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Smartphone Use, Work–Home Interference, and Burnout: A Diary Study on the Role of Recovery

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This diary study examines the impact of daily recovery experiences on daily work–home interference (WHI) and daily burnout symptoms within a group of smartphone users. A total of 69 employees using smartphones on the initiative of their employer completed a diary questionnaire on five successive workdays (N = 293 data points). We hypothesised that particularly for intensive smartphone users it would be important to engage in activities fostering psychological detachment and relaxation in order to reduce the risk of WHI. We predicted that smartphone use would be positively related to WHI. Finally, we predicted that the positive relationship between WHI and state levels of burnout would be stronger for intensive smartphone users. Overall, the results of multi-level analyses supported these hypotheses. The findings emphasise the importance of a clear organisational policy regarding smartphone use during after-work hours.

INTRODUCTION

In our society today, characterised as it is by economic crisis and downsizing, the workload of the employees who have managed to keep their jobs tends to increase. In addition, technological advances have resulted in an increase in non-standard work schedules, including evening, night, and weekend work (Härmä, 2006). Nowadays organisations' increasing expectations regarding availability suggest that employees feel compelled to immediately respond to work-related messages even during leisure time (Davis, 2002). Previous between-person studies on the potential downsides of smartphone use have reported that smartphone use is associated with norms that individuals should be available to others at any time and any place (Green, 2001); that many users experience great pressure to respond when the phone indicates new messages (Jarvenpaa & Lang, 2005); that the instant messaging facilitated by smartphones derails work and attention as users are interrupted by incoming messages (Rennecker & Godwin, 2005); that mobile devices blur

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the distinctions between the public and private domains of life (Green, 2002); and that smartphone users experience increased work pressure and an inability to separate and keep their distance from work (Jarvenpaa & Lang, 2005). It seems difficult, if not impossible, for mobile users to maintain a satisfactory balance between their work and personal life. In addition, when employees are socialised into occupational cultures that are characterised by equating long hours with organisational commitment and productivity, it is difficult to turn work off and to effectively manage the juggling of work and family (Jacobs & Winslow, 2004). In conclusion, there are some indications that smartphone use can cause a higher level of interference from the work to the home domain.

Work–home interference (WHI) refers to a process of negative interaction between work and home domains (van Hooff, Geurts, Kompier, & Taris, 2006). WHI is defined as a form of inter-role conflict in which the role pressures from the work and the family domains are mutually incompatible so that participation in the home role conflicts with participation in the work role (Greenhaus & Beutell, 1985). Greenhaus and Beutell argued that WHI could occur in three distinct ways. First, time demands can make it physically impossible to be in two places at the same time (e.g. working long hours). Second, spillover of strain from work to home may occur (e.g. stress at work can make it more difficult to relax at home). Finally, specific behavior that is expected at work may be incompatible with the behavior that is expected at home. There is ample evidence for the existence of time-based work–home conflict (e.g. Beutell & Greenhaus, 1982; Burke, Weir, & DuWors, 1980; Greenhaus, Parasuraman, Granrose, Rabinowitz, & Beutell, 1989) and the spillover of strain from the work to the home domain (e.g. Bakker, Demerouti, & Dollard, 2008; Greenhaus et al., 1989; Jones & Butler, 1980). However, research on behavioral role conflict is scarce (e.g. Stoner, Hartman, & Arora, 1990). In the present study, we therefore only focus on time- and strain-based work–home conflict.

Employees who have the habit of staying connected to their work by means of their smartphones make it very hard, if not impossible, for themselves to psychologically detach from work at the same time. In other words, work–home interference impedes the recovery process. Many studies on recovery have focused on weekend and holiday effects (Fritz & Sonnentag, 2005, 2006). However, since the beneficial effects of vacations fade out quickly (De Bloom, Kompier, Geurts, De Weerth, Taris, & Sonnentag, 2009), daily recovery during evening hours seems more crucial for employee health, well-being, and performance (Sonnentag, 2001, 2003). Sonnentag (2001) showed that employees need evening hours to detach from work in order to recover properly from stress expenditure. Furthermore Derks, Ten Brummelhuis, Zecic, and Bakker (2012) showed that staying connected to work during evening hours through smartphones has consequences for

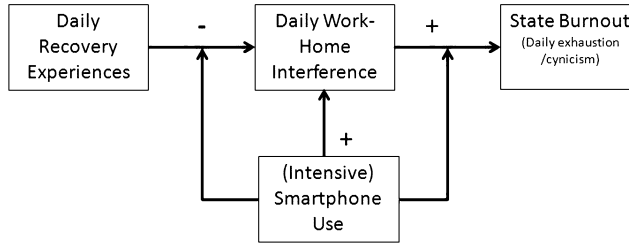

FIGURE 1. Research model.

recovery. In their diary study, smartphone users were less successful in initiating activities aimed at recovery in response to high WHI, in comparison to non-users.

The anytime-anywhere connectedness of employees to their work facilitated by modern technologies blurs the traditional boundaries that have customarily separated work from family and has changed the meaning of being at home (e.g. Galinsky, Kim, & Bond, 2001; O'Mahony & Barley, 1999). Indeed, previous studies have associated smartphone use with difficulties in managing work–home balance (e.g. Davis, 2002; Jarvenpaa & Lang, 2005). Furthermore compulsive routines of chronic checking, escalation of commitment (Mazmanian, Orlikowski, & Yates, 2006), and information overload (Allen & Shoard, 2005) are associated with smartphone use. Remarkably, however, the impact of this new technology on employee recovery and burnout symptoms is still under-researched.

In addition, the results of the reported studies on smartphone use are mainly based on qualitative studies interviewing limited numbers of respondents. Furthermore, quantitative studies on the work–home interface and recovery lack the link with new media in general and smartphone use in particular. Therefore, the current study aims to explore the impact of recovery on daily work–home interference, smartphone use, and state levels of burnout using a within-person design. All hypothesised relations are displayed in Figure 1.

We focus on smartphone use during after-work hours, which is part of a theoretical framework referred to as technology-assisted supplemental work (TASW) (Fenner & Renn, 2004). It is differentiated from the current new ways of working perspective, which implies that employees spend part of their regular work time in locations other than the office, mostly the home (Peters, den Dulk, & van der Lippe, 2009). Furthermore, in the new way of working it is implied that employees make formal agreements with their employer about how, where, and when to work. This is not necessarily the case in smartphone use.

