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Need for recovery, home–work interference and performance: Is lack of concentration the link?

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Abstract

This study examines the mechanisms through which experiences in the home domain influence work performance by bringing together the literature on recovery and the work–family interface. A longitudinal study among 123 employees from different organizations was conducted to investigate whether need for recovery and home–work interference (HWI) impeded concentration at work 1 month later, and whether concentration adversely affected in-role performance over time. Structural equation modeling analysis supported these hypotheses. Whereas need for recovery and HWI had negative, lagged effects on concentration, concentration had a positive lagged effect on in-role performance. Moreover, need for recovery and HWI were reciprocal and negatively related over time, suggesting that these two states may create a negative spiral in the home domain that could easily intrude into the work domain. These findings increase our insight in the processes leading to reduced performance at work, and suggest that organizations should facilitate opportunities for recovery.

Keywords: Concentration; Effort–recovery; Home–work interference; Job performance; Panel design

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1. Introduction

Few people will doubt that the time employees spend outside work is important for their functioning at work. Whereas recuperation and rest during non-work time may have favorable consequences for behavior at work (Fritz & Sonnentag, 2005; Sonnentag, 2003), the main body of work–family research has focused on more general aspects of non-work life that may *interfere* with work behavior (Eby, Casper, Lockwood, Bordeaux, & Brinley, 2005). Such aspects include family and household obligations, child care, conflicts with family members, and non-work hassles (Bolger, DeLongis, Kessler, & Wethington, 1989). The present study focuses on the unfavorable effects that life outside work may have on performance. Specifically, we examine how need for recovery and strain-based home-to-work interference (HWI) affect cognition and in-role performance at work. Using a longitudinal study design, we test the assumption that when employees have a strong desire to rest and when tensions at home interfere with work activities, they will be less able to concentrate on their work tasks. As a consequence, they will perform suboptimally at work.

Whereas this mechanism seems intuitively plausible, as yet it has not been tested integrally. However, there is some evidence that supports this reasoning. On the one hand, research in occupational health psychology has suggested that inadequate recovery impairs well-being and performance at work. For example, long working hours and the ensuing limited time available for leisure and relaxation have been linked to adverse well-being and decreased mental functioning (Sparks, Cooper, Fried, & Shirom, 1997; Taris, Beckers, Dahlgren, Geurts, & Tucker, in press; Van der Hulst, 2003, for reviews). Further, higher levels of exhaustion (a correlate of need for recovery) are associated with lower levels of objectively measured in-role performance (reviews in Demerouti & Bakker, 2006; Taris, 2006). In a related domain, work–family researchers have found that non-work hassles or other family stressors can interfere with work and may diminish performance (e.g., Charles, Dinwiddie, & Massey, 2004; Netemeyer, Maxham, & Pullig, 2005; Shellenback, 2004; Tetrick, Miles, Marcil, & Van Dosen, 1994). On the other hand, the work psychological literature shows that enhanced concentration on one's tasks leads to better performance (among others, Lieberman et al., 2006; Van der Linden, Keijsers, Eling, & Van Schaijk, 2005). Our study brings these research traditions together in an attempt to enhance our understanding of the consequences of non-work experiences for work performance, proposing that impaired concentration is the concept that links these two lines of research.

1.1. Need for recovery

According to Sonnentag and Zijlstra (2006), fatigue is the state that results from being active in order to deal with the work demands (i.e., effort expenditure), while recovery is the process of replenishing depleted resources or rebalancing suboptimal psycho-physiological systems. Need for recovery is the *sense of urgency* that people feel to take a break from their demands, when fatigue builds up. Inherent in the experience of need for recovery is a temporal reluctance to continue with the present demands or even to accept new demands (Schaufeli & Taris, 2005). Therefore, need for recovery from work can be viewed as an early stage of a long-term strain process leading to prolonged fatigue, psychological distress and cardiovascular complaints (e.g., Jansen, Kant, & Brandt, 2002; Kivimaki et al., 2006). Typical examples of need for recovery experiences are that employees find

it difficult to relax at the end of a working day, cannot concentrate during their free time after work, need free days to rest, and feel tired when they start a new work day (cf. Van Veldhoven & Meijman, 1994; Winwood, Winefield, & Lushington, 2006).

High need for recovery during non-work time implies that employees are strained due to dealing with work demands; otherwise recovery would not be necessary. When people have the time and the opportunity to satisfy their need for recovery (by resting or by engaging in appropriate leisure activities), their need for recovery will be fulfilled (Sonnentag & Zijlstra, 2006). This will be the case in the absence of work demands during a respite, which allows one to invest in new resources and to initiate a resource gain (Eden, 2001).

