



## Having a creative day: Understanding entrepreneurs' daily idea generation through a recovery lens



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### ABSTRACT

Prior research has shown that trait creativity is important for becoming an entrepreneur and successful in business. We explore a new perspective by investigating how recovery from work stress influences entrepreneurs' daily idea generation, a key aspect of creativity. Physiological and mental recovery enables the cognitive processes of creative problem-solving. Moreover, differences in mental recovery processes help to explain age-related changes in entrepreneurs' creativity. Multilevel analyses based on 415 daily data from 62 entrepreneurs support our predictions. Our study introduces a new "state" perspective to understanding entrepreneurs' creativity, and highlights the critical role of recovery processes for idea generation. © 2017 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

### Executive summary

Creativity, the generation of useful and novel ideas (Amabile, 1988), is important for entrepreneurs' business success. Creativity enables entrepreneurs to solve daily administrative and strategic problems, to identify new opportunities for growing their businesses, and to generate innovations such as new products or services (e.g., Dimov, 2007; Ward, 2004). Research on entrepreneurs' creativity to date views creativity as a stable personality trait that one is born with and does not change much over one's lifetime.

We introduce a new complementary perspective that considers creativity as a much more changeable state, rather than solely a trait. We explore how entrepreneurs' creativity may change on a daily basis, and whether and why entrepreneurs may be more creative on one day than on another day. This perspective views entrepreneurs' creativity as malleable, and opens up new possibilities for supporting entrepreneurs to be more creative. In particular, how well entrepreneurs are able to recover after work from their stressful jobs may be a key influence on their creativity the following day.

Recovery from work refers to activities, experiences, and states that rebuild mental and physiological resources after work and help to recuperate from job stress (Zijlstra and Sonnentag, 2006). We propose that the physiological and mental recovery of entrepreneurs after work enhances their creativity on the following day by stimulating the cognitive processes of creative problem-solving. In particular, we investigate entrepreneurs' nighttime sleep as a primary physiological recovery state (Åkerstedt, 2006). We also explore entrepreneurs' work-related problem-solving pondering after work, defined as a goal-oriented repetitive thinking

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about potential solutions to business-related problems (Cropley and Zijlstra, 2011), as a form of mental recovery. Moreover, we propose that with increasing age entrepreneurs ponder less about work-related problems during their leisure time. This reduced work-related problem-solving pondering may explain why older entrepreneurs appear to be less creative.

We conducted a diary study with 62 entrepreneurs over twelve days. We measured entrepreneurs' daily creativity and work-related problem-solving pondering after work in evening telephone interviews, and assessed their sleep efficiency objectively through actigraphic devices that entrepreneurs wore on their wrists during the night. In multilevel analysis, we regressed evening and nighttime recovery on creativity measured the following day, while controlling for evening creativity on the previous day. About 77% of the total variance in daily creativity was due to within-person fluctuations and 23% was due to between-person (trait) differences between the individual entrepreneurs. We found positive effects of sleep efficiency and work-related problem-solving pondering on entrepreneurs' daily creativity. We also found that with increasing age, entrepreneurs' creativity decreases because entrepreneurs engage less in work-related thinking during their leisure time.

Our study contributes a new state perspective on entrepreneurs' creativity, and complements the existing research on entrepreneurs' creativity that views creativity solely as a trait. Our findings highlight that entrepreneurs' creativity is shaped by daily influences and that entrepreneurs can boost their creativity through regulating their recovery processes. In doing so, our research also draws attention to the recovery processes, which are largely overlooked in entrepreneurship research despite, as we demonstrate, influencing creativity. A recovery lens also has the potential to offer new insights for research on entrepreneurs' stress and well-being. Furthermore, our study clarifies mixed findings on the effects of psychological detachment (or "switching off") from work in organizational behavior research (e.g., Wendsche and Lohmann-Haislah, 2017) by highlighting the benefits of emotional-neutral engagement with work-related problems.

## 1. Introduction

*Jim and Tom are co-owners and managers in a software development company for over 15 years. CEO Jim, age 38, is appreciated for his professional expertise and for being highly creative. He often comes up with novel solutions to complex problems; literally overnight. He enjoys pondering work-related issues in his leisure time, mentally playing out various "what-if" scenarios that allow him to analyze problems in new ways. At times, he tried to phone Tom, aged 58, to talk through these issues, but Tom draws clear lines between work and leisure time, and immediately disconnects from work when closing his office door. It is 3 months since Jim became a proud father to Saily. Jim used to sleep like a log, but some nights Saily cries for many hours, making Jim's sleep restless. Jim wonders if the lack of restful sleep may account for the lower creativity he recently experienced at work on certain days.*

This study investigates why and how entrepreneurs like Jim and Tom produce on one day more and on another day fewer creative ideas. We suggest that creativity should not be solely seen as a fixed personality trait, but that creativity is malleable and can vary from one day to the next, depending on the recovery processes that take place after work. Thus, we explore between-person (cf. Jim's vs. Tom's creativity) and within-person (cf. Jim's creativity today vs. Jim's creativity the next day) differences in entrepreneurs' daily creativity. We examine entrepreneurs' recovery after work through sleep (cf. Jim), and through mentally disconnecting ("switching off") from work issues (cf. Jim vs. Tom), as key drivers of daily creativity, and connect these to age-related differences in recovery and creativity.

Creativity typically refers to the generation of useful and novel ideas, ranging from "big" ideas about business opportunities or innovations, to "small" ideas for coping with daily challenges at work (Amabile, 1988; Dimov, 2007). Research on entrepreneurs' creativity is important because entrepreneurs need to be creative to deal with ongoing poorly defined business problems, such as managing human and financial resources. They also need to recognize business opportunities (Dimov, 2007), e.g., for international expansion or for developing innovations such as new or improved products and services that meet the demands of their customers (Ward, 2004). Existing research focuses on entrepreneurs' creativity as a personality trait and demonstrates its contribution to business success, including opportunity recognition (DeTienne and Chandler, 2004; Shane and Nicolaou, 2015), firm innovation (Saroghi et al., 2015), and businesses' growth (Gielnik et al., 2012a).

In this paper, we propose a new "state" or within-person perspective on entrepreneurial creativity that complements existing research, by viewing creativity as a trait. A state perspective recognizes that creativity can vary on a daily basis (Bledow et al., 2012) and that it is malleable because it is influenced by both personal and situational factors (Shalley et al., 2004). Thus, considering entrepreneurs' creativity from a *state* as opposed to a *trait* perspective opens up new possibilities for developing entrepreneurs' creativity, and consequently enhancing firm performance through training and other creativity interventions. Specifically, a state perspective is pertinent for two reasons.

First, the nature of entrepreneurs' jobs means that their business's success depends on the entrepreneur's capacity to generate creative ideas not merely occasionally, but on a *daily* basis. As Anita Roddick, founder of the Body Shop, put it "*Nobody talks about entrepreneurship as survival, but that's exactly what it is and what nurtures creative thinking.*"<sup>1</sup> For example, when a business grows, entrepreneurs often experience staff shortages and need to find creative ways, on a daily basis, to deal with this lack of human resources and keep the business operating. More so than employees' work, entrepreneurs' jobs are characteristically complex, uncertain, and challenging; and entrepreneurs have much higher levels of autonomy to make decisions about their business and work (e.g., McMullen and Shepherd, 2006; Schjoedt, 2009; Stephan and Roesler, 2010). While these characteristics of

<sup>1</sup> This quote was taken from <https://www.kabbage.com/blog/100-quotes-from-successful-entrepreneurs>.

entrepreneurs' work mean that they experience high levels of stress (Cardon and Patel, 2015; Wincent et al., 2008), they also lead to high intrinsic motivation that triggers creativity (cf. Oldham and Cummings, 1996).

Second, there is related evidence in research on employees that documents substantial within-person fluctuations in daily creativity (Bledow et al., 2012) and indicates that we cannot simply generalize from between- to within-person differences (Binnewies and Wörnlein, 2011; Curran and Bauer, 2011). In other words, there are likely unique determinants of entrepreneurs' state creativity that we do not know about, because *entrepreneurs'* daily creativity has not yet been investigated.

We propose that a recovery perspective is especially pertinent for understanding entrepreneurs' daily creativity. Recovery refers to processes and activities of recuperation from work stress (Sonnetag and Fritz, 2007; Zijlstra and Sonnetag, 2006). Recovery differs between individuals, as well as fluctuates within individuals (e.g., when we “get a good nights' sleep”, Sonnetag and Fritz, 2015). Although largely overlooked in entrepreneurship research, recovery is arguably especially important for entrepreneurs, considering the stressful nature of their work (Cardon and Patel, 2015; Wincent et al., 2008). We explore two key aspects of recovery: physiological recovery and mental recovery, both of which may stimulate the cognitive processes of creative problem-solving and thereby enhance creativity. *Sleep* as a *physiological* recovery process (Åkerstedt, 2006) involves an incubation period that enables new combinations of previous thoughts (Sio and Ormerod, 2009). *Mental* recovery in the form of *problem-solving pondering*, i.e., a cognitive state which is emotionally neutral and characterized by repetitive thinking about work-related problems (Cromptley and Zijlstra, 2011), enables creative problem exploration (e.g., Amabile and Mueller, 2008). Knowledge about these determinants of creativity may enable entrepreneurs to self-regulate their recovery and boost their creativity.

Indeed compared to employees, entrepreneurs may especially benefit from recovery processes in terms of their creativity, and may be more inclined to engage in adaptive mental and physiological recovery. This is because there is a tendency for “stress tolerant” individuals (e.g., those with high psychological capital and positive affect) to become entrepreneurs (Baron et al., 2016; Baron et al., 2012). Moreover, entrepreneurs are more likely than employees to be prone to engage in pondering after work, due to the demanding nature of their work (Cardon and Patel, 2015) and their high levels of decision making autonomy to deal with work demands (Stephan and Roesler, 2010). This combination has been shown to trigger problem-solving pondering in past research on employees (Bennett et al., 2016).

