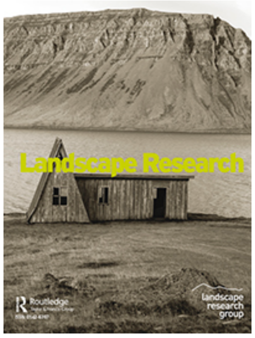

Landscape Research

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/clar20

Restorative experiences across seasons? Effects of outdoor walking and relaxation exercise during lunch breaks in summer and winter

Svein Åge Kjøs Johnsen, Marin Kristine Brown & Leif Werner Rydstedt

To cite this article: Svein Åge Kjøs Johnsen, Marin Kristine Brown & Leif Werner Rydstedt (2022) Restorative experiences across seasons? Effects of outdoor walking and relaxation exercise during lunch breaks in summer and winter, Landscape Research, 47:5, 664-678, DOI: 10.1080/01426397.2022.2063268

To link to this article: https://doi.org/10.1080/01426397.2022.2063268

Published online: 25 Apr 2022.

LANDSCAPE RESEARCH
2022, VOL. 47, NO. 5, 664–678
https://doi.org/10.1080/01426397.2022.2063268

Restorative experiences across seasons? Effects of outdoor walking and relaxation exercise during lunch breaks in summer and winter

Svein Åge Kjøs Johnsen, Marin Kristine Brown and Leif Werner Rydstedt

Department of Psychology, Inland School of Business and Social Sciences, Inland Norway University of Applied Sciences, Lillehammer, Norway

ABSTRACT
This study aimed to explore whether a walk outdoors during a lunch break would promote restorative experiences for a sample of office workers ($N = 52$), compared to following instructions from an online video of progressive muscle relaxation. Furthermore, the study aimed to compare the impact of a walk during winter to a walk in a summer landscape. Compared to baseline measures, walking in winter and summer were both associated with significantly increased subjective vitality and psychological detachment from work, but there were no significant differences in these specific wellbeing indicators between winter and summer conditions. The indoor muscle relaxation exercise had no effect on psychological detachment from work, but participants who had the relaxation session during summer reported a significant increase in subjective vitality. Active outdoor restoration seems to have a beneficial impact on mental wellbeing, while indoor muscle relaxation may also have some benefits.

KEYWORDS
Nature; recovery; restoration; vitality; seasons; wellbeing; work

People divide their time between rest and activity, and most people take regular breaks during their work hours. However, just taking a break might not be sufficient to promote recovery during the workday (internal recovery, see Geurts & Sonnentag, 2006), especially if the environmental conditions (e.g. Kaplan, 1995) and the type of activity (e.g. Sonnentag & Fritz, 2015) are unfavourable. Going outdoors for a short walk may promote recovery from stress (Olafsdottir et al., 2020), and although planners have recently addressed interventions and design strategies to increase wellbeing and activity in cold winter spaces (McDonald-Yale & Birchall, 2021; Stout et al., 2018), we still know relatively little about the specific health impacts of winter walks.

Seasonal variations may generate differences in environmental conditions and opportunities for recovery. Relevant aspects to consider in regions with significant seasonal variations include temperature, daylight exposure, the presence of snow, and the presence or absence of greenery. For example, in Norway, winters are cold with temperatures often well below zero degrees Celsius, the landscape is covered with snow, and there is little greenery. Seasonal variations seem to influence wellbeing (Adamsson, Laike, & Morita, 2018; Winthorst, Bos, Roest, & de Jonge, 2020), and although general effects may be small, some may suffer to a greater extent, for

CONTACT Marin Kristine Brown marin.henriksen@inn.no

example, one study has found winter depression to be relatively common in Sweden (Rastad, Sjödén, & Ulfberg, 2005). Furthermore, studies conducted in Sweden and Australia have found that cortisol levels are higher during winter (Hadlow, Brown, Wardrop, & Henley, 2014; Persson et al., 2008), indicating higher levels of stress and possibly a greater need for recovery. Some studies show that exposure to daylight may be relevant for mood (e.g. Beute & de Kort, 2018), however, this may not be the case across seasons, although daylight levels fluctuate (see Adamsson et al., 2018). Person-level factors have also been studied and the impact of seasons on mood may be moderated by neuroticism (Winthorst et al., 2020).

