Digital Disconnection or Digital Drain? A Diary Study on Virtual Recovery and Well-being

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Abstract

As digital technologies become increasingly integrated into daily life, virtual recovery activities, such as watching TV, using social media, or playing video games, have emerged as common forms of post-work leisure. However, the psychological impact of these activities on next-day well-being remains unclear. This study investigated the role of virtual recovery in predicting next-morning recovery using a 14-day daily diary design among working adults (n = 298). Grounded in recovery theory, the study also explored whether affective experience during digital leisure moderates this relationship and whether age predicts engagement in virtual recovery in the first place. Results from multilevel modelling revealed a negative association between virtual recovery activities and next-morning recovery, challenging assumptions about the restorative value of digital leisure. Affective experience did not moderate this relationship. Additionally, age negatively predicted engagement in virtual recovery, with younger individuals using digital leisure more frequently than older participants. These findings highlight that not all post-work digital leisure is restorative, suggesting the need for a more nuanced understanding of when and for whom virtual activities support recovery. They further point to the value of promoting non-digital leisure options, particularly for younger workers who more often rely on virtual recovery.

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In today's demanding work environments, employees frequently face long hours, heavy workloads, and high job demands, which can lead to stress, fatigue, and burnout (Sonnentag et al., 2021). To maintain long-term well-being and performance, it is essential for employees to engage in effective recovery activities after work. Recovery activities refer to behaviours or experiences undertaken during non-work time that allow individuals to replenish depleted psychological and physiological resources, restore energy, and prepare for the demands of the following workday (Sonnentag & Fritz, 2007). In fact, recovery has been associated with improved affective states, reduced stress, and even enhanced work engagement (Sonnentag et al., 2017; ten Brummelhuis & Bakker, 2012). Traditionally, research has focused on physical, social, and outdoor recovery activities, such as exercising, meeting with friends, or taking a walk (ten Brummelhuis & Bakker, 2012; Sonnentag et al., 2017, 2021). Such activities have been shown to promote psychological detachment from work, relaxation, mastery, and control (Sonnentag & Fritz, 2014; Sonnentag et al., 2017). These four recovery experiences form the foundation of effective recovery and their efficacy has been widely supported (Sonnentag & Fritz, 2007).

With the growing presence of digital technology in everyday life, many individuals now engage in virtual activities as a dominant form of post-work leisure (Akello, 2024). These include watching TV, playing video games, using social media, surfing the internet, and other screen-based entertainment formats (Alameer et al., 2023). Digital leisure is attractive due to its accessibility, ease of use, and capacity to fulfil emotional and social needs, including relaxation, entertainment, and social interaction (Gellmers & Yan, 2023; Whiting & Williams, 2013). Some studies suggest that digital leisure can support recovery by promoting relaxation, positive affect, and psychological detachment from work (Koçak et al.,

2023; Kuykendall et al., 2020; Reinecke, 2009; Wagener et al., 2025). Still, most existing research has focused on specific digital behaviours, such as screen time, gaming, or social media use, and their associations with outcomes like well-being, sleep, or mood (Ahmed et al., 2024; Bayer et al., 2019; Koçak et al., 2023). These studies rarely conceptualise virtual leisure as a unified form of recovery or examine its role within the broader framework of recovery theory. Consequently, little is known about whether, and under what conditions, engaging in digital leisure facilitates recovery from work demands. This is a significant gap, given the increasing role of digital leisure in daily life and its potential to serve as either a restorative or draining experience. Understanding the role of virtual recovery is essential for advancing theory and informing practical strategies for sustainable recovery in modern work environments.

Despite evidence suggesting potential benefits for recovery, the broader effects of virtual activities on well-being remain contested. Concerns have been raised about excessive screen time and its negative consequences, including impaired sleep, increased cognitive load, and reduced emotional well-being (Bayer et al., 2019; Hale & Guan, 2014; Silvani et al., 2022). While some digital activities may be relaxing and enjoyable, others may evoke stress, frustration, or overstimulation (Koçak et al., 2023; Ramadhan et al., 2024). Even the same type of activity can have different effects on recovery, depending on how it is experienced (Demerouti et al., 2009). Together, these mixed findings prompt a key question about the conditions under which virtual leisure serves as a restorative experience. One possible answer lies in the affective experience that accompanies the activity. The affective tone of a recovery activity, that is, whether it is experienced as pleasant or unpleasant, may significantly influence whether the activity restores or drains an individual's resources (Oerlemans et al., 2014). Although affective responses have frequently been studied as outcomes of recovery activities (i.e., improved mood, reduced tension, feeling refreshed;

Sonnentag & Fritz, 2007), their role in influencing how recovery activities relate to recovery outcomes has received little attention. This study proposes that the affective experience during virtual recovery activity may determine its impact on next-morning recovery.

Beyond these situational factors, individual characteristics may also shape how people engage with and benefit from virtual recovery. One such factor is age, which has been shown to influence recovery preferences, particularly in regards to technology use. Emotional and social needs, such as relaxation, entertainment, and social connection, may be especially prominent for younger generations, who tend to be more attracted to digital leisure formats due to their familiarity with technology and the central role it plays in their social lives (Ahmed et al., 2024; Akello, 2024; Carcelén-García et al., 2023; Whiting & Williams, 2013). In contrast, older individuals often prefer more traditional or offline forms of recovery, such as spending time in nature or engaging in face-to-face social activities (Virtanen et al., 2019). Despite these age-related differences, little is known about how age predicts the actual likelihood of engaging in virtual recovery activities in daily life.