1.2. Strain-based home–work interference

Strain-based home–work interference (HWI) suggests that strain experienced in the home domain intrudes into and interferes with participation in the work domain (Carlson, Kacmar, & Williams, 2000; Greenhaus & Beutell, 1985). Work–home interaction represents a mechanism linking family (work) characteristics to work (family) and individual outcomes (Voydanoff, 2002). Strain-based conflict is usually characterized by a spillover of negative emotions from one domain into the other. For example, anxiety and fatigue caused by one role will likely make it difficult to perform well in another role. Work characteristics have consistently been associated with interference originating from the work environment, whereas home characteristics are the major antecedents of interference stemming from the home domain (e.g., Demerouti, Geurts, & Kompier, 2004b; Frone, Russell, & Cooper, 1992; Geurts et al., 2005).

1.3. What happens at home

When people feel that they are not sufficiently recovered, they will lack the energy to participate in family life because of depleted individual resources. Hobfoll's (1989, 2002) conservation of resources (COR) theory proposes that individuals aim to preserve, protect, and build resources. Resources represent objects, conditions, characteristics, or energies that are important for the individual. A basic premise in COR theory is that anticipated or actual resource loss or a failure to gain resources after resource investment will induce stress. Grandey and Cropanzano (1999) applied COR theory to work–family relationships and proposed that "interrole conflict leads to stress because resources are lost in the process of juggling both work and family roles" (p. 352). Their findings revealed that as chronic work and family stressors drained resources over time, participants experienced increased stress reactions, such as job and family dissatisfaction, life distress, and poor physical health. A later study by Demerouti et al. (2004b) provided evidence for the cyclical nature of work–home interference loss spirals. They used a three-wave longitudinal study design and found that work pressure, work–home interference and exhaustion had causal and reversed causal relationships over time. For example, results showed that work pressure caused loss of resources, which evoked work–family interference and then feelings of exhaustion. These feelings of chronic fatigue then resulted in more work pressure, thus starting the cycle over again.

Highly relevant to the present study is Sonnentag's (2001) diary research on recovery. Her research showed that employees who engaged in work-related activities during their evening off-hours reported higher strain before going to sleep. In contrast, those who

engaged in social, physical (e.g., sports or dancing), or low-effort (e.g., watching TV or taking a bath) activities reported less strain. Thus, work spillover into family life resulted in higher strain. Fritz and Sonnentag (2005) extended this research and showed, among other things, that non-work hassles (e.g., conflict with the partner, working at home) and low social activity predicted strain. These findings suggest that building one's personal resources, or instituting gain spirals during time away from the job, may be a preventative measure to reduce the onset of strain at work. However, the restorative benefits of time away may evaporate if one is thinking about work, or experiencing non-work hassles.

Applying these insights to our study, we propose that high (work-induced) need for recovery will make people more prone to reserve their free time for resting as a self-regulative strategy to increase their personal resources. As a consequence, they will invest a limited amount of time in household activities. Such behavior may create emotionally loaded situations and strain as family members will claim the full participation of the individual in family life and the fulfillment of family requirements. Therefore, the higher the need for recovery, the higher the strain experienced during non-work time and, consequently, the higher the potential that this strain will interfere with work. This leads to our first hypothesis.

Hypothesis 1a. Need for recovery is positively related to HWI across time.

When people feel that their home situation negatively influences their work, they will try to cope with and eventually resolve these negative emotions. The self-regulative processes and actions involved in coping with these negative emotions (e.g., thinking about these emotions, devising actions to prevent these emotions from occurring, cf. Carver, 2004) use up energy reservoirs because they require effort, in the end depleting the available supply (Rothbarth, 2001). For instance, a young mother who experiences excessive and incompatible demands from the family and work domains will be overloaded and, consequently, will have a high need for rest. Thus, the tension associated with strain-based HWI will increase the need for recovery. Therefore, we also hypothesize:

Hypothesis 1b. HWI is positively related to need for recovery across time.

Taken together, Hypothesis 1a and 1b imply that need for recovery and HWI are reciprocal over time.

1.4. Predicting job performance

Under normal conditions, employees have enough time to recover after work, such that they can recharge their energy levels and are able to perform well the next day (Fritz & Sonnentag, 2005). However, if the physiological and psychological systems that were activated during daily work effort are re-activated subsequent to insufficient recovery, the employee must make additional, compensatory effort (Geurts & Sonnentag, 2006; Meijman & Mulder, 1998) in order to successfully complete their work tasks. According to Meijman and Mulder (1998), under conditions of fatigue or excitement it takes more effort to concentrate or to divide attention between various task elements, or to solve a difficult problem (Van der Linden et al., 2005). In such cases, the employee's information processing capacity is less than optimal for the performance of a certain task.

