | I was proud of the work that I did. |
| 8 | I am immersed in my work. | I was immersed in my work. |
| 9 | I get carried away when I am working. | I got carried away when I was working. |

Burnout

Original SMBM: Shirom, A., & Melamed, S. (2006). A comparison of the construct validity of two burnout measures in two groups of professionals. *International Journal of Stress Management*, *13*(2), 176.

Shortened 6-item SMBM: Almén, N., & Jansson, B. (2021). The reliability and factorial validity of different versions of the Shirom-Melamed Burnout Measure/Questionnaire and normative data for a general Swedish sample. *International Journal of Stress Management*.

| | **Original** | **Adapted** |
|---|---|---|
| | Below, a number of conditions that each person may experience from time to time are described. Describe the extent to which you experienced these the last month. | Below, a number of conditions that each person may experience from time to time are described. Describe the extent to which you experienced these **this week.** |
| | 1 (almost never), 7 (almost always) | 0 (never), 1 (almost never), 2 (rarely), 3 (sometimes), 4 (often), 5 (very often), 6 (always) |
| 1 | At my work, I feel bursting with energy. | At my work, I felt bursting with energy. |
| 2 | At my job, I feel strong and vigorous. | At my job, I felt strong and vigorous. |
| 3 | I am enthusiastic about my job. | I was enthusiastic about my job. |
| 4 | My job inspires me. | My job inspired me. |

| | | |
|---|---|---|
| 5 | When I get up in the morning, I feel like going to work. | When I get up in the morning, I felt like going to work. |
| 6 | I feel happy when I am working intensely. | I felt happy when I was working intensely. |
| 7 | I am proud of the work that I do. | I was proud of the work that I did. |
| 8 | I am immersed in my work. | I was immersed in my work. |
| 9 | I get carried away when I am working. | I got carried away when I was working. |

**Main Study Controls**

Trait Positive/Negative Affectivity

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*, 1063-1070. doi:10.1037/0022-3514.54.6.1063

Response scale:
1 = Very slightly or not at all, 2 = A little, 3 = Moderately, 4 = Quite a bit, 5 = Extremely

Instructions: The following words describe different feelings and emotions. Next to each item, indicate to what extent you feel this way on a typical day.

Items:

Positive Mood

1. Interested (PA1)
2. Excited (PA2)
3. Strong (PA3)
4. Enthusiastic (PA4)
5. Proud (PA5)
6. Alert (PA6)
7. Inspired (PA7)
8. Determined (PA8)
9. Attentive (PA9)
10. Active (PA10)

Negative Mood

1. Distressed (NA1)
2. Upset (NA2)
3. Guilty (NA3)
4. Scared (NA4)
5. Hostile (NA5)
6. Irritable (NA6)
7. Ashamed (NA7)
8. Nervous (NA8)
9. Jittery (NA9)
10. Afraid (NA10)

Quantitative Workload Inventory

Spector, P. E., & Jex, S. M. (1998). Development of four self-report measures of job stressors and strain: interpersonal conflict at work scale, organizational constraints scale, quantitative workload inventory, and physical symptoms inventory. *Journal of Occupational Health Psychology*, *3*(4), 356.

Response scale:

1 = less than once per month or never, 2 = once or twice per month, 3 = once or twice per week, 4 = once or twice per day, 5 = several times per day

1. How often does your job require you to work very fast?
2. How often does your job require you to work very hard?
3. How often does your job leave you with little time to get things done?
4. How often is there a great deal to be done?
5. How often do you have to do more work than you can do well?

Job Autonomy

Morgeson, F. P., Delaney-Klinger, K., & Hemingway, M. A. (2005). The importance of job autonomy, cognitive ability, and job-related skill for predicting role breadth and job performance. *Journal of Applied Psychology*, *90*(2), 399.

| | **Original** | **Adapted** |
|---|---|---|
| | No instructions provided | Please indicate the extent to which you agree with the following statements. |

Response scale:
1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree

1. I have significant autonomy in determining how I do my job.
2. I can decide on my own how to go about doing my work.
3. I have considerable opportunity for independence and freedom in how I do my job.