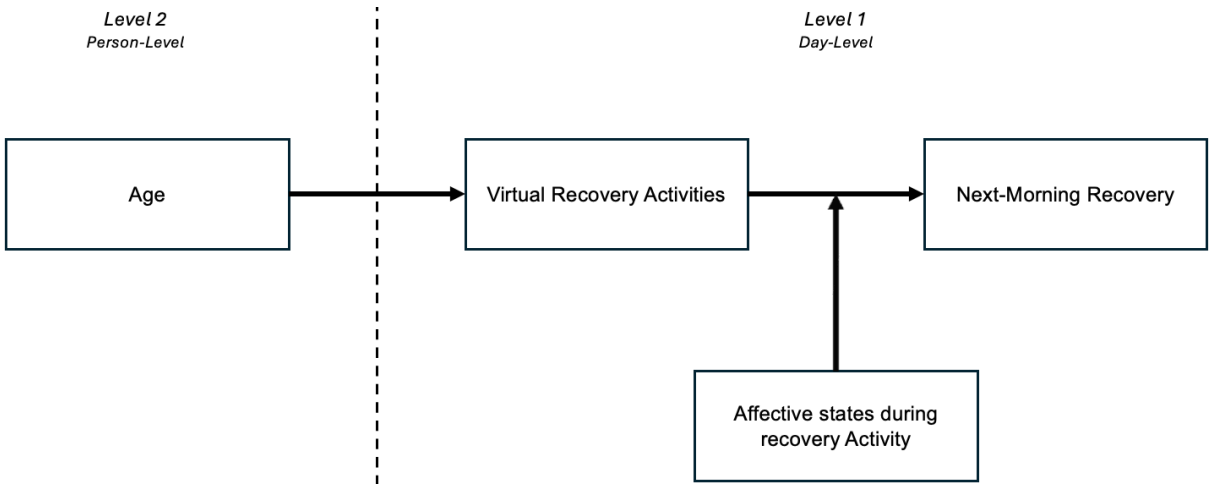
This study provides several contributions to the recovery literature. First, by conceptualising virtual recovery as a unified construct rather than analysing isolated behaviours (i.e., gaming, social media, streaming, or blue light exposure), the study responds to calls for more integrated approaches in understanding digital recovery (Alameer et al., 2023). While prior research has examined specific screen-based behaviours in relation to well-being, this study treats virtual recovery as a broader category of post-work activity, grounded in established recovery theory. Second, the study advances the recovery field by introducing affective experience as a moderator of the digital leisure-recovery link. By examining both positive and negative affect during virtual activities, this research uncovers when virtual recovery may be effective, moving beyond the simple view of digital leisure as either entirely good or bad. This focus on the contextual quality adds to our understanding of

recovery processes and opens new ways for future intervention research. Third, the study explores age as a meaningful between-person predictor of virtual recovery engagement. Although generational differences in digital behaviour are often assumed, empirical evidence linking age to daily recovery choices remains limited. Examining age not only addresses this empirical gap but also clarifies whether virtual recovery represents a universal recovery strategy or one that is primarily characteristic of younger generations. Understanding such differences is important for both theory and practice, as organisations increasingly face the challenge of supporting recovery in multigenerational workforces.

Taken together, the thesis examines whether virtual recovery activities truly support the recovery process, whether the emotional experience during these activities alters this relationship, and whether age predicts engagement in virtual recovery. These aims are integrated into a daily diary framework (see Figure 1), and together they contribute to a more nuanced understanding of modern recovery processes.

Figure 1

The Role of Digital Leisure in Work Recovery: A Multilevel Model



Theory and Hypotheses

Virtual Recovery Activities as a Form of Recovery

The Conservation of Resources (COR) Theory (Hobfoll, 1989) offers a useful framework, explaining stress and recovery in terms of resource depletion and replenishment. According to COR theory, people strive to acquire, retain, and protect their resources. Stress arises if these resources are threatened or lost, and recovery activities function as a way to restore lost resources (Hobfoll, 1989). Virtual activities can help restore these resources by facilitating detachment from work, promoting relaxation, and providing a sense of control and mastery. For instance, watching a favourite series in the evening may help an employee mentally detach from work tasks, listening to calm music may promote relaxation, and improving gaming skills or completing challenging levels can provide a sense of control and mastery. Complementing this view, the Effort-Recovery Model (Meijman & Mulder, 1998) emphasises that recovery occurs when work-related demands are no longer present, allowing psychological and physiological systems to return to baseline. From this perspective, virtual activities may support recovery when they create opportunities for disengagement and low-effort restoration.

Extending these theoretical insights with empirical evidence, virtual recovery activities are particularly effective when they are self-chosen, immersive, and emotionally engaging (Koçak et al., 2023; Mella et al., 2023). Such activities may support psychological detachment from work through mental absorption and distraction, while also fostering feelings of control and mastery (Gellmers & Yan, 2023). Evidence for these mechanisms is found in studies on common forms of digital leisure. Collins et al. (2019), for instance, showed that enjoyable casual gaming after work enhanced recovery experiences over time, while Koçak et al. (2023) further reported that immersive, self-selected formats such as video games or streaming can help users mentally disengage from work. Beyond these more

common activities, immersive technologies such as virtual reality have been shown to replicate the restorative effects of natural environments, with nature simulations improving mood and relaxation (Mattila et al., 2020; Walters et al., 2022). Together, these findings indicate that digital leisure can restore resources not only through detachment and mastery but also through emotional restoration. This interpretation is further supported by studies linking virtual leisure to stress reduction and the fulfilment of basic psychological needs. Reinecke (2009) and Wagener (2025) found that casual gaming after work lowered stress and emotional exhaustion, suggesting a detachment-enhancing effect, while Kuykendall et al. (2020) demonstrated that screen-based leisure activities foster autonomy and relaxation, both of which are positively associated with well-being.

Together, this body of evidence indicates that virtual leisure can support recovery when it enables detachment, fosters mastery, restores positive mood, and satisfies psychological needs. If these mechanisms hold, people who engage more in virtual recovery activities should feel more restored the next day. Based on this reasoning, the first hypothesis is:

> ***H1:*** *Engaging in virtual recovery activities is positively associated with next-morning recovery.*

The Role of Affective Experience in Recovery

A growing body of research suggests that the emotional quality of leisure experience is crucial for its effectiveness. According to the Broaden-and-Build Theory (Fredrickson, 2001), positive emotions are thought to undo the physiological and cognitive effects of stress and build lasting psychological resources. In contrast, negative emotions may constrain cognitive flexibility and prolong stress responses (Fredrickson, 2001). Applied to virtual recovery, this framework suggests that it is not merely the activity itself but the emotional state experienced during the activity that determines its restorative value. A virtual activity

may foster recovery when it evokes calmness, enjoyment, or relaxation, but it may undermine recovery if it is accompanied by frustration, boredom, or overstimulation. Therefore, the affective experience during digital leisure may moderate the effectiveness of virtual recovery in supporting next-day restoration. This reasoning is consistent with the Effort-Recovery Model (Meijman & Mulder, 1998), which highlights that the effectiveness of recovery depends on what happens during non-work time, not simply on the absence of work demands. From both perspectives, positive affect can facilitate emotional unwinding and disengagement, whereas negative affect may sustain activation and undermine recovery.

Empirical findings further support this theoretical perspective and underscore the moderating role of affective experience during leisure. Demerouti et al. (2009) reported that the same type of activity can have beneficial, neutral, or even detrimental effects on recovery depending on how it is experienced, underlining the role of affective quality. Building on this, Oerlemans et al. (2014) found in a daily diary study that momentary happiness during off-job activities significantly influenced end-of-day recovery. According to their study, social and physical activities were associated with better recovery only when they were experienced as enjoyable. Conversely, when positive affect was low, these same activities were ineffective or even detrimental (Oerlemans et al., 2014). Whether an individual experiences a virtual activity as calming, enjoyable, frustrating, or overstimulating may shape how effective that activity is in supporting recovery.