Field and experimental studies on fatigue show that people under naturally occurring or experimentally induced fatigue prefer work procedures that require less effort to the ones requiring more effort and tend to rely on simple, previously automatized routines (e.g.,

Frese & Zapf, 1994; Holding, 1983; Sperandio, 1972; Taris & Kompier, 2005). For instance, they prefer to make successive simple yes–no decisions than to use attention demanding decision processes. Employees make such adjustments in work strategies in order to protect themselves against mental (over)load such that they can still perform acceptably (Welford, 1978). Generally, fatigued and sleep-deprived individuals have a shortened attention span and cannot concentrate on tasks that require the same vigilance and sustained alertness (Van der Linden et al., 2005; Van Duinen, Lorist, & Zijdewind, 2005) as when they are rested. Intermittent dream-like intrusions of irrelevant thoughts cause lapses of attention and decreased ability to concentrate (Ohslund, Dalton, Reams, Rose, & Oswald, 1991). As fatigue and sleep deficit increase, the duration and number of lapses of attention will increase as well. Thus, we formulated our second hypothesis.

Hypothesis 2. Need for recovery diminishes concentration at work over time.

A similar process is expected to operate when employees experience strain-based HWI. Experiencing HWI suggests that employees, for one reason or another, face situations at home that mentally preoccupy them when they are at work (Tetrick et al., 1994). Imagine, for instance, an employee who while being at work worries about conflict with a family member the day before. Such strain-based HWI may act as a distracter of the attention that people could otherwise direct towards their work tasks. Since attention is a limited resource (Meijman & Mulder, 1998), HWI draws on the attention capacity of individuals and diminishes concentration. To our knowledge, there is no direct evidence supporting this relationship. However, experiencing HWI makes people feel negative emotions and stress (Eby et al., 2005). There is considerable evidence to suggest that people under high levels of stress and anxiety perform most tasks less successfully than when non-stressed (for a review, see Kavanagh, 2005), and it has been suggested that a key reason for this is that the anxious person engages in task-irrelevant cognitive activities (e.g., Van der Linden et al., 2005; Wine, 1971). Deffenbacher (1978) found that people high on anxiety and under stress conditions spent only 60% of the available time actually engaged in the task; they used a high proportion of the time worrying about how their performance would match with the other individuals and about the consequences of their performing poorly. Moreover, there is evidence that anxiety impairs performance because individuals misdirect attention to task-irrelevant information processing, particularly when they perform a demanding rather than a simple automatic task (Mayer, 1977). This leads to our third hypothesis:

Hypothesis 3. Strain-based HWI diminishes concentration at work over time.

Performance efficiency is reduced by distraction and enhanced by task-relevant concentration. Particularly in tasks performed under stressful circumstances, the focus of attention must be on the processes relevant for completing the task to achieve the best outcomes (Beal, Weiss, Barros, & MacDermid, 2005; Jones & Hardy, 1989). The focus on task-relevant information ensures that all resources available to the employee are used fully and in the most efficient manner possible (Rushall, 1995).

According to Meijman and Mulder (1998), under conditions of fatigue or excitement it takes more effort to concentrate on or to divide attention between various tasks elements or to solve a difficult problem. In such cases people's information processing capacity is less than optimal for the performance of a certain task. When employees are not in the state needed for optimal task performance, they will mobilize additional energy, known also as compensatory effort (Hockey, 1993). While people are generally able to regulate

their activities efficiently such that they avoid performance decrements (Hockey, 1993; Meijman & Mulder, 1998), when they are in a suboptimal state (as in case of fatigue), specific aspects of performance will deteriorate (cf. Taris, 2006). For example, Meijman (1989) found that bus drivers at the end of their working shift maintained the reaction time but not the quality of the reaction since they made more errors. Hockey, Wastell, and Sauer (1998) showed that whereas sleep deprivation (a possible precursor of high need for recovery) had no effect on primary task performance, it did influence secondary performance parameters (e.g., reaction time). Taken together, specific aspects of job performance are expected to deteriorate with diminished concentration. In the present study, we will focus on in-role performance which represents those officially required outcomes and behaviors that directly serve the goals of the organization (Motowildo & Van Scotter, 1994).

Hypothesis 4. Concentration at work leads to better in-role performance over time.

