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How Is Leisure Time Interacting with Nature Related to the Need for Recovery from Work Demands? Testing Multiple Mediators

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The study compared the importance of spending time in interacting with nature to other leisure activities regarding recovery from work demands. In addition, a multiple mediation model between time spent in interacting with nature and need for recovery through four mediators was tested. Employees of five organizations answered a questionnaire (N = 527). Exercise and being outdoors during free-time was evaluated as the most effective activity for recovery from work stress, and the time spent in interacting with nature was mentioned as second in importance. Time spent in exercise and being outdoors, life satisfaction, and relaxation mediated significantly the relationship between time spent in interacting with nature and need for recovery from work.

Keywords exercise, interaction with nature, life satisfaction, need for recovery, relaxation, work recovery

Recovery refers to the process during which an individual’s functioning returns to its prestressor level, and it has been described as the process of replenishing depleted resources (Sonnentag & Zijlstra, 2006). In the work recovery literature, need for recovery is one of the concepts used to capture the basic elements in the recovery process. More specifically, need for recovery refers to a person’s desire to be temporarily relieved of work demands in order to replenish internal resources (Sluiter, van der Beek, & Frings-Dresen, 1999). It refers to the sense of urgency that people feel to take a break from their obligations when fatigue builds up.

In the literature on off-job activities (time spent outside the workplace) related to recovery, one of the main classifications of leisure activities includes low-effort, physical, and social activities (Sonnentag & Zijlstra, 2006). According to the Effort-Recovery model (Meijman & Mulder, 1998), engaging in activities that draw on the same resources (e.g., cognitive and physical resources) already used on the job may hamper the recovery process. Therefore, as they require little effort and impose few or no demands on the individual, low-effort activities (e.g., watching TV, taking a bath) are expected to help in recovering. By contrast, physical activities like exercise or going to a certain place do require effort, but they draw on resources different from those needed in most jobs. Therefore, the original
resources are not further expended (see Meijman & Mulder, 1998). Social activities such as speaking with a colleague or friend or being together with relatives provide opportunities for social support that is related to well-being (Viswesvaran, Sanchez, & Fisher, 1999) and restoration of resources (Hobfoll, 1998).

It has been shown that physical activities promote recovery from work and reduce the need for recovery in particular (Rook & Zijlstra, 2006; Sonnentag, 2001; Sonnentag & Zijlstra, 2006; Winwood, Bakker, & Winfield, 2007). There is also evidence of the effectiveness of low-effort (Sonnentag, 2001) and social activities (Fritz & Sonnentag, 2005; Sonnentag, 2001; Sonnentag & Zijlstra, 2006; Winwood, Bakker, & Winfield, 2007) in terms of recovery. However, some studies failed to observe the effectiveness of low-effort (Rook & Zijlstra, 2006; Sonnentag & Zijlstra, 2006) or social activities (Rook & Zijlstra, 2006). Off-job activities can be complemented by work-related activities (the continuation of work-tasks in off-job time) and household activities (e.g., cleaning, cooking), which have not generally proved to promote recovery (Sonnentag, 2001; Sonnentag & Zijlstra, 2006).

Further examples of off-job activities related to recovery are strategies for changing a bad mood and raising energy and alertness that include combinations of physical settings and behaviors such as “changing location” and “going out to get some fresh air” (Thayer, Newman, & McClain, 1994). However, little is known about the places people go to in these situations or the incidence and relative effectiveness of this activity. A single study has shown that elementary teachers’ spontaneous place choices to implement restorative coping strategies were related to sources of stress (Gulwadi, 2006). More teachers with high-frequency vocational stress (vs. home-related or interpersonal stress) mentioned natural settings as restorative places than did the low-frequency vocational stress group. Teachers with high-frequency interpersonal stress sought places providing social contact the most. More generally, studies on the recreation opportunity production process have shown that both activities (e.g., biking, hiking) and settings (e.g., a remote forest or village) usually influence both recreation experiences (e.g., feeling more self confident, feeling stronger spiritually) and the beneficial outcomes (e.g., types of learning) realized by recreation users but to a different degree (Pierskalla et al., 2004). Because studies are lacking on this issue, we compare in the study reported here the importance of spending time in interacting with nature to other leisure activities, and investigate its relationship to need for recovery.