Taken together, these theoretical frameworks and empirical findings suggest that the emotional quality of virtual recovery activities plays a key role in moderating their impact on next-morning recovery. Enjoyable and calming experiences are expected to enhance the benefits of virtual recovery, while frustrating or overstimulating ones may undermine or reverse them. Based on this, this study proposes the following hypothesis:

H2a: *Positive affect during virtual activities moderates the relationship between virtual recovery activities and next-morning recovery, such that the relationship is stronger when positive affect is high (vs. low).*

H2b: *Negative affect during virtual activities moderates the relationship between virtual recovery activities and next-morning recovery, such that the relationship weakens or becomes negative when negative affect is high (vs. low).*

Age Differences in Engagement with Virtual Recovery

While emotional experience may influence the effectiveness of virtual recovery on a daily level, individual differences, such as age, may also shape how often people choose to engage in virtual leisure activities in the first place. Age is known to shape how individuals interact with digital technologies and, consequently, their likelihood of choosing virtual recovery strategies. Research consistently shows that younger individuals are more likely to engage in digital entertainment compared to older individuals (Ahmed et al., 2024; Akello, 2024; Carcelén-García et al., 2023; Charness & Boot, 2022). This difference is often attributed to higher digital literacy, greater exposure to technology from an early age, and increased comfort with digital interfaces, making virtual recovery activities more accessible and appealing for younger employees (Charness & Boot, 2022; Hauk et al., 2018). In contrast, older individuals tend to engage less in digital activities due to various psychological and structural barriers. These may include lower perceived usefulness of digital leisure tools, reduced interest in digital entertainment, and negative attitudes toward new technologies (Krueger et al., 2018; Hauk et al., 2018). These patterns reflect not only age-related preferences but also broader generational differences in digital socialisation. Younger individuals, having grown up with digital media as a central part of their daily lives, often view it as an integral part of their identity, social connection, and leisure routines (Rustad et al., 2024).

These preferences are also reflected in the types of recovery activities individuals choose. Younger employees are more likely to engage in gaming, social media, and streaming services as their primary forms of relaxation and are often embedded in the everyday routines of younger individuals (Ahmed et al., 2024; Akello, 2024; Carcelén-García et al., 2023). In contrast, older employees may prefer non-digital recovery strategies, such as physical activity, in-person social interactions, or engaging in hobbies that promote creativity and mastery (National Institute on Aging, 2022). These preferences may stem from the need for meaningful engagement, familiarity with traditional forms of leisure, or discomfort with rapidly evolving digital platforms (Krueger et al., 2018). These differences are supported by evidence showing that older adults often derive greater recovery benefits from control- and mastery-based activities, while younger individuals benefit more from relaxation- and detachment-based strategies (Virtanen et al., 2019). This supports the broader understanding in occupational psychology that recovery is not a universal concept, but its effectiveness depends rather on how well it aligns with an individual's personality, values, and situational context (Sonnentag et al., 2021).

Building on this body of evidence, age can be considered a relevant individual-level predictor of virtual recovery behaviour. Given the generational differences in digital literacy and familiarity with digital media, it is likely that younger employees are more inclined to select virtual activities as a way to unwind after work. This study, therefore, examines age as a between-person variable to predict the frequency of virtual recovery engagement.

> ***H3:*** *Age influences the likelihood of choosing virtual recovery activities, with younger individuals engaging in virtual recovery activities more frequently than older individuals.*

Methods

Sample

This study was part of a larger research project investigating various recovery activities and their effects on well-being. While the broader study included a wide range of recovery variables and outcomes, the present thesis focused specifically on the role of virtual recovery activities. Ethical approval for the study was obtained from the Ethics Review Committee Psychology and Neuroscience (OZL_277_21_02_2024). Of the initial 328 participants, 25 were excluded for not completing the intake or any daily surveys. An additional 5 participants were excluded due to careless responding (n=3) or missing both the afternoon and bedtime surveys every day (n=2), resulting in a final sample of 298 participants (response rate = 90.9%). Most participants identified as female (57%), followed by male (42.7%), and one person preferred not to disclose their gender (0.3%). Participants had a mean age of 36.89 years (SD = 14.34). On average, they reported working 34.72 hours per week (SD = 9.57) and had been with their current employer for an average of 8.61 years (SD = 10.65). Participants were employed across a variety of sectors. The most frequently represented sectors were Education & Research (14.4%), followed by Healthcare (10.7%), Service (9.4%), Engineering (8.7%), and Accountancy & Finance (6.4%).

Procedure

The study recruited a diverse sample of employees from various industries. Recruitment took place via social media (Instagram, LinkedIn), flyers distributed on Maastricht University campus, and personal networks, ensuring a wide participant pool. To be eligible for the study, individuals had to be at least 18 years old, be fluent in English and/or German, work a minimum of 20 hours per week, and maintain standard daytime working hours (i.e., 9 a.m. to 5 p.m.). To encourage daily compliance, participants received an 8€

Amazon voucher for completing 50 – 80% of the surveys and a 15€ Amazon voucher for completing at least 80% of all surveys.

The study was carried out entirely via the Avicenna Research mobile app. Following consent, participants first completed an initial intake survey before starting the daily diary phase. This intake survey collected demographic information, including age, gender, and work schedule. Following the intake, participants completed three brief surveys per day over the course of 14 consecutive days. The afternoon survey was completed after work and assessed post-work states. Although the afternoon survey was part of the larger study, it was outside the scope of this thesis as it did not directly relate to the focus on recovery activities, their affect and next-morning outcomes. The evening survey was completed before bedtime and assessed the type of recovery activity participants engaged in and their affective experience during the activity. The morning survey was completed upon waking and measured the participants' recovery levels. Each survey took approximately three to five minutes to complete. This daily design improved ecological validity by capturing real-time recovery experiences and minimising retrospective bias (Shiffman et al., 2008).

Measures

Virtual recovery activities

Participants reported the extent to which their recovery activities involved digital and virtual environments using the Two-Item Recovery Activity Questionnaire established by Alameer et al. (2023). This brief scale was chosen to reduce participant burden in the daily diary format while maintaining acceptable reliability. The two items were: "Today after work, to what extent did you engage in activities that… occurred through digital devices (e.g., smartphone, computer, tablet)" and "… were virtual (e.g., using digital technology)?". Responses were recorded on a Likert scale ranging from 1 (*not at all*) to 5 (*to an extremely*

large extent). Across 14 days, Cronbach's alpha averaged 0.88 (ranging from 0.82 to 0.91), indicating good internal consistency.