Yet, recovery processes may not be the same for all entrepreneurs. For instance, prior studies imply that entrepreneurs' age may affect their mental recovery. Aging involves a shift from financial towards social and health-related priorities (Gielnik et al., 2012b; Wach et al., 2016), and this motivational shift may in turn affect entrepreneurs' mental recovery. It reduces their willingness to put effort and their leisure time into trying to solve work-related problems, while simultaneously increasing their motivation to switch off from work. Such reduced work-related problem-solving pondering is, in turn, likely to decrease entrepreneurs' daily creativity.

This study makes four contributions to the literature. First, it offers a fresh perspective on entrepreneurs' creativity by documenting substantial day-to-day variations in creativity. Where past research has focused on creativity as a trait (e.g., Ardichvili et al., 2003), we propose a complementary state perspective, highlighting malleability in entrepreneurs' creativity. Second, we introduce a novel recovery perspective to entrepreneurship research. The consideration of recovery extends the literature on entrepreneurs' stress (e.g., Baron et al., 2016; Cardon and Patel, 2015; Stephan and Roesler, 2010) by documenting recovery processes as novel drivers of entrepreneurs' creativity, and highlighting the importance of both objectively measured physiological and mental recovery processes. This perspective importantly enables entrepreneurs to enhance their creativity by self-regulating their recovery behavior.

Third, we contribute to research on recovery and creativity in organizational behavior more broadly, by making sense of counterintuitive results in past research on mental recovery and creativity (Wendsche and Lohmann-Haislah, 2017). We distinguish mental recovery processes based on the involvement of emotions, and consequently find that that emotionally-neutral problem-solving pondering after work stimulates daily creativity. Fourth, our findings, linking entrepreneurs' age, recovery, and creativity, help us to understand how aging populations (of entrepreneurs) especially in developed countries (Cohen, 2003) may impact entrepreneurial activities and performance (Lévesque and Minniti, 2006). Finally, we also discuss practical implications for policy-makers and educators.

## 2. Theoretical framework

### 2.1. Creativity

Creative ideas can be understood as a necessary but not sufficient condition to identify opportunities and introduce innovations (e.g., Dimov, 2007). Although there are ongoing debates about the specific components of creativity (Sternberg, 2005), creativity is commonly defined as the generation of *novel* and *useful* ideas. Creativity involves (1) novelty or originality, i.e., creative ideas should either recombine or completely change existing elements, and (2) usefulness or appropriateness, i.e., creative ideas should be appropriate for the work task or problem at hand (Amabile, 1988; Amabile and Mueller, 2008; George, 2007). This definition applies to a range of creative ideas, from ideas about small incremental changes to improve upon existing work processes, products, services, and problem solutions, to those that are radically novel and unearth opportunities that redefine entire industries. Ideas that contain standard or obvious solutions are not deemed “creative” (Amabile, 1988; Amabile and Mueller, 2008; Dimov, 2007; George, 2007).

Exceptionally, idea generation results in innovations that make a difference to entire economies or societies. However, not all creative ideas lead to innovative outputs. In innovation management and across various models of innovation, creativity as idea

generation is studied as the first step in innovation processes that ultimately lead to innovative outputs such as new or improved products, services, or processes. The innovation process commonly starts with individual idea generation, followed by idea implementation at the team or organizational level in later stages (see Lukes and Stephan, 2017, for a review). At the same time, innovation processes are complex and require multi-faceted behaviors, such as idea communication, involving stakeholders, and overcoming obstacles that may prevent creative ideas from being implemented as innovations (Lukes and Stephan, 2017; Sarooghi et al., 2015). This means that studying daily creative ideas circumvents a selection bias, which occurs when only those ideas are studied that were implemented as innovations (Dimov, 2007).

The definition of creativity also encompasses *daily* creative ideas. However, to date, entrepreneurship researchers have applied a between-person approach, focusing on creativity as a trait of entrepreneurs (e.g., Ardichvili et al., 2003; Baron and Tang, 2011). Studies have analyzed creative personality profiles (DeTienne and Chandler, 2004; Shane and Nicolaou, 2015), and divergent thinking capabilities (Ames and Runco, 2005; Gielnik et al., 2012a; Gielnik et al., 2014). The latter are composed of different measures of idea fluency, flexibility, originality, and elaboration (Guilford, 1950). By adopting a state perspective, we explore the possibility that creativity can vary within entrepreneurs on a daily basis.

Daily creativity helps entrepreneurs to deal with their complex, challenging, and uncertain work (McMullen and Shepherd, 2006) and can involve more “mundane” creativity, e.g., finding a creative solution for staff shortage. Creativity also enables entrepreneurs to identify new opportunities and develop innovations (Dimov, 2007; Ward, 2004). For example, an entrepreneur may come up with the idea for a new product on one day, and the next day he or she tries to find ideas for an improved marketing strategy. Indeed, past research implies that the generation and shaping of ideas may be a daily phenomenon for entrepreneurs. For instance, research found that entrepreneurs allocate up to a third of their daily working time to exploration activities, such as discussing new business options (Mueller et al., 2012), and expend effort on creative tasks on a daily basis (Uy et al., 2015). Similarly, related research in organizational behavior documents that employees' creativity varies daily as a function of short-term person- and situation-related states, such as moods (Amabile et al., 2005), motivation (George, 2007), or changing job characteristics (Binnewies and Wörnlein, 2011).

## 2.2. Recovery from work

Entrepreneurs' recovery has rarely been researched. So far, two studies examine entrepreneurs' leisure activities (Goldsby et al., 2005; Gunnarsson and Josephson, 2011), and one study examines holiday time (Rau et al., 2008). Nevertheless, there is reason

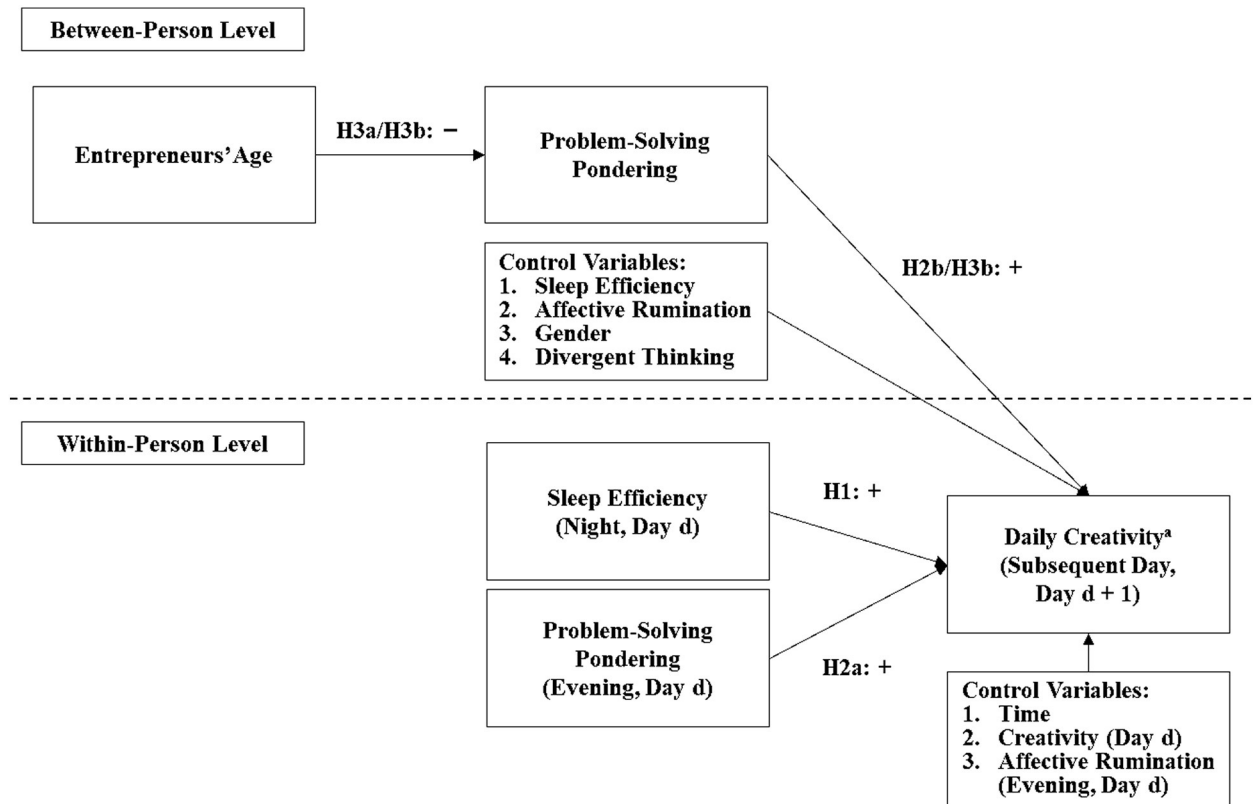


Fig. 1. Between- and within-person influences on entrepreneurs' daily creativity. <sup>a</sup> Note that the dependent variable daily creativity consists of within-person and between-person variance.



to expect that, given the stressful nature of entrepreneurs' jobs (Cardon and Patel, 2015), recovery may be important for entrepreneurs and, critically, will impact on their creativity. The organizational behavior literature increasingly recognizes that recovery processes during non-work time (e.g., after work or vacation, "off-job") have a positive impact on individuals' well-being and also on their on-job work performance, including creativity (Binnewies et al., 2010; de Jonge et al., 2012). Behaviors, activities, and experiences such as vacations, social and physical off-job activities, as well as physiological states (such as sleep), are all part of the recovery process because they help to rebuild mental and physiological resources (Zijlstra and Sonnentag, 2006). Recovery helps to avoid allostatic load, a state which by the constant exposure to stressors results in physiological strain and an elevated risk of mental and physical illness (McEwen, 2004).

Sleep as a primary physiological recovery process deactivates and regenerates the body (Åkerstedt, 2006). During sleep, homeostatic processes, i.e., meeting the need of sleep, and circadian body regulation occur (Borbély, 1982; Litwiller et al., 2016). For instance, sleep involves metabolic processes of energy restoration (Porkka-Heiskanen, 2013). Impaired sleep leads to insufficient physiological recovery, and long-term physical and mental health problems (Åkerstedt, 2006).