According to Sonnentag and Fritz (2007), it is not a specific activity *per se* that helps people to recover. Rather, the psychological attributes attached to these activities are relevant for recovery. They distinguished between four such recovery experiences: psychological detachment, relaxation, mastery, and control during off-job time. The first two experiences have their roots in the Effort-Recovery Model (Meijman & Mulder, 1998), and the last two in the Conservation of Resources Theory (Hobfoll, 1998). According to the Effort-Recovery Model, psychological detachment and relaxation may be helpful because they imply that no further demands are made on the functional systems or internal resources called upon during work. Mastery-oriented strategies, that is, mastery and control, may aid recovery because they build up new and restore threatened internal resources such as energy, self-efficacy, or positive mood.

Thus far, most studies have focused on only one or two of the experiences, and most often only psychological detachment has been the focus (e.g., Sonnentag & Bayer, 2005; Sonnentag, Mojza, Binnewies, & Scholl, 2008). Consequently, there is lack of studies that take multiple recovery experiences simultaneously into account. Recent exceptions to this trend are the studies by Sonnentag and Fritz (2007) and Siltaloppi, Kinnunen, and Feldt (2009). More specifically, there is a lack of research that concerns the role of all four recovery experiences as mediators between recovery activities and need for recovery. Thus,
this issue is investigated in the present study. By taking these all into account, we are able to compare their mutual effectiveness.

Psychological detachment implies disengaging mentally from work during off-job time (Sonnentag & Fritz, 2007). Avoiding work tasks, however, is not sufficient. An individual also needs to detach psychologically, to stop thinking about his or her job and job-related affairs. Thus, psychological detachment is often experienced as “switching off” during off-job time (Sonnentag & Bayer, 2005). Relaxation is characterized by low sympathetic activation and increased positive affect, thus promoting recovery (Sonnentag & Fritz, 2007). This state may be either a result of deliberately chosen strategies or occur less intentionally. For example, relaxation occurs to some extent while performing such activities as taking a walk or listening to music. The mastery experience refers to pursuing off-job activities, such as taking a language class or learning new sports, that offer an individual challenges or opportunities to learn or master new skills (Fritz & Sonnentag, 2006; Sonnentag & Fritz, 2007). These activities challenge the individuals without overtaxing their capabilities and are expected to enhance recovery because they help to build up new internal resources such as skills, self-efficacy, or positive mood (Sonnentag & Fritz, 2007). Control refers to control over such decisions such as which activity to pursue, and when and how to pursue a chosen activity. The experience of control during leisure may increase self-efficacy and feelings of competence; therefore, it may promote recovery from job strain (Sonnentag & Fritz, 2007).

In addition to the four psychological experiences suggested by Sonnentag and Fritz (2007), there also are other experiences that might filter need for recovery or be helpful for it in the context of leisure activities. Namely, earlier evidence shows that satisfaction with life is positively associated with stress-alleviating, restorative experiences obtained particularly in natural favorite places (Korpela, Ylén, Tyrväinen, & Silvennoinen, 2008). Satisfaction with life represents the top-down perspective of well-being (Feist, Bodner, Jacobs, Miles, & Tan, 1995), assuming that general well-being dispositions (e.g., well-being, satisfaction with life) can filter the perception of daily experience such as need for recovery. Moreover, there is evidence that life satisfaction is a state-like, contextually dependent, “on-line construction” showing noteworthy intra-individual variation in a three-week diary study (Heller, Watson, & Ilies, 2006). The amount of intra-individual variation in life satisfaction was similar in magnitude to self-esteem but less than in positive and negative affect (Heller et al., 2006). Thus, satisfaction with life also represents the bottom-up approach of well-being where daily events such as finding a coin or relaxation in natural settings (as in the present study) may affect life-satisfaction assessments (Heller et al., 2006).