Positive and negative affect

To assess affective experience during recovery, participants rated their positive and negative affect during leisure activities using the Affective Circumplex Model (Larsen & Diener, 1992; Scott et al., 2020), as already used in Young et al. (2023). They responded to the prompt, "To what extent did you feel the following emotions during your leisure activity?" using six positive (i.e., "enthusiastic", "cheerful", "excited", "calm", "relaxed", "peaceful") and six negative (i.e., "mad", "angry", "nervous", "tired", "sluggish", "disappointed") affect items. All items were rated on a Likert scale from 1 (*to a very small extent*) to 5 (*to a very large extent*). For positive affect, Cronbach's alpha averaged 0.86 (ranging from 0.83 to 0.89), reflecting good reliability across measurement occasions. For negative affect, Cronbach's alpha averaged 0.75 (ranging from 0.66 to 0.83), which is acceptable, although the lower bound approaches the threshold for questionable reliability (Nunally & Bernstein, 1994).

Next-morning recovery

Next-morning recovery was measured using three items from the State of Being Recovered Scale (Sonnentag, 2003), rated on a Likert scale from 1 (*not at all*) to 5 (*extremely*). Participants reported the extent to which they felt "restored", "recovered", and "refreshed" upon waking. Across 14 days, Cronbach's alpha averaged 0.96 (ranging from 0.93 to 0.97), indicating excellent reliability.

Statistical Analysis

All analyses were conducted in R (version R-4.5.1). Given the nested structure of the data with daily measurements (Level 1) nested within individuals (Level 2), linear mixed-effects models were used to account for both within-person fluctuations and between-person

differences. This approach is appropriate for repeated-measures diary data and allows for modelling intra-individual variance over time while controlling for inter-individual variability.

To test H1, a random-intercept, fixed-slope linear mixed-effects model was estimated with person-mean-centred virtual recovery activity predicting next-morning recovery. A random intercept for each participant was included to account for individual differences in baseline recovery levels. For H2a and H2b, two multilevel moderation models were estimated. Each model tested whether the effect of person-mean-centred virtual recovery activity on next-morning recovery was moderated by either person-mean-centred positive affect (H2a) or negative affect (H2b). To properly separate within- and between-person effects, both the day-level and individual-level components of virtual recovery and affect were included in each model. Each model included fixed effects for both main effects (virtual recovery and affect), the interaction between their within-person components, and random intercepts to account for individual variability. To test H3, which proposed that age would predict engagement in virtual recovery, a between-person dataset was created by aggregating each participant's daily virtual recovery scores across all measurement occasions into an overall mean score. A simple linear regression was then conducted using age as the predictor and person-mean virtual recovery as the outcome. Statistical significance was evaluated at $\alpha = .05$. Effect sizes (b), standard errors (SE), t-values, p-values and 95% confidence intervals (CI) are reported for all fixed effects.

Results

Descriptive statistics and bivariate correlations for key study variables are presented in Table 1. To test our hypotheses, a series of linear mixed-effects and regression models was

estimated. The full results are shown in Tables 2 and 3. The hypotheses are accompanied by visualisations, which are included in the Appendix (Figures A1 to A4).

Table 1

Descriptive Statistics and Correlations among Study Variables

Variable	M	SD	ICC	1	2	3	4
Level 1							
1. Virtual recovery activities	2.59	1.09	0.36	-	-.09***	-.18***	.17***
2. Next-morning recovery	3.16	0.97	0.48	.07	-	.29***	-.22***
3. Positive affect during activity	3.22	0.78	0.48	.08	.61***	-	-.42***
4. Negative affect during activity	1.57	0.54	0.40	.14*	-.25**	-.27***	-
Level 2							
5. Age	36.85	14.33	-	-.37***	.09	-.12*	-.33***

Note. M = Mean. SD = Standard deviation. ICC = Intraclass Correlation Coefficient. Correlations below the diagonal are at the between-person level; those above are at the within-person level. For age, the correlations are only shown at the between-person level. *$p < .05$, **$p < .01$, ***$p < .001$ (two-tailed).

Hypothesis 1 predicted a positive association between engaging in virtual recovery activities and next-morning recovery. Contrary to expectations, the results revealed a negative association (b = -0.07, SE = 0.02, t (166.15) = -3.32, $p < .001$, 95% CI [-0.11, -0.03]). Therefore, Hypothesis 1 was not supported.

Hypothesis 2a proposed that positive affect would moderate the relationship between virtual recovery and next-morning recovery, such that the relationship would be stronger when positive affect was high. The interaction between virtual recovery and positive affect was not significant (b = 0.02, SE = 0.04, t (1418.22) = 0.49, p = .625, 95% CI [-0.06, 0.09]).

Therefore, Hypothesis 2a was not supported. Hypothesis 2b proposed that negative affect would moderate the relationship between virtual recovery and next-morning recovery. The interaction between virtual recovery and negative affect was not significant (b = -0.05, SE = 0.05, t (1438.48) = -0.92, p = .357, 95% CI [-0.15, 0.05]). Therefore, Hypothesis 2b was not supported.

Table 2

Multilevel Model Estimates Predicting Next-Morning Recovery

Predictor	**Model H1** Estimate (SE)	**Model H2a** Estimate (SE)	**Model H2b** Estimate (SE)
Intercept	3.15 (.05)***	3.16 (.05)***	3.16 (.05)***
Virtual recovery activity	-0.07 (.02)***	-0.02 (.02)	-0.04 (0.02)
Positive affect	-	0.37 (.03)***	-
Negative affect	-	-	-0.37 (.05)***
Virtual recovery × positive affect	-	0.02 (.04)	-
Virtual recovery × negative affect	-	-	-0.05 (.05)
Intercept variance	0.44 (.05)	0.45 (.05)	0.45 (.05)

Note. SE = Standard error. Estimates are unstandardised regression coefficients. Intercept variance refers to the random effect of the intercept at the person level.

*p < .05, **p < .01, ***p < .001 (two-tailed).

Hypothesis 3 proposed that age would negatively predict engagement in virtual recovery activities. Results showed that age significantly predicted lower average virtual recovery use (b = -0.02, SE = 0.00, t (289) = -6.77, p < .001, 95% CI [-0.03, -0.01]). Therefore, Hypothesis 3 was supported. The results of all individual path coefficients are illustrated in Figure 2.