It is also important to note that the participants in our diary study were all smartphone users who obtained the smartphone from their employer and were compelled rather than had chosen to use the smartphone. Fenner and Renn (2004) argue that employees who receive technical tools from their employers will more likely view this as an example of the organisation's support for their work and in turn use these tools in the performance of supplemental work at home. This implies in our case that the respondents probably assume the employer to have strong expectations regarding their availability for work during after-work hours.

THEORETICAL BACKGROUND

Recovery Experiences

The important role of recovery can be explained from the perspective of Effort-Recovery theory (Meijman & Mulder, 1998). Its central assumption is that effort expenditure at work is unavoidably associated with acute load reactions. Under optimal circumstances, these stress-related acute load reactions return to pre-stressor levels during after-work hours, and recovery is completed before the next working day starts. In this situation, health is not at risk (Meijman & Mulder, 1998). However, when stress-related acute load reactions prolong or re-occur during after-work hours, recovery is incomplete. In this situation, the worker will start the subsequent workday in a suboptimal condition and will have to invest compensatory effort in order to perform adequately at work.

A core component of recovery inherent in leisure activities is psychological detachment—an individual's sense of being away from work (Etzion, Eden, & Lapidot, 1998). It implies more than just being physically away from work. It suggests that the individual stops thinking about work and disengages mentally from it (Sonnentag & Kruel, 2006). This implies that individuals stop doing work-related tasks such as receiving job-related phone calls or reading emails at home, because such activities will make psychological detachment impossible (Siltaloppi, Kinnunen, & Feldt, 2009). Psychological detachment is particularly important after stressful and demanding working days (Sonnentag & Bayer, 2005). On these days, in particular, individuals might continue working at home, ruminate about work-related matters, and lack recovery (e.g. Taris, Beckers, Dahlgren, Geurts, & Tucker, 2007). Empirical research has shown that employees who successfully detach from work during after-work hours experience higher levels of life satisfaction and well-being (Sonnentag & Fritz, 2007), and show better performance (e.g. Binnewies, Sonnentag, & Mojza, 2009; Demerouti, Bakker, Geurts, & Taris, 2009; Meijman & Mulder, 1998). Continuous preoccupation with work during after-work hours and the inability to switch off from work is part of

an unhealthy pattern characterised by high levels of fatigue, sleep complaints, and other indicators of poor well-being (Grebner, Semmer, & Elfering, 2005; Van Hooff et al., 2006).

Sonnentag and Fritz (2007) argue that people may differ in what leisure activities they experience as recovering. It is not necessarily the activity itself that helps recovery, but the mechanisms behind those activities, such as relaxation and psychological distancing from job-related issues, which help people to recover from strain. Sonnentag and Fritz developed a scale to rate how individuals experience recovery activities. In the current study, we adopted the two types of recovery experience that are the most relevant for our group of smartphone users: (a) psychological detachment or the ability to disengage oneself mentally from work; and (b) relaxation, characterised by low activation and increased positive affect. We included only these two types of recovery experience since they have their roots in Effort-Recovery theory (Siltaloppi et al., 2009). Psychological detachment and relaxation have the potential to help employees recover because they imply that no further demands are made on the functional systems activated during work. Since we are interested in the relation between recovery experiences and work–home interference, these two concepts are especially relevant because they imply that employees recuperate from work-related activities and thoughts during after-work hours. In contrast, mastery and control are aimed at building new resources (Siltaloppi et al., 2009) which is a different process (Hobfoll, 1998; Sonnentag, Binnewies, & Mojza, 2008a; Sonnentag & Fritz, 2007). The vast majority of recovery studies include psychological detachment, which is considered a core component of recovery (e.g. Sonnentag & Bayer, 2005; Sonnentag, Binnewies, & Mojza, 2010; Sonnentag, Mojza, Binnewies, & Scholl, 2008b; von Thiele-Schwarz, 2011). Finally, since we conducted a diary study we had to be careful not to overload our participants with a long questionnaire each day. We thus decided to focus on psychological detachment and relaxation, and to exclude mastery and control. When smartphone users succeed in undertaking activities aimed at recovery, the time spent on these activities prohibits them from engaging in work-related activities, with lower levels of experienced work–home interference as a consequence.

Hypothesis 1: The recovery experiences of daily psychological detachment (1a) and daily relaxation (1b) during after-work hours decrease the level of daily work–home interference.

Consequences of Daily WHI for State Burnout

The link between the conflict between the work and private domains and the detrimental effects on employee health and well-being is well established (e.g. Demerouti, Bakker, & Bulters, 2004; Kinnunen, Feldt, Geurts, &

Pulkkinen, 2006). Work–home interference is associated with psychological strain (Kinnunen et al., 2006), poor self-reported physical health (Frone, Russell, & Cooper, 1997), higher levels of fatigue (Jansen, Kant, Kristensen, & Nijhuis, 2003), lower sleep quality (Williams, Franche, Ibrahim, Mustard, & Layton, 2006), and with depression and anxiety (Frone, Russell, & Barnes, 1996). Altogether, these studies make a strong case that the experience of negative spillover from the work to the home domain, that is characteristic of WHI, is strongly related to indicators of well-being. We have no indications that for the group of smartphone users this will be different. In addition, most of the reported studies are between-person survey studies; the current study contributes to the literature in examining daily fluctuations in WHI and burnout symptoms using a within-person diary design.

Periods of rest from work are important in maintaining well-being at work (Eden, 2001) and result in a decrease in perceived job stress and burnout (Westman & Etzion, 2001). We operationalised burnout symptoms in our study in terms of day levels of exhaustion (related to fatigue) and cynicism (indicator of a decrease in work enjoyment), both well-known core dimensions of the burnout concept (Demerouti, Mostert, & Bakker, 2010; Maslach & Leiter, 1997; Maslach, Schaufeli, & Leiter, 2001). However, we measure both exhaustion and cynicism on a daily basis, to get an indication of how these concepts referred to as state burnout vary from day to day. Based on these previous studies, we predict that within our group of smartphone users WHI is positively related to indicators of state burnout.

Hypothesis 2: Daily work–home interference is positively related to daily burnout symptoms (exhaustion (2a) and cynicism (2b)).

Furthermore, we expect that recovery, WHI, and burnout symptoms are interrelated. They are all part of the same process. Therefore in our research model (see Figure 1) we have depicted an indirect effect of recovery experiences via WHI on burnout symptoms. In other words, daily psychological detachment and relaxation might be related to a decrease in exhaustion and cynicism through the experience of less work–home interference.

Hypothesis 3: Daily recovery experiences (psychological detachment and relaxation) impact daily burnout symptoms (exhaustion and cynicism) via daily WHI.

