Perceived interdependencies between settings as constraints for self-reported restoration

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1. Introduction

Many researchers consider recreational behavior in natural environments both a powerful countermeasure against stress and mental fatigue and as a protective and promoting factor for health and well-being (e.g., Nielsen & Nilsson, 2007; Nilsson, Sangster, & Konijnendijk, 2011). Numerous studies emphasize the positive association between outdoor recreation, human well-being, and (mental) health (for overviews, see Abraham, Sommerhalder, & Abel, 2010; Barton & Pretty, 2010; Bowler, Buyung-Ali, Knight, & Pullin, 2010).

Concerning psychological restoration, one of the most prominent theories is attention restoration theory (ART; Kaplan & Kaplan, 1989; Kaplan, 1995). ART provides a theoretical framework that is well suited to explain why people benefit in terms of health and well-being from recreation, particularly when performed in natural environments like forests, parks, or other green spaces. The basic assumptions of ART are that everyday tasks and daily demands require directed attention. This is the case when we have to focus and concentrate on many different aspects to accomplish tasks in daily life. For example, when commuting to work, we have to be aware of traffic, other people, timetables etc. Kaplan and Kaplan (1989) assumed that we only have a limited (cognitive) capacity to maintain directed attention. Once our capacity is reached and the resources for maintaining directed attention are depleted, mental fatigue is supposed to follow (e.g., Boksem & Tops, 2008; Kaplan & Kaplan, 1989). It is further assumed that the cognitive resources needed for directed attention become depleted on a regular basis over the course of a day, particularly in the face of prevailing stressors and challenges for self-regulation (Kaplan & Kaplan, 1989). We can thus consider restoring depleted cognitive resources for directed attention as a fundamental for maintaining health and well-being. ART proposes that those environments that actively promote the opportunity to let our mind wander and enable us to not have to willfully focus on those things that need attention provide a more complete restoration compared to other environments (e.g., Berman

et al., 2012; Hartig, 2012; Kaplan & Kaplan, 1989). Whether an environment provides effortless attention and thus may support restorative processes depends on the perception of the dimensions “fascination”, “extent”, “compatibility”, and “being away” (e.g., Kaplan & Kaplan, 1989). *Fascination* comprises elements of the environment that draw attention to them, without us having to willfully concentrate or focus. Thus, these elements promote effortless attention, as no directed attention is needed. *Extent* relates to two aspects of an environment: it means both the perceived physical as well as imagined vastness and scope of an environment (Kaplan, Kaplan, & Ryan, 1998). *Compatibility* can be understood as the fit between a person and the environment. Compatibility is thus given if we find everything in an environment that we prefer, intend, and/or need at the moment when we are there. The fourth dimension, *being away*, means the perceived psychological distance from the demands of everyday life and associated mental effort (Kaplan et al., 1998). Being away does not mean the physical distance from environments where we experience high demands for directed attention or stress, but the degree to which the whole setting is similar or dissimilar to settings that provoke mental fatigue (Kaplan, 1995). Kaplan et al. (1998) concluded that environments that comprise fascinating elements; are perceived as coherent and of substantial scope; are compatible with what we want to do and have to do; and that allow us to have a strong sense of being away are most likely to support the restoration of depleted cognitive resources for directed attention, and thus contribute to our health and well-being. Such environments are commonly termed *restorative environments* (Kaplan & Kaplan, 1989; see also Hartig, 2004; von Lindern, Lymeus, & Hartig, 2016).

However, the kind of restoration has to correspond with the source of stress and mental fatigue. Hartig, Catalano, and Ong (2007) pointed out that sleep, for example, might not help people to recover from depleted social resources; an active, shared behavior would be more likely to support restoration in this case (Hartig, Catalano, Ong, & Syme, 2013). This notion as well as the definitions of fascination, extent, compatibility, and being away suggest that

restorative characteristics are not *per se* attributes of any given environment, but that the amount of actually experienced restoration also depends on human-environment and human-human transactions. Hartig (2004, p. 274) concluded that “some form of contrast with another relatively demanding environment” is needed for the successful restoration of depleted cognitive resources.

1.1 Constrained restoration

The constrained restoration concept is particularly relevant in the above-mentioned regard. Imagine hiking with a close friend on a beautiful trail that is winding along the banks of a small river. It is easy to understand such a hiking trip as taking place in a restorative environment, as it fulfills most, if not all, criteria for qualities that are associated with restorative environments. We might thus conclude that the imagined hiking trip likely supports restorative processes that result in feelings of improved health and well-being. But what happens if your accompanying friend receives a phone call during that hiking trip, informing him/her that his/her work contract will not be renewed at the end of the month? This certainly does not affect the qualities of the physical environment. However, it is, in this situation, very unlikely that the hiking trip actually sustains restorative processes anymore, as these processes will be undermined by stressful thoughts about possible future unemployment. This example should serve as an illustration of what can be understood as a case of constrained restoration.

Recent studies have provided empirical evidence supporting the concept of constrained restoration. As illustrated in the study of cold summer weather and the dispensation of antidepressants (Hartig, Catalano, & Ong, 2007), restorative processes may be constrained not only by directly stressful events, but also indirectly by other, more subtle aspects that are not in and of themselves particularly demanding. Further, restoration reported to have occurred with forest visits during leisure time was constrained for people who had a profession related to forests (von Lindern, Bauer, Frick, Hunziker, & Hartig, 2013). People who visited a

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wilderness park during their leisure time reported a weaker sense of being away and less restoration the more they perceived people, activities, or had cognitions that they associated with daily stress and demands (von Lindern, 2015). Further, Collado, Staats, and Sorrel (2016) recently reported empirical evidence for an impaired sense of being away for children who helped out on farms and spend their free time in agricultural areas compared to children who did not have to help out on farms and also spend their free time in agricultural areas.