We propose that poor sleep quality will negatively affect entrepreneurs' creativity on the subsequent day (see Fig. 1). This is because, during sleep, cognitive processes of incubation take place which enhance creative idea development (Amabile et al., 2005; Sio and Ormerod, 2009; Wallas, 1926). Physiological recovery during sleep provides an incubation period in which work problems are temporarily put away and no conscious effort is spent on these problems, but where new associations are triggered by covert or unconscious processes (see Sio and Ormerod, 2009, for a meta-analytic review). Cognitive elements activated during the day when facing work problems are subconsciously recombined into novel ideas. This incubation process stimulates the search for possible problem solutions in previously ignored knowledge networks, inhibits irrelevant or inappropriate solutions, and allows restructuring and recombination of the information related to the problem at hand (Amabile et al., 2005; Simonton, 1999; Sio and Ormerod, 2009).

Sleep research has shown that experiences during the day are consolidated into our memory during sleep by re-activating these experiences (Buzsáki, 1998; Maquet, 2001) and through restructuring processes (Amabile et al., 2005; Wagner et al., 2004). In physiological terms, the activation of the dopaminergic system during sleep can enhance cognitive flexibility, i.e., leading to greater breadth of cognitive associations (Perogamvros et al., 2013). For instance, an experiment showed that after nocturnal sleep, participants could solve a cognitive task better than after nocturnal or daytime wakefulness (Wagner et al., 2004). In addition, several studies provide support for the premise that sleep deprivation impairs cognitive flexibility and originality, elements that are important for creative idea generation (Harrison and Horne, 2000; Horne, 1988; Wimmer et al., 1992). In particular, REM sleep has been shown to have beneficial effects on creativity (Cai et al., 2009; Walker et al., 2002). As for entrepreneurs, initial studies suggest that they may suffer from fatigue and sleep difficulties (e.g., Kallioniemi et al., 2009), highlighting the importance of investigating the consequences of low sleep efficiency.

Sleep research frequently uses sleep efficiency, i.e., the time asleep while in bed, as a key indicator of good sleep health or sleep quality (Buysse, 2014; Eatough et al., 2016). Sleep efficiency incorporates several important sleep parameters: sleep onset latency, i.e., the time between wakefulness and sleep; total sleep time; total wake time, i.e., time of wake after sleep onset (WASO); and awakening time. Sleep efficiency is an estimate for uninterrupted sleep as it takes wake times during sleep into account (Buysse, 2014). Sleep efficiency may relate to the quality and intensity of the incubation process, as these processes are likely to unfold their impact more effectively during uninterrupted sleep. If long or frequent awake intervals interrupt sleep, incubation processes are likely to be disrupted, and this may hinder creative idea generation. Thus, we expect sleep efficiency to influence entrepreneurs' creativity on the subsequent day positively.

A wide range of factors, such as stress, are known to influence the sleep/wake cycle on a daily basis, and lead to high within-person variability (Bei et al., 2015). Indeed, prior studies found high within-person variance in sleep efficiency (Knutson et al., 2007; Pereira et al., 2014; Tworoger et al., 2005; Van Hilten et al., 1993) and sleep fragmentation (Buysse et al., 2010; Mezick et al., 2009). Here, we focus on within-person variations in entrepreneurs' daily sleep efficiency – and control for between-person differences in sleep efficiency.<sup>2</sup> We predict that within-person variability in entrepreneurs' sleep efficiency affects creativity on the subsequent day.

**Hypothesis 1.** Sleep efficiency is positively related to entrepreneurs' creativity on the subsequent day on the within-person level.

Beyond physiological recovery that takes place during sleep, we also expect mental recovery in the form of problem-solving pondering to stimulate entrepreneurs' creativity. After work, several deliberate mental recovery processes occur. For example, people may mentally recover from work by no longer thinking about work issues, or by engaging in other activities like a hobby or volunteer work (Sonnentag and Fritz, 2007). We focus on work-related problem-solving pondering outside of working hours as an emotionally neutral rumination process, i.e., it occurs *without* psychophysiological arousal such as anxiety (Cropley and Zijlstra, 2011; Pravettoni et al., 2007; Querstret and Cropley, 2012). We propose that for entrepreneurs, problem-solving pondering is one form of mental recovery which rebuilds their resources. As a cognitive process of repetitive thoughts about work

<sup>2</sup> As two reviewers helpfully pointed out, there are also between-person differences in sleep efficiency. For instance, between-person differences in sleep efficiency in young and older individuals, i.e., over 60 years and much older, likely arise from the degeneration of the nervous system (Vitiello et al., 2004) and in particular, the decline of the structure and function of the circadian timing system with age (Huang et al., 2002). In addition, such differences are particularly pronounced for individuals with chronic psychiatric disorders, probably inducing higher levels of psychophysiological arousal affecting sleep (Baglioni et al., 2016; Benca et al., 1992). Nevertheless, such individuals are not the focus of our study. Our sample includes typical healthy, middle-aged entrepreneurs. Thus, we controlled for between-person sleep efficiency and particularly explored the effects of between-person sleep efficiency on creativity in the additional analyses section – and found no effects.

issues, it can take place during other activities, e.g., while driving home or having a dinner. For entrepreneurs, problem-solving pondering is expected to occur often, given their challenging and stressful work situation on the one hand (Cardon and Patel, 2015; McMullen and Shepherd, 2006) and their high levels of decision making autonomy on the other (Schjoedt, 2009; Stephan and Roesler, 2010). Indeed, similar work characteristics have been found to trigger problem-solving pondering in employees (Bennett et al., 2016).

Psychological detachment, i.e., switching off mentally, is often conceptualized as a prerequisite for complete recovery (Hamesch et al., 2014; Sonnentag et al., 2010). This means that ruminating, by contrast, should inhibit mental recovery because it delays unwinding from work (Brosschot et al., 2006). However, research indicates that rumination in the form of problem-solving pondering might constitute a beneficial form of mental recovery because it does *not* include the negative emotions that accompany affective rumination (Querstret and Cropley, 2012). Instead, it has been suggested that problem-solving pondering can involve positive work reflections (Binnewies et al., 2009; Hamesch et al., 2014; Zijlstra et al., 2014). Recent research on employees supports this, showing fewer detrimental or neutral effects of problem-solving pondering on well-being (e.g., Clancy et al., 2016; Firoozabadi et al., 2016). Moreover, when combined with other recovery experiences like relaxation, problem-solving pondering even showed positive effects on well-being (Bennett et al., 2016).

Entrepreneurs may even enjoy problem-solving pondering. They may be intrinsically motivated to ruminate about work-related issues because they like work-related thinking as an interesting activity (Cropley and Zijlstra, 2011). In addition, these thoughts can help them to get closer to possible solutions and move forward their business. This is likely to be rewarding (Querstret and Cropley, 2012) and may elicit feelings of entrepreneurial competence and self-efficacy, enhancing entrepreneurs' positive self-identity.

Problem-solving pondering consists of goal-oriented thoughts about improvements of work-related issues (Cropley and Zijlstra, 2011), and can stimulate cognitive processes of creative problem-solving (Amabile and Mueller, 2008). During problem-solving pondering, the problem at hand undergoes a process of redefinition and exploration; additional information about possible solutions is gathered, and preliminary attempts at problem solving take place (Amabile and Mueller, 2008; Sio and Ormerod, 2009). Even if the problem is not solved, these attempts may facilitate the later development of creative solutions (Sio and Ormerod, 2009). Individuals may learn from previous problem-solving attempts and return more efficiently to the problem the next time they address it; for example, because they then can start to think about the problem at a more developed level, and rule out some previous unproductive approaches (Sio and Ormerod, 2009). A so-called "Zeigarnik effect" on how individuals memorize different tasks might also play a role. This means that individuals remember unsolved problems better than solved ones (Sio and Ormerod, 2009; Zeigarnik, 1927). The greater salience of unsolved problems enables individuals to return faster to these problems when encountering new information. In particular, the longer and the more intense the problem-solving pondering, the higher the number of searches and preliminary attempts to find solutions.

The research relating problem-solving pondering and recovery to creativity is still relatively scarce and somewhat conflicting. A recent meta-analysis of five studies focused on between-person differences and employees. It concluded that a lack of psychological detachment (a concept closely related to problem-solving pondering) enhances employees' creativity (Wendsche and Lohmann-Haislah, 2017). However, a diary study of employees found the opposite effect (Niks et al., 2016). It is unclear whether these findings may generalize to problem-solving pondering (which emphasizes emotionally neutral engagement with work issues) and to entrepreneurs who face more challenging job characteristics (Stephan and Roesler, 2010). Building on our arguments about the beneficial effects of problem-solving pondering and searches for problem solutions for creativity, we propose:

**Hypothesis 2a.** Work-related problem-solving pondering is positively related to entrepreneurs' creativity on the subsequent day on the within-person level.

Work-related problem-solving pondering may also represent a cognitive thinking style in which entrepreneurs differ from each other. Some entrepreneurs might generally think more about work-related issues after work than others. As a result, those entrepreneurs who habitually engage in work-related problem-solving pondering would generate more creative ideas. Indeed, some studies demonstrate a relatively high stability (Kinnunen et al., 2016) and between-person variation in problem-solving pondering (Firoozabadi et al., 2016; Syrek et al., 2016). Moreover, on the between-person level, the related concepts of lack of (cognitive) detachment from work (de Bloom et al., 2015; de Jonge et al., 2012) and engaging in positive work reflections (Binnewies et al., 2009) were found to further creativity (Wendsche and Lohmann-Haislah, 2017). Hence, we propose:

**Hypothesis 2b.** Work-related problem-solving pondering is positively related to entrepreneurs' creativity on the between-person level.

### 2.3. Aging, mental recovery, and creativity

A recovery perspective on creativity can also help to explain why older entrepreneurs might generate fewer creative ideas. To understand how this may occur, we first discuss the relationship between age and mental recovery. We then outline how age, through influencing mental recovery, indirectly influences creativity. To do so we build on the relationship between problem-solving pondering and creativity outlined above (H2b). In sum, problem-solving pondering may act as one mechanism through which age reduces entrepreneurs' creativity.