1.5. The present study

To test the hypothesized relationships we applied a longitudinal design in which all constructs were measured twice with a 1-month time lag between the study waves. This relatively short lag was chosen because it was assumed to match the hypothesized duration of the investigated phenomena. If need for recovery extends over longer periods of time we might run the danger that irreversible fatigue develops (Schaufeli & Taris, 2005). Moreover, the literature suggests that work–family conflict relates significantly and positively to strain when the time lag is 6 months or less (e.g., Demerouti, Bakker, & Bulters, 2004a; Grandey & Cropanzano, 1999). Weaker or null relationships emerged when the time lag exceeded 1 year (e.g., Frone, Yardley, & Markel, 1997; Peeters, de Jonge, Janssen, & van der Linden, 2004). This is perhaps because people develop strategies to cope with conflicting situations. The same might apply to concentration, since employees will develop strategies to overcome long concentration decrements, such that they are able to do their job.

We hypothesize that need for recovery and HWI will eventually lead to diminished in-role performance through concentration. However, we do not suggest that concentration is a *mediator* in the abovementioned relationships. Rather, it represents the linking mechanism, i.e., an *indirect effect*, through which both need for recovery and HWI are related to performance. This implies that both need for recovery and HWI do not need to have a direct effect on performance (cf. Mathieu & Taylor, 2006). The reason is that empirical evidence supporting such relationships over time is still missing and the existing cross-sectional evidence is also rather scarce and not convincing (for HWI—in-role performance: Netemeyer, Boles, & McMurrian, 1996; Witt & Carlson, 2006; for need for recovery: Fritz & Sonnentag, 2006). In such cases, Mathieu and Taylor (2006) suggest to hypothesize and test indirect (instead of mediation) effects since the requirement of a significant direct effect from the predictor to the outcome is not necessary (as is the case for mediation effects).

2. Method

2.1. Participants and procedure

The participants in the present study were employed in several different sectors and job positions in The Netherlands. This variation increases the chances of finding meaningful

variation in job characteristics and work-related experiences (Warr, 1990). Participants were approached through their supervisors. Supervisors from nine companies that varied in size received a letter explaining the goal of the study. They were then were contacted by telephone to ask whether they would join the study. Eight companies agreed to participate, including departments of a bank, ministry, a train engineering/consultancy agency, a training office, a donation service office, a production company and a transport company.

In total, 305 questionnaires were distributed. In the accompanying letter, the anonymity and confidentiality of the data was emphasized. Furthermore, employees were informed that they would be approached for a second measurement 1 month later. Participants could return their completed questionnaire in a pre-stamped envelope. For the first questionnaire we obtained an above-average response rate of 60% ($N = 183$, cf. Baruch, 1999). The participants received the second questionnaire four weeks after the distribution of the questionnaires. In order to increase the response rate in this study wave, employees were informed that for each completed questionnaire, the researchers would donate a small amount of money to a good purpose. This time 130 (i.e., 42.6% of the original sample) questionnaires were returned, of which 123 could be matched to a previously completed questionnaire.

Of the 123 employees who completed the questionnaire twice, 61.5% was male. Their age ranged from 21 to 62 years with an average of 38.6 years ($SD = 10.3$). Furthermore, 36.8% of the participants lived only with a partner; 46% had children; and 35% had a partner and children living at home. Thirteen percent had at least one child until 3 years old, 34% had at least one child between 4 and 12 years old and 28% had at least one child in the age of 13 years old or older. The majority of the sample held a college or a university degree (58.7%). Organizational tenure was 9.7 years ($SD = 11.0$), and the majority of the sample worked full-time. Most participants worked with people (44.5%); 29.4% worked primarily with information, 2.5% worked primarily with things, while 23.5% reported combinations of these.

2.2. Measures

Need for recovery was assessed using an 11-item scale of the VBBA (the Dutch Questionnaire on Experience and Evaluation of Work; Van Veldhoven & Meijman, 1994). This scale contains yes/no questions representing short-term effects of a day of work, with questions like "I find it hard to relax at the end of a working day" (1 = 'no', 2 = 'yes'). In the present study, the items formed two factors in an exploratory factor analysis. Therefore, we included only the items that clearly measured need to recuperate from work-induced fatigue, experienced after a day of work (8 items). A mean score was calculated by averaging the scores on the individual items, such that higher scores indicated a higher need for recovery. Jansen et al. (2002) provide a more detailed description and correlates of need for recovery with fatigue and psychological distress.

Strain-based *home–work interference* was measured by three items based on Carlson et al. (2000). Two items represent direct translation of Carlson et al.'s scale while the third item was modified such that it was positively worded, namely "I have no problems at work because of tensions at home" (1 = 'strongly disagree', 4 = 'strongly agree').