The results of the studies mentioned above suggest that the constraint of restoration occurs not only because of direct or indirect exposure to some kind of stressor, but rather because we find it harder to achieve a sense of psychological distance from work-related demands, or from challenges in private life and through daily hassles. Thus, “having a sense of being away” seems to be very susceptible to circumstances that can be considered constraints for restoration. These findings suggest that the sense of being away is a construct that is worth analyzing in more depth.

We typically measure the sense of being away without looking deeper into *why* a certain socio-physical environment promotes while another one undermines a sense of being away. What is problematic with this kind of measurement is that the sense of being away is assessed only on a general and descriptive layer. Respondents and study subjects can only indicate to what degree they do or do not have a sense of being away in a certain context. While this kind of measure of being away could very well be associated with restorative outcomes (e.g., relief from unwanted demands, relax one’s focus, gives one a break, refuge from unwanted distraction), the sources that actually promote or impair having a sense of being away are not explicitly covered by it. This is problematic when, for example, planning interventions with the aim to increase the sense of being away and the related likelihood of stronger restorative outcomes. Without a theoretical concept of what psychological processes underlie a sense of being away or how a sense of being away can be created, a socio-physical environment cannot systematically be utilized for supporting health-promoting interventions that aim at

increasing the likelihood of restoration through an increased sense of being away. We can therefore argue that generating a deeper understanding of *why* people perceive a sense of being away is an important task for research in environmental and health psychology.

1.2 Complementing attention restoration theory with behavior setting theory

Behavior setting theory (BST) (Barker, 1978) provides a promising approach in this regard. BST integrates psychological, social, and physical aspects of environments and combines them with specific behavior, resulting in behavior settings (hereinafter simply “settings”). Settings can be defined as physical and psychological frames, which inherit specific social functions and roles (Wicker, 1992). In our daily life, we usually move from one setting to another, and thus take over different roles and use different functions of settings (e.g., the setting changes both from “home/family” to “work” when we physically leave home to go to work, but also when we stay at home and work out of a home office). Barker (1968) stated that events that occur in a setting as well as the (physical) characteristics of the setting itself impact our perception and behavioral or affective response. Interaction between humans and physical objects is essential for settings. Settings are therefore defined by humans, physical objects, and behavior involving interaction between humans and humans as well as between humans and objects. With this conceptualization, BST offers an approach to assess the restorative effects of environments that can be linked to “being away” in ART: The setting approach implies that every setting has special requirements and content (behavior, objects, and persons) that influence behavior in so far as its special characteristics hinder or foster (or even evoke) particular behavior (Schoggen, 1989). This implies that settings can be differentiated by their degree of interdependence in terms of behavior, objects, and persons. The more interdependence there is, the harder it is to discriminate two settings from each other. In BST, it is assumed that interdependencies between settings can be perceived in the seven dimensions of *person, leadership, cognition, object, behavior, location, and time* (Schoggen, 1989; von Lindern, 2015; also see Table 1 for an operationalization and

description of these dimensions). The more similar settings are in these dimensions, the more these settings are perceived as psychological-related, and the harder it becomes for us to discriminate between these settings (Schoggen, 1989; von Lindern, 2015).

With this definition of settings and their possible sources of interdependencies, it becomes apparent that assessing the amount of perceived setting interdependencies provides an excellent approach to measure what Hartig (2004, p. 274) called “some form of contrast with another relatively demanding environment” when referring to those environments that promote restorative processes. We can thus conclude that having a sense of being away should be strongest if there are almost no interdependencies between settings that have high demands for directed attention and settings that are perceived as restorative environments. Accordingly, weak setting interdependencies should be positively associated with a stronger sense of being away, stronger feelings of restoration, and better self-perceived health and well-being for a person moving away from the more demanding setting in which the specific need for restoration develops (Figure 1).

This association between ART and BST has, to the best of my knowledge, not received much attention in research on restorative environments until now, although this linkage is promising in explaining why some people experience a strong sense of being away and more complete restoration while others may not – independent of the physical characteristics of the environment. This account of settings and their characteristics encourages the consideration of restorative environments as settings with particular social and physical properties that support particular behaviors, and it particularly directs attention to the degree to which settings meant or expected to support restoration are free from interdependencies with settings where stressful demands usually are experienced. When strong behavior setting interdependencies with demanding settings are experienced while spending time in a setting ordinarily relied on for restoration, the restoration process is likely to be constrained. This approach also implies that if we interact with completely different objects, have other cognitions, and/or meet

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people who are not primarily associated with settings in which we usually experience demands, then the setting will help more to support restoration of our resources depleted in other settings.

Starting from the theorizing outlined above, this study focused on the associations between perceived setting interdependencies, having a sense of being away from tasks and demands, and restorative outcomes in terms of health and well-being. The following specific research questions were assessed:

1. Is the perceived sense of being away related to the amount of perceived setting interdependencies?
2. Can perceived interdependencies between settings usually relied on for restoration and settings where demands and stress are experienced constrain restorative processes, and thus impact health and well-being?

To answer these research questions, a measure for perceived setting interdependencies was developed, and a survey of a sample from the German population has been conducted. Participants were asked to report on their daily life, what they do in their leisure time, how strong their sense of being away was during their leisure time, how strong their perceived setting interdependencies were, and how they rate their health and well-being.