Aging involves changes in individuals' priorities and interests (Kanfer and Ackerman, 2004) that are likely also relevant for entrepreneurs' mental recovery. These motivational changes with age stem from a reduced focus on occupational opportunities. The

number of future occupational opportunities and career goals decreases with age, due to a shorter time perspective and reduced physical strength (Gielnik et al., 2012b; Zacher and Frese, 2009). Older entrepreneurs have likely already achieved a range of their personal and business-related goals and are thus more satisfied with, and attribute less importance to, their financial status than do younger entrepreneurs (Gielnik et al., 2012b; Gorgievski et al., 2011). Instead, the priorities of older entrepreneurs appear to shift towards social aspirations, such as contributing to society (Wach et al., 2016), and towards health-related goals, like maintaining their own physical and mental well-being.

In sum, older entrepreneurs likely emphasize different goals compared to younger entrepreneurs. Consequently, their motivation to engage in work-related problem-solving pondering during their leisure time is likely to be lower. They are likely to avoid additional cognitive effort related to work-related problems, and prefer to switch off mentally after work. In other words, older entrepreneurs use a different self-regulation strategy to achieve mental recovery compared to younger entrepreneurs. Rather than engaging in work-related problem-solving pondering, older entrepreneurs would seek to preserve their resources, detaching from their jobs in order to recover more efficiently from work stress. Some studies support this idea for employees. For instance, a study on aging and rumination (Sütterlin et al., 2012) found that older individuals (63 years and older) reported less reflective pondering (similar to problem-solving pondering) than did other age groups. The highest level of pondering was reported by individuals between 25 and 37 years. This is in line with other studies showing that older persons more generally experience less work strain (Hertel et al., 2015; Rauschenbach and Hertel, 2011) and that with older age, entrepreneurs' psychological capital more strongly reduces their perceived stress (Baron et al., 2016). Hence, we propose:

**Hypothesis 3a.** Entrepreneurs' age is negatively related to work-related problem-solving pondering on the between-person level.

Past research suggests that different countervailing mechanisms mediate the relationship between age and creativity (Baltes, 1997; Kanfer and Ackerman, 2004). On the one hand, older individuals experience a loss of fluid intelligence, i.e., reasoning, which may decrease creativity. On the other hand, their crystallized intelligence, i.e., experiences, knowledge, and skills, augments and likely enhances creativity (Baltes, 1997). To date, organizational research supports neither a positive nor a negative relationship between age and creativity (Ng and Feldman, 2008; Ng and Feldman, 2013). In entrepreneurship research, there is no study investigating the relationship between entrepreneurs' age and creativity. A study of Gielnik et al. (2012b) indicates the possibility of a negative relationship between entrepreneurs' age and creativity. They found that venture growth decreases with entrepreneurs' age, because of a reduced focus on occupational opportunities, highlighting entrepreneurs' changing priorities with age.

We suggest that problem-solving pondering may act as one of the mechanisms through which age influences creativity. Due to entrepreneurs' age-related motivation and interests, problem-solving pondering may decrease with age (H3a). This does not imply that older entrepreneurs are automatically less creative, but that they may focus less on work-related issues in their leisure time. This lower engagement in work-related problem-solving pondering, in turn, lowers their work-related creativity. H3a predicts a negative effect of entrepreneurs' age on between-person problem-solving pondering. In H2b, we postulated a positive effect of problem-solving pondering on entrepreneurs' creativity on the between-person level. H3a and H2b together suggest a possible negative indirect effect of entrepreneurs' age on creativity. Hence, we propose:

**Hypothesis 3b.** There is an indirect negative effect of entrepreneurs' age via reduced work-related problem-solving pondering on creativity.

### 3. Methodology

This study used daily repeated measures to separate between- and within-person differences in the variables of interest (Curran and Bauer, 2011; Raudenbush and Bryk, 2002). We employed a day reconstruction method (Bakker et al., 2013; Kahneman et al., 2004), asking entrepreneurs to report their day's creativity every evening. Daily sleep efficiency and daily work-related problem-solving pondering were measured in an experience sampling approach, also known as ecological momentary assessment (Ilies et al., 2016; Uy et al., 2010), which allowed us to capture immediate ongoing processes. We tested relationships across consecutive workdays, thus independent variables refer to day  $d$  and creativity to the following day  $d + 1$ .

#### 3.1. Data collection procedures

We recruited entrepreneurs at diverse entrepreneurship events and via social networks. We emphasized voluntary participation and handled all data confidentially, assuring the anonymity of participants. We offered personal feedback on health and sleep quality as well as a summary of the study results as an incentive. Of the 128 persons who first agreed to participate, 85 took part in the study, resulting in a response rate of 66.41%.

We collected data between April 2014 and March 2015. Each entrepreneur participated in the study for 12 consecutive days, starting on a Monday and ending on the Friday of the following week. We asked entrepreneurs to choose two consecutive regular workweeks. At the beginning of the study, entrepreneurs filled out an online ( $n = 48$ ) or paper-and-pencil ( $n = 14$ ) questionnaire, which included demographic questions and a divergent thinking task. In addition, we distributed actigraphic devices<sup>3</sup>

<sup>3</sup> Prior to the main study, we conducted a pilot study with scholars and friends who carried the actigraphic device up to two weeks to check its appropriateness and usability.

(wrist watches) to entrepreneurs to record their sleep, starting on the first Monday at 18:00 until the last Friday at 18:00. Similar to ambulatory sleep assessment, entrepreneurs also recorded their sleeping and waking times.

We collected daily measures every day after work via a standardized telephone interview of 5 min. Entrepreneurs should have had at least 1 h and a half of leisure time after having finished their work when we called them in the late evening ( $M = 9:15$  p.m.;  $SD = 01:18$ ;  $n = 406$ ).<sup>4</sup> Trained research assistants asked the participants to reconstruct their creativity level during the day, and to rate their current state of problem-solving pondering and other study variables according to rating scales handed out at the beginning of the study. At the end of each interview, interviewers asked the participants for the best time for calling them on the next evening. During the 12 consecutive days, entrepreneurs performed additional online divergent thinking tasks, once in the middle of the first week and once in the middle of the second week, which we used to control for their divergent thinking ability.

### 3.2. Sample

Of the 85 study participants, we excluded three participants who did not finish the study, eight managers without business ownership, and 12 participants with no ( $n = 8$ ) or less than three ( $n = 4$ ) “day pairs”, i.e., data on sleep efficiency on day  $d$  and creativity on day  $d + 1$ . A technical error in the actigraphs caused the latter. The final sample consisted of 62 owner-managers or self-employed people working independently for their own account and risk (Stephan and Roesler, 2010).

On the day level, we first excluded those days with four or fewer hours of work, as we aimed to analyze relations between consecutive working days, resulting in 510 working days. Second, we excluded all days with missing data on the dependent variable creativity. The lagged measure of daily creativity was not collected on holidays or weekend days, reducing the sample size to 428 working days. Third, we excluded days on which participants felt ill (Winzeler et al., 2014), resulting in 418 working days. Additionally, we excluded three days with missing data on problem-solving pondering. This procedure led to a total sample of 415 “day pairs”, ranging from three to ten day pairs per participant ( $M = 6.69$ ;  $SD = 1.60$ ). Unequal numbers of days per participant are allowed in multilevel analysis and are not problematic for estimation (Tabachnick and Fidell, 2013).

Most of the participants were male (85.5%), German (98.4%), and had a higher education degree (82.3%). Their mean age was 40.94 years<sup>5</sup> ( $SD = 10.13$ ), ranging from 26 to 62 years. Our sample moderately differs from a representative German sample from the European Social Survey (ESS). We found that our sample included younger ( $M = 40.94$  vs.  $M_{ESS} = 50.76$ ;  $N_{ESS} = 208$ ), more male (85.5% vs. 72.5%<sub>ESS</sub>;  $N_{ESS} = 209$ ), and more highly educated entrepreneurs (82.3% vs. 71.9%<sub>ESS</sub>;  $N_{ESS} = 119$ ).

We like to provide some further background information to demonstrate that our participants are typical entrepreneurs, and not for example, some extreme populations or minorities such as singles without families. While most entrepreneurs (77.4%) lived in a committed relationship, less than half of the sample lived with one to three children under 18 years at home (41.9%). They worked on average 55.35 h a week for their business ( $SD = 10.57$ ; Range: 30–90 h). Most entrepreneurs worked in the service sector (85.5%). Their companies were founded between May 1949 and August 2014, mostly by themselves (82.3%;  $n = 51$ ). According to the number of employees and the EU definition of SMEs, most entrepreneurs owned micro businesses, i.e., they had fewer than ten employees (67.7%;  $n = 42$ ). The other entrepreneurs owned small, i.e., 10 to fewer than 50 employees (25.8%;  $n = 16$ ), and medium, i.e., 50 and more employees (6.5%;  $n = 4$ ), businesses. On average, they had 15.32 employees ( $SD = 32.39$ ; Range: 0–180) and a revenue of 4.45 million euros ( $SD = 22.23$ ; Range: 0.08–164.00 million euros;  $n = 55$ ) in the year 2013. Nearly all companies (95.2%) were situated in Saxony, Germany.

### 3.3. Measures

We presented all items in German, using a 5-point Likert scale (1 = do not agree at all; 5 = totally agree). We preferred short scales, since a daily study implies high effort for the participants (Scollon et al., 2003; Scott and Barnes, 2011; Uy et al., 2015). We used person averages (mean scores) of daily variables to analyze them as independent variables (between-person problem-solving pondering) and as control variables (e.g., between-person sleep efficiency) on the between-person level. Our repeated measures design of daily creativity as a dependent variable permitted separating its variance in within- and between-person effects, and establishing a temporal sequence (Curran and Bauer, 2011).