Impact of Smartphone Use

Nowadays, millions of employees use electronic tools to do their jobs away from the traditional office (Hill, Ferris, & Märtinson, 2003). A smartphone

is a wireless device with functions to manage the calendar, make phone calls, browse the Internet, and to receive and answer e-mails anytime, anywhere. The main reason for having a smartphone is to send and receive e-mails (Middleton, 2007). Smartphones may affect social relationships at the workplace by enabling new forms of interaction and collaboration between co-workers (Lyytinen & Yoo, 2002). Other arguments often associated with smartphones are increased productivity (Locke, 2005), increased flexibility in work schedules, improved responsiveness, and the availability of real time information (Rood, 2005).

Through computer-mediated communication technologies, such as e-mail, cell phones, smartphones, and PDAs, employees are able to stay connected to work even when not formally on the job (Boswell & Olson-Buchanan, 2007). Many employees perform unpaid job-related work at home by means of digital media identified as finishing off or catching up on their work. Furthermore, a large part of these employees report that being available for work during leisure time is in the nature of the job (United States Department of Labor, 2002). The smartphone causes the employee to literally take work into the home domain. This leads to blurring boundaries between work and home domains and to work–home interference.

According to Greenhaus and Beutell (1985), WHI can occur in three distinct ways. As argued earlier, we focus on the time- and strain-based work–home conflict. The smartphone is associated with permeable boundaries between work and home domains, which implies that it might contribute to the experience of work–home interference. With regard to the first type of conflict, we have to remark that the smartphone makes it possible to "be" at work in the living room. In other words, time demands are challenged in a more subtle way than in the situation in which overwork takes place at the office. In particular, this subtle way of working overtime is our concern since answering e-mails outside office hours may seem trivial and therefore the consequences might remain unnoticed. In addition, Jarvenpaa, Lang, and Tuunainen (2005) have argued that it is impossible to engage in two activities at the same time. Thus, engaging in smartphone activities often implies that the individual disengages from home activities. For example, when the smartphone indicates that there are new messages, people are curious and feel the need to check them, regardless of whether they are work-related or not. This seems harmless because it takes only a few minutes of time. However, without realising it, people may spend more time with their smartphone than they might think. In addition, since the request to work initiated by the smartphone is external and uncontrollable, and lack of control is an indicator of work–life stress (Duxbury, Higgins, & Lee, 1994), it is plausible that intensive smartphone users are susceptible to experiencing work–home interference. Or, stated more formally:

Hypothesis 4: Smartphone use is positively related to daily work–home interference.

The common factor underlying most recovery definitions is that recovery occurs after strain when the stressor is no longer present (Sonnentag & Geurts, 2009). In particular, prolonged exposure to work demands (e.g. daily overtime work) is a risk factor as a demand is made on the same psychophysiological systems that were already activated during normal work hours (Geurts & Sonnentag, 2006). Work-related activities carried out during after-work hours may impair daily recovery (Taris et al., 2007). By introducing the smartphone into our private domains, the stressor of work has become salient in our living rooms. It is plausible that the smartphone with its request for 24/7 availability disturbs the important process of disengaging from work and recovery. Recently, von Thiele Schwarz (2011) has shown that the inability to withdraw from work has negative consequences in terms of recovery and fatigue. It is important to note that in our group of respondents, smartphone use was initiated and encouraged by their employer. Therefore, it is likely that the request to stay connected to work during evening hours—undermining the possibility to psychologically detach from work—is external rather than internal.

Bakker, Demerouti, Oerlemans, and Sonnentag (2012) have shown that the overall negative association between time spent on work-related activities during leisure time and the feeling of recovery at bedtime was stronger for employees scoring high (vs. low) on workaholism. However, they also found that the positive relation between time spent on sport and exercise on the one hand and the state of being recovered on the other hand was stronger for those scoring high (vs. low) on workaholism. In other words, "workaholics" benefit more from spending after-work time on sport and exercise. The analogy between workaholics and employees who intensively use their smartphone in the evening hours is that (a) they both start working in the evening in a state in which their energy levels are already depleted (Hockey, 1997); (b) they do not necessarily work because they enjoy it (Schaufeli, Taris, & Bakker, 2008); and (c) they often work in the evening, which intrudes into their family life (Taris, Schaufeli, & Verhoeven, 2005).

Taking into account that recovery experiences have the potential to decrease the experienced WHI of employees and that work-related tasks initiated by the smartphone make psychological detachment impossible (Siltaloppi et al., 2009), it is plausible that the group of intensive smartphone users, in particular, can decrease their WHI by initiating recovery experiences. In line with this, we hypothesise that (intensive) smartphone use moderates the negative relation between recovery experiences and WHI. In other words, daily recovery reduces daily work–home interference especially for employees who use their smartphone intensively.

Hypothesis 5: Daily recovery (psychological detachment and relaxation) is more strongly negatively related to daily work–home interference for employees who use their smartphone intensively as compared to employees who refrain from smartphone use.

As argued earlier, frequently using a smartphone contributes to a blurring of the boundaries between work and leisure time. The increased productivity associated with staying connected to work in the evening hours is often achieved at the cost of higher stress levels which may lead to poor recovery, impaired performance (Binnewies et al., 2009), fatigue, and sleep complaints (Van Hooff et al., 2006). It has been argued that in modern society, characterised by anywhere, anytime connectedness to work, the lack of recovery could have even more impact on an individual's well-being and health than strain itself (Lundberg, 2005; Sonnentag & Zijlstra, 2006). As stated earlier, the link between WHI and impaired well-being is well established. In addition, we expect that intensive smartphone users suffer more from this work–home interference in terms of exhaustion and cynicism since they are exposed to work-related issues for a larger part of their evening. Furthermore, when an employee decides to stay online during after-work hours, the employee has no prior information about the frequency and the quantity of requests that will be made on his/her account. Employees experience low levels of control when they feel compelled to respond to work-related e-mails in the evening (Middleton & Cukier, 2006). This differentiates smartphone use from regular work-related computer use during after-work hours. Computers are more passive technologies relative to smartphones because users have to sit down and turn them on before the access they facilitate can contribute to work–home interference. In line with this, Chesley (2005) showed that mobile phone use was associated with increases in negative forms of spillover linked to increased distress and lower family satisfaction, whereas regular computer use was not.

Finally, Bakker and colleagues (2012) found strong evidence that for employees scoring high (vs. low) on workaholism, the negative relation between work-related activities in the evening and well-being at bedtime was stronger than for non-workaholics. Building on these findings, we argue that intensive smartphone users (as compared to less intensive users) experience more exhaustion and cynicism during evenings with high WHI. The rationale behind this is that smartphone users drain the same energy resources during the evening as during the workday, which will accelerate the fatigue process.