2. Methods

2.1 Study design

An online survey study was designed to analyze whether perceived setting interdependencies can be associated with the sense of being away and restorative outcomes experienced during leisure time. The study was realized with the online tool Unipark, and participants were recruited via PsyWeb. PsyWeb provides access to an online panel of the German population and is maintained by the Universities of Münster and Leipzig, Germany (for details see <https://psyweb.uni-muenster.de>). The study was designed as a cross-sectional survey and separated into four parts. The first part contained questions about work life, daily

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hassles, sources of stress, and the nature of situations that are perceived as stressful and demanding. The participants were asked to provide information about their self-perceived health, well-being, affective state, degree of mental fatigue, and need for restoration after they have experienced a situation that they described as a typical source of stress in their daily life. The second part of the survey contained questions about what the participants usually do during their leisure time and how they cope with stress and hassles reported in the foregoing part of the survey. The second part also comprised items about participants' sense of being away perceived with leisure time activities and their perceived setting interdependencies. Additionally, the participants were asked to provide ratings for their self-perceived health, well-being, affective state, degree of mental fatigue, and need for restoration after their leisure time. To ensure that the participants always thought about the same situations when asked about sources of stress and their typical recovery behavior, the online questionnaire featured a reminder of the individual situation described by the participant on every page (where appropriate).

The third part of the survey asked participants to provide socio-demographic data, and the fourth and last part provided the participants with feedback on their leisure time behavior. The feedback was created automatically based on the individual differences of the self-reported health and well-being measures between work/everyday life and leisure time. Besides being financially compensated by PsyWeb, the feedback served as incentive for the participants to complete the survey. On average, completing the survey took 23 minutes. The questionnaire was pretested by colleagues from the University of Zurich, Switzerland, and Uppsala University, Sweden, before data collection started. The field phase was from June 24 until July 24, 2014.

2.2 Informed consent and ethical approval

Informed consent was obtained from the participants by informing them that participating in the study was completely voluntary, that they could stop participating anytime they wanted, and that they would face no negative consequences if quitting. Further, the participants were ensured that their answers would only be analyzed in the frame of the study, that all information would be processed anonymously, and that no personal data would be given to any third party. The study fulfilled all criteria for being considered unproblematic in an initial ethics screening by the ethics commission of the University of Zurich, Switzerland, and no special approval was required.

2.3 Sample

A total of 1035 individuals initially opened the online survey in their web browser. Of those, 993 (95.9%) provided informed consent and proceeded with the survey. Another 188 participants dropped out while completing the first three pages of the questionnaire, where they were asked to describe the main sources of daily hassles and demands. Finally, data from an additional 79 individuals had to be excluded from the analyses due to missing values on all relevant variables or completion time of less than 10 minutes, which was only possible when just clicking through the questionnaire. All excluded cases have been individually reviewed to prevent the loss of information. After screening the dataset, the total sample comprises $N = 726$ individuals. This equals a response rate of 70.2% (based on 1035 individuals who opened the survey in their web browser).

The majority of the sample was female (66%). The mean age was 45 years ($SD = 11.85$ years; range between 18 to 74 years); 59% were married or engaged, 27% single, 13% divorced, and 1% widowed. Half (50%) of the participants reported having no children, 19% had one child, 23% two children, and 8% three or more children living in their home at the time they participated in the survey. The levels of education were quite diverse: as their level of highest education, 4% stated primary school, 15% high school, 20% vocational training,

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22% higher education or teacher training, 33% university or technical university, and 5% did not state their highest level of education. The sample is relatively comparable to the German population in terms of socio-demographic measures. According to the German Federal Statistical Office Destatis, 51.2% of the German population is female and the median age is 45.4 years. However, married and divorced individuals were slightly overrepresented in this study (German population: 45.8% and 7.8%, respectively) whereas singles and widowed individuals were slightly underrepresented (German population: 39.9% and 7.2%, respectively). All participants reported that they were employed at the time of the survey, with an average of 67% ($SD = 39\%$) equivalent of full-time employment.

2.4 Measures

2.4.1 Need for restoration

The need for restoration was measured using only one item. Participants were asked about their need for restoration the first time immediately after they described what they experience as major source of stress in their daily life and the second time after they described what they usually do to recover from daily stress during their leisure time. The item wording was “After you have experienced the situation you described above, how would you describe your need for restoration?” A five-point rating scale ranging from 1 (very weak) to 5 (very strong) was provided. The need for restoration was used to assess how severe the stressful situations were perceived by the respondents and how well they recovered during their leisure time, respectively. Higher values represent a stronger need for restoration.

2.4.2 Perceived setting interdependencies

The measure for the amount of perceived setting interdependencies (PSI scale) was based on a pilot study conducted at the Wilderness Park Zürich, Switzerland (for details, see von Lindern, 2015). The PSI scale was revised and extended to ensure that every dimension

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of a setting was represented by a total of two items. The PSI scale was pretested in German by researchers from the Department of Psychology at the University of Zurich (Switzerland) and in English by colleagues from the Institute for Housing and Urban Research at Uppsala University (Sweden). Based on the pretest, some item wording was refined so that the items were more concise and easier to understand. Additionally, the answer format was changed from “(almost) never” – “(almost) always” to “not true at all/ never” – “completely true/ always.” The German and English items of the final version of the PSI scale are shown in Table 1.

The PSI scale is meant to parallel the index of interdependencies (κ) described in BST (see Schoggen, 1989). A higher mean score reflects stronger perceived interdependencies between two settings, whereas a lower mean score represents a stronger contrast between two settings, or weaker perceived setting interdependencies. As the PSI scale has been newly developed and been applied for the first time in this study, no recommendations about a typical mean score can be made yet. However, item analysis suggested that the item SI_2r (see Table 1) received a very low item-total correlation (.12). Additionally, exclusion of this item would increase Cronbach’s alpha for the scale by .02. The item was therefore excluded from further analyses. Cronbach’s alpha for the 13-item PSI scale was .85.