To summarize, we first compare the importance of spending time in interacting with nature to other leisure activities regarding recovery from work stress. Second, we investigate the relationship between time spent in interacting with nature (an independent variable) and need for recovery (a dependent variable) through the following mediators: time spent in exercise and being outdoors, recovery experiences (psychological detachment from work, relaxation, mastery, and control during leisure time) and satisfaction with life. This implies a multiple mediation model (Preacher & Hayes, 2008). We include the amount of time spent in exercise and being outdoors in our model as a mediator because being outdoors may take place in natural (but also in entirely built) environments. Moreover, we do not expect exercise and being outdoors to be the only significant mediator. Restorative environment studies suggest that natural settings may promote recovery by affecting physiological stress, relaxation, directed attention, restorative experiences (e.g., being away from everyday routines), and mood positively, not only through physical activity but also through observational and low-intensity physical activity (Hartig et al., 2003; Kaplan & Berman, 2010; Kaplan & Kaplan, 1989; Ulrich et al., 1991).
In all, our model is based on the restorative environments studies, the Effort-Recovery Model, the Conservation of Resources Theory, and the top-down perspective of well-being (life satisfaction). As socioeconomic status (education and professional status) may be a confounder affecting the opportunities to interact with nature (through the choice of the place of residence), it is controlled for in our investigation of multiple mediation. Because our model is correlational and it is obvious that the relationship between time spent in interacting with nature and need for recovery may be recursive and bidirectional (a high need for recovery may also increase the probability of using natural settings for leisure), we test our model in both directions by reversing independent and dependent variables.

Methods

Participants and Procedure

The target group included employees of five organizations from various sectors such as business, telecommunications and information technology, hotel and catering, travel services, and education. By sampling different organizations we were able to study employees from a variety of different jobs. Data collection was performed in spring 2007, using a 12-page questionnaire distributed to each employee at his or her workplace. The completed questionnaires were returned in closed envelopes to the researchers by mail. Of the 1,042 employees contacted, 527 returned the completed questionnaire after a reminder, yielding a response rate of 51%.

Of the participants, 53% were women. Participants’ mean age was 42.4 (SD = 11.7). Most participants (77%) were living with a partner (either married or cohabiting), and 43% had children (average of two) living at home. The majority (60%) had an academic degree, 21% had a higher vocational diploma, and the rest (19%) had a vocational school education or less. Of the participants, 53% worked in the public sector as teachers and researchers, and 47% worked in the private sector. The private sector included jobs in hotels (17%), in an information technology company (11%), in travel services (9%), and in hardware stores (10%). Most participants had a permanent job (68%) and worked full-time (87%). Mean number of working hours per week were 43.3 (SD = 9.9).

Measures

The measures were parts of a lengthy, 12-page questionnaire including sections of a) work and well-being, b) work recovery and leisure activities, c) personal resources, d) health and sleep, and e) background variables. The order of the measures in the questionnaire was the following: need for recovery, recovery experiences, off-job activities, life satisfaction, and socioeconomic status. The measures were not presented sequentially or related to each other in the questionnaire; there were always one to two other measures or questions between the measures reported here.

Off-job activities and perceived effectiveness of off-job activities for recovery. We asked the participants to assess 12 items of off-job activities (see Figure 2) belonging to the following categories: work-related activities (e.g., finishing or preparing for work duties, studying), household activities (e.g., cooking, doing the dishes, shopping), low-effort activities (e.g., watching TV, lying on the sofa), social activities (e.g., meeting others, making a phone call in order to chat), exercise and being outdoors (e.g., keep-fit, cycling, dancing), activities in natural environments (enjoying nature e.g., walking, gardening or nature hobby), and other (open-ended). Each activity was elicited with one single item “How often do you spend your time on this off-job activity?” on a 4-point rating scale.
ranging from 1 (never) to 4 (nearly always). This procedure with a similar classification of off-job experiences has been used by Sonnentag (2001).

After that the respondents were asked “How effective for recovery from work stress is the time spent on this off-job activity?” on a 4-point rating scale ranging from 1 (not at all effective) to 4 (very well effective). We used the item describing time spent in interacting with nature and the item describing the time spent in exercise and being outdoors in our multiple mediation model.

A caveat on the wording of our item concerning activities in natural environments is called for. The item was “enjoying nature, for example, walking, gardening or nature hobby,” whereas the other free-time activities did not include the word “enjoying” but were, among others, “exercise and being outdoors” or “household chores,” that is, not “enjoying being outdoors” or “enjoying household chores.” The term enjoy may have made this particular item distinctive. However, in the Finnish language, the phrase “enjoy nature” is customary and does not bring to mind the necessity to experience strong emotions but rather the activities that were given as examples in a similar fashion as in other items. Thus, the item can be regarded as comparable to others.