Trait Connection to Nature

Hunt, A., Stewart, D., Richardson, M., Hinds, J., Bragg, R., White, M., Burt, J. (2017). *Monitor of Engagement with the Natural Environment: Developing a method to measure nature connection across the English population (adults and children).* (NECR233). Natural England.

Response Scale:
1 = completely disagree, 7 = completely agree

The following questions are about you and nature. By nature we mean all types of natural environment and all the plants and animals living in them. Nature can be close to where you live in towns; the countryside or wilderness areas further away.

Using the words on the screen please tell me how much you agree or disagree with the following:

1. Being in nature makes me very happy.

2. I find being in nature really amazing.
3. Spending time in nature is very important to me.
4. I always treat nature with respect.
5. I feel part of nature.

# APPENDIX B: MAIN STUDY SURVEY ITEMS

**Table A1**

*List of Main Study Survey Measures*

| Measure | Number of Items |
|---|---|
| Survey Scheduling Questions | |
| Time zone | 1 |
| Typical work hours | 1 |
| Level 1 Measures | |
| Naturalness of break environment | 1 |
| Break activity | 1 |
| Break location | 1 |
| Recovery experiences (detachment, relaxation, control) | 3 |
| Enjoyment | 1 |
| Positive/negative work reflection | 2 |
| Problem-solving pondering | 1 |
| State of being recovered | 1 |
| Strain | 1 |
| Performance capacity | 3 |
| Affect | 8 |
| Engagement | 9 |
| Burnout | 6 |
| Level 2 Measures | |
| Gender | 1 |
| Age | 1 |
| Race/ethnicity | 1 |
| Level of education | 1 |
| Job title | 1 |
| Job function | 1 |
| Job role tenure | 1 |
| Remote, in-person, or hybrid work arrangement | 1 |
| Typical number of breaks taken per week | 1 |
| Typical break duration | 1 |
| Typical break activities | 1 |
| Typical break recovery experiences | 17 |
| Typical natural environment visit frequency | 1 |
| Trait positive/negative affectivity | 20 |
| Job demands (workload) | 5 |
| Job autonomy | 3 |
| Trait connection to nature | 5 |
| Engagement | 9 |
| Burnout | 6 |
| **Total Number of Items** | **117** |

*Items below are for survey scheduling purposes, not screening*

Time Zone

4. What time zone do you reside in?
    - Eastern Daylight (1)
    - Central Daylight (2)
    - Mountain Daylight (3)
    - Mountain Standard (4)
    - Pacific Daylight (5)
    - Alaska Daylight (6)
    - Hawaii-Aleutian Standard (7)
    - Other: (8) _____

Typical Schedule

5. What are your typical work hours (e.g., 9-5; 7-3)?
    - _____

**Level 1 Measures**

Took Break

1. Did you take a break today?
    a. Yes
    b. No

Break Location

1. Where did you spend your break?

Break Activity

2. What did you do during your break?
    _____

Naturalness of Work Break Environment

Based on item description from:
Van den Berg, A. E., Jorgensen, A., & Wilson, E. R. (2014). Evaluating restoration in urban green spaces: Does setting type make a difference? *Landscape and Urban Planning*, *127*, 173-181.

Response scale:
1 = completely manmade, 2 = mostly manmade, 3 = somewhat manmade, 4 = Half natural, half manmade, 5 = somewhat natural, 6 = mostly natural, 7 = completely natural

How **natural** (i.e., containing natural elements such as trees, plants, water; limited manmade, built structures and human interference) would you rate the **physical environment** in which you spent your most recent work break?

Work Break Recovery Experiences

*Psychological detachment, relaxation, control:*
Sonnentag, S., & Fritz, C. (2007). The Recovery Experience Questionnaire: development and validation of a measure for assessing recuperation and unwinding from work. *Journal of Occupational Health Psychology*, *12*(3), 204.