2.4.3 Sense of being away during leisure time

The sense of being away during leisure time was assessed with the being away subscale of the Perceived Restorativeness Scale (PRS) developed by Hartig et al. (1997). The being away subscale comprised five items (e.g., “Being here helps me to get relief from unwanted demands on my attention”) and could be answered on a scale from 1 (not at all) to 11 (always). Higher scores are associated with having a stronger sense of being psychologically away and experiencing more psychological distance to attentional demands. Cronbach’s alpha for the being away subscale was .87.

2.4.4 Dimensions of affect

Positive and negative affect was measured with the German short version of the Positive Affect, Negative Affect Schedule (PANAS; Krohne, Egloff, Kohlmann, & Tausch, 1996). The scale comprises 10 adjectives, of which five represent positive (*enthusiastic, excited, inspired, alert, determined*) and another five negative affect (*afraid, upset, nervous, scared, distressed*). The participants could report on a five-point scale to what degree they experienced the given affect (1 = not at all, 5 = very much).

The scale was implemented two times in the survey. It was applied for the first time to assess positive and negative affect after having experienced a stressful situation. The participants were instructed to think about the situation that they have described as the main source of stress and demands in their daily life and to relate their answers to how they typically feel after having experienced that situation. The same scale was used a second time to assess positive and negative affect after leisure time. Accordingly, the participants were instructed to think about how they typically feel after they have done what they usually do to recover from the stressful situation they mentioned before.

Cronbach's alpha for positive affect was .76 (after experiencing a stressful situation) and .87, respectively (after what respondents did for recovery). For negative affect, Cronbach's alpha was .78 and .85, respectively. The higher the scores for positive affect, the more positive affect participants reported. A higher score for negative affect was associated with stronger negative affect.

To assess the respondents' valence and activation after experiencing a stressful situation and after their usual recovery behavior, the Swedish Measure of Core Affect (SCAS; Västfjäll & Gärling, 2007) was employed. The valence and activation dimensions were measured each by three pairs of adjectives (valence: sad – glad, depressed – happy, displeased – pleased;

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activation: dull – peppy, passive – active, sleepy – awake). The rating format was a 9-point scale for each pair of adjectives, with the adjective labels as left and right scale anchors.

Cronbach's alpha was .87 for valence and .64 for activation after experiencing the stressful situation; and .91 for valence and .85 for activation after performing the recovery behavior. A higher score for valence means a more positive and happier mood, and a higher activation score means a more active and lively affect.

2.4.5 Degree of mental fatigue

To assess the degree of perceived mental fatigue, eight items used by Staats, Kieviet, and Hartig (2003) were employed. Four of these items were used to measure *affective states* that are associated with mental fatigue (feeling irritated, tired, worn out, mentally exhausted), and four items targeted *behavioral dimensions* associated with mental fatigue (able to make a well-balanced decision, able to concentrate, foresee implications of a complex situation, pay attention to a long lecture) (cf. Hartig & Staats, 2006). The answer scale ranged from 1 (not at all) to 7 (very much/well). Cronbach's alpha for the affective states of mental fatigue was .70 after the stressful situation and .82 after the recovery phase, respectively. For the behavioral dimension associated with mental fatigue, Cronbach's alpha was .83 after the stressful situation, and .88 after the recovery behavior took place. The higher the scores for the affective state, the more mentally fatigued the participants were. The scores for the behavioral dimension associated with mental fatigue have been recoded, so that a higher score reflects more mental fatigue.

2.4.6 Self-reported mental health

The General Health Questionnaire (GHQ) in its 12-item version was designed to screen for general psychiatric morbidity (Schmitz, Kruse, & Tress, 1999). The GHQ-12 asks respondents if they have lately experienced symptoms like, for example, a loss of confidence,

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feeling unhappy and depressed, or if they could not make decisions. The items could be answered on a four-point rating scale, ranging from 1 (less than usual) to 4 (much more than usual) (Salama-Youne, Montazeri, Ismail, & Roncin, 2009). In this study, the GHQ-12 was first applied related to the situation described as major source of stress and then a second time related to the recovery situation. The scale received a Cronbach's alpha of .86 and .92, respectively. The items were recoded so that higher scores are associated with fewer reports of major depression, dysthymia, depressive mood, and other symptoms associated with depression and can thus be interpreted as a measure for mental health.

2.4.7 Perceived restorative effect

The perceived restorative effect of the recovery behavior respondents reported to engage in after they encountered a stressful situation was measured by a single item only. The item was worded "How recovered do you usually feel after performing your typical recovery behavior?" The five-point answer scale ranged from 1 (not at all) to 5 (completely). A higher score indicates a stronger self-reported recovery from the before-mentioned stressful situation.

2.4.8 Outcomes related to self-perceived health

Outcomes related to self-perceived health were not assessed directly with manifest indicators. This construct was defined as a second-order factor, whereas the latent first-order factors positive affect, negative affect, valence, activation, behavioral and affective mental fatigue, self-reported mental health, and the perceived restorative effect were taken as indicators of the second-order factor. The reasons for this step were twofold: first, the latent first-order factors related to health and well-being correlated strongly (all $|r| > .41$). This means that treating the first-order factors as single measures for outcomes related to self-perceived health would neglect the relative strong conceptual overlap in the meaning of the

constructs. Second, defining a second-order factor is the more parsimonious solution compared to having multiple and strongly related outcomes for health and well-being. Thus, employing a second-order factor reduces the complexity of the overall model and therefore enhances understanding. The coefficient ω for the second-order factor was 0.90 (calculated with the R package *semTools* using the approach described by McDonald, 1999).

All items were presented in German.