Concentration was measured by five items. Four of these came from Jackson and Marsh's (1996) flow state scale, assessing the degree to which employees have a complete focus upon their task (e.g., "My attention was focused entirely on what I was doing",

1 = 'strongly disagree', 4 = 'strongly agree'). One additional item was especially developed for the present study, namely "My thoughts were wandering to other things during the task" (reverse-coded). Participants had to recall their main activities of the previous month and to report the degree to which they agreed with each statement.

In-role performance was assessed with the nine items proposed by Goodman and Svyantek (1999). Example items are "Demonstrates expertise in all job-related tasks" and "Achieves the objectives of the job". Participants were asked to indicate the extent to which they found each statement characteristic of themselves (0 = 'not at all characteristic', 6 = 'totally characteristic'). Previous research has found a correlation of $r = .30$ among self- and other-ratings of in-role performance (Demerouti et al., submitted for publication).

2.3. Statistical analysis

The data were analyzed with covariance structure modeling (Jöreskog & Sörbom, 1993) using the maximum-likelihood method implemented in the AMOS computer program (Arbuckle, 2003). Model fit was assessed using the standard χ^2 test, as well as the root mean square residual (RMSEA), the goodness-of-fit index (GFI), the Tucker–Lewis index (TLI), the comparative fit index (CFI), and the incremental fit index (IFI). Values of .05 and lower (for RMSEA) or .90 and higher (GFI, TLI, CFI, and IFI) signify good model fit (Byrne, 2001).

3. Results

3.1. Descriptive statistics

Means, standard deviations, Pearson correlations, and internal consistencies of the study variables are presented in Table 1. To test whether need for recovery, HWI, and concentration are different from each other we conducted confirmatory factor analyses, comparing the fit of a three-factor model (with the items of the three scales loading on their respective factor) to that of several two-factor models and a one-factor model (with all

Table 1
Means, standard deviations, Pearson correlations, and Cronbach's alpha (on the diagonal) of the study variables, $N = 123$

	M	*SD*	1	2	3	4	5	6	7	8
Time 1										
1. Home–work interference	1.76	.67	.79							
2. Need for recovery	1.51	.29	.19*	.82						
3. Concentration	3.08	.54	−.23*	−.16	.78					
4. In-role performance	3.02	.41	−.25**	−.21*	.31**	.81				
Time 2										
5. Home–work interference	1.80	.62	.66**	.18*	−.17	−.24**	.75			
6. Need for recovery	1.53	.30	.19*	.70**	−.04	−.11	.14	.83		
7. Concentration	3.06	.57	−.23*	−.23*	.56**	.28**	−.22*	−.17	.83	
8. In-role performance	3.01	.42	−.09	−.07	.24**	.74**	−.08	−.09	.38**	.84

*$p < .05$, **$p < .01$.

items of the three scales loading on the same latent factor). The fit of the three-factor model was satisfactory ($\chi^2 = 130.37$, $df = 87$, $p < .002$, GFI = .89, RMSEA = .06, TLI = .91, CFI = .92, IFI = .91) and significantly better than the fit of the two-factor models (collapsing HWI and concentration in one factor, $\Delta\chi^2 = 85.48$, $df = 2$, $p < .001$; collapsing need for recovery and concentration in one factor $\Delta\chi^2 = 129.61$, $df = 2$, $p < .001$; collapsing HWI and need for recovery in one factor $\Delta\chi^2 = 97.19$, $df = 2$, $p < .001$). Moreover, the three-factor model was significantly better than the one-factor model ($\Delta\chi^2 = 220.30$, $df = 3$, $p < .001$). This indicates that these three concepts can empirically be distinguished from each other.

3.2. Test of the home–work interference and job performance model

All variables were modeled as single-indicator latent factors. The use of latent variables with multiple indicators was avoided in order to have sufficient cases for the number of parameters to be estimated. All latent factors were corrected for random measurement error by setting the random error variance of each construct equal to the product of its variance and one minus its internal consistency (Jöreskog & Sörbom, 1993). A series of nested models was fitted to the data. First of all, a model without cross-lagged structural paths but with temporal stabilities (i.e., associations between the time 1 and time 2 measurements of the same variables) and synchronous (within-wave) correlations was specified (Model 1). This model estimates the total stability coefficient between measurement waves (Pitts, West, & Tein, 1996). This model exhibited deficient fit ($\chi^2 = 33.66$, $df = 12$, $p < .001$, cf. Table 2).