*Enjoyment:*
Sianoja, M., Syrek, C. J., de Bloom, J., Korpela, K., & Kinnunen, U. (2018). Enhancing daily well-being at work through lunchtime park walks and relaxation exercises: Recovery experiences as mediators. *Journal of Occupational Health Psychology*, *23*(3), 428.

| | **Original** | **Adapted** |
|---|---|---|

| | | |
|---|---|---|
| | No instructions provided | Please rate your level of agreement with the following statements about the **work break you just took**. |
| | During time after work, ... | |
| | 1 (I do not agree at all) to 5 (I fully agree) | 1 (Strongly disagree) to 5 (Strongly agree) |
| 1 | I forget about work. | I forgot about work |
| | I don't think about work at all. | (excluded) |
| | I distance myself from my work. | (excluded) |
| | I get a break from the demands of work. | (excluded) |
| | I kick back and relax. | (excluded) |
| | I do relaxing things. | (excluded) |
| 2 | I use the time to relax. | I used the time to relax. |
| | I take time for leisure | (excluded) |
| 3 | I feel like I can decide for myself what to do. | I felt like I could decide for myself what to do. |
| | I decide my own schedule. | (excluded) |
| | I determine for myself how I will spend my time. | (excluded) |
| | I take care of things the way that I want them done. | (excluded) |
| 13 | I enjoyed my lunch break. | I enjoyed my break. |

Positive and Negative Work Reflection

Binnewies, C., Sonnentag, S., & Mojza, E. J. (2009). Feeling recovered and thinking about the good sides of one's work. *Journal of Occupational Health Psychology, 14*(3), 243-256.

Fritz, C., & Sonnentag, S. (2006). Recovery, well-being, and performance-related outcomes: the role of workload and vacation experiences. *Journal of Applied Psychology*, *91*(4), 936.

| | **Original** | **Adapted** |
|---|---|---|
| | During vacation/during leisure time, ... | (included with above) |
| | 1 (not true at all) to 5 (totally true) | 1 (strongly disagree) to 5 (strongly agree) |

| | | |
|---|---|---|
| | I realized what I like about my job. | (excluded) |
| 1 | I thought about the positive points of my job. | I thought about the positive aspects of my job. |
| | I considered the positive aspects of my job. | (excluded) |
| | I realized what I did not like about my job. | (excluded) |
| 2 | I considered the negative aspects of my job. | I thought about the negative sides of my work. |
| | I noticed what is negative about my work | (excluded) |

Problem-Solving Pondering

Cropley, M., Michalianou, G., Pravettoni, G., & Millward, L. J. (2012). The relation of post-work ruminative thinking with eating behaviour. *Stress and Health, 28*(1), 23-30.

| | **Original** | **Adapted** |
|---|---|---|
| | No instructions provided | (included with above) |
| | 1 (very seldom or never), 2 = seldom, 3 = sometimes, 4 = often and 5 = very often or always | 1 (strongly disagree) to 5 (strongly agree) |
| | In my free time I find myself re-evaluating something I have done at work. | (excluded) |
| 1 | I find solutions to work-related problems in my free time. | I thought about solutions to work-related problems. |

State of Being Recovered

Sonnentag, S. (2003). Recovery, work engagement, and proactive behavior: a new look at the interface between nonwork and work. *Journal of Applied Psychology, 88*(3), 518.

| | **Original** | **Adapted** |
|---|---|---|
| | No instructions provided | Please indicate how you feel **right now**. |
| | Because of the leisure activities pursued yesterday, ... | |

| | 1 (not true at all) to 5 (totally true) | 1 (strongly disagree) to 5 (strongly agree) |
|---|---|---|
| 1 | I feel recovered. | recovered (not adapted) |
| | I feel relaxed. | (excluded) |
| | I am in a good mood. | (excluded) |

Strain

Sianoja, M., Syrek, C. J., de Bloom, J., Korpela, K., & Kinnunen, U. (2018). Enhancing daily well-being at work through lunchtime park walks and relaxation exercises: Recovery experiences as mediators. *Journal of Occupational Health Psychology*, *23*(3), 428.

| | **Original** | **Adapted** |
|---|---|---|
| | No referent provided | (included with recovery state instructions above) |
| | 1 (strongly disagree) to 7 (strongly agree) | 1 (strongly disagree) to 5 (strongly agree) |
| 1 | I feel stressed and tense. | stressed and tense |

Performance Capacity

Hunter, E. M., & Wu, C. (2016). Give me a better break: Choosing workday break activities to maximize resource recovery. *Journal of Applied Psychology*, *101*(2), 302.