Table 3

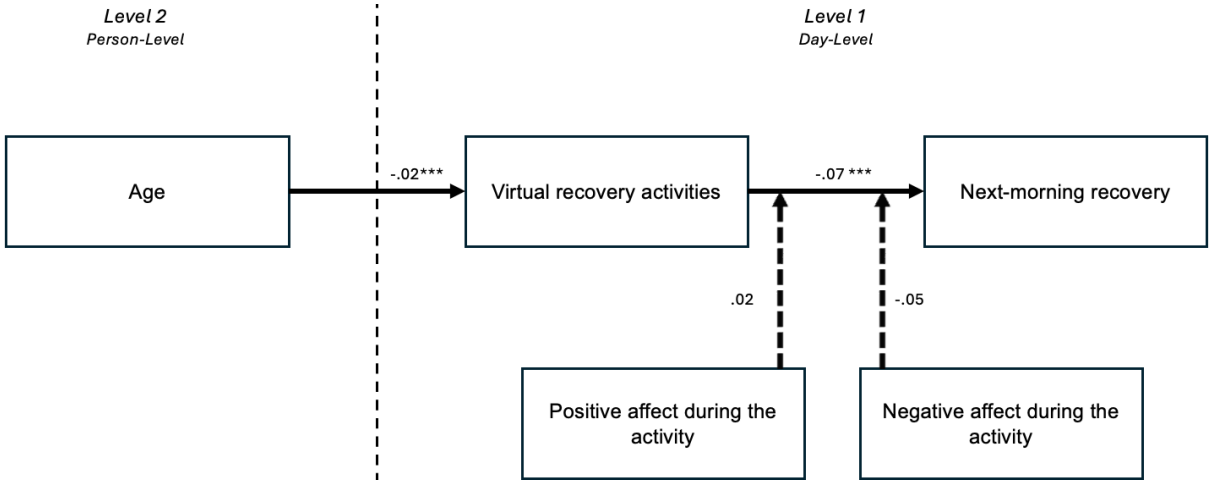
Linear Regression Predicting Virtual Recovery Activity from Age (H3)

	Estimate	SE
Intercept	3.34***	0.11
Age	-0.02***	0.00

Note. *$p < .05$, **$p < .01$, ***$p < .001$ (two-tailed).

Figure 2

Single Path coefficients



Note. Solid arrows indicate significant effects; dashed arrows indicate non-significant paths. *$p < .05$, **$p < .01$, ***$p < .001$ (two-tailed).

Discussion

The study aimed to investigate the role of virtual recovery activities in predicting employees' next-morning recovery and whether this relationship is moderated by affective states. Specifically, the analysis examined whether virtual recovery activities are positively related to next-morning recovery. It was further hypothesised that affective experience would be a moderator in this relationship, given research suggesting that the emotional quality of leisure strongly shapes its restorative potential. In addition, age was examined as a predictor

of virtual recovery engagement, reflecting well-documented generational differences in technology use and leisure preferences. Testing these hypotheses with multilevel models yielded several key findings, some of which were unexpected.

The finding that virtual recovery activities were associated with lower next-morning recovery contradicts Hypothesis 1 and the expectation derived from prior studies that highlighted the restorative potential of digital leisure. Earlier research suggested that screen-based activities can satisfy psychological needs such as autonomy and relaxation, thereby reducing stress and promoting unwinding after work (Kuykendall et al., 2020; Reinecke, 2009). Instead, the present findings align more with a growing body of critical literature questioning the restorative value of screen-based leisure, particularly when used excessively or in high-arousal formats (Koçak et al., 2023; Silvani et al., 2022). Rather than facilitating restoration, digital leisure may offer only superficial relief. While it can serve as a distraction from work, it may fail to foster true psychological detachment or replenish deeper cognitive and emotional resources (Park et al., 2011). Similarly, activities such as social media scrolling, binge-watching, or gaming may feel immediately gratifying, yet often lack core recovery experiences like mastery, control, or low-effort relaxation (Sonnentag et al., 2017). Viewed from this perspective, our results are consistent with prior evidence linking evening screen time to impaired sleep, disrupted circadian rhythms, and limited opportunities for emotional downregulation. Exposure to stimulating or emotionally intense content may prevent the body from winding down, which helps explain why virtual activities in this study were associated with lower next-morning recovery (Green et al., 2017; Hale & Guan, 2014; Silvani et al., 2022). Viewed through the COR framework, this means that such activities may consume rather than restore valuable psychological resources (Hobfoll, 1989; Kuykendall et al., 2020; Reinecke, 2009). For instance, staying up rather late to binge-watch a series may cut into sleep time, leaving individuals with fewer physical and cognitive resources the next

morning. Similarly, extended social media use may trigger social comparison or information overload, draining emotional resources instead of replenishing them. Taken together, these results suggest that while digital leisure can have restorative potential under certain conditions, its benefits should not be assumed. This underscores the need for a more differentiated view of digital leisure in recovery research, paying closer attention to factors such as activity type, timing, and intensity of use.

To further investigate the relationship between digital activities and recovery, this study also explored whether the affective experience during digital leisure moderates its impact on recovery (H2a and H2b). Contrary to expectations, neither positive nor negative affect significantly moderated the relationship between virtual recovery and next-morning recovery. This finding is noteworthy, as it suggests that even when one is in a positive mood during virtual activities, they may still fail to promote recovery or may even impede it, regardless of the emotional experience. The absence of moderation effects raises questions about the conditions under which digital recovery supports well-being. Prior research has shown that affective experience can enhance or diminish the restorative value of leisure, particularly when emotional states are closely tied to specific activities (Oerlemans et al., 2014). However, the findings of the present study suggest that in the context of everyday virtual leisure, recovery outcomes may be shaped less by affect alone and more by the interaction between affect and type of activity. For instance, feeling relaxed while casually watching a series might support recovery differently than experiencing excitement during competitive gaming. In other words, it may be the combination of activity characteristics and emotional experience that determines restorative potential. It is also possible that other factors, such as the type of digital activity or the level of cognitive engagement, may play a more dominant role in shaping recovery outcomes than the accompanying emotional tone.

Consistent with Hypothesis 3 and prior research, age negatively predicted virtual recovery engagement. Younger participants were more digitally immersed, more fluent in navigating online environments, and more likely to choose digital leisure formats for their daily recovery (Ahmed et al., 2024; Akello, 2024; Carcelén-García et al., 2023). This aligns with evidence suggesting that younger workers often turn to digital platforms for emotional regulation and social connection, integrating them into their recovery routines (Gellmers & Yan, 2023; Rustad et al., 2024). In contrast, older participants reported significantly lower engagement in virtual recovery. This likely reflects both preference and perceived efficacy, as older adults may favour offline activities, such as walking, reading, or in-person socialising, that they perceive as more restorative or meaningful (Virtanen et al., 2019). These findings highlight the importance of accounting for age-related differences in recovery behaviour and suggest that digital leisure may not represent a universally adopted strategy across generations.

Limitations and Future Directions

Several limitations should be acknowledged to put these results into context and guide future research. First, the study relied on self-report measures for behaviour, affect, and recovery, which introduces potential bias. While the use of person-centred predictors in multilevel modelling helps mitigate some of these concerns by isolating within-person fluctuations and controlling for stable individual response tendencies (reference), future research could further strengthen validity by incorporating objective behavioural data on virtual recovery engagement (i.e., screen time logs) or physiological indicators (i.e., sleep quality). These multimethod approaches would provide a more robust understanding of virtual recovery processes and filter out potential confounding effects.