Recovery experiences. Each recovery experience—psychological detachment, relaxation, mastery, and control—was measured using the Recovery Experience Questionnaire (Sonnentag & Fritz, 2007). Participants were asked to respond to the items with respect to their free time outside work. All scales included four items: for example, “I distance myself from my work” (psychological detachment), “I use the time to relax” (relaxation), “I seek out intellectual challenges” (mastery), and “I decide my own schedule” (control). The items were rated on a 5-point scale ranging from 1 (totally agree) to 5 (totally disagree) and recorded so that a high score on each scale indicated a high level of belief about the experience of interest. The hypothesized four-factor structure of the Finnish Recovery Experience Questionnaire was supported in the study by Kinnunen, Feldt, Siltaloppi, and Sonnentag (forthcoming). Internal consistency (Cronbach’s alpha) was .89 for psychological detachment, .82 for relaxation, .83 for mastery, and .85 for control in their study.

Life satisfaction. One item from a satisfaction scale (including satisfaction with marriage, parenting, family life, work, and free-time) was used to measure general life satisfaction (“How satisfied are you with your life in general?”). The item was rated on a 5-point scale from 1 (very dissatisfied) to 5 (very satisfied). Such single items have been used in longitudinal studies of life satisfaction (Luhmann & Eid, 2009; Röcke & Lachman, 2008).

Need for recovery. To assess the short-term effects of a day of work, we used nine items from the Need for Recovery Scale developed by Sluiter, van der Beek, and Frings-Dresen (1999). All the items used focus on the time outside the working day (e.g., “After a working day I am often too tired to start other activities”) and were rated on a 4-point scale from 1 (never) to 4 (always). Higher scores indicate a greater need for recovery. The Cronbach’s alpha for need for recovery was .89.

Socioeconomic status. We gathered data about education and professional status but not about income level. The highest level of education was measured with a single question (1 = no occupational education to 7 = licentiate’s or doctor’s degree). Professional status varied from 1 = blue collar worker, 2 = lower white collar worker, to 3 = upper white collar worker.
Analytical Strategy

The perceived effectiveness of different off-job activities for work recovery was compared with the 95% confidence intervals of the means (see Figure 2).

In order to achieve adequate statistical power and to assess the mediation hypothesis (the indirect relationship between an independent and dependent variable via mediator variables) with more statistical rigour than in the “traditional” mediator variable approach (based on ordinary regression analyses; Baron & Kenny, 1986), we used more recent nonparametric bootstrap sampling to investigate multiple mediation (MacKinnon, 2008; MacKinnon, Krull, & Lockwood, 2000; Preacher & Hayes, 2004, 2008).

To test the model of multiple simultaneous mediators (indirect effects), we started with correlating our variables (see Table 1 in the Results section) because multicollinearity may attenuate the effects of the mediators in multiple mediator models in a similar fashion as in ordinary multiple regression (Preacher & Hayes, 2008). Our criterion for acceptable multicollinearity among the mediators was less than 10% of common variance ($r \leq .32$) (Tabachnick & Fidell, 2007). Therefore, two mediators (i.e., psychological detachment and control) on the basis of multicollinearity were dropped away from our main model (Figure 1).

However, we also ran the full mediation model with six mediators (Table 2) to check whether leaving potential mediators out of our model due to multicollinearity changes our main results. To clarify the possibly recursive direction of the relationship between time spent in interaction with nature and need for recovery, we also investigated the reversed direction of this relationship (Table 2). Thus, we reversed independent (X) and dependent (Y) variables in our multiple mediation model. This analysis tries to tackle the problem of “conditional probability” by analyzing whether the amount of explained variance is equal in both directions (from X to Y, and Y to X). For all multiple mediation models, we used the nonparametric bootstrapping procedure (with 1,000 bootstrap resamples) utilizing an SPSS macro presented by Preacher and Hayes (2008).