Response scale: 1 (very low) to 5 (very high)

Morning survey (not adapted)

1. What is your current level of _____?
    a. Energy
    b. Concentration
    c. Movation

End-of-workday survey (adapted)

1. This afternoon after your work break, what has been your level of _____?
    a. Energy
    b. Concentration
    c. Motivation

Affect (not adapted)

Yoon, D. J., Bono, J. E., Yang, T., Lee, K., Glomb, T. M., & Duffy, M. K. (2021). The balance between positive and negative affect in employee well-being. *Journal of Organizational Behavior*, 1-20.

Response scale:
1 (strongly disagree) to 5 (strongly agree)

Instructions: Please indicate how you are feeling right now.

9. Happy
10. Excited
11. Content
12. Relaxed
13. Nervous
14. Angry
15. Sad
16. Fatigued

Engagement

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.

| | **Original** | **Adapted** |
|---|---|---|
| | The following 9 statements are about how you feel at work. Please read each statement carefully and decide if you ever feel this way about your job. If you have never had this feeling, cross the "0" (zero) in the space after the statement. If you have had this feeling, indicate how often you felt it by crossing the number (from 1 to 6) that best describes how frequently you feel that way. | The following 9 statements are about how you feel at work. Please read each statement carefully and decide if you have felt this way about your job **this week**. Indicate how often by selecting the response option that best describes how often you felt this way **this week**. |
| | 0 (never), 1 (almost never), 2 (rarely), 3 (sometimes), 4 (often), 5 (very often), 6 (always) | 0 (never), 1 (almost never), 2 (rarely), 3 (sometimes), 4 (often), 5 (very often), 6 (always) |
| 1 | At my work, I feel bursting with energy. | At my work, I felt bursting with energy. |
| 2 | At my job, I feel strong and vigorous. | At my job, I felt strong and vigorous. |
| 3 | I am enthusiastic about my job. | I was enthusiastic about my job. |

| | | |
|---|---|---|
| 4 | My job inspires me. | My job inspired me. |
| 5 | When I get up in the morning, I feel like going to work. | When I get up in the morning, I felt like going to work. |
| 6 | I feel happy when I am working intensely. | I felt happy when I was working intensely. |
| 7 | I am proud of the work that I do. | I was proud of the work that I did. |
| 8 | I am immersed in my work. | I was immersed in my work. |
| 9 | I get carried away when I am working. | I got carried away when I was working. |

Burnout

Original SMBM: Shirom, A., & Melamed, S. (2006). A comparison of the construct validity of two burnout measures in two groups of professionals. *International Journal of Stress Management*, *13*(2), 176.

Shortened 6-item SMBM: Almén, N., & Jansson, B. (2021). The reliability and factorial validity of different versions of the Shirom-Melamed Burnout Measure/Questionnaire and normative data for a general Swedish sample. *International Journal of Stress Management*.

| | **Original** | **Adapted** |
|---|---|---|
| | Below, a number of conditions that each person may experience from time to time are described. Describe the extent to which you experienced these the last month. | Below, a number of conditions that each person may experience from time to time are described. Describe the extent to which you experienced these **this week.** |
| | 1 (almost never), 7 (almost always) | 0 (never), 1 (almost never), 2 (rarely), 3 (sometimes), 4 (often), 5 (very often), 6 (always) |
| 1 | At my work, I feel bursting with energy. | At my work, I felt bursting with energy. |
| 2 | At my job, I feel strong and vigorous. | At my job, I felt strong and vigorous. |
| 3 | I am enthusiastic about my job. | I was enthusiastic about my job. |
| 4 | My job inspires me. | My job inspired me. |
| 5 | When I get up in the morning, I feel like going to work. | When I get up in the morning, I felt like going to work. |
| 6 | I feel happy when I am working intensely. | I felt happy when I was working intensely. |

| | | |
|---|---|---|
| 7 | I am proud of the work that I do. | I was proud of the work that I did. |
| 8 | I am immersed in my work. | I was immersed in my work. |
| 9 | I get carried away when I am working. | I got carried away when I was working. |