2.5 Statistical treatment of the data

The statistical software R (MacOS) was used for all analyses. To assess the relative effectiveness of the recovery behavior that respondents reported that they typically do when they encounter stress and demands in their daily life, pairwise t-tests for the PANAS, SCAS, degree of mental fatigue, mental health (GHQ-12), and the perceived restorative effect were calculated. In a second step, a structural equation model (SEM) was designed to analyze whether and to what degree the perceived sense of being away was associated with perceived setting interdependencies and outcomes related to self-perceived health. Additional variables were employed as covariates to control for gender, education, age, and other socio-demographic aspects. Direct and indirect effects from perceived setting interdependencies via perceived sense of being away on restorative outcomes were additionally calculated. The package *lavaan* for R (Rosseel, 2012) was used to calculate the SEM. Missing data were treated with full information maximum likelihood procedures for the SEM (Arbuckle, 1996), and robust standard errors were taken into account to deal with possible non-normality of the data. The model fit was evaluated using the chi-square test, the chi-square value divided by degrees of freedom (Chi-square/df), the comparative fit index (CFI), Tucker-Lewis index (TLI), the root mean squared error of approximation (RMSEA), and the standardized root mean squared residual (SRMR) (cf. Hu & Bentler, 1999). Hu and Bentler (1999) have argued that a good model fit is reflected by the CFI and TLI close to .95, the SRMR close to .08, and

the RMSEA close to or below .06. However, Kenny (2012) concluded that “there is considerable controversy about fit indices.” This means that the values discussed by Hu and Bentler (1999) should not necessarily be seen as strict cut-off criteria, but rather as desirable values. This notion should be kept in mind when evaluating the model fit.

3. Results

On average, the respondents reported a substantial need for restoration after having experienced a situation that they described as both stressful and typical for their daily life ($M = 4.07$, $SD = 0.88$, five-point scale). The majority of participants (42%) situated their main source of stress in work-related settings, whereas 25% mentioned challenging situations in private life as their main sources of stress. The rather strong need for restoration was also reflected by the values obtained for self-reported mental health, valence, activation, positive and negative affect, and the degree of mental fatigue reported after experiencing the described situation. The stronger the need for restoration was, the lower the self-reported mental health, valence, activation, and positive affect, while negative affect and behavioral and affective mental fatigue were positively associated with a stronger need for restoration (Table 2).

Regarding the self-reported restorative outcomes of the behavior typically conducted after experiencing a stressful or demanding situation, an opposite picture emerged. The average amount of self-reported restorative outcomes was $M = 3.6$ ($SD = 0.81$, five-point scale), which translates to a rather substantive amount of restoration. Correlation analyses suggested that stronger self-reported restorative outcomes were associated with more self-reported mental health, valence, activation, and positive affect, and with less negative affect as well as lower behavioral and affective mental fatigue (Table 3).

Calculating pairwise dependent-sample t-tests (after experiencing stress and after the restoration phase) indicated significant improvements in all health and well-being related measures (Table 4). All effect sizes can be considered medium to large (Cohen's $d \geq 0.7$).

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The respondents reported, on average, a quite strong sense of being away regarding their restoration behavior ($M = 7.34$, $SD = 2.49$, 11-point scale), and perceived setting interdependencies were on average rather weak ($M = 2.42$, $SD = 0.69$; five-point scale).

To assess the relationship between the sense of being away, perceived setting interdependencies, and the measures associated with health and well-being after restoration, a structural equation model was employed. The measurement model was evaluated (see supplementary material, Figure S1) before the regression paths between perceived setting interdependencies, the perceived sense of being away, and the second-order factor representing outcomes related to self-perceived health were defined. The structural model additionally accounted for possible impacts from the type of situation to which people allocated their main source of stress, age, level of education, gender, number of children living in the household, and percentage of full-time employment by including regression paths to every latent construct. Overall, the structural model fit the empirical data well ($N = 726$; free parameters = 228; $\chi^2 = 3280.396$; $df = 1697$; $p < .01$; $\chi^2/df = 1.93$; CFI = .92; TLI = .92; RMSEA = 0.04, 90% CI [0.03, 0.04]; SRMR = 0.05). All latent constructs were represented satisfactorily by their manifest indicators. The SEM results are presented in Figure 2.

Overall, the model accounted for 54% of the explained variance for the outcomes related to self-perceived health. The results from the SEM further indicate that having a sense of being away was strongly associated with positive changes in the outcomes related to self-perceived health ($\beta = .29$, $p < .01$). This means that a stronger sense of being away was related to more positive health and well-being outcomes. The opposite effect was found for perceiving strong setting interdependencies, which was significantly associated with lower outcomes related to self-perceived health ($\beta = -.52$, $p < .01$). Most striking was that the path from perceived setting interdependencies to having a sense of being away was strong and negative ($\beta = -.63$, $p < .01$), which means that the stronger perceived setting

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interdependencies were, the lower the sense of being away people reported. Perceived setting interdependencies accounted for 43% of the explained variance for the sense of being away. Additionally, the analysis revealed a significant indirect effect from perceived setting interdependencies via having a sense of being away on outcomes related to self-perceived health ($\beta = -.19, p < .01$). These findings suggest that perceiving strong setting interdependencies significantly constrains the positive effect of having a sense of being away: the negative indirect effect was relatively strong compared to the positive direct effect of the sense of being away on the outcomes related to self-perceived health. Even more, when calculating the total effect of perceiving setting interdependencies on outcomes related to self-perceived health, it becomes apparent that setting interdependencies have a very strong and negative impact.