Hypothesis 6: Daily work–home interference is more strongly positively related to daily burnout symptoms (daily exhaustion and daily cynicism) for employees who use their smartphone, as compared to employees who refrain from smartphone use.

METHOD

Procedure and Participants

The participants were recruited by invitation e-mails with a request to participate in a diary study on the evaluation of their work. A precondition of participation was that respondents were in possession of a smartphone for business purposes. Importantly, participants did not use their smartphone on their own initiative; instead, their employer initiated it. In all cases, the employer took complete care of the smartphone-related expenses, including private use of the smartphone. A final condition for being included in the study was that participants were employed full time. The e-mail explained the survey process and assured confidentiality of the responses. The data were collected via questionnaires that could be filled out online. Respondents were first invited to fill out a background questionnaire with demographics and a questionnaire assessing their e-mail use and their smartphone use. Subsequently, participants were contacted through e-mail for five successive workdays within one week. These e-mails included the link to a diary questionnaire that could be filled out online at the end of each of five workdays, in the evening before going to sleep.

All participants participated on a voluntary basis. In total, 69 participants filled out the background questionnaire and at least three of the five diaries. This led to 293 study occasions at the within-subject level. Participants were 22 male (31.9%) and 47 female (68.1%) employees. Their mean age was 32.8 years (SD = 9.9). Most of the participants (71%) were highly educated. All participants had full access to their work e-mail account on their devices.

Measures

The experience of daily psychological detachment was measured using the subscale psychological detachment (four items) of the Sonnentag and Fritz (2007) recovery experiences instrument. These items were adjusted for daily measurement by adding "In my free time after work . . ." to each item. An example item is the following: "I tried to forget about work". All items were rated on a 5-point scale (1 = totally disagree, 5 = totally agree). Cronbach's α of the average of the scale was .89, indicating good reliability.

The experience of daily relaxation was measured using the subscale relaxation (four items) of the Sonnentag and Fritz (2007) recovery experiences instrument. These items were also adjusted for daily measurement by adding "In my free time after work . . ." to each item. An example item is: "I used the time to relax" (subscale relaxation, $\alpha = .86$). All items were rated on a 5-point scale (1 = totally disagree, 5 = totally agree), with the average Cronbach's $\alpha = .86$, indicating good reliability.

Daily work–home interference was measured using the eight-item subscale of the SWING (Survey Work–home Interaction NijmeGen; Geurts, Taris, Kompier, Dikkers, Van Hooff, & Kinnunen, 2005). Van Hooff and colleagues (2006) adjusted the items to day-level measurement. Example items are: "Today, I had difficulties fulfilling my domestic obligations because I was constantly thinking about my work" (strain-based), and "Today my work schedule made it difficult for me to fulfil my domestic obligations" (time-based). All items were rated on a 5-point Likert scale (1 = totally disagree, 5 = totally agree). The overall Cronbach's α of the scale, averaged over 5 days, was .88, indicating good reliability.

State burnout was measured with the two subscales *Exhaustion* and *Cynicism* of the Dutch version of the Maslach Burnout Inventory (Schaufeli & Van Dierendonck, 2001) adjusted for daily assessment. The exhaustion scale included five items, such as "I felt exhausted at the end of my workday". The cynicism scale consisted of four items, including "I noticed that I was less involved in my work today". All items were rated on a 5-point scale (1 = totally disagree, 5 = totally agree). The average Cronbach's α was .88 for daily exhaustion and $\alpha = .82$ for daily cynicism, indicating good reliability. It is important to note that we had no intention of measuring the "clinical form" of burnout. We intended to measure the daily fluctuations in burnout symptoms, exhaustion and cynicism, during the day.

Intensive smartphone use was measured with a self-constructed scale including four items. Since we did not expect smartphone use, often considered as a habit, to fluctuate on a daily basis we included it as a trait measure in our questionnaire. Example items are: "I use my smartphone intensively", and "When my smartphone blinks to indicate new messages, I cannot resist checking them". All items were rated on a 5-point Likert scale (1 = totally disagree, 5 = totally agree). Cronbach's α of the scale was .80, indicating good reliability.

Strategy of Analysis

Our repeated measures data can be viewed as multi-level data, with repeated measurements nested within individuals. This leads to a two-level model with the repeated measures at the first level (N = 345 study occasions) and the individual persons at the second-level (N = 69 participants). Multi-level analysis with the MlwiN program (Rashbash, Browne, Healy, Cameron, & Charlton, 2000) was applied. Predictor variables at the day level (Level 1, e.g. WHI) were centered to the individual mean, and the person level (Level 2) predictor variable (smartphone use) was centered to the grand mean. None of the control variables was significant predictors of either day-level of recovery activities, work–home interference, exhaustion, or cynicism, and were therefore excluded from further analyses.

RESULTS

Descriptive Statistics

Table 1 presents the means, standard deviations, and correlations among the study variables. In order to examine the proportion of variance that is attributed to the different levels of analysis, we calculated the intra-class correlation for each day-level variable. The results showed that 39 per cent of the variance in work–home interference, 71 per cent of the variance in psychological detachment, 60 per cent in relaxation, 65 per cent in exhaustion, and 56 per cent in cynicism was attributable to within-person variations justifying our multi-level approach.

Hypotheses Testing

We hypothesised that the recovery experience of daily psychological detachment (Hypothesis 1a) and daily relaxation (Hypothesis 1b) during after-work hours decrease the level of daily work–home interference. In Table 2, the multi-level analyses are shown for the effects of psychological detachment and relaxation on daily experienced WHI. The model containing both psychological detachment and relaxation as predictor variables showed a significant improvement over the null model, Δ-2x log = 17.199, $df = 2$, $p < .001$. The estimates of psychological detachment ($\gamma = -.208$, $SE = .078$), $t = 2.667$, $p < .005$, and relaxation ($\gamma = -.180$, $SE = .088$), $t = 2.045$, $p < .025$, were both significant and in the hypothesised direction, providing evidence for Hypothesis 1.