**Level 2 Measures**

Gender

9. Please indicate your gender:
    - Male (1)
    - Female (2)
    - Non-binary/gender non-conforming (3)
    - Prefer to self-describe: _____ (4)
    - Prefer not to say (5)

Age

10. What is your age (in years)?
    - _____

Race/Ethnicity

11. Please indicate your race or ethnicity (select all that apply):
    - American Indian or Alaskan Native (1)
    - Asian or Asian American (2)
    - Black or African American (3)
    - Hispanic, Latinx, or Spanish origin (4)
    - Middle Eastern or North African (5)
    - Native Hawaiian or Other Pacific Islander (6)
    - White/Not Hispanic (7)
    - Other race or ethnicity not listed: _____ (8)
    - Prefer not to answer (9)

Education Level

12. What is the highest level of education you have completed?
    - Less than high school (1)
    - High school/GED (2)
    - Some college (3)
    - 2 year degree (4)
    - 4 year degree (5)
    - Master's degree (6)
    - Professional degree (PhD, JD, MD) (7)
    - Prefer not to say (8)

Job Title

13. Which of the following most closely matches your job title?
    - Intern (1)
    - Entry level (2)
    - ADP (3)
    - Analyst/Associate (4)
    - Senior Analyst/Associate (5)
    - Manager (6)

- Senior Manager (7)
- Director (8)
- Vice President (9)
- Senior Vice President (10)
- C-level Executive (CIO, CTO, COO, CMO, etc.) (11)
- President or CEO (12)
- Prefer not to say (13)

Job Function

14. Which of the following best describes your job function?
    - Administration (1)
    - Business Strategy (2)
    - Communications & Corporate Affairs (3)
    - Corporate Services (4)
    - Customer Service (5)
    - Engineering (6)
    - Finance (7)
    - General (8)
    - General Management (9)
    - Global Integrated Supply Chain (10)
    - Human Resources (11)
    - Information Technology (12)
    - Legal (13)
    - Marketing (14)
    - Operational Excellence (15)
    - Product Management (16)
    - Project Management (17)
    - Sales (18)
    - Services (19)
    - Prefer not to say (20)

Role Tenure

15. How many years have you worked in your current role?
    - _____

FOW

16. Are you currently working remotely or in-person?
    - Fully remote (1)
    - Hybrid (2)
    - Fully in-person (3)

Typical Break Frequency

17. How often do you take work breaks (excluding lunch) during your typical workweek? (For the current study, work breaks are defined as time periods of

about 15 minutes where you are not working on work-related tasks, nor are you expected to).

- Rarely or never (1)
- Occasionally (1-3 times a week) (2)
- Regularly (4-5 times per week) (3)
- Very often (over 5 times per week) (4)

Typical Break Length

18. How long are your work breaks (excluding lunch) on average?
    _____ minutes

Typical Break Activities

19. What do you typically do during your work breaks (excluding lunch)?

Typical Break Recovery Experiences

Sonnentag, S., & Fritz, C. (2007). The Recovery Experience Questionnaire: development and validation of a measure for assessing recuperation and unwinding from work. *Journal of Occupational Health Psychology*, *12*(3), 204.

| | **Original** | **Adapted** |
|---|---|---|
| | No instructions provided | Please rate your level of agreement with the following statements. |
| | During time after work, ... | During my breaks from work, ... |
| | 1 (I do not agree at all) to 5 (I fully agree) | 1 (Strongly disagree) to 5 (Strongly agree) |
| 1 | I forget about work. | (not adapted) |
| 2 | I don't think about work at all. | (not adapted) |
| 3 | I distance myself from my work. | (not adapted) |
| 4 | I get a break from the demands of work. | (not adapted) |
| 5 | I kick back and relax. | (not adapted) |
| 6 | I do relaxing things. | (not adapted) |
| 7 | I use the time to relax. | (not adapted) |
| 8 | I take time for leisure. | (not adapted) |
| 9 | I learn new things. | (not adapted) |
| 10 | I seek out intellectual challenges, | (not adapted) |
| 11 | I do things that challenge me. | (not adapted) |

| | | |
|---|---|---|
| 12 | I do something to broaden my horizons. | (not adapted) |
| 13 | I feel like I can decide for myself what to do. | (not adapted) |
| 14 | I decide my own schedule. | (not adapted) |
| 15 | I determine for myself how I will spend my time. | (not adapted) |
| 16 | I take care of things the way that I want them done. | (not adapted) |
| 17 | I enjoyed my lunch break. | I enjoy my break. (new) |