Second, although the study hypothesised that positive and negative affect during virtual recovery would moderate the relationship between such activities and next-morning

recovery, the affect measurement used was relatively broad and not linked to any specific recovery activity. Participants were asked to rate their affective experiences during their overall leisure time, without specifying whether the reported emotions were tied to virtual or non-virtual activities (i.e., “To what extent did you feel the following emotions during your leisure activity?”). As such, it remains unclear whether the affect reported directly reflected experiences during virtual recovery or stemmed from doing alternative activities such as socialising, exercising, or reading. This lack of specificity may have introduced noise into the moderation analyses, potentially masking any true interaction effects between virtual recovery and affect. Additionally, the study did not account for overlapping or simultaneous recovery behaviours. Participants may have engaged in multiple activities in a single evening (i.e., watching TV while chatting with friends), making it difficult to attribute recovery outcomes to any specific behaviour. This overlap introduces potential confounds, as the restorative or emotional effects of one activity could have influenced outcomes that were attributed to another. Without separating activities, it is challenging to determine whether the effects observed were due to virtual recovery itself or to other co-occurring behaviours. Addressing these issues in the future may require more detailed activity tracking or experience sampling methods to capture multiple concurrent activities and the affective responses tied to each.

Third, virtual recovery was deliberately conceptualised as a broad category encompassing a range of digital activities, including gaming, social media use, streaming, and virtual reality. This integrative approach advances recovery research by moving beyond isolated behaviours, yet it also comes with limitations. Treating these activities as a single construct may mask important differences in their emotional tone, cognitive load, or interactivity levels. Prior research suggests specific digital behaviours can have divergent effects on recovery. For instance, as explained earlier, casual gaming has been associated with

relaxation and psychological detachment (Reinecke, 2009; Wagener et al., 2025), whereas competitive gaming may lead to overstimulation and emotional exhaustion (Koçak et al., 2023). Similarly, while some social media use can promote social connection and mood improvement, excessive or passive use is linked to increased stress and social comparison (Bayer et al., 2019), and also streaming content can vary in its impact on arousal and sleep, depending on genre and viewing patterns (Silvani et al., 2022). By grouping these activities into a single category, the present study has likely obscured important distinctions in their restorative potential. Future research should therefore investigate which specific digital activities, and under what conditions, are most beneficial or detrimental for recovery.

Fourth, in the present thesis, affect was conceptualised as a moderator due to practical considerations in the diary design and because its moderating role has been suggested in prior research (i.e., Fredrickson, 2001; Oerlemans et al., 2014), yet remains largely unexplored in the context of virtual recovery. Nonetheless, some empirical evidence also suggests that affect may function as a mediator, with digital activities evoking specific emotions that in turn influence recovery outcomes. Testing this pathway would require designs that allow clearer temporal separation between activity and emotional experience, which was not possible in the current study. Future research could therefore explore mediation models to better capture these processes.

Finally, while this study identified age differences in engagement with virtual recovery, it did not test whether these strategies are equally effective across age groups. It remains an open question whether older adults, who tend to rely more on offline recovery, experience higher recovery benefits than younger individuals who engage more frequently in virtual leisure. Even though this question was beyond the scope of the present design, this remains an important question. Future research should explore potential age-recovery interactions to determine whether the effectiveness of different recovery strategies varies by

age, which could provide deeper insights into tailoring recovery recommendations for multigenerational workforces.

Practical Implications

The study highlights the meaningful impact that self-chosen virtual leisure activities can have on daily recovery, offering several implications for individuals aiming to enhance their well-being. First, given the finding that engaging in virtual recovery activities was associated with lower next-morning recovery, individuals should be mindful that not all leisure is equally restorative. While digital activities may offer immediate enjoyment or distraction, they do not always support true psychological detachment or emotional replenishment. Individuals might benefit from reflecting on the quality of their evening activities. For example, choosing low-arousal, relaxing formats over highly stimulating or interactive digital content, to foster a more effective recovery. Becoming aware of how different leisure choices influence next-day well-being can help individuals build healthier, more intentional recovery routines. Setting boundaries around screen use, such as limiting digital engagement before bedtime, may also support better recovery. Even short periods of non-digital wind-down activities, like reading or stretching, could buffer against the overstimulation linked to late-night screen exposure.

These insights may be particularly relevant for younger individuals, who were found to engage in virtual recovery more frequently than older participants. As digital leisure is more embedded in their daily routines, younger employees may face greater risks of over-relying on screen-based activities that offer immediate gratification but limited restorative value. Encouraging awareness around digital habits and promoting a more intentional approach to evening recovery may be especially important for this group.

Lastly, while recovery ultimately depends on individuals' choices, workplaces can also play a role by raising awareness about healthy digital habits. Well-being programs could

incorporate guidance on balancing digital leisure with restorative offline activities, helping employees make more informed choices after work. For example, organisations might offer short seminars, digital well-being check-ins, or provide access to apps that help track screen use and promote healthier routines.

Conclusion

This study found that, contrary to expectations, virtual recovery activities were associated with lower next-morning recovery, suggesting that digital leisure may hinder rather than support effective psychological restoration. Positive and negative affect did not moderate the relationship between virtual activities and next-morning recovery, indicating that the quality of the emotional experience during digital leisure may play a smaller role than anticipated. The finding that younger individuals engaged more often in virtual recovery points to generational differences in leisure behaviour, which may have implications for how recovery strategies are tailored across age groups. Overall, the results suggest that not all leisure time contributes equally to recovery, especially activities that do not create genuine mental distance from work or foster relaxation.

Declaration of the Use of Generative AI

During the preparation of this thesis, I, Pelle Barthel, used ChatGPT in order to refine phrasing and simplify complex sentences. Following the use of this tool, I reviewed and edited the content as necessary, and I take full responsibility for the content of this publication.