According to Hypothesis 2, daily WHI is positively related to daily exhaustion (Hypothesis 2a) and daily cynicism (Hypothesis 2b). Table 3 shows the results of the multi-level analyses. The model containing daily WHI as

TABLE 1
Means, Standard Deviations, and Correlations of Study Variables

	Mean	SD	*1.*	*2.*	*3.*	*4.*	*5.*	*6.*
1. Gender (1 = male, 2 = female)	0.68	0.47						
2. Smartphone use	3.34	0.93	0.55					
3. WHI	2.31	0.69	.23	.21**				
4. Psychological detachment	3.02	0.88	.09	−.35**	−.29**			
5. Relaxation	3.75	0.66	.04	−.18**	−.27**	.48**		
6. Exhaustion	2.50	0.77	.18	.30**	.50**	−.19**	−.30**	
7. Cynicism	2.24	0.67	.12	.07	.44**	−.04**	−.11	.56**

** $p < .01$; $n = 69$.

TABLE 2
Multi-Level Results of Psychological Detachment, Relaxation and WHI

	WHI			
	Null model		*Predictor model*	
	Estimate	*Std. er.*	*Estimate*	*Std. er.*
Intercept	2.311***	0.062	2.311***	0.062
Psychological Detachment			–0.208**	0.078
Relaxation			–0.180*	0.088
Variance level 2 (employee)	0.288 (61%)	0.027	0.267	0.025
Variance level 1 (day)	0.185 (39%)	0.044	0.190	0.044
–2 Log likelihood	554.842		537.643	

*** $p < .001$; ** $p < .005$; * $p < .025$. Data points = 293 of 345 cases in use (respondents $n = 69$, days $n = 5$).

predictor variable of daily exhaustion showed a significant improvement over the null model, Δ-2x log = 42.133, $df = 1$, $p < .001$. The estimate of daily WHI was $\gamma = .350$, $SE = .051$, $t = 6.863$, $p < .001$. This provides evidence for Hypothesis 2a. Furthermore, the model containing daily WHI as predictor variable of daily cynicism showed a significant improvement over the null model, Δ-2x log = 15.745, $df = 1$, $p < .001$. The estimate of daily WHI was $\gamma = .214$, $SE = .053$, $t = 4.038$, $p < .001$. These results support Hypothesis 2b.

Hypothesis 3 stated that daily recovery experiences impacted daily burnout symptoms via daily WHI. To test for an indirect effect of recovery experiences via WHI on burnout symptoms, we examined whether both the predictor and the outcome variable were significantly related to the mediator. The results related to Hypothesis 1 already showed significant relationships between recovery experiences (psychological detachment and relaxation) and WHI. In addition, the results regarding Hypothesis 2 established the relationships between WHI and both exhaustion and cynicism. Sobel tests showed significant indirect effects for psychological detachment via WHI on exhaustion ($z = –2.49$, $p < .01$) and cynicism ($z = –2.23$, $p < .05$). Similar indirect effects were found for the relation of relaxation via WHI on both exhaustion ($z = –1.96$, $p < .05$) and cynicism ($z = –1.82$, $p < .05$). These results support Hypothesis 3.

According to Hypothesis 4, there is a positive relationship between intensive smartphone use and daily WHI. The multi-level model that contained smartphone use as the predictor of daily WHI was compared to the null model that included only the intercept. The model containing smartphone use as a predictor showed a significant improvement over the null model, Δ-2x log = 5.65, $df = 1$, $p < .05$. The estimate of smartphone use ($\gamma = 0.157$, $SE = .065$), $t = 2.415$, $p < .01$, is significant, confirming Hypothesis 4.

TABLE 3
Multi-Level Results of WHI on State Burnout (Exhaustion and Cynicism)

	Exhaustion				*Cynicism*			
	Null model		*Predictor model*		*Null model*		*Predictor model*	
	Estimate	*Std. er.*	*Estimate*	*Std. er.*	*Estimate*	*Std. er.*	*Estimate*	*Std. er.*
Intercept	2.478***	0.080	2.477***	0.080	2.227***	0.066	2.227***	0.066
WHI			0.350***	0.051			0.214***	0.053
Variance level 2 (employee)	0.207 (35%)	0.020	0.171	0.016	0.194 (44%)	0.018	0.181	0.017
Variance level 1 (day)	0.383 (65%)	0.076	0.392	0.075	0.245 (56%)	0.051	0.247	0.050
−2 Log likelihood	514.438		472.305		474.758		459.013	

*** $p < .001$; ** $p < .01$; * $p < .05$. Data points = 293 of 345 cases in use (respondents $n = 69$, days $n = 5$).

TABLE 4
Multi-Level Results of the Interaction of Psychological Detachment and Intensive Smartphone Use on Experienced WHI

	WHI			
	Null model		*Interaction model*	
	Estimate	*Std. er.*	*Estimate*	*Std. er.*
Intercept	2.311***	0.062	2.692***	0.224
Psychological Detachment			–.126	0.109
Smartphone			0.227**	0.075
Psych Detach*Smartphone			–0.039*	0.022
Variance level 2 (employee)	0.288 (61%)	0.027	0.270	0.025
Variance level 1 (day)	0.185 (39%)	0.044	0.163	0.040
–2 Log likelihood	554.842		533.070	

*** $p < .001$; ** $p < .01$; * $p < .05$. Data points = 293 of 345 cases in use (respondents $n = 69$, days $n = 5$).

Hypothesis 5 stated that the daily recovery experiences of psychological detachment and daily relaxation are more strongly negatively related to daily WHI for intensive smartphone users in comparison to less intensive smartphone users. The estimates of the interaction terms of both psychological detachment and smartphone use ($\gamma = -.039$, $SE = .022$), $t = 1.77$, $p < .05$, and relaxation and smartphone use ($\gamma = -.052$, $SE = .027$), $t = 1.96$, $p < .05$, were both significant (see Tables 4 and 5). Furthermore, the interaction models showed a significant improvement over the null model, Δ-2x log = 21.772, $df = 2$, $p < .001$ (psychological detachment) and Δ-2x log = 19.675, $df = 2$, $p < .001$ (relaxation).