In order to test Hypotheses 1a (suggesting a lagged effect of need for recovery on HWI) and 1b (suggesting a lagged effect of HWI on need for recovery), we added these paths to the baseline, stability model. This reciprocal model (Model 2) fitted the data acceptably well ($\chi^2 = 27.22$, $df = 10$, $p < .002$), and was significantly better than the stability model ($\Delta\chi^2 = 6.44$, $df = 2$, $p < .05$). Consistent with Hypotheses 1a and 1b, T1 HWI led to higher need for recovery over time, while T1 need for recovery was also positively related to T2 HWI ($\gamma = .27$ and $\gamma = .23$, p's $< .05$, respectively). Thus, need for recovery and HWI affected each other reciprocally over time.

In order to test Hypothesis 2 (suggesting a lagged effect of need for recovery on concentration) we built a new model (Model 3) by including the path from T1 need for recovery to T2 concentration in the reciprocal model (Model 2). The fit of the model improved significantly by the addition of this path ($\Delta\chi^2 = 7.89$, $df = 1$, $p < .01$), whereas the path itself was also significant and in the expected direction ($\gamma = -.27$, $p < .01$). In a similar vein, in

Table 2
Goodness-of-fit indices (maximum-likelihood estimates) for the nested cross-lagged models, $N = 123$

Model	χ^2	*df*	*p*	GFI	RMSEA	TLI	CFI	IFI
1. Stability model	33.66	12	.001	.93	.12	.85	.93	.94
2. Model 1 & Reciprocal effects	27.22	10	.002	.95	.12	.86	.95	.95
3. Model 2 & Need for recovery → concentration	19.33	9	.023	.96	.10	.91	.97	.97
4. Model 3 & HWI → concentration	16.08	8	.041	.97	.09	.92	.98	.98
5. Model 4 & Concentration → performance	11.42	7	.121	.98	.07	.95	.99	.99

Note. χ^2, chi square; *df*, degrees of freedom; GFI, Goodness-of-fit index; RMSEA, root mean square error of approximation; TLI, Tucker–Lewis index; CFI, comparative fit index; IFI, incremental fit index.

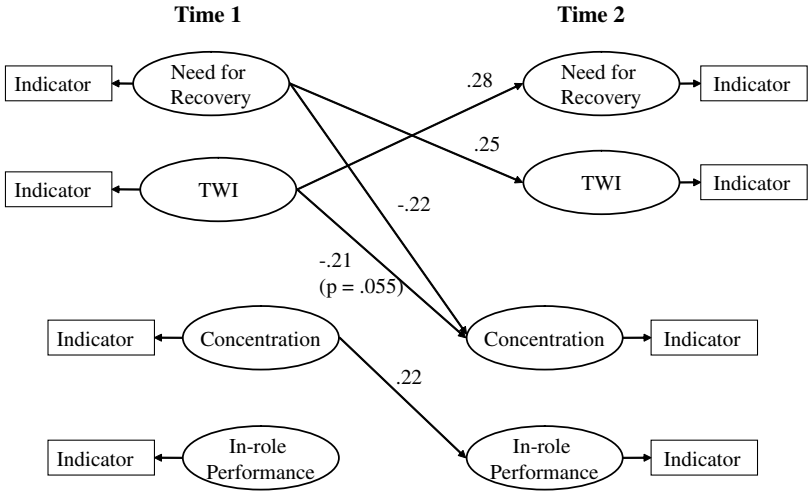

Fig. 1. Results of structural equation modeling (maximum-likelihood estimates), $N = 123$. *Note*. Autocorrelations and synchronous correlations are omitted for reasons of clarity. All paths are significant at $p < .05$, except where indicated otherwise.

order to test Hypothesis 3 (suggesting a lagged effect of HWI on concentration) we added the path from T1 HWI to T2 concentration. While this model (Model 4) showed a good fit, it was not significantly better than the more parsimonious Model 3 ($\Delta\chi^2 = 3.25$, $df = 1$, *ns*). Additionally, the lagged path from HWI to concentration was marginally significant at $p = .055$. Thus, while need for recovery led to less concentration at work confirming in this way Hypothesis 2, HWI was only marginally related to concentration at work over time, providing weak support for Hypothesis 3.

The final hypothesis (4) suggested a lagged effect of concentration on in-role performance. This hypothesis was tested by adding the path from T1 concentration to T2 in-role performance in the previous model. This model (Model 5) had a satisfactory fit to the data and was significantly better than the previous model ($\Delta\chi^2 = 4.66$, $df = 1$, $p < .05$). Since T1 concentration had a positive, lagged effect on T2 in-role performance ($\gamma = .22$, $p < .05$), Hypothesis 4 was supported. The model displayed in Fig. 1 explained 12% of the variance in concentration and 5% of the variance in in-role performance.