Typical Nature Visit Frequency

Based on Ojala, A., Korpela, K., Tyrväinen, L., Tiittanen, P., & Lanki, T. (2019). Restorative effects of urban green environments and the role of urban-nature orientedness and noise sensitivity: A field experiment. *Health & Place*, *55*, 59-70.

20. How often do you visit natural or green outdoor places?
    - Every day (6)
    - 4-6 times per week (5)
    - 2-3 times per week (4)
    - Once a week (3)
    - 1-3 times per month (2)
    - Less often (1)

Trait Positive/Negative Affectivity

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,* 1063-1070. doi:10.1037/0022-3514.54.6.1063

Response scale:
1 = Very slightly or not at all, 2 = A little, 3 = Moderately, 4 = Quite a bit, 5 = Extremely

Instructions: The following words describe different feelings and emotions. Next to each item, indicate to what extent you feel this way on a typical day.

Items:

Positive Mood
1. Interested (PA1)
2. Excited (PA2)
3. Strong (PA3)

Negative Mood
11. Distressed (NA1)
12. Upset (NA2)
13. Guilty (NA3)

4. Enthusiastic (PA4)
5. Proud (PA5)
6. Alert (PA6)
7. Inspired (PA7)
8. Determined (PA8)
9. Attentive (PA9)
10. Active (PA10)
14. Scared (NA4)
15. Hostile (NA5)
16. Irritable (NA6)
17. Ashamed (NA7)
18. Nervous (NA8)
19. Jittery (NA9)
20. Afraid (NA10)

Quantitative Workload Inventory

Spector, P. E., & Jex, S. M. (1998). Development of four self-report measures of job stressors and strain: interpersonal conflict at work scale, organizational constraints scale, quantitative workload inventory, and physical symptoms inventory. *Journal of Occupational Health Psychology*, *3*(4), 356.

Response scale:
1 = less than once per month or never, 2 = once or twice per month, 3 = once or twice per week, 4 = once or twice per day, 5 = several times per day

1. How often does your job require you to work very fast?
2. How often does your job require you to work very hard?
3. How often does your job leave you with little time to get things done?
4. How often is there a great deal to be done?
5. How often do you have to do more work than you can do well?

Job Autonomy

Morgeson, F. P., Delaney-Klinger, K., & Hemingway, M. A. (2005). The importance of job autonomy, cognitive ability, and job-related skill for predicting role breadth and job performance. *Journal of Applied Psychology*, *90*(2), 399.

| | **Original** | **Adapted** |
|---|---|---|
| | No instructions provided | Please indicate the extent to which you agree with the following statements. |

Response scale:
1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree

1. I have significant autonomy in determining how I do my job.
2. I can decide on my own how to go about doing my work.
3. I have considerable opportunity for independence and freedom in how I do my job.

Trait Connection to Nature

Hunt, A., Stewart, D., Richardson, M., Hinds, J., Bragg, R., White, M., Burt, J. (2017). *Monitor of Engagement with the Natural Environment: Developing a method to measure nature connection across the English population (adults and children).* (NECR233). Natural England.

Response Scale:
1 = completely disagree, 7 = completely agree

The following questions are about you and nature. By nature we mean all types of natural environment and all the plants and animals living in them. Nature can be close to where you live in towns; the countryside or wilderness areas further away.

Using the words on the screen please tell me how much you agree or disagree with the following:

1. Being in nature makes me very happy.
2. I find being in nature really amazing.
3. Spending time in nature is very important to me.
4. I always treat nature with respect.
5. I feel part of nature.