To examine whether the direction of the interactions was in line with our expectations we visualised the interactions in Figures 2 and 3. Figure 2 shows that daily psychological detachment is more strongly negatively related to daily WHI for employees who use their smartphone intensively as compared to employees who refrain from smartphone use. This implies that when smartphone users succeed in psychologically detaching themselves from work, they are able to significantly decrease their WHI. To examine the interaction patterns in more detail, we conducted simple slope tests as suggested by Preacher, Curran, and Bauer (2006). The multi-level interaction between daily psychological detachment and smartphone use in relation to experienced daily WHI is significant ($z = 1.96$, $p < .05$). This implies that the negative relation between psychological detachment and WHI is stronger when intensive smartphone use is high. When smartphone use is low, the relation between daily psychological detachment and WHI is still negative, but less strong. A similar pattern is depicted in Figure 3 that shows that for

TABLE 5
Multi-Level Results of the Interaction of Relaxation and Intensive Smartphone Use on Experienced WHI

	WHI			
	Null model		*Interaction model*	
	Estimate	*Std. er.*	*Estimate*	*Std. er.*
Intercept	2.311***	0.062	2.962***	0.338
Relaxation			–0.063	0.134
Smartphone			0.334**	0.111
Relaxation*Smartphone			–0.052*	0.027
Variance level 2 (employee)	0.288 (61%)	0.027	0.272	0.026
Variance level 1 (day)	0.185 (39%)	0.044	0.163	0.040
–2 Log likelihood	554.842		535.167	

*** $p < .001$; ** $p < .01$; * $p < .05$. Data points = 293 of 345 cases in use (respondents $n = 69$, days $n = 5$).

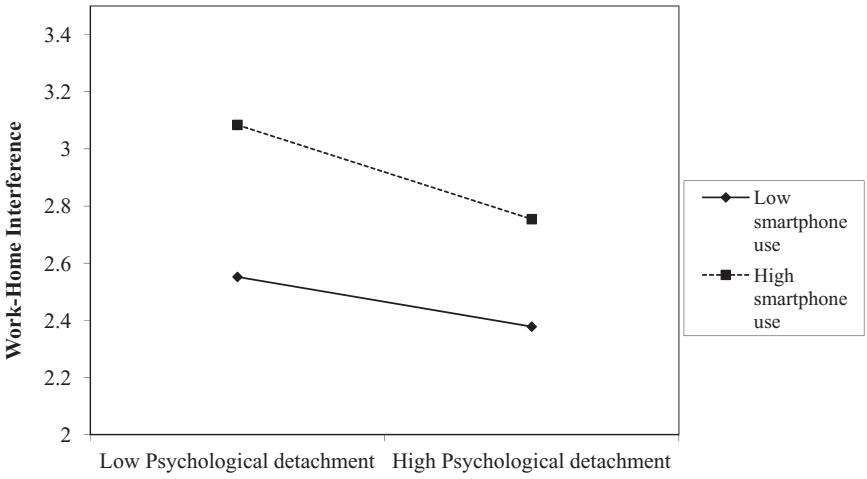

FIGURE 2. Moderation of smartphone use on the relationship between psychological detachment and work–home interference (WHI).

intensive smartphone users the negative relationship between daily relaxation and daily WHI is stronger than for less intensive smartphone users. So, for all smartphone users recovery experiences decrease their experienced WHI; however, this relation is stronger for those employees who use their smartphone intensively. Again, simple slope analysis showed that the interaction

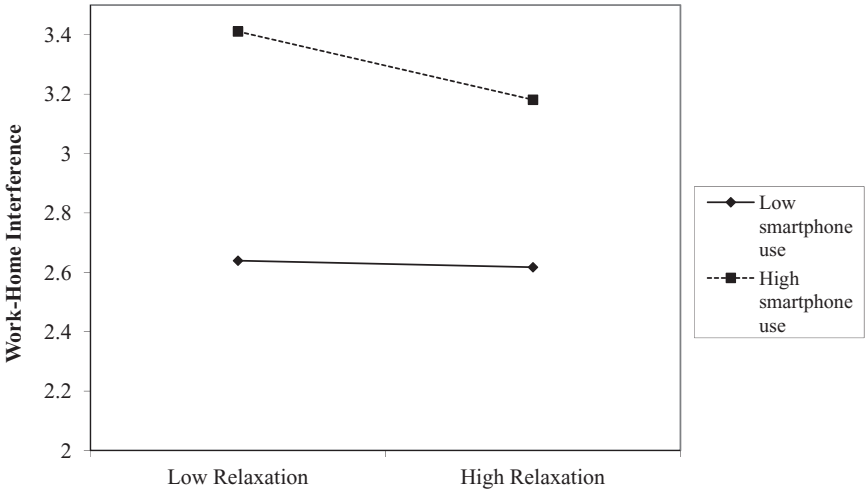

FIGURE 3. Moderation of smartphone use on the relationship between relaxation and work–home interference (WHI).

effect of intensive smartphone use and daily relaxation experiences on daily WHI is significant ($z = 1.96$, $p < .05$). In other words, the negative relation between relaxation and WHI is stronger when intensive smartphone use is high. In this case, when smartphone use is low, daily relaxation and WHI are unrelated. The direction of the interaction effects is in line with the hypothesised patterns. Therefore, these results provide strong support for Hypothesis 5, indicating that intensive smartphone users, in particular, have the potential to decrease their daily experience of WHI by undertaking recovery activities that lead to psychological detachment and relaxation.

The final hypothesis stated that daily WHI is more strongly positively related to indicators of state burnout (exhaustion, 6a; and, cynicism 6b) for intensive smartphone users in comparison to employees who refrain from smartphone use during after-work hours. The results of the multi-level analyses are shown in Table 6. The estimate of the interaction term between WHI and smartphone use on exhaustion is significant ($\gamma = -.083$, $SE = .036$), $t = 2.31$, $p < .05$, and the interaction model showed a significant improvement over the null model, Δ-2x log = 56.437, $df = 1$, $p < .001$. The interaction between WHI and smartphone use on cynicism was not significant ($\gamma = -.035$, $SE = .033$), $t = 1.06$, $p = ns$. In other words, the relation between daily WHI and daily cynicism was not significantly moderated by intensive smartphone use. Thus, Hypothesis 6b was rejected.

Figure 4 gives more insight into the moderation effect of intensive smartphone use on the relationship between daily WHI and daily exhaustion.

TABLE 6
Multi-Level Results of the Interaction of WHI and Smartphone Use on State Burnout (Exhaustion and Cynicism)

	Exhaustion				*Cynicism*			
	Null model		*Interaction model*		*Null model*		*Interaction model*	
	Estimate	*Std. er.*	*Estimate*	*Std. er.*	*Estimate*	*Std. er.*	*Estimate*	*Std. er.*
Intercept	2.478***	0.080	1.829***	0.288	2.227***	0.066	1.955***	0.270
WHI			0.042	0.142			0.084	0.135
Smartphone			0.037	0.123			–0.036	0.113
WHI*Smartphone			0.083*	0.036			0.035	0.033
Variance level 2 (employee)	0.207 (35%)	0.020	0.174	0.016	0.194 (44%)	0.018	0.186	0.017
Variance level 1 (day)	0.383 (65%)	0.076	0.288	0.057	0.245 (56%)	0.051	0.217	0.046
–2 Log likelihood	514.438		458.001		474.758		457.697	