#### 3.3.1. Dependent variable

Daily creativity was assessed in the evening telephone interviews. Participants rated their own idea generation during the working hours of the present day, using three items from the scale provided by Janssen (2000) to measure idea generation as a part of innovative work behavior. We translated items into German and backwards into English. Afterwards, we compared both versions with regard to content and meaning. In addition, we adapted these items to measure daily creativity. The items were “Today, during my work, I have created new ideas for difficult issues”; “Today, during my work, I have searched out new

<sup>4</sup> In six instances, we asked entrepreneurs to fill out a written version of this evening interview because of long working hours. In other three instances, we assessed these variables in a telephone interview on the next day, asking questions in a retrospective way because we could not contact entrepreneurs on the day before. Excluding these nine cases had no significant effect on our results.

<sup>5</sup> This fits the common cut-off at 40 years in organizational research on “older workers”, which is based on legal definitions, e.g., the U.S. Age Discrimination in Employment Act of 1967, as well as the age range of active workforce between 16 and 65 years old (Ng and Feldman, 2008).



working methods, techniques, or instruments”; and “Today, during my work, I have generated original solutions for problems”. We calculated a Cronbach's alpha<sup>6</sup> of  $\alpha = 0.76$  across the day sample ( $N = 415$ ).

### 3.3.2. Independent variables

*Daily sleep efficiency*, the percentage of the time asleep while in bed, was measured objectively with actigraphy. Actigraphy uses devices worn on the wrist and is equipped with an accelerometer for movements. It is a reliable and valid instrument for sleep assessment (Sadeh, 2011) and avoids a subjective bias (Litwiller et al., 2016). As a cost-effective non-invasive instrument, sleep researchers have applied it in many settings and with different samples (Eatough et al., 2016). In this study, we used the wrist-watch model Actiwatch 2 (Philips Respironics, PA, USA). It registered movements from the non-dominant wrist and created raw scores of activity 24 h a day. After data collection, the Actiware software (Philips Actiware, Version 6) calculated sleep-wake activity with computerized and empirically tested algorithms (Tonetti et al., 2008). We used a standard threshold for determining sleep or wakefulness in every 30-second interval (Weiss et al., 2010). We asked our participants to wear the Actiwatch continuously and note the times in their daily sleep logs when they took it off, e.g., when taking a shower. Additionally, we used written daily sleep logs of participants to cross-validate starting and ending times of sleep (Eatough et al., 2016; Winzeler et al., 2014).

*Daily work-related problem-solving pondering* was measured with five items of the work-related rumination questionnaire (WRRQ) (Cropley et al., 2012; Querstret and Cropley, 2012) in the evening telephone interviews. These authors provided a German version of the original scale. We also adapted these five items for a daily assessment. Sample items were “Today, after work, I have tended to think of how I can improve my work-related performance” and “Today, after work, I have found myself re-evaluating something I have done at work”. Participants rated their answers in the evening telephone interviews. For work-related problem-solving pondering, the Cronbach's alpha was  $\alpha = 0.81$  across the day sample ( $N = 415$ ).

Finally, we measured *age* in years. We assessed it with a single item in the questionnaire distributed at the beginning of the study.

### 3.3.3. Control variables

Since we had daily repeated measures, we included a *time* index, representing the consecutive working days for each participant, to control for the linear trajectory. Additionally, we controlled for *creativity on the previous day*, i.e., the autocorrelation of the lagged dependent variable. We captured *daily work-related affective rumination* on the within- and between-person level to control for the negative affect associated with this type of maladaptive rumination. Work-related affective rumination describes thinking about work that elicits negative emotions. Thus, it could be called “stressful” problem-solving pondering. We measured it with five items of the German version of the WRRQ (Cropley et al., 2012; Querstret and Cropley, 2012) in the evening telephone interviews. Again, we adapted all items to measure daily fluctuations. Sample items were “Today, after work, I have become tense when I thought about work-related issues” and “Today, after work, I have been annoyed by thinking about work-related issues”. The Cronbach's alpha was  $\alpha = 0.82$  across the day sample ( $N = 415$ ). In addition, on the person level, we assessed *gender* with a single item and *divergent thinking* with eight ingenuity tasks of the Berlin Intelligence Structure Test (Berliner Intelligenzstruktur-Test, Form 4) (Jäger et al., 1997). It is a creative-thinking ability test. The tasks measure fluency, i.e., the absolute number of solutions (five tasks), and flexibility, i.e., the diversity of solutions (three tasks), within verbal and numerical categories. We analyzed approximately one half of the participants' answers (48.83% of all answers) with two raters and computed an average inter-rater reliability ICC (2,2) for all eight divergent thinking measures of 0.97 (Range: 0.90–1.00). For our final measure of divergent thinking, we first calculated the respective means for fluency and flexibility and then averaged them into a combined mean ( $r = 0.72$ ). We included it to control for differences in entrepreneurs' trait creativity.

## 3.4. Statistical analyses

We conducted multilevel analyses (also referred to as generalized linear mixed models) for hypotheses testing (Raudenbush and Bryk, 2002) because of hierarchically structured data with daily measures, nested in individuals. Multilevel models do not require independent observations.

In order to analyze within-person fluctuations, we centered daily independent and control variables, except time, on their group mean. This eliminated the between-person variance. This reduces multicollinearity and produces more stable predictors (Field, 2013). These group-mean centered variables represent each participant's daily deviation from his or her mean score across days (person averages). We included group-mean values (person averages) of daily variables (i.e., sleep efficiency, work-related problem-solving pondering, and work-related affective rumination) at the person-level for analyzing between-person differences. Creativity on the subsequent day (day  $d + 1$ ) as dependent variable and other between-person variables, i.e., age, gender, and divergent thinking, remained uncentered (Tabachnick and Fidell, 2013).

To test H1, H2a, and H2b, we included age, gender, divergent thinking, between-person affective rumination, and between-person sleep efficiency, as controls on the between-person level and time, within-person creativity on the previous day (day  $d$ ), and within-person affective rumination, as controls on the within-person level to rule out alternative explanations. Furthermore, we used full maximum likelihood as an estimator for more accurate estimates of fixed effects. We performed likelihood ratio tests to compare the goodness-of-fit between two models (e.g., Estrin et al., 2013). We specified our models with fixed

<sup>6</sup> We used these three items of daily creativity and calculated Cronbach's alpha across all available days, i.e., 415 days, in one estimation. We applied the same procedure to obtain Cronbach's alpha for other daily variables, i.e., work-related problem-solving pondering and affective rumination.

**Table 1**

Means, standard deviations, and zero-order correlations.

Variable	M	SD	1	2	3	4	5	6
<i>Daily variables</i>								
1 Sleep efficiency (day d)	86.48 <sup>b</sup>	7.34		0.06	−0.04	0.09		
2 Problem-solving pondering (day d)	2.45	0.90	0.11		0.36**	0.14**		
3 Affective rumination (day d)	1.73	0.73	−0.19	0.32*		0.01		
4 Creativity (day d + 1)	2.50	0.93	0.11	0.40**	<−0.01			
<i>Between-person level</i>								
5 Age	40.94	10.13	0.17	−0.27*	−0.21	−0.28*		
6 Gender <sup>a</sup>	0.85	0.36	−0.19	−0.17	−0.03	−0.23	−0.07	
7 Divergent thinking	6.21 <sup>c</sup>	1.87	0.01	0.05	−0.13	0.11	−0.25*	<−0.01

Note: Correlations above the diagonal are daily correlations ( $N = 415$ ). Correlations below the diagonal are between-person correlations ( $N = 62$ ). Means and standard deviations are aggregated across all days.

<sup>a</sup> 0 = Female, 1 = Male.

<sup>b</sup> Minimum = 26.48, Maximum = 98.00.

<sup>c</sup> Minimum = 3.13, Maximum = 11.00.

\*  $p \leq 0.05$ .

\*\*  $p \leq 0.01$  (2-tailed).

slopes, i.e., only allowing the intercept to vary (random intercept model), since random slopes of our five within-person independent and control variables were non-significant, and would have required a more complex model with more daily data from each person (Winzeler et al., 2014).

To analyze H3a regarding the effect of age on between-person problem-solving pondering and to investigate the indirect effect on entrepreneurs' creativity (H3b), we tested the following: (1) whether the independent variable (age) negatively relates to the mediator (problem-solving pondering), i.e., path a; (2) whether the mediator positively relates to the dependent variable (creativity), i.e., path b; and (3) whether the indirect effect ab is significant. We also tested path c, i.e., the total effect of the independent variable on the dependent variable (Baron and Kenny, 1986); however, this path was not required to be significant (Hayes, 2009; Zhao et al., 2010).

For the mediation analyses, we used multilevel structural equation modeling (MSEM) which provides nonconflated within- and between-person estimates of indirect effects (Preacher et al., 2010; Winzeler et al., 2014). We simultaneously controlled for the same variables that we had included when testing the direct effects. We conducted preliminary data checks and multilevel analyses with SPSS (Version 23) and conducted the multilevel mediation analysis with STATA (Version 14).

## 4. Results

We display means, standard deviations, and correlations in Table 1. For between-person correlations, we aggregated our daily variables on the between-person level across 415 days. Entrepreneurs' daily creativity was moderate ( $M = 2.50$ ;  $SD = 0.93$ ;  $Min = 1.00$ ;  $Max = 5.00$ ). Results also show that entrepreneurs report lower levels of daily work-related affective rumination ( $M = 1.73$ ;  $SD = 0.73$ ;  $Min = 1.00$ ;  $Max = 4.60$ ) compared to daily work-related problem-solving pondering ( $M = 2.45$ ;  $SD = 0.90$ ;  $Min = 1.00$ ;  $Max = 5.00$ ). This might reflect more trait positive affect (Baron et al., 2012), stress resistance and coping skills of entrepreneurs (Baron et al., 2016). Entrepreneurs' daily sleep efficiency can be categorized as "good" as they sleep 86% of their time they spend in bed ( $M = 86.48$ ;  $SD = 7.34$ ;  $Min = 26.48$ ;  $Max = 98.00$ ). For instance, Huang et al. (2002) report a very similar actigraphic sleep efficiency ( $M = 86.15$ ;  $SD = 8.38$ ) of healthy middle-aged ( $M = 42$ ;  $SD = 3$ ) persons. In addition, correlations show that problem-solving pondering and affective rumination correlate to a moderate degree on the day level ( $r = 0.36$ ) and the between-person level ( $r = 0.32$ ).