No clear picture emerged with regard to the covariates included in the model. Higher age could be associated with reduced outcomes related to self-perceived health ($\beta = -.10, p < .01$) and a stronger perceived sense of being away ($\beta = .16, p < .01$), while the number of children was positively associated with self-perceived health ($\beta = .11, p < .01$) as was the degree of employment ($\beta = .03, p = .03$). A higher level of education was found to be related to weaker perceived setting interdependencies ($\beta = -.10, p = .02$). For all other covariates, the associations were mostly insignificant and rather weak. However, a rather stronger and significant relation emerged between the amount of perceived setting interdependencies and the situation in which resources for directed attention are typically depleted: People who experienced stress and attentional demands in private life seemed to also report stronger setting interdependencies related to settings they usually rely on for restorative purposes ($\beta = -.23, p < .01$). Interestingly, having a sense of being away seemed to be unrelated to the type of situation in which stress and demands are experienced ($\beta = -.02, p = .69$).

4. Discussion

The results support the assumptions pointed out in the introduction. This means that complementing ART with BST resulted in a reasonable model in which the amount of setting interdependencies was significantly associated with having a sense of being away and outcomes related to self-perceived health. In this regard, the study can be understood as empirical support for the concept of constrained restoration (e.g., Collado et al., 2016; Hartig et al., 2007; von Lindern et al., 2013; von Lindern, 2015). The newly developed PSI scale to measure perceived interdependencies between settings in which stress and demands are experienced and those ordinarily used for restorative purposes turned out to be a useful instrument for measuring interdependencies. The PSI scale is promising for providing a better understanding of what circumstances allow, promote, or undermine having a sense of being away.

A special focus is placed not only on the direct negative impact from strong setting interdependencies on the sense of being away, but also on the indirect effect from setting interdependencies on outcomes related to self-perceived health mediated via an impaired sense of being away. This means that perceiving strong setting interdependencies is not only a stressor on its own, but that it also significantly impairs restorative processes in a more subtle, indirect way by compromising the sense of being away (cf. von Lindern et al., 2016). In particular, the strong negative and statistically significant path coefficient from perceived setting interdependencies to the sense of being away ($\beta = -.63, p < .01$) in combination with the significant indirect pathway on outcomes related to self-perceived health provides strong empirical evidence for the concept of constrained restoration and the underlying conceptual model (see Figure 1 above). This means that the conceptual model is likely suited to explain constraints on restoration by introducing assumptions from BST into research on restorative environments. What was surprising was the finding that the amount of perceived setting interdependencies was strongly and directly associated with the outcomes related to

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self-perceived health, meaning that the amount of setting interdependencies was not fully, but partially mediated through the sense of being away. Though this result provides empirical evidence that the sense of being away is a mediator for the association between perceived setting interdependencies and outcomes related to self-perceived health, the question arises regarding what other mediators might play a role. The sense of being away was a very prominent candidate, as it is topically defined as psychological distance from environments in which attentional resources are diminished (e.g., Kaplan & Kaplan, 1989; Hartig, 2004). However, also experiencing fascination might be impacted by perceived setting interdependencies, as when interdependencies demand attention and thus prevent attention from being drawn by fascinating environmental characteristics. An alternative explanation for setting interdependencies being partially mediated through the sense of being away might be that the measure used for assessing the sense of being away does not cover all relevant aspects of the being away construct defined in ART. Another aspect that should be considered in future studies on the relationship between perceived setting interdependencies and outcomes related to self-perceived health is the distinction between experiencing fascination and being away through environmental features and/or through activities. In this regard, the measures for fascination and the sense of being away that focus environmental features and perception (Hartig et al., 1997) could be complemented by the perceived restorativeness in activity scale (Norling, Sibthorp, & Ruddell, 2008), which focuses on experiencing fascination and the sense of being away during activities. Last but not least, it might be that some people are more prone to restoration and/or perceiving setting interdependencies than others. In this sense, future research could also assess how far personality could be framed as a mediator or moderator for the associations between perceiving setting interdependencies, experiencing fascination and being away (related to activities and/or the environment), and restoration.

Of course, when interpreting the results, we have to keep several limitations in mind. First, this study and the conducted analyses are based on cross-sectional data. This means

causal interpretations are problematic. A longitudinal study design with experimental conditions would be needed to make stronger causal claims about the relationship between perceived setting interdependencies, having a sense of being away, and outcomes related to self-perceived health. On the other hand, the instructions and item wordings in the online survey implied a temporal sequence: the respondents were first asked to report on the sources of daily stress and their need for restoration, followed by items asking what the respondents typically do to recover, how strong the sense of being-away and perceived setting interdependencies were, and finally how they rate their health and well-being after spending time on restoration. It can thus be argued that this sequence of items and the item wording created a quasi-longitudinal design, which allows better interpretation than correlations without any relation to a time sequence.

Another point that has to be kept in mind is that the findings are based on self-reports only. This means that no objective data were available for this study, and it might be that respondents over- or underestimated the stressors they face in daily life, their need for restoration, perceived setting interdependencies, their sense of being away during leisure time activities, or the diverse health and well-being related outcomes. However, the underlying data give no reason to assume that respondents provided significantly biased data: the descriptive values (e.g., *M*, *SD*, Cronbach's alpha) were all in reasonable ranges and comparable to other cases of application. Additionally, the correlational patterns among the variables in the analyses could be interpreted in a meaningful way and the fit criteria of the SEM were all satisfactory. Another source of bias could be that the respondents received incentives for participating in the study. It might thus be that some individuals merely participated because they wanted the incentives offered by PsyWeb (which was credits that participants can swap for money). Those individuals who participated only to receive the incentives cannot be completely excluded from the analyses, but initial data-screening and preliminary analyses were conducted to identify these cases (for details see the sample

description in the methods section, above). Again, the distribution of and correlational patterns among the variables in the analyses indicate that the data quality was good. Although this study is based upon data from a comparably large sample of $N = 726$ individuals from the German population, and comparison of the characteristics of this sample with demographic data from the German Federal Statistical Office Destatis indicated no severe deviations from the German population, it is not clear how representative the results are for the German or other populations. This means that the results should only be generalized with caution. Furthermore, it has to be acknowledged that the model has to be tested in follow-up studies and that studies that allow for making causal claims are still missing (e.g., longitudinal and experimental studies).