*** $p < .001$; ** $p < .01$; * $p < .05$. Data points = 293 of 345 cases in use (respondents $n = 69$, days $n = 5$).

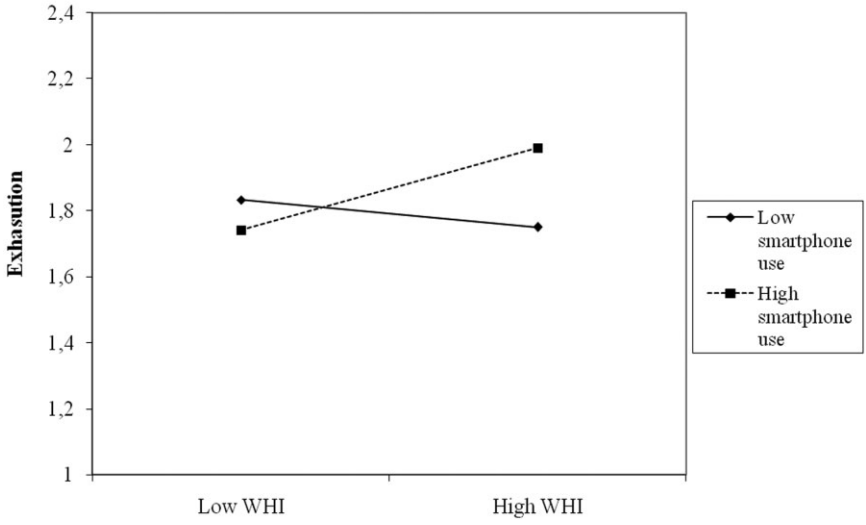

FIGURE 4. Moderation of smartphone use on the relationship between work–home interference (WHI) and exhaustion.

Simple slope analysis (Preacher et al., 2006) showed that intensive smartphone use significantly moderated the relationship between daily WHI and daily exhaustion ($z = 1.91$, $p < .05$). As can be seen, the positive relationship between daily WHI and daily exhaustion is stronger for intensive smartphone users, confirming Hypothesis 6a. In other words, when faced with high levels of WHI, intensive smartphone users experience significantly more exhaustion than less intensive smartphone users.

DISCUSSION

Technological advances, for example the smartphone, have facilitated employees to stay connected to work at home. The inability to disengage from work has negative consequences in terms of recovery and exhaustion (von Thiele Schwarz, 2011). Millions of employees are already using smartphones to do their jobs away from the office (Hill et al., 2003); and the trend in organisational life indicates that this number continues to increase. Therefore, the present study aimed to explore the impact of smartphone use on the relations between daily recovery experiences, work–home interference (WHI), and burnout symptoms. There is ample evidence that WHI, recovery, and experienced exhaustion and cynicism are interrelated (e.g. Kinnunen et al., 2006; Moreno-Jiménez, Mayo, Sanz-Vergel, Geurts, Rodríguez-

Muñoz, & Garrosa, 2009; Sonnentag, 2001). However, the literature lacks empirical studies that examine the impact of (intensive) smartphone use—and thus expectations regarding availability—on these processes. In addition, the scarce studies that have examined the impact of smartphone use on employee well-being are either qualitative (e.g. Jarvenpaa & Lang, 2005; Middleton, 2007) or cross-sectional in nature (e.g. Hill et al., 2003; Olson-Buchanan & Boswell, 2006). Our study is the first diary study that captures daily fluctuations in psychological detachment, relaxation, WHI, and state levels of burnout within a group of smartphone users. A fundamental benefit of diary methods is that they permit the examination of experiences in their natural, spontaneous context, providing information that is complementary to that obtainable by more traditional designs (Reis, 1994). In addition, the amount of time that elapses between an experience and the account of this experience is minimised (Bolger, Davis, & Rafaeli, 2003), resulting in more accurate observations. Since in our sample the explained variance on the day level was high, it adds to our argument that daily measurements are justified.

We expected that the daily experiences of psychological detachment and relaxation would have the potential to decrease the daily experience of WHI. Our data confirm that smartphone users who succeeded in engaging in activities to psychologically detach and/or relax indeed experienced less WHI. Hence, employees with the habit of using their smartphone intensively, but who succeed in engaging in activities leading to psychological detachment and relaxation on a specific day, experienced less WHI on that day. In other words, for intensive smartphone users, in particular, there is potential to decrease their daily levels of WHI by undertaking these kinds of recovery activities during after-work hours. These results are in line with previous studies that have already shown that psychological detachment from work is important in coping with conflict between work and family domains (Moreno-Jiménez et al., 2009; Sonnentag & Kruel, 2006). Furthermore, Sonnentag et al. (2008a) showed that relaxation during evening hours had beneficial effects on employee well-being. However, none of these studies considered the impact of smartphone use on these relations. Hence, our study contributes to the literature by extending the insights on recovery and burnout symptoms by taking into account the impact of smartphone use on these relations. Our results consistently show that intensive smartphone use leads to increased levels of WHI and that this group, in particular, can benefit from engaging in activities aimed at psychological detachment and relaxation.

The results showed that daily WHI was positively related to state burnout operationalised as exhaustion and cynicism. Other, cross-sectional, studies have consistently shown this relation (e.g. Kinnunen et al., 2006; Netemeyer, Boles, & McMurrian, 1996). We can extend this knowledge in two ways. First, by capturing the daily fluctuations in both WHI and exhaustion and

cynicism including within-person variations which is more informative than a strictly between-person design. Second, this is the first study to our knowledge that maps the interrelations between WHI and state burnout within smartphone users. Besides the direct effects of WHI on state burnout and recovery experiences on WHI, we also found strong evidence for an indirect effect of recovery experiences via WHI on burnout symptoms.

In line with earlier studies indicating that smartphone users might have difficulties in managing their work–home balance (e.g. Davis, 2002; Jarvenpaa & Lang, 2005), our results showed that smartphone use was positively related to WHI. An important difference between our study and earlier studies linking smartphone use and WHI is that we examined smartphone use during after-work hours. Furthermore, these findings are an important contribution to the literature since we captured daily fluctuations in WHI, which are less subject to biased recall in comparison to earlier work conducted by Boswell and Olson-Buchanan (2007). They showed in a survey study that communication technology use after hours was positively associated with an employee's work-to-life conflict as reported by the employee as well as a significant other of the employee.