We analyzed the variation of creativity, calculating the intra-class correlation (ICC) from the Null (intercept-only) Model. It provides an estimation of the proportion of between- and within-person variance in the total variance (Tabachnick and Fidell, 2013). For entrepreneurs' daily creativity, within-person variation caused 77.01% of the total variance. Within-person variance accounted for 61.84% of the total variance in problem-solving pondering, for 67.69% in affective rumination, and for 66.21% in sleep efficiency. Multilevel analysis is appropriate because of substantial within- and between-person variance.

### 4.1. Test of hypotheses

#### 4.1.1. Direct effects on entrepreneurs' creativity: H1, H2a, H2b

Table 2 displays the results that predict entrepreneurs' creativity the subsequent day. We present multilevel estimates, standard errors, and t-values for all variables included. We tested H1, H2a, and H2b with four models, adding variables successively. First, we calculated the Null Model ( $-2 \text{ Log Likelihood (LL)} = 1076.19$ ), excluding independent and control variables. In Model 1 (see Table 2, columns 1–3), we included our control variables on the within-person level, i.e., time, within-person creativity on the previous day (day d), and within-person affective rumination, and on the between-person level, i.e., gender, divergent

**Table 2**Multilevel estimates for models with daily creativity on the subsequent day (day  $d + 1$ ) as dependent variable.

	Model 1			Model 2			Model 3			Model 4		
	Est	SE	t	Est	SE	t	Est	SE	t	Est	SE	t
Intercept	2.16	1.36	1.59	2.70	1.33	2.03*	2.72	1.33	2.05*	2.56	1.23	2.08*
<i>Within-person variables</i>												
Time	−0.04	0.02	−2.05*	−0.04	0.02	−1.98*	−0.04	0.02	−2.18*	−0.04	0.02	−2.31*
Within-p. creativity the previous day (day $d$ )	−0.04	0.05	−0.81	−0.04	0.05	−0.81	−0.05	0.05	−0.87	−0.05	0.05	−0.87
Within-p. affective rumination	−0.05	0.07	−0.66	−0.05	0.07	−0.66	−0.01	0.08	−0.14	−0.01	0.08	−0.14
Within-p. sleep efficiency							0.02	0.01	2.30*	0.02	0.01	2.30*
Within-p. problem-solving pondering							−0.08	0.07	−1.20	−0.08	0.07	−1.21
<i>Between-person variables</i>												
Age				−0.02	0.01	−2.34*	−0.02	0.01	−2.33*	−0.01	0.01	−1.60
Gender <sup>a</sup>	−0.35	0.19	−1.83	−0.37	0.18	−2.03*	−0.37	0.18	−2.04*	−0.30	0.17	−1.78
Divergent thinking	0.04	0.04	0.99	0.01	0.04	0.31	0.01	0.04	0.31	0.01	0.03	0.29
Between-p. affective rumination	0.04	0.14	0.26	−0.03	0.14	−0.22	−0.03	0.14	−0.23	−0.15	0.13	−1.09
Between-p. sleep efficiency	0.01	0.01	0.41	0.01	0.01	0.76	0.01	0.01	0.76	<0.01	0.01	0.16
Between-p. problem-solving pondering										0.33	0.11	3.12**
−2 Log Likelihood (LL)	1066.38			1061.11			1054.40			1045.41		
$\Delta$ −2 Log Likelihood (LL)	9.81			5.27*			6.71*			8.99**		
$\Delta$ Df	7			1			2			1		
AIC	1086.38			1083.11			1080.40			1073.41		
Within-p. Intercept Variance ( $\sigma^2_w$ )	0.66	0.05		0.66	0.05		0.64	0.05		0.65	0.05	
Between-p. Intercept Variance ( $\sigma^2_b$ )	0.17	0.05		0.15	0.05		0.15	0.05		0.12	0.04	

Note: Est = Estimate. SE = Standard error.  $N$  at between-person level = 62.  $N$  at within-person level = 415. AIC = Akaike Information Criterion. We report unstandardized coefficients.

<sup>a</sup> 0 = Female, 1 = Male.

\*  $p \leq 0.05$ .

\*\*  $p \leq 0.01$ .

thinking, between-person affective rumination, and between-person sleep efficiency.<sup>7</sup> Model 1 did not show a significant improvement in comparison with the Null Model ( $\Delta -2 LL = 9.81$ ,  $\Delta df = 7$ , n.s.). In Model 2 (Table 2, columns 4–6), we further included age on the between-person level, showing a significant improvement over Model 1 ( $\Delta -2 LL = 5.27$ ,  $\Delta df = 1$ ,  $p \leq 0.05$ ). In Model 3 (Table 2, columns 7–9), we added within-person sleep efficiency and within-person problem-solving pondering on the within-person level. Compared to Model 2, Model 3 showed a significant improvement ( $\Delta -2 LL = 6.71$ ,  $\Delta df = 2$ ,  $p \leq 0.05$ ). Finally, adding between-person problem-solving pondering on the between-person level in Model 4 (Table 2, columns 10–12) significantly improved model fit ( $\Delta -2 LL = 8.99$ ,  $\Delta df = 1$ ,  $p \leq 0.01$ ).

Within-person sleep efficiency positively influenced entrepreneurs' creativity on the subsequent day ( $\beta = 0.02$ ,  $p \leq 0.05$ , see Models 3 and 4), supporting H1. In support of H2b, work-related problem-solving pondering showed the hypothesized positive effect on next day creativity on the between-person level ( $\beta = 0.33$ ,  $p \leq 0.01$ , see Model 4) but not on the within-person level ( $\beta = -0.08$ , n.s., see Models 3 and 4, rejecting H2a).<sup>8</sup> Age related negatively to between-person creativity ( $\beta = -0.02$ ,  $p \leq 0.05$ ) in Models 2 and 3. However, the effect was no longer significant in Model 4 ( $\beta = -0.01$ , n.s.), in which we added work-related problem-solving pondering on the between-person level. This provided preliminary support for Hypothesis 3b and suggested an indirect effect of entrepreneurs' age on creativity via problem-solving pondering. With regard to our control variables, we observed no significant effects for gender, divergent thinking, between-person sleep efficiency, between- and within-person affective rumination, and creativity on the previous day (see Models 1–4). Time, i.e., the number of consecutive working days, exerted a significant negative influence on the entrepreneurs' creativity on the subsequent day ( $\beta = -0.04$ ,  $p \leq 0.05$ , see Models 1–4), highlighting a negative linear trajectory of daily creativity. This may be due to a regression to the mean<sup>9</sup> in entrepreneurs' daily creativity which is likely in longitudinal datasets (Barnett et al., 2005).

#### 4.1.2. Aging, mental recovery, and creativity: H3a, H3b

We conducted multilevel structural equation modeling to further test H3a and H3b, predicting a direct effect of entrepreneurs' age on between-person problem-solving pondering (H3a) and an indirect effect of entrepreneurs' age via between-person problem-solving pondering on entrepreneurs' creativity (H3b). As displayed in Table 3, the results demonstrate that age negatively relates to work-related problem-solving pondering (path a), and problem-solving pondering positively relates to creativity (path b).

<sup>7</sup> We decided to exclude age in Model 1 but to include it in Model 2. This allowed us to compare both models in terms of significant changes due to age. We used the model comparison as a preliminary analysis with regard to the indirect effect of age on creativity via problem-solving pondering, stated in H3b.

<sup>8</sup> We also tested an inverse u-shape relationship between problem-solving pondering and daily creativity on the within- and between-person level. However, we found no significant quadratic effects.

<sup>9</sup> Regression to the mean describes a statistical effect common in repeated measurements studies. More extreme measurements converge to the true mean of a person over time (Barnett et al., 2005).

**Table 3**

Direct, total, and indirect effects of age on creativity via work-related problem-solving pondering (between-person level).

Multilevel structural equation modeling			
	Est	SE	z
<b>c:</b> Total effect of age on creativity	−0.016	0.007	−2.33*
<b>c'</b> : Direct effect of age on creativity	−0.010	0.007	−1.59
<b>a:</b> Direct effect of age on problem-solving pondering	−0.017	0.003	−5.90**
<b>b:</b> Direct effect of problem-solving pondering on creativity	0.334	0.107	3.12**
<b>ab:</b> Indirect effect of age via problem-solving pondering on creativity	−0.006	0.002	−2.76**

Note: Est = Estimate. SE = Standard Error. We report unstandardized coefficients.

N at between-person level = 62. N at within-person level = 415. Control variables: Time, within-p. creativity the previous day, within-p. affective rumination, within-p. sleep efficiency, within-p. problem-solving pondering, gender, divergent thinking, between-p. affective rumination, between-p. sleep efficiency.

\*  $p \leq 0.05$ .

\*\*  $p \leq 0.01$ .

The indirect effect of these two paths was significant,  $\beta = -0.006$ , CI [−0.010, −0.002]. In sum, we found support for H3a and H3b; thus, older entrepreneurs engage less in problem-solving pondering which negatively affects their creativity.

#### 4.2. Robustness checks

We ran several tests to check the robustness of our findings. First, we tested if a different covariance structure, i.e., in the form of a variance-covariance matrix, would change the results. We specified a first-order autoregressive structure, AR(1), assuming highest correlations between adjoining repeated measurements. The  $t$ -score for the effect of within-person sleep efficiency on creativity the subsequent day slightly dropped ( $t = 2.02$ ,  $p \leq 0.05$ ) but remained significant. The effect of time, i.e., the linear trajectory, was no longer significant ( $\beta = -0.04$ , n.s.). Instead, creativity the previous day exerted a negative significant effect on creativity the subsequent day ( $\beta = -0.24$ ,  $p \leq 0.01$ ). Within this autoregressive structure, creativity the previous day, i.e., the autocorrelation of the dependent variable, may now capture the regression to the mean effect (Barnett et al., 2005) in entrepreneurs' repeated daily creativity ratings, similar to the effect of time shown above in Table 2. All other effects remained the same.