The methodology that we followed to test our hypotheses agrees with the recommendations of Taris and Kompier (2006) for testing mediation in a two-wave panel study with the only difference being that we did not expect and test a direct effect from (T1) need for recovery and HWI on (T2) performance. According to the interpretations of Mathieu and Taylor (2006) and MacKinnon et al. (2000), our findings suggest that concentration represents the linking mechanism that ties need for recovery/HWI to in-role performance.

4. Discussion

The present study was designed to examine the links among home–work interference, need for recovery, concentration, and in-role performance. Based on an integration of findings obtained in cognitive work psychology, research on the work–home interface

and occupational health psychology, we proposed that (i) home–work interference and need for recovery would mutually affect each other, such that HWI would lead to a higher need for recovery and vice versa; (ii) HWI and need for recovery would have a negative impact on concentration; and (iii) the resulting low concentration would have a deleterious effect on in-role performance. These notions were tested in a two-wave full panel design, allowing us to temporally separate the causal variables from their presumed effects.

Covariance structure modeling confirmed most of our hypotheses. Consistent with the idea that the regulation of high levels of strain draws on scarce energetic resources (Carver, 2004; Rothbarth, 2001), high levels of HWI (as a source of strain) were longitudinally associated with high need for recovery. Conversely, high need for recovery was also longitudinally associated with high levels of HWI. This is consistent with Hobfoll's (1989) COR theory, in that we presumed that high need for recovery would lead workers to protect their energetic resources by withdrawing themselves from their household tasks, in turn leading to home-related stress that could potentially interfere with one's work tasks. Further, we found that both high levels of HWI and high need for recovery predicted low levels of concentration. This agrees with previous findings that both high levels of fatigue and high levels of stress impair cognitive functioning (for the effects of fatigue, see Meijman & Mulder, 1998; Van der Linden et al., 2005; Van Duinen et al., 2005; for stress, see Kavanagh, 2005; Tetrick et al., 1994; Van der Linden et al., 2005). Finally, low concentration was longitudinally associated with low self-rated in-role performance, which supports previous findings on this relationship (e.g., Meijman, 1989; Tetrick et al., 1994).

The longitudinal design of the study allowed the investigation of the processes through which experiences at home impair organizational behavior. It was shown that home–work interference or the related need for recovery (being another experience directly related to non-work time) intruded into the work domain to the extent that they impaired concentration. Thus, concentration, i.e., the ability to focus attention, was the mechanism linking negative load effects from home to work. This means that feeling insufficiently rested and that experiences at home interfere with work does not automatically translate into worse performance at work. Because achieving job targets is an important goal for every employee, people will self-regulate experiences threatening their goal achievement and will do everything they can to avoid failure. One strategy they can apply is to focus on their primary job tasks (and ignore secondary or unimportant ones) such that their remaining resources are optimally used (Demerouti, Verbeke, & Bakker, 2005). An alternative explanation for this process is that people actively separate the two life domains (Lambert, 1990). Both domains are considered (psychologically, physically, temporally, and functionally) separate domains, whereby the activities in each domain are assumed to make unique demands on the individual. Additionally, experimental evidence suggests that when people manage to identify appropriate event boundaries they can improve memory for what has happened and the learning of new skills (Zacks & Swallow, 2007).

Taken together, an important contribution of the present study is that it integrates and expands previous research on HWI and performance. We have argued and shown that HWI and need for recovery impair concentration, which, in turn, has a detrimental effect on in-role performance. Most previous studies restricted themselves to showing that HWI has an impact on employee well-being (see Byron, 2005; Eby et al., 2005, for overviews). The present study suggests that HWI has a negative impact on performance as well, and is thus an important indicator of strain that should be addressed with the right measures.

4.1. Study limitations

Before we discuss the implications of our study in more detail, we want to mention some limitations. First, our hypotheses were tested using self-reported data. This could potentially lead to inflated correlations due to common method variance, memory effects and similar processes (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). However, we believe this is not a major problem in our study. First, our conclusions are based on the longitudinal (and not the cross-sectional) associations and it seems unlikely that during the second study wave participants recalled their answers during the first study wave. Second, inspection of the correlation matrix reveals that most of our correlations were relatively weak. This suggests that our associations were certainly not inflated by common method bias. Finally, there is no reason to assume that common method variance and similar artifacts would operate more strongly for some pairs of variables than for others. As the strength of the correlations varied considerably (from .07 to .38, excluding stability effects), there is little reason to assume that common method bias systematically affected our findings.