In bootstrapping the sampling distribution of the indirect effects (of X on Y), resamples from the original sample are repeatedly taken (at least 1,000 times) and estimates for the indirect effects are derived from the resampled data set. Such a bootstrapping method does not impose the assumption of normality of the sampling distribution but rather provides high statistical power (MacKinnon, Lockwood, & Williams, 2004) and reduces the likelihood of Type I error (Preacher & Hayes, 2008). Both bias-corrected (BC) and bias-corrected and accelerated (BCa) 95% confidence intervals were derived; when the interval does not include a value $= 0$, the test statistic is significantly different from zero (Preacher & Hayes, 2004, 2008). The procedure also calculates contrasts to test whether two indirect effects (mediation effects) are equal in size.

Results

Perceived Effectiveness of Different Off-job Activities for Recovery from Work Stress

The results shown in Figure 2 indicate that “time spent in interacting with nature” was assessed the second most effective ($M = 3.85, SD = .36$; on the 4-point scale, 1 = not at all effective for recovery, 4 = very well effective for recovery) and popular (86% of the sample used it) activity helping recovery among 12 leisure activities. Only exercise and being outdoors was evaluated more effective for recovery from work stress.
### TABLE 1 Pearson Correlations Between the Variables of the Hypothetical Full Multiple Mediation Model

<table>
<thead>
<tr>
<th></th>
<th>Time spent in nature</th>
<th>Time spent in exercise and being outdoors</th>
<th>Life satisfaction</th>
<th>Detachment</th>
<th>Relaxation</th>
<th>Mastery</th>
<th>Control</th>
<th>Education</th>
<th>Professional status</th>
<th>Need for recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time spent in nature</td>
<td>.32**</td>
<td>.13**</td>
<td>-.03</td>
<td>.14**</td>
<td>.09*</td>
<td>.03</td>
<td>.02</td>
<td>.04</td>
<td>.03</td>
<td></td>
</tr>
<tr>
<td>Time spent in exercise and being outdoors</td>
<td>.08</td>
<td>.14**</td>
<td>.25**</td>
<td>.15**</td>
<td>.22**</td>
<td>-.02</td>
<td>-.11*</td>
<td>-.18**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life satisfaction</td>
<td></td>
<td></td>
<td>.23**</td>
<td>.28**</td>
<td>.28**</td>
<td>-.06</td>
<td>-.03</td>
<td>-.44**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detachment</td>
<td></td>
<td></td>
<td></td>
<td>.64**</td>
<td>.01</td>
<td>.41**</td>
<td>-.29**</td>
<td>-.34**</td>
<td>-.46**</td>
<td></td>
</tr>
<tr>
<td>Relaxation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.62**</td>
<td>-.24**</td>
<td>-.27**</td>
<td>-.46**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mastery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.25**</td>
<td>.02</td>
<td>.003</td>
<td>-.19**</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.20**</td>
<td>-.27**</td>
<td>-.41**</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.77**</td>
<td>-.01</td>
<td>-.01</td>
</tr>
</tbody>
</table>

* = p < .05; ** = p < .01.
**TABLE 2** The bootstrap 95% confidence intervals (lower and upper bounds) for the indirect effects of three models.

<table>
<thead>
<tr>
<th>Mediators</th>
<th>a) Main model: IV: time spent in interacting with nature, DV: need for recovery</th>
<th>b) Reversed model: IV: need for recovery, DV: time spent in interacting with nature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bootstrap</td>
<td>Bootstrap</td>
</tr>
<tr>
<td></td>
<td>Bias-corrected (BC) 95% CI</td>
<td>Bias-corrected and accelerated (BCa) 95% CI</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>Upper</td>
</tr>
<tr>
<td>Relaxation</td>
<td>-.08</td>
<td>-.02</td>
</tr>
<tr>
<td>Life satisfaction</td>
<td>-.07</td>
<td>-.01</td>
</tr>
<tr>
<td>Time spent in exercise and being outdoors</td>
<td>-.05</td>
<td>-.01</td>
</tr>
<tr>
<td>Mastery</td>
<td>-.01</td>
<td>.005</td>
</tr>
<tr>
<td>TOTAL</td>
<td>-.16</td>
<td>-.06</td>
</tr>
</tbody>
</table>

|                                              | c) Hypothetical full model (including multicollinearity), IV: time spent in interacting with nature, DV: need for recovery |
|                                              | Bootstrap                                                                 |
|                                              | Bias-corrected (BC) 95% CI                                                  |
|                                              | Lower                      | Upper                      |
| Life satisfaction                            | -.06                       | -.01                       |
| Time spent in exercise and being outdoors    | -.04                       | -.01                       |
| Relaxation                                   | -.03                       | -.002                      |
| Detachment                                   | -.02                       | .03                        |
| Control                                      | -.02                       | .01                        |
| Mastery                                      | -.01                       | .002                       |
| TOTAL                                        | -.12                       | -.02                       |