Limitations notwithstanding, this study provides an approach to integrating the concept of setting interdependencies into research on restorative environments. The PSI scale for measuring interdependencies obtained good psychometric values, and the analyses revealed meaningful, interpretable associations between the constructs under scrutiny. It can be concluded that the results in combination with the relatively high shares of explained variance point out the relevance to not only focus whether an environment can be considered restorative due to its relative degree of naturalness or due to how its environmental characteristics are perceived, for example, in terms of ART. Moreover, assessing the perceived interdependencies between settings complements the effort undertaken in research on restorative environments by providing a direct measure for human-environment and human-human transactions in socio-physical settings. Such an assessment highlights entry points for theory development in the domain of research on restorative environments. For example, the approach depicted in this study provides researchers and practitioners, who plan to promote attention restoration, with an operationalization of the sense of being away through interdependencies that allows for psychological interventions. By targeting perceived interdependencies between settings with interventions (e.g., encouraging people to use

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settings for leisure time activities in which they will likely not be confronted with stimuli associated with stress and demands or by providing planning to reduce disturbances during restoration) both the sense of being away and outcomes related to self-perceived health can likely be impacted. However, interventions aiming at strengthening or weakening the perception of setting interdependencies should not be understood as competing with, for example, creating, providing or improving the quality of green spaces in urban environments, but more to complement the current state of the art in the fields of research on restorative environments, health, and well-being. Of course, future research has to prove that psychological interventions can impact the amount of perceived setting interdependencies and, consequently, the sense of being away and outcomes related to self-perceived health.

The assessment of interdependencies between settings and the results focused in this study provide implications for and touch points with several other domains in research and practice that are also situated outside the concern of restorative environments research. These implications will be detailed in the following: For example, research concerned with social exchange processes such as social support might consider to what extent a source of social support contributes to weaker or stronger perceived interdependencies between settings. If a person who provides social support at the same time triggers strong interdependencies with settings that are associated with stress and demands, it might be that the support could not achieve its desired effect and that instead reactance and impaired well-being might follow.

The principle of interdependencies between settings could also inform interventions in the domain of consumer behavior and habits: Verplanken and Wood (2006) argued that interventions that aim at breaking habits and creating new behavior are more likely to be successful if they are applied when we experience change (e.g., during teachable moments like changing job, moving house). We might hypothesize in this frame that the experience of change can be supported if there are only weak or even no interdependencies perceived between the settings prior to and after the change, which might then increase the likelihood of

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successful intervention. Or, on the other hand, if the settings before and after the change event are defined by strong interdependencies, it might be that interventions are less likely successful, as the perceived interdependencies attenuate the effect of change for breaking habits and creating new behavior. A further implication might be of relevance for corporate trainings or retreats, as perceiving strong setting interdependencies might influence training or team-building processes. Last but not least, it should also be mentioned that in some cases strong interdependencies might be desired: If we think about individuals who suffer from, for example, dementia or cognitive impairments, perceiving strong interdependencies between different settings might actually help those individuals to orientate and increase the quality of life. In this sense, strong setting interdependencies might contribute to a positive person-environment fit, which was identified as a significant predictor for preventing falls of older people in their home (e.g., Iwarsson, Horstmann, Carlsson, Oswald, & Wahl, 2009).

However, the above-mentioned cases should not be understood as exhaustive, but rather as examples for how research on perceived setting interdependencies might inform or inspire disciplines and research outside of the restorative environments research domain. Thus, I would like to encourage fellow researchers and practitioners to include the possible impact of perceived setting interdependencies in future studies.

6. References

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Figure 1. Conceptual model for the linkage of perceived setting interdependencies to mental fatigue and restoration. The stronger perceived setting interdependencies are, the more constrained are the associated psychological processes.

Figure 2. Structural equation model depicting the direct and indirect associations between perceived setting interdependencies, having a sense of being away, and outcomes related to self-perceived health (after spending time in a setting usually relied on for restorative purposes) while controlling for possible influences from socio-demographical covariates. All path coefficients are standardized values (beta). Please note that error terms, manifest indicators and correlations between the constructs are omitted due to readability (see Figure S1 Measurement model in the supplementary material for further details).

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Fit criteria: $N = 726$; Free parameters = 228; CFI = .92; TLI = .92; $df = 1697$
 $\chi^2 = 3280.396$, $p < .01$; $\chi^2/df = 1.93$; RMSEA = .04, 90% CI [.03, .04]; SRMR = .05

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Table 1.

Revised version of the scale to measure perceived setting interdependencies (PSI).