Secondly, the fact that all variables were measured using self-reports might also endanger the validity of these measures. This would not seem to apply to need for recovery, home–work interference, and concentration; employees are probably the best judges of their own attitudes and cognitive and energetic states. However, this is different for our measure of in-role performance. Objective (e.g., supervisor, colleague, and client) performance evaluations and subjective assessments may well disagree. Although often moderately strong correlations between objective and subjective performance measures are reported (e.g., Bommer, Johnson, Rich, Podsakoff, & MacKenzie, 1995, reported a meta-analytically derived mean correlation of .39 between subjective and objective measures of employee performance), it is clear that these two types of measures tap partly different concepts. It seems plausible that participants will rate their own performance higher than others would do (Taris, 2006, for a discussion), and in that sense the means and standard deviations reported in Table 1 should certainly not be taken as reflecting true performance. However, the present study focused on *associations* among concepts, and it is not immediately clear how these would be affected through the use of subjective performance measures. As said above, it is well possible that within-wave correlations among variables are inflated by common method bias, but it seems less obvious how this bias would affect the longitudinal correlations as well. In that sense, there is little reason to believe that the use of self-rated performance discredits the longitudinal findings.

Finally, our hypotheses were tested using a relatively small sample (final N was 123 workers). Although our response rate was quite acceptable (cf. Baruch, 1999) meaning that there is relatively little reason to suspect selectivity, this small sample could in itself lead to two problems. First, there is the possibility that the low N leads to insufficient power to reject the null hypothesis of no effect. The results reported in Fig. 1 show that this does not apply to the present study, as all hypotheses were confirmed. However, a small sample could also mean that a small number of outliers could disproportionally affect the findings. As the results reported here were in full agreement with those obtained in previous research, it would appear that outliers did not strongly affect our findings.

4.2. Study implications

Despite these limitations, the present study extends and enhances previous research and theorizing in at least three ways. First, we believe that our findings underline the usefulness of integrating different perspectives on the relationships among home–work interference, need for recovery, concentration, and job performance. By integrating insights obtained in cognitive work psychology, research on the work–home interface and occupational health psychology, we were able to build a heuristic model for the relations among these concepts that was strongly supported in an empirical longitudinal test. As such, this model holds some promise for future research on home–work interference and performance. This responds to the call of Campbell Clarke (2000) for more theory on the process of work–family balance.

Second, our findings suggested that self-regulative cognitive processes (especially lack of concentration) are responsible for the link between need for recovery and home–work interference on the one hand, and employee performance on the other. Whereas this idea was grounded in earlier studies (e.g., Van der Linden et al., 2005; Van Duinen et al., 2005), it should be noted that much of this research was conducted in a laboratory setting. By showing that similar processes operate in a more ecologically valid field context, we have shown that previous experimentally obtained findings are practically of considerable value.

A final interesting finding obtained in the present research was the fact that need for recovery and home–work interference were reciprocal, such that high need for recovery increased levels of home–work interference across time whereas high home–work interference led to a higher need for recovery. This suggests the existence of a negative spiral (cf. Hobfoll, 1989, 2002) in which employees' scores on these concepts become increasingly more adverse. As both concepts were also linked (through concentration) to work performance, this finding suggests that problems in the home domain could easily intrude in the work domain, adversely affecting work performance. These findings offer insight in the process of home–work interference, and add to other recent evidence showing that the home situation can have a negative influence on organizational behavior (e.g., Grzywacz et al., 2005; Netemeyer et al., 2005).

From a practical point of view, our findings show that organizations should be aware of the links among lack of recovery, home–work interference and performance, and especially that difficulties experienced in the home domain may adversely affect functioning in the work sphere. As such, these findings thus underline that organizations should not be indifferent to employees' calls that their employer should facilitate recovery and participation of employees in family life by diminishing demands at work. Previous research has shown that the implementation of family-friendly policies (such as flexible working times) may be beneficial for combining work and family responsibilities (e.g., Demerouti, 2006; Dikkers et al., 2007); the present research suggests that such policies may well be beneficial for organizational performance as well. Therefore, organizations, governments, and policy makers should enhance the means and policies that they provide to facilitate family life. This is vital from an ethical point of view since every employee has the right to have a private life outside work. Moreover, such policies are beneficial for the organization itself because they are translated to better performance and thus more profit.

Finally, this study showed that concentration forms the missing link between interference from home to work domain and need for recovery on the one hand and job perfor-

mance on the other hand. As we stated, employees do everything they can to keep their job performance intact and independent from home matters. However, at the same time they probably allow certain favorable characteristics to facilitate their work behavior. Future research should illuminate the type of strategies employees use to keep a balance between their work and home life.

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