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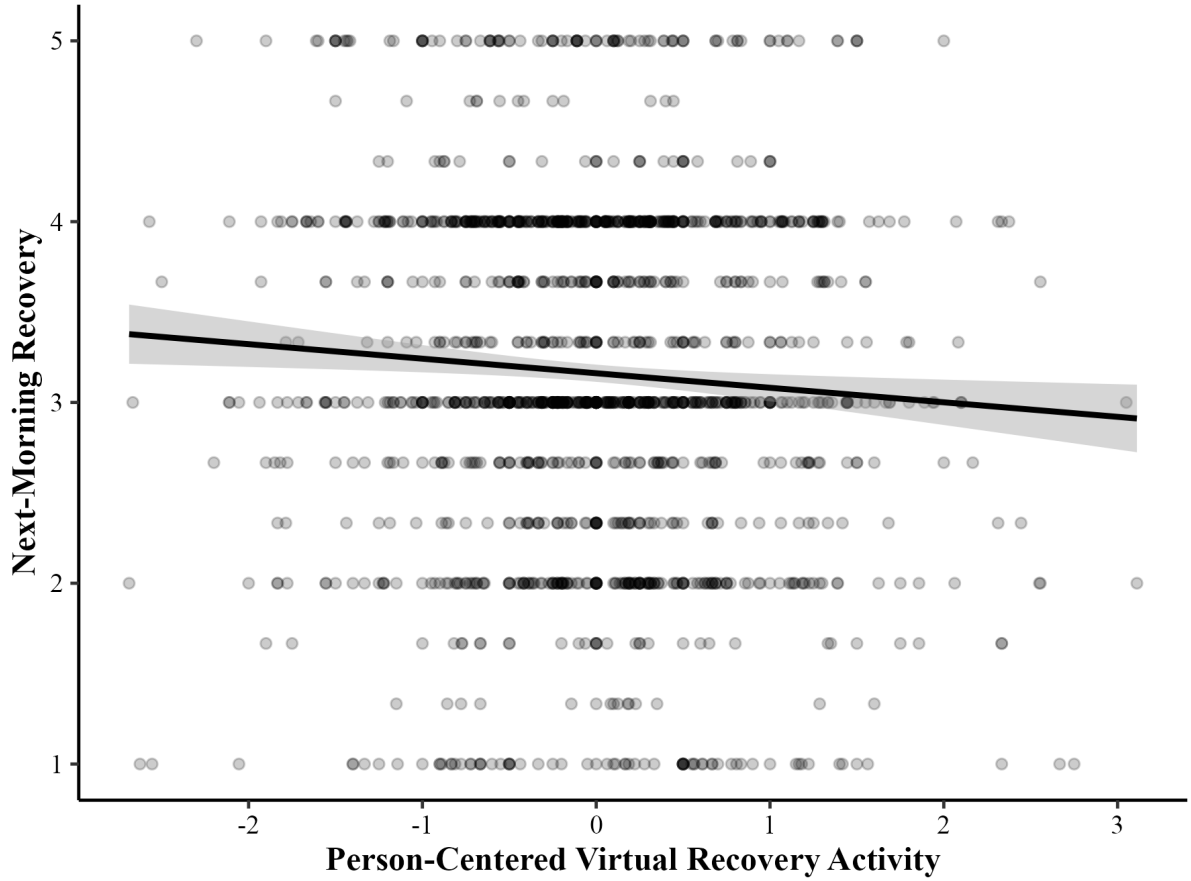
APPENDIX

Figures of Hypotheses

Figure A1

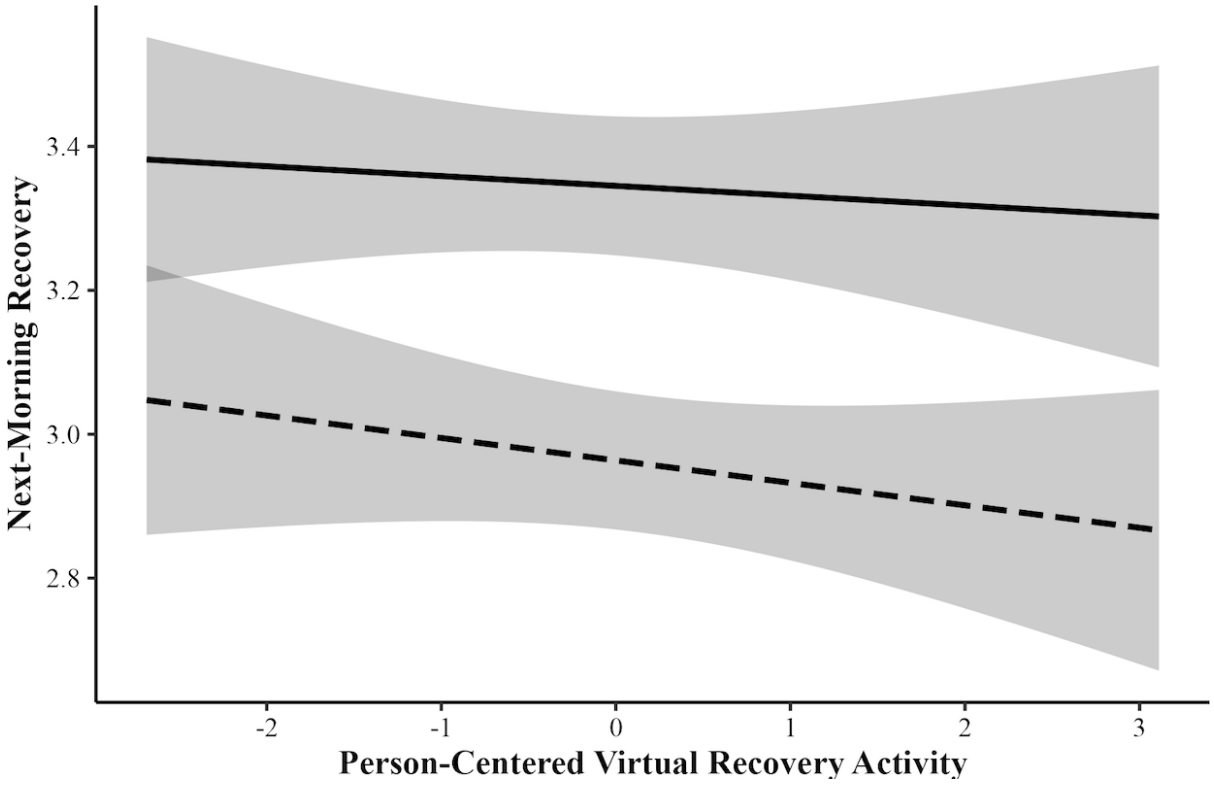
Association between Person-Centred Engagement in Virtual Recovery Activities and Next-morning Recovery (H1)



Note. Scatterplot shows the relationship between person-centred virtual recovery activities and next-morning recovery. The line represents the fixed-effect slope from the multilevel model. The shaded area represents the 95% confidence interval.