		PSI (revised and extended scale)		
		English	German	
Setting characteristic	Item	During leisure time...	Während ich mich erhole...	r_{it}
Person	SI_1	...I encounter the same people who are also present in mentally demanding or fatiguing situations.	...begegne ich denselben Personen wie in mental beanspruchenden oder ermüdenden Situationen.	.49
	SI_2r*	...the presence of other people helps me to forget mental demands or fatigue.	...helfen mir andere Personen alleine durch ihre Anwesenheit dabei, mentale Beanspruchung oder Ermüdung zu vergessen.	.12
Leadership	SI_3	...the same persons as in mentally demanding or fatiguing situations have the lead and make decisions.	...geben dieselben Personen wie in mental beanspruchenden oder ermüdenden Situationen "den Ton" an und treffen Entscheidungen.	.49
	SI_4r	...I let nothing and no-one tell me what I should do.	...lasse ich mir von Nichts und Niemandem vorschreiben, was ich tun soll.	.40
Cognition	SI_5	...I think about the same things I also think about in mentally demanding or fatiguing situations.	...denke ich an dasselbe wie in mental beanspruchenden oder ermüdenden Situationen.	.55
	SI_6	...I find myself carrying over thoughts from mentally demanding or fatiguing situations.	...„ertappe“ ich mich dabei, dass ich Gedanken aus mental beanspruchenden oder ermüdenden Situationen weiterverfolge.	.49
Object	SI_7r	...I intentionally leave all those things behind that I associated with mental demands or fatigue (e.g., cellphone, calendar etc.)	...verzichte ich ganz bewusst auf all jene Gegenstände und Dinge (z.B. Mobiltelefon, Agenda), die ich mit mentaler Beanspruchung oder Ermüdung verbinde.	.34
	SI_8	...specific objects remind me of mental demands or fatigue just through their presence	...erinnern mich Dinge und Gegenstände durch ihr blosses Vorhandensein an mentale Beanspruchung oder Ermüdung.	.59
Behavior	SI_9r	...I do something completely different from those activities in which I usually face mental demands or fatigue.	...mache ich etwas völlig anderes als in mental beanspruchenden oder ermüdenden Situationen.	.54
	SI_10	...I find myself doing the same things I usually do in mentally demanding or fatiguing situations.	...„ertappe“ ich mich oft dabei, dass ich genau das gleiche mache, was ich sonst üblicherweise in mental beanspruchenden oder ermüdenden Situationen mache.	.57
Location	S_11r	...the location is completely different compared to the location where I experience mental demands or fatigue.	...bin ich an völlig anderen Orten als wenn ich mentale Beanspruchung oder Ermüdung erlebe.	.52
	SI_12	...I feel reminded of mental demands or fatigue just through the place I use for recreation.	...werde ich allein durch den Ort, den ich zur Erholung nutze, an mentale Beanspruchung oder Ermüdung erinnert.	.58
Time	SI_13	...I am interrupted by episodes of mental demands.	...erlebe ich immer wieder zwischendurch mentale Beanspruchung oder Ermüdung.	.57
	SI_14r	...I let nothing and no-one interrupt me.	...lasse ich mich durch Nichts und Niemanden dabei unterbrechen.	.43

Note: Answer format ranges from 1 (not true at all/ never) to 5 (completely true/ always). Cronbach's alpha 14-

Item version: .83; Cronbach's alpha 13-Item version: .85; N = 726; "r" indicates that the item is reverse coded.

* = Item was excluded from analyses because of low item-total correlation.

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Table 2.

Descriptive values and correlations for self-reported mental health, valence, activation, positive and negative affect, need for restoration and the degree of mental fatigue reported after experiencing a stressful or demanding situation.

	<i>M</i>	<i>SD</i>	Min	Max	N	Correlation						
1) Self-reported mental health	24.97	5.64	12	48	699	(1)						
2) Valence	3.33	1.68	1	9	721	.67	(2)					
3) Activation	4.03	1.57	1	9	717	.41	.45	(3)				
4) Positive affect	2.05	0.74	1	5	709	.50	.49	.56	(4)			
5) Negative affect	2.55	0.93	1	5	717	-.63	-.65	-.22	-.30	(5)		
6) Need for restoration	4.07	0.88	1	5	724	-.38	-.24	-.25	-.28	.28	(6)	
7) Mental fatigue (affect)	4.88	1.21	1	7	711	-.48	-.34	-.36	-.34	.36	.56	(7)
8) Mental fatigue (behavior)	3.88	1.33	1	7	716	-.41	-.22	-.30	-.36	.26	.30	.39

Note: all $p \leq .001$

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Table 3.

Descriptive values and correlations for self-reported mental health, valence, activation, positive and negative affect, self reported restorative effect and the degree of mental fatigue reported after spending time for restoration.

	<i>M</i>	<i>SD</i>	Min	Max	N	Correlation				
1) Self-reported mental health	34.04	6.2	12	48	686	(1)				
2) Valence	6.07	1.9	1	9	717	.78	(2)			
3) Activation	5.82	1.72	1	9	719	.71	.89	(3)		
4) Positive affect	2.92	0.92	1	5	714	.72	.79	.82	(4)	
5) Negative affect	1.61	0.72	1	5	719	-.66	-.76	-.57	-.54	(5)
6) Restorative effect	3.6	0.81	1	5	723	.55	.67	.61	.62	-.56 (6)
7) Mental fatigue (affect)	2.91	1.31	1	7	704	-.68	-.68	-.71	-.64	.63 -.56 (7)
8) Mental fatigue (behavior)	2.95	1.25	1	7	713	-.53	-.56	-.65	-.58	.41 -.45 .65

Note: all $p \leq .00$

Table 4.

Mean differences after experiencing stress and after restoration for the health and well-being related measures.

	Mean difference	95% CI	<i>t</i>	df	<i>p</i>	Cohen's d
Self-reported mental health	9.01	8.50, 9.51	34.72	660	< .01	1.53
Valence	2.73	2.59, 2.88	36.34	712	< .01	1.53
Activation	1.79	1.64, 1.94	23.47	710	< .01	1.09
Positive affect	0.88	0.81, 0.95	24.65	696	< .01	1.04
Negative affect	-0.94	-0.99, -0.88	-32.89	710	< .01	1.13
Mental fatigue (affect)	-1.99	-2.10, -1.88	-35.44	691	< .01	1.04
Mental fatigue (behavior)	-0.93	-1.03, -0.83	-18.70	703	< .01	0.72