Finally, we expected that daily WHI would be more strongly positively related to indicators of state burnout (exhaustion and cynicism) for smartphone users in comparison to non-users. Indeed, that is exactly what we found for exhaustion. When faced with high levels of WHI, intensive smartphone users are more exhausted than less intensive smartphone users. A possible explanation for this result is that smartphone use prolongs exposure to work demands in the evening, drawing on the same resources, and creating a situation where health is at risk (Meijman & Mulder, 1998). Furthermore, the smartphone users in our sample had no free choice about working mobile. As a consequence they might experience a lower level of job control which is a strong predictor of poor well-being (Duxbury et al., 1994). Contrary to our expectations intensive smartphone use had no impact on the relation between daily WHI and daily cynicism. Cynicism is characterised by withdrawal from work (Schaufeli & Van Dierendonck, 2001). It is plausible that it is more difficult to keep one's distance from work when it is salient in the home domain by means of the smartphone.

In sum, we found strong evidence that smartphone use during after-work hours has a significant impact on the work–home interface. Intensive smartphone users experience more WHI on a daily basis. Furthermore, the costs of high WHI in terms of exhaustion are disproportionally loaded on the intensive smartphone user. However, since our results showed that smartphone users who succeed in experiencing psychological detachment and/or relaxation during after-work hours experience less WHI, this might be an opportunity for intensive smartphone users to protect themselves from the potential negative consequences of high WHI. Finally, since psychological

detachment is a precondition of proper recovery (Etzion et al., 1998), these findings add theoretically to the work on the Effort-Recovery theory (Meijman & Mulder, 1998) by showing the impact of intensive smartphone use on the important process of daily recovery.

Limitations and Future Research

Most studies have several limitations; unfortunately this study is no exception. First, we treated intensive smartphone use as a relatively stable "trait-like" variable since we considered smartphone use as a habit. Turel, Serenko, and Bontis (2008) argue that users of modern technologies such as smartphones may present problematic excessive behaviors. The terms addiction (Griffiths, 1999), problematic use (Davis, Flett, & Besser, 2002), over-use (Whang, Lee, & Chang, 2003), and high engagement (Charlton & Danforth, 2007) are associated with these kinds of behavior. In addition, the results of Mazmanian and colleagues (2006) show that employees who use their smartphones intensively become dependent and feel discomfort when turning it off. Therefore, we chose to operationalise intensive smartphone use as relatively stable behavior. However, it is also conceivable that smartphone use during after-work hours fluctuates on a daily basis. For example, on days where the workload is higher than "normal", individuals might feel the need to use their smartphone more extensively. For future research it would be interesting to explore whether smartphone use fluctuates on the day level.

Second, we measured intensive smartphone use, using statements with a Likert scale response format. However, to get a more precise view of how employees actually use their smartphone during after-work hours, objective data about frequency of use or a log book would be very helpful. It would be interesting to include a behavioral measure of smartphone use in future studies.

Third, two issues should be considered in interpreting our results. First, we did not include overall time dedicated to work at home, besides smartphone use, in our model. It is possible that employees spent time on work-related activities other than smartphone use. Furthermore, we had no insight into the type of messages employees sent during evening hours. Since they used a business smartphone with an employer taking care of all expenses, we assumed that they used it mainly for work issues. However, it is possible that employees used them for private purposes as well. Future studies should consider including these two variables.

Fourth, it should be noted that the reported findings were all synchronous effects. We conducted multi-level analyses using diary data, but the temporal order of the variables could not be established within our design. All our data were collected at the same time: at the end of the day. Importantly, a lagged variables analysis did not result in significant effects, but this may also be

ascribed to the fact that the phenomena under study operate on a daily basis (on the same day). In other words, the WHI on one day does not need to have an impact on state burnout the next day, but is only expected to have an impact on experienced exhaustion and cynicism on the same day. It is also possible that a good night's sleep is sufficient to recover with no negative effects on burnout symptoms in the morning as a result. However, Sanz-Vergel, Demerouti, Mayo, and Moreno-Jimenez (2011) examined the moderating impact of sleep quality on the relation between WHI and psychological strain and did not find any evidence for a moderating effect. Therefore, it is important that future studies establish the temporal order of the model variables by assessing the variables at different points in time during the day.

Since we were interested in experienced smartphone users who internalised smartphone use in their lifestyles, we used an existing group of smartphone users. It is likely that this is a selective group linked to a specific, knowledge-based, work field. It is notable that our sample is highly educated and works for the large part in the consultancy business. Therefore we have to be careful about generalising our results to the general population. For future research it would be interesting to set up an experimental design with a longitudinal focus using zero-history groups in smartphone use. Then it would be possible to see how the benefits and potential drawbacks of smartphone use and the accompanying issues regarding availability develop over time.

Implications for Practice

Next to the contribution to theory development in the field of new media and work, the findings of our study also have practical implications. We found strong evidence that intensive smartphone use during after-work hours can lead to difficulties in managing a healthy work–home balance. Therefore it is important for organisations to realise that although communication technology is likely to allow for greater connectivity to and flexibility in managing work demands, such integration (or boundary blurring) may come at a price for an individual (Boswell & Olson-Buchanan, 2007). There are indications that employees who are more effective at managing time and boundaries may experience less work–family conflict than those unable to manage time and work and home boundaries (Ashforth, Kreiner, & Fugate, 2000). In order to keep employees healthy, organisations have the responsibility to make employees aware of these effects and should encourage them to adopt a strategy that is aimed at setting concrete boundaries between work and family life.

Indeed, the popular press is replete with examples and discussions of smartphones and mobile e-mail, tying employees to their jobs, leaving little room to disengage (e.g. Robinson, 2006; Zambrowicz, 1998). The results of

our study show that intensive smartphone users, in particular, have the potential to decrease their work–family conflict by successfully engaging in activities that lead to psychological detachment and relaxation. Moreno-Jiménez and colleagues (2009) suggest that organisations can help employees to deal with potential work–home interference by developing programs that facilitate psychological detachment.

The smartphone users in our sample were compelled to work mobile. Duxbury and colleagues (1994) found indications that higher job control over where, when, and how to work was a strong predictor of the experienced level of work–life stress of the employee. In our study, we find a strong link between WHI and state burnout symptoms. In addition, intensive smartphone users suffered more from high WHI in terms of exhaustion than less intensive users. Similarly, Montreuil and Lippel (2003) showed in their study that employees who had a choice about mobile working experienced fewer negative consequences. Therefore, it might be useful for employers to discuss with employees whether they want to use smartphones and if so under what conditions regarding availability. Since most organisations aspire to healthy and productive employees we would recommend that they set up a clear policy including their expectations regarding the availability of their employees during after-work hours. In the end it is in everyone's interest to profit from the advantages of smartphones and to reduce the potential side effects where possible.

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