Second, we tested our results using a winsorizing technique to control for one outlier in sleep efficiency. We replaced the original value with another score, i.e., 3.29 standard deviations ( $SD = 7.34$ ) from the mean ( $M = 86.48$ ), because a  $z$ -score of  $-3.29$  and  $+3.29$  refers to the area of the standard normal distribution within which 99.9% of all scores should lie (Field, 2013). The  $t$ -score for the effect of within-person sleep efficiency on creativity the subsequent day dropped ( $t = 1.89$ ) and the significance level slightly changed to  $p = 0.06$ . Thus, the effect did not disappear and would probably increase in a larger sample.

Third, we reran the multilevel analyses with a smaller sample ( $n = 397$ ), excluding days on which participants mentioned in the evening interview that they either just stopped working, were still working when the interview started, or planned to continue working after the interview in the later evening. On these days, participants probably referred to their prospective work-related problem-solving pondering instead of their actual one. Nevertheless, the effects of work-related problem-solving pondering on the within-person ( $\beta = -0.11$ , n.s.) and between-person level ( $\beta = 0.35$ ,  $p \leq 0.01$ ), as well as other main results, remained the same.

Fourth, we tested our hypotheses with both other controls<sup>10</sup> and with no controls at all. In particular, we controlled for entrepreneurs' trait positive affect as entrepreneurs may have higher levels of positive affect compared to employees (Baron et al., 2012), which may bias their creativity ratings (Baron et al., 2012). We used three items of the German version (Krohne et al., 1996) of the Positive and Negative Affect Schedule (PANAS) scale (Watson et al., 1988) to assess high-activated positive mood, which, compared to low-activated positive mood, relates more to creativity (Baas et al., 2008). In the demographic questionnaire, we asked how "enthusiastic", "inspired", and "excited" entrepreneurs felt "in general", using the same items as another study on affect and innovative behavior (Madrid et al., 2014). Cronbach's alpha was  $\alpha = 0.89$  across the person sample ( $N = 62$ ). When including trait positive affect in our main analyses (in Models 1–4 in Table 2), positive affect was positively related to creativity (e.g., in Model 3:  $\beta = 0.18$ ,  $t = 2.17$ ,  $p \leq 0.05$ ).<sup>11</sup> The inclusion did not significantly change effects of within-person sleep efficiency and within- and between-person problem-solving pondering, but slightly reduced the age effect on entrepreneurs' creativity in Models 2 and 3 (e.g., in Model 3:  $\beta = -0.01$ ,  $t = -1.98$ ). We attributed this result to the loss in statistical power (Becker, 2005) and to the inclusion of two (reversely poled) emotion-related variables, i.e., trait positive affect and between-person affective rumination.

We also tested Models 3 and 4 without any controls to rule out the possibility that they are explaining or adjusting our results (Becker et al., 2016; Bernerth and Aguinis, 2016). We included within-person sleep efficiency, within-person problem-solving pondering, and age in Model 3, and in addition, between-person problem-solving pondering in Model 4. The results of our hypotheses were essentially identical to the main analyses presented above.

<sup>10</sup> Other control variables that we used were for example within- and between-person working hours, education, and trait negative activation. Results remained the same.

<sup>11</sup> When including positive affect in Model 4, its effect was not significant ( $\beta = 0.15$ ,  $p = 0.06$ ).



### 4.3. Additional analyses

We tested a multilevel structural equation model to explore whether between-person sleep efficiency may act as an additional mediator of the negative age effect on entrepreneurs' creativity. As two reviewers pointed out, sleep efficiency can suffer in older age and this may diminish creativity. Indeed, age positively predicted entrepreneurs' between-person sleep efficiency.<sup>12</sup> However, entrepreneurs' creativity was not influenced by between-person sleep efficiency. At the same time, the indirect effect of problem-solving pondering remained unaffected. Moreover, compared to Model 2 in our main analyses (see Table 2), the inclusion of age together with both *between-* and *within-*person sleep efficiency in Model 3 did not reduce the age effect on creativity as we would expect in the case of a mediation. Thus, we conclude that between-person differences in sleep efficiency do not mediate the effect of age on daily creativity. This finding may reflect the age structure of our sample ( $M = 40.94$ ;  $SD = 10.13$ ;  $Min = 26$ ,  $Max = 62$ ), representing middle-aged entrepreneurs. An indirect effect of entrepreneurs' age on their creativity via reduced sleep efficiency may be more probable for much older entrepreneurs (Huang et al., 2002; Vitiello et al., 2004). We also investigated if accumulated sleep debts relate to creativity at the end of the week (Barnes, 2012) by summing up values for sleep efficiency over the course of each week, and analyzing their potential effects on creativity on Fridays. However, correlation analyses showed no significant relationships.

## 5. Discussion

Creativity is important for entrepreneurs. It stimulates innovation (Sarooghi et al., 2015) and venture growth (Gielnik et al., 2012a), and helps entrepreneurs reap competitive advantage for their business. Studying entrepreneurs' daily creativity longitudinally over 12 days, our study reveals substantial within-person variation in creativity, and highlights physiological and mental recovery processes as drivers of daily creativity. These findings are robust to a number of robustness checks. Our study contributes to entrepreneurship research in two ways: first, it offers a new perspective on entrepreneurs' creativity that sees creativity as malleable. Second, it introduces a novel recovery lens to entrepreneurship research. It establishes recovery processes as a key influence on entrepreneurs' creativity and finds that they are a pathway through which entrepreneurs' age impacts creativity. Our study also contributes new insights, and helps to resolve conflicting findings in research on recovery and creativity in the broader organizational behavior literature.

### 5.1. A fresh perspective on entrepreneurs' creativity

Our study adopts a new state perspective, and highlights the existence of daily fluctuations in entrepreneurs' creativity, implying that entrepreneurs' creativity is not fixed but malleable, and can be developed. Indeed, most of the variation in entrepreneurs' creativity (77% of the total variation in creativity) resides within individuals (whereas 23% of the variation can be attributed to between-person differences, such as trait creativity). This state perspective on creativity contrasts with and complements the prevailing trait perspective in research on entrepreneurial creativity (e.g., Ardichvili et al., 2003). It supports the idea that, to a certain degree, entrepreneurs are "made" and not so much born (e.g., Rauch and Frese, 2007). By adopting a process approach and capturing entrepreneurs' daily (and nightly) life experiences of recovery and creativity, this study contributes insights into the micro-foundations of entrepreneurs' creativity as a constituent element of entrepreneurial action (Shepherd, 2015). Besides the high within-person variability of entrepreneurs' daily creativity, we highlight a sequence of recovery after work and during the night, and creativity the subsequent day.

We found a significantly higher within-person variation in entrepreneurs' creativity compared to the within-person variation reported in studies on employees in organizational behavior research. Those studies report within-person variation in creativity of 23 to 58% (Binnewies and Wörnlein, 2011; Bledow et al., 2012; Ohly and Fritz, 2010). This difference reinforces our argument that entrepreneurs are required to be creative on a daily basis. They need to deal with the challenging, complex and uncertain nature of their work (e.g., McMullen and Shepherd, 2006), and have the decision making autonomy that enables them to do so (e.g., Schjoedt, 2009; Stephan and Roesler, 2010). Nevertheless, parts of the within-person variation in creativity remained unexplained in our study, and we hope future research will explore further the personal and situational influences on entrepreneurs' daily creativity.

### 5.2. A novel recovery lens for entrepreneurship research

Our study introduces a novel recovery lens to entrepreneurship research. Our findings show that entrepreneurs' recovery is a key driver of creativity and, importantly, one that is under the control of the entrepreneurs. Physiological and mental recovery enhances entrepreneurs' daily creativity. Moreover, mental recovery also explains age-related differences in entrepreneurs' creativity. The cognitive processes underlying physiological and mental recovery stimulate creative idea generation (Amabile and Mueller, 2008; Sio and Ormerod, 2009; Wallas, 1926). This recovery lens enables entrepreneurs to influence their creativity because they can (learn to) self-regulate their recovery behavior.

<sup>12</sup> This effect might be in line with our reasoning that, when getting older, entrepreneurs change their priorities and interests towards more health-related goals; in this case, a better physiological recovery.

Recovery has hitherto been largely overlooked in entrepreneurship research, despite extant research in organizational behavior on the importance of recovery processes for limiting the negative effects of workplace stress (see McEwen, 2004; Sonnentag and Fritz, 2015; Wendsche and Lohmann-Haislah, 2017, for reviews). Beyond entrepreneurs' creativity, the consideration of recovery can enrich and provide a new perspective for other domains of entrepreneurship such as entrepreneurial stress and well-being (e.g., Baron et al., 2016; Cardon and Patel, 2015; Stephan and Roesler, 2010). Recovery processes may help entrepreneurs to deal with the challenges of their stressful jobs, enhance their well-being, and maintain psychological and physical health. Moreover, entrepreneurs' recovery could be an essential tool to maintain high levels of effort and remain productive; thus, future research may also study recovery in relation to performance.

Our findings also advance our understanding of the consequences of entrepreneurs' older age for mental recovery and creativity. We found that older entrepreneurs engaged in less work-related problem-solving pondering in their leisure time, and this in turn affected their creativity. This mechanism suggests that entrepreneurs' age does not automatically reduce their creativity. If older entrepreneurs wish to enhance their creativity, they could adapt their mental recovery processes and engage in more problem-solving pondering after work. Entrepreneurs with high growth aspirations, or those that start their first business at an older age may also experience a higher intrinsic motivation to engage in work-related problem-solving pondering during leisure time, with its positive effects on daily creativity. As such our findings offer a view of age differences that are not fixed but are likely malleable according to entrepreneurs' motivation. At the same time, however, the shifting priorities of older entrepreneurs, resulting in more detachment from work, may also benefit their work-life balance, well-being, and health (Wendsche and Lohmann-Haislah, 2017). We hope future research can explore these possible countervailing effects.