Figure A2

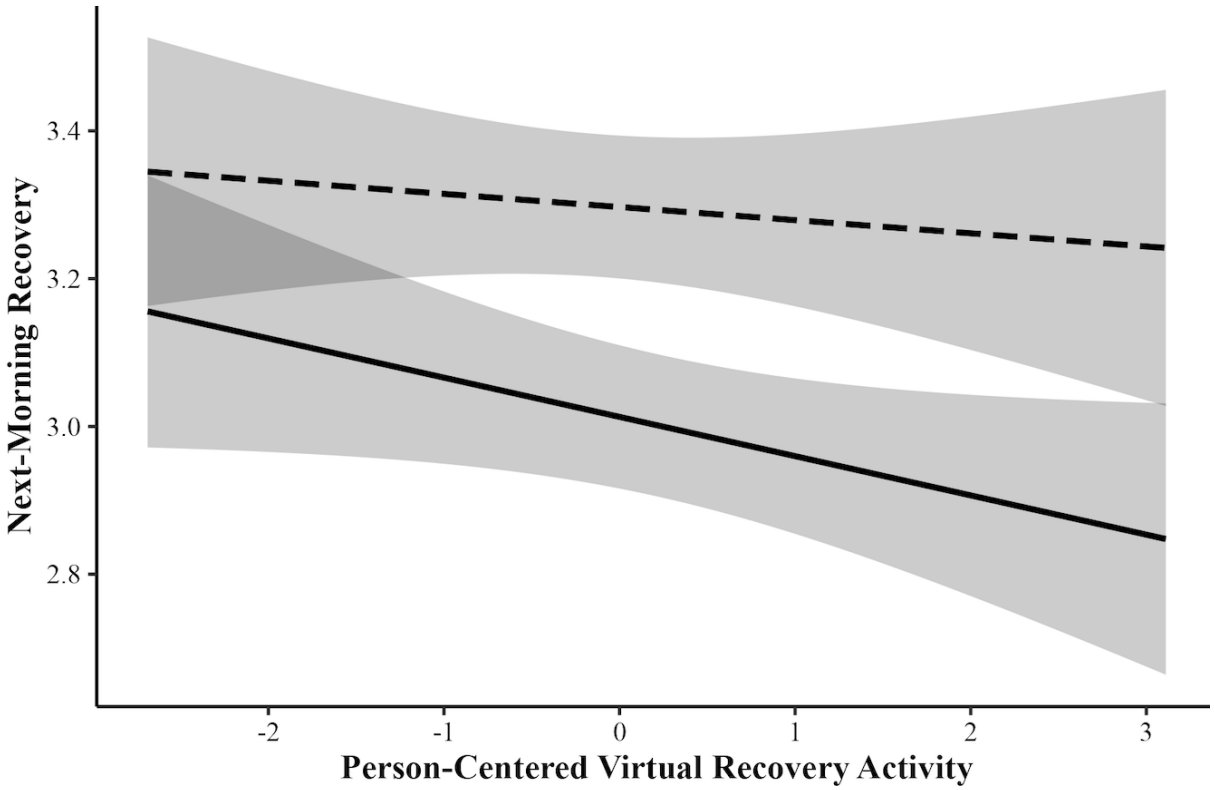
Interaction of Person-Centred Virtual Recovery Activity and Positive Affect Predicting Next-Morning Recovery (H2a)



Note. The figure displays the simple slopes of person-centred virtual recovery activity at high (solid line) and low (dashed line) levels of positive affect. Shaded regions represent 95% confidence intervals.

Figure A3

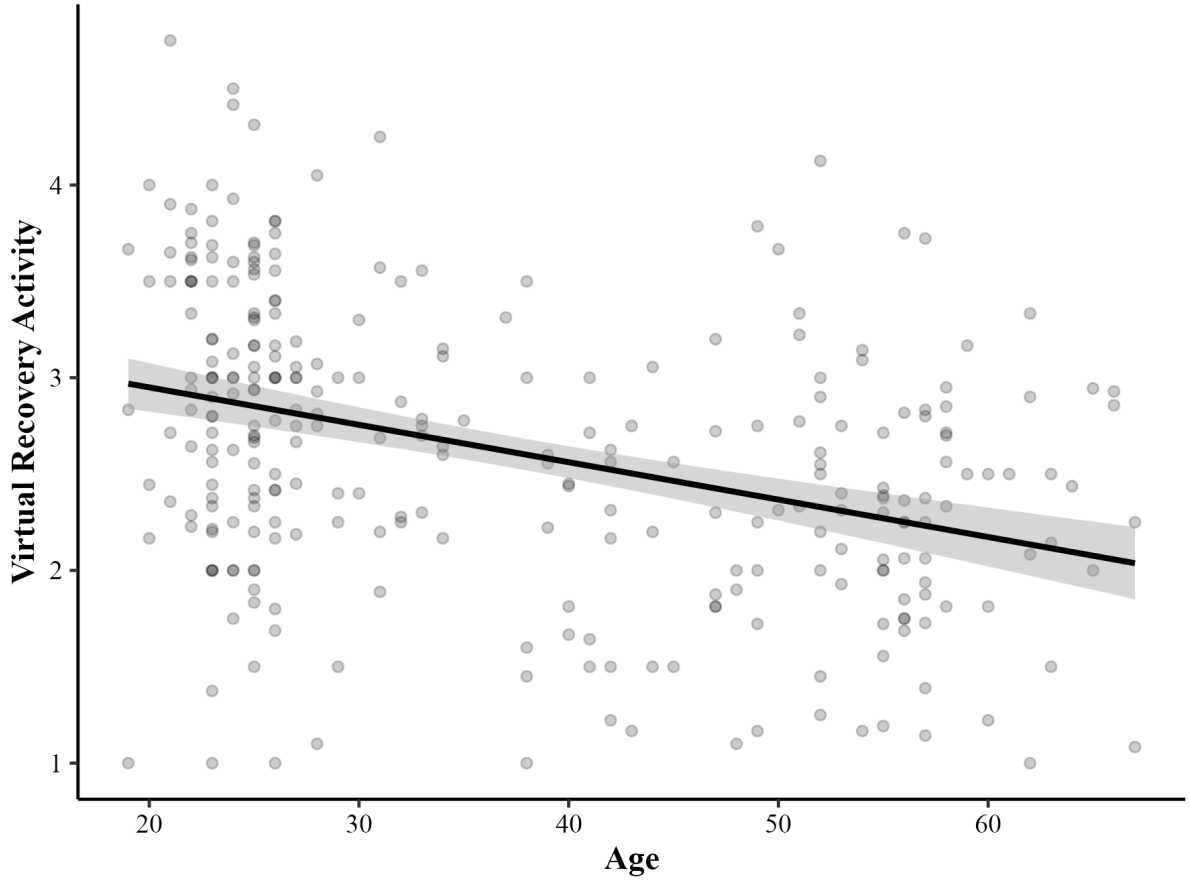
Interaction of Person-Centred Virtual Recovery Activity and Negative Affect Predicting Next-Morning Recovery (H2b)



Note. The figure displays the simple slopes of person-centred virtual recovery activity at high (solid line) and low (dashed line) levels of negative affect. Shaded regions represent 95% confidence intervals.

Figure A4

Regression of Age on Virtual Recovery Activity (H3)



Note. Figure displays the association between participants' age and their average engagement in virtual recovery activities across days. Each data point corresponds to one participant´s mean virtual recovery activity score. The shaded area represents the 95% confidence interval.