*Note:* a) the time spent in interacting with nature on need for recovery from work through four mediators; adjusted for professional status (N = 504; 1,000 bootstrap samples, Adj $R^2 = .363$), b) need for recovery from work on the time spent in interacting with nature through four mediators; adjusted for professional status (N = 504; 1,000 bootstrap samples, Adj $R^2 = .146$), and c) the time spent in interacting with nature on need for recovery from work through six mediators; adjusted for professional status (N = 504; 1,000 bootstrap samples, Adj $R^2 = .421$). The models also include the total effect (TOTAL) which is the total relation between IV (independent variable) and DV (dependent variable) without consideration of other variables.
FIGURE 1 Multiple mediation model: indirect mediation effects ($a_i b_j$ paths) from time spent in interacting with nature (independent variable) on need for recovery from work (dependent variable).

**Multiple Mediation of the Indirect Effects of the Time Spent Interacting with Nature on Need for Recovery**

Table 1 shows that among the four aspects of recovery experience, relaxation correlates strongly (around 38% common variance) with detachment and control (correlating also with each other), enabling us to exclude these last two experiences from the multiple mediation model (Figure 1). As education and professional status correlate strongly with each other, we chose professional status to the model as a covariate.

Time spent in interaction with nature and time spent in exercise and being outdoors significantly correlate with each other. However, time spent in interaction with nature is significantly correlated both to life satisfaction and relaxation, but time spent in exercise and being outdoors is correlated only to relaxation suggesting that the effects of nature do not reduce solely to physical activity.

The results of the main mediation analysis (Figure 1) and additional mediation analyses are shown in Table 2. The table shows that the total indirect effect of time spent in interacting with nature on need for recovery through four mediators adjusted for professional status is significant (both BC 95% CI and BCa 95% CI are between $-0.16$ and $-0.06$, the intervals do not include zero; the adjusted degree of explained variance is 36.3%). More specifically, time spent in exercise and being outdoors, relaxation, and life satisfaction are unique, significant mediators because the contrast tests were insignificant, indicating that the strength of these effects did not differ. Uniqueness means that all three variables have the ability to mediate the relationship when controlling for all other mediators. Mastery experiences are not a significant mediator in the model. Thus, the time spent in interacting with nature during free time is negatively related to the need for recovery from work through time spent in exercise and being outdoors, relaxation, and satisfaction with life in general. The more individuals interact with nature and the more they have the mediating physical activities or recovery experiences, the less their need for recovery.
Reversed and Full Mediation Models

To investigate the reversed direction of the relationship, we reversed the independent (X) and dependent variables (Y) in our model (Table 2). To investigate the effect of leaving potential mediators out due to multicollinearity, we also included all six originally potential mediators to our model (Table 2). First, when reversing Y and X in the model, the same three mediators (time spent in exercise and being outdoors, relaxation, and satisfaction with life) were significant and the direction of the relationship was still negative: the less need for recovery, the more interaction with nature. However, the total amount of explained variance of the model was only 14.6%. Second, when including all six mediators in the model, the basic finding of same three statistically significant mediators held. However, the total amount of variance was now increased to 42.1%. Altogether, the basic results (the negativity of the relationships and the three significant mediators) remained the same in all mediation analyses.

Discussion

Exercise and being outdoors during free-time was evaluated as the most effective activity for recovery from work stress, with time spent in interacting with nature mentioned as second. It is notable that both these off-job activities may largely refer to natural environments. However, being outdoors may also take place in entirely built environments. According to a national inventory, 95% of Finns recreate outdoors (mainly walking) in near-home areas (mainly natural areas) every second day on average (Pouta & Sievänen, 2001). Thus, our result of the effectiveness of nature-recreation may reflect the Finnish situation, and
international comparisons would provide an interesting perspective on this matter. A more precise look on the settings of outdoor physical activity is also needed in future studies.