### 5.3. Implications for research on recovery and creativity in organizational behavior

We find a positive effect of mental recovery (specifically, engaging in problem-solving pondering) on creativity among entrepreneurs. This contrasts with existing organizational behavior research on employees, which typically finds that continuing engagement with work during leisure time (so-called lack of detachment from work) is bad for employees' well-being (Sonnentag and Fritz, 2015; Wendsche and Lohmann-Haislah, 2017). However, recently mixed findings started to emerge, some documenting less detrimental and even unexpectedly positive effects of continuing engagement with work in leisure time on employees' well-being and creativity (Clancy et al., 2016; Firoozabadi et al., 2016; Wendsche and Lohmann-Haislah, 2017).

Our findings help to reconcile these findings and suggest the need to consider the role of negative emotions on mental recovery, i.e., the extent to which the work-related thoughts entail negative emotions. We find creativity-enhancing effects for cognitive aspects of recovery (i.e., problem-solving pondering) but not for negative emotional aspects (i.e., affective rumination, which we include as a control variable). Thus, we highlight the importance of the absence of negative emotions during the cognitive scrutiny of a problem after work in order for it to be beneficial for creativity. It may be that entrepreneurs' typical work situation, which is characterized by high levels of decision-making autonomy, is helpful for their recovery since entrepreneurs are enabled to be in control of the situation and to take action (Stephan and Roesler, 2010). Consequently, entrepreneurs' work problems may become less threatening and evoke fewer negative emotions, thereby triggering a greater likelihood of effective problem-solving pondering rather than the ineffective affective rumination during leisure time. Similarly, entrepreneurs' higher stress tolerance (Baron et al., 2016) may lead towards a more adaptive recovery compared to employees.

Although we found a positive effect of between-person problem solving pondering (similar to an habitual thinking style) on creativity, we did not find the expected positive effect of daily, within-person engagement in problem-solving pondering on creativity. It may be that this effect depends on the daily challenges that entrepreneurs confront. It could be that the effect of problem-solving pondering becomes neutral on those days when entrepreneurs deal with particularly complex and difficult problems, evoking more problem-solving pondering than usual. Such "big" problems might not be solved easily, and thus, on such days, the entrepreneurs' problem-solving pondering will perhaps not produce any greater success in finding a solution (Sio and Ormerod, 2009), causing a zero net effect on creativity.

Our study also increases our knowledge of the relationship between sleep and creativity in a realistic setting. Mostly, this relationship has been researched in experimental laboratory studies and with student samples (e.g., Wagner et al., 2004; Wimmer et al., 1992). In addition, we measured sleep efficiency with actigraphy, which is a methodology new to entrepreneurship research. Actigraphic measures in general have only rarely been applied in organizational contexts to date (Litwiller et al., 2016).

### 5.4. Limitations and future research

Our study has limitations. First, we used self-reported measures of daily creativity. Future research may include more objective evaluations of entrepreneurs' ideas, for instance, in the form of ratings from others (Shalley et al., 2004). Yet, self-report measures of creativity are best practice in daily studies like ours (e.g., Bledow et al., 2012; Ohly and Fritz, 2010) because one's daily idea generation may not be observed by others throughout the day (Bledow et al., 2012). Thus, other-ratings of creativity are not necessarily feasible in daily studies, and especially for entrepreneurs who may work alone or are unlikely to disclose ideas to employees. Moreover, other-ratings may also change the nature of ideas captured, i.e., focusing only on those ideas that entrepreneurs deem suitable to communicate. For instance, considering competitive pressures, entrepreneurs are unlikely to volunteer particularly creative ideas.

Moreover, common method bias (Podsakoff et al., 2003), which is often seen to affect self-reported measures, is less likely to occur for repeated-measure studies such as ours (Foo et al., 2009; To et al., 2012). Additionally, we collected information for several variables using different measures, including more objective measures such as trait creativity assessed through an intelligence test, and sleep through actigraphy. We also collected information on the independent, control, and dependent variables at different time points. While we assessed problem-solving pondering and creativity in the same evening interview, we used a lagged analysis: we examined the dependent variable (creativity) on the subsequent day (measured the next day in the evening), while controlling for creativity on the prior evening (i.e., the autocorrelation with creativity on the previous day). We also controlled for other potential biases, like positive affect, in robustness checks.

Nevertheless, future studies might seek to use a combination of self-report and external assessments of creativity. Researchers may consider the use of external coders, e.g., members of the researcher team, who could rate daily narratives of entrepreneurs, using coding schemes to identify creative thoughts (Amabile et al., 2005).

Second, our study does not evaluate entrepreneurs' innovative outputs, which could be seen as another limitation. However, such outputs depend on various factors beyond the control of the entrepreneur, and involve a range of different innovative behaviors, e.g., idea communication, involvement of others, and overcoming obstacles (Lukes and Stephan, 2017), which we could not capture in this daily study. Instead, we focused on entrepreneurs' daily creativity in the form of their creative idea generation as a necessary first step in the innovation process (Sarooghi et al., 2015). Furthermore, entrepreneurs' creative ideas for future innovations, as well as those for everyday challenges in their complex jobs, are equally worth studying and understanding (Welter et al., 2016). We also did not measure entrepreneurs' daily creative requirements. To address this potential limitation, we conducted additional robustness checks, controlling for day-specific cognitive stressors, namely, tasks that demand high concentration and cognitive effort, as proxies for creative requirements. Our results remained unchanged.

Third, a few participants answered questions regarding their prospective work-related problem-solving pondering, as at the time of the evening interview, they were still working, had just stopped working, or mentioned that they might continue working in the later evening. Thus, their working and leisure time overlapped. After controlling for such overlap in our robustness checks, our results did not change. Nevertheless, future research should take the role of different types of entrepreneurs' work-leisure boundaries into account.

Lastly, we analyzed a convenience sample of entrepreneurs from the region of Saxony in Germany which was moderately different compared to a representative German sample as outlined in the sample description. Although convenience samples are common in entrepreneurship studies, this limits the generalizability to other entrepreneurs and regions. However, we controlled for gender and education and they did not affect the results. The representativeness of our sample may also be limited because of a possible underrepresentation of extremely busy entrepreneurs (Taris et al., 2008). This may have restricted the variance in our main study variables, i.e., sleep efficiency, problem-solving pondering, and creativity. Such restriction of variance, however, would result in an underestimation of effect sizes. Thus, our findings may be seen as conservative estimates of the role of recovery for creativity.

We may also have attracted entrepreneurs who are particularly interested in their own health and participated because we offered personalized feedback on sleep quality and health. Another reason to participate in our study might be entrepreneurs' prosocial motivation, i.e., a wish to support our research team and contribute generally to knowledge development. It is unclear whether the self-interested motivation to learn more about their health or the prosocial motivation dominated. The different motives may coexist and neutralize each other in their effects on our study variables. Nevertheless, we encourage future research to replicate our findings with a different sample, for instance with innovative start-up entrepreneurs, or females who were underrepresented in our study.

We hope this paper stimulates research on entrepreneurs' creativity from a state perspective, identifying additional drivers of and barriers to daily creativity. Daily internal determinants may be entrepreneurs' intrinsic motivation (e.g., Amabile and Mueller, 2008; Sternberg, 2012) or emotional states (e.g., Bledow et al., 2012) such as feeling relaxed or tense before going to work or during commuting time. Daily external determinants could be entrepreneurs' work environments or the dynamics within entrepreneurial teams.

Finally, our findings from the entrepreneurial setting could also inform research on strategic leaders and their recovery and creativity. These leaders appear to share similar personality and job characteristics (such as complexity, ambiguity, information overload) with entrepreneurs (Simsek et al., 2015).

### 5.5. Implications for practice

We suggest that entrepreneurs might pay attention to their sleep efficiency in order to generate creative ideas on a daily basis. When noticing sleep problems, e.g., via devices that record sleep, entrepreneurs could consult health advisors in the case of severe sleep problems, or enhance their sleep efficiency by applying validated interventions. For instance, they could listen to relaxing music or avoid activating activities prior to bedtime (e.g., Barnes, 2012; de Niet et al., 2009). Additionally, mindfulness and yoga improve sleep quality in healthy adults (Atkinson and Permuth-Levine, 2009) and elderly individuals (Alexander et al., 2013). Moreover, business consultants could suggest owner-managers to consider having members of different ages on their executive boards in order to maintain a high level of creativity and sustain competitive advantage (Wegge et al., 2008).

Entrepreneurs who regularly think about work problems in their leisure time enhance their creativity at work. Thus, staying "switched on" after work is good for entrepreneurs' creativity. However, as soon as negative emotions occur or affective rumination takes over, this beneficial effect disappears. If entrepreneurs learn to self-regulate their mental recovery and negative

emotions, e.g., via problem- or emotion-focused coping strategies, they may enhance their creativity. While problem-focused coping strategies deal with the *problem* causing *negative emotions*, e.g., work reorganization, emotion-focused coping deals with the *negative emotions*, e.g., seeking emotional support or distraction (Patzelt and Shepherd, 2011; Uy et al., 2013). Both coping approaches could help entrepreneurs to engage in problem-solving pondering rather than affective rumination.

Our study has also implications for practitioners and policy-makers seeking to support entrepreneurship and start-ups. Individuals may be reluctant to start their own business because they do not see themselves as being creative, and they believe that creativity is required to be a successful entrepreneur. Based on our findings, educators could highlight the malleability of creativity when speaking about entrepreneurship, e.g., in entrepreneurship courses offered at universities and at various start-up initiatives. Educators could discuss implicit theories held by students about entrepreneurs' personality (cf. born vs. made debate), and highlight possible tactics to enhance creativity, e.g., through creativity trainings and recovery. Similarly, policy-makers could promote start-up initiatives by depicting creativity as something that can be learned.

## 6. Conclusion

Our study introduces a new perspective on entrepreneurs' creativity that regards creativity not primarily as a stable trait but emphasizes its character as a state which changes on a daily basis. We propose a novel recovery lens for entrepreneurship research, and demonstrate that physiological and mental recovery drive entrepreneurs' creativity. Additionally, our study highlights the role of mental recovery as one mechanism in the relationship between entrepreneurs' age and creativity. This opens up a number of opportunities for entrepreneurs to enhance their daily creativity, in particular via recovery mechanisms such as sleep. The study also offers several avenues for future research on entrepreneurs' creativity, recovery, and aging, and suggests implications for research on entrepreneurs' well-being.

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