In work recovery research, physical environments have received relatively little attention, although recovery settings (e.g., various types of vacations with respect to location or geographical region) have been examined (see Sonnentag & Geurts, 2009). In this context, the conceptual similarity between recovery in occupational health psychology and restorative experiences in environmental psychological literature is noteworthy. Namely, physical environments and natural settings in particular are pivotal in the psychophysiological restoration process (Berman, Jonides, & Kaplan, 2008; Chang, Hammitt, Chen, Machnik, & Su, 2007; Hartig et al., 2003; Kaplan & Berman, 2010; Li, 2010). Following attentional fatigue or psychophysiological stress, restoration involves renewing diminished functional resources (Hartig & Staats, 2003). Restorative experience involves positive shifts in mood, the enhancement of subjective vitality (sense of having physical and mental energy), decline in arousal (indexed by blood pressure, heart rate, skin conductance, muscle tension), cognitive clarification, and reflection on oneself (Hartig et al., 2003; Ryan et al., 2010; Ulrich et al., 1991). Decreases in heart rate variability (Park et al., 2009) and adrenaline and noradrenaline in urine (Li, 2010) after walking in forest settings also have been reported. It would be an important result for coping, recovery, and environmental health research if the (perceived) effectiveness of visiting nature in work recovery proves to be a general phenomenon, also apparent internationally. This would bring recovery research and restorative environments research closer together.

In our cross-sectional study, time spent in exercise and being outdoors, relaxation, and life satisfaction significantly mediated the effect of time spent in interacting with nature (as an off-job free-time activity) on need for recovery from work demands. The strength of these mediated effects did not differ; that is, they can be regarded as equally important as mediators. It is noteworthy that the relationship between interaction with nature and need for recovery is not mediated exclusively by time spent in exercise and being outdoors although it is one of the significant mediators (when controlling for other mediators). This result leaves room for the interpretation that interaction with nature also includes other aspects (such as observation) producing relaxation and life satisfaction. Moreover, our results showed that the relationship between interacting with nature and need for recovery may go in both directions, but need for recovery through the three significant mediators (exercise and being outdoors, relaxation and satisfaction with life) explained much less variance (14.6%) in interacting with nature than vice versa (36.3%). Thus, it seems that to a large extent a higher level of interaction with nature implicates lower need for recovery. In reverse, insufficient recovery from work is to a smaller extent linked to a lower level of interacting with nature through lower levels of exercise and being outdoors, relaxation, and satisfaction with life. However, the direction of the relationship (and causality) can be adequately solved only by using a longitudinal design.

The result concerning relaxation as a unique mediator (after controlling for others) is in accordance with the psychophysiological restoration theory (Ulrich et al., 1991). Again, there is an interesting conceptual analogy between recovery experiences and restorative experiences. Psychophysiological restoration proceeds through physiological relaxation and increased positive affect (Ulrich et al., 1991). Moreover, the experiential mechanisms through which everyday favorite places are connected to self- and emotion-regulation include relaxation and control (Korpela, 1989, 1992). Satisfaction with life also mediated the association between time spent in interacting with nature and need for recovery, which is in accordance with earlier findings that life satisfaction is related to restorative experiences in natural favorite places (Korpela et al., 2008). Mastery did not mediate the effect of free-time in interacting with nature on need for recovery in our model. This finding suggests
that on average interacting with nature offers more experiences related to relaxation and satisfaction than new challenges.

Our sample was quite heterogeneous and relatively large for mediation tests (Fritz & MacKinnon, 2007) but not all-inclusive, leaving room for other studies with employees from different sectors and from different countries. We were able to control for professional status, but it might be important to control for job types or organizational types in future studies. We were not able to establish the reliability of our single item measures of life satisfaction and time spent in nature. However, we expect that limited reliability is likely to attenuate rather than exaggerate the mediation effects. The model is correlational based on cross-sectional self-report data which precludes reliable causal inferences. A more rigorous test for mediation would require longitudinal studies where independent, mediator and dependent variables are measured at different points of time.

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References