Whether at work or in everyday life, human activities directed by will and effort entail an investment of limited mental or physical energetic resources (Hobfoll, 1989). Fatigue, diminished motivation and difficulties in sustaining concentration and attention are subjective signals indicating that the individual's resources are on the verge of becoming exhausted, which generates a desire to interrupt working in order to recover (and restore) energetic resources (Meijman & Mulder, 1998). A major issue in occupational stress research has been to analyse how high workload relates to need for recovery (see Zijlstra, Cropley, & Rydstedt, 2014 for an overview) and, furthermore, to identify efficient strategies that allow people to detach from work during non-work time – so as to promote recovery (Sonnentag & Fritz, 2015). However, there is no conclusive agreement among researchers on the definition of recovery (from work). Zijlstra et al. (2014) have presented arguments for considering the recovery construct as comprising several dynamic processes, rather than as a static concept or a depleted state (i.e. 'need for recovery'). The individual must make energetic resources available for use in order to meet demands at work and may replenish such depleted resources during non-work time (Zijlstra et al., 2014). In accordance with this view, recovery is the dynamic process of fluctuating energetic resources, i.e. spending and replenishing energy. Individuals may experience such fluctuations as fatigue, or as being more or less energised.

Furthermore, a distinction has been made between 'internal recovery' that takes place during work and 'external recovery' that occurs during non-work time (Geurts & Sonnentag, 2006). Arguably, researchers have focussed predominantly on the impact of external recovery (see also Geurts & Sonnentag, 2006). Free-time activities that best promote recovery from work are those that activate systems not mainly used during work. Modern work-life primarily requires mental and cognitive efforts; thus, sport and other physical activities have been found to promote recovery (Sonnentag, 2012; Sonnentag & Fritz, 2015). Researchers have focussed less on the impact of internal recovery on wellbeing; however, one recent study showed that recovery during work hours may be one of the most important factors for self-reported health (Cropley, Rydstedt, & Andersen, 2020; Ejlertsson, Heijbel, Ejlertsson, & Andersson, 2018). Moreover, other studies have shown that relaxation or park walks during lunch-time can promote wellbeing (de Bloom et al., 2017; Steidle, Gonzalez-Morales, Hoppe, Michel, & O'shea, 2017).

With a particular focus on the benefits of nature exposure, researchers within environmental psychology have studied the restoration of affect and attention. Kaplan (1995) has identified four cognitive restorative properties of natural environments as key elements for mental replenishment: being away, extent, fascination and compatibility. This perspective emphasises the restoration of attentional or mental resources following the conscious utilisation of directed attention, arguing that natural environments require less effortful information processing. Ulrich (1993) has developed a psycho-evolutionary perspective to explain the stress-reducing and restorative properties of unthreatening natural environments, arguing that restorative responses in these settings is an evolved adaptation. The notion that natural environments have superior restorative qualities (both affective and cognitive), compared to urban environments, has received firm empirical support in experimental studies (e.g. Berman, Jonides, & Kaplan, 2008; Hartig, Evans, Jamner, Davis, & Gärling, 2003; see McMahan & Estes, 2015; but also Stevenson, Schilhab, & Bentsen, 2018). However, nature is mostly studied as a green or green/blue environment (e.g. Hartig et al., 2003; see also Velarde, Fry, & Tveit, 2007).

To the best of our knowledge, only a limited number of studies have been published on restoration or recovery experiences elicited by walking in winter environments (Brooks, Ottley, Arbuthnott, & Sevigny, 2017; Perkins, Searight, & Ratwik, 2011; Song et al., 2013). All these studies had relatively high levels of experimental control, and used student samples, rather than being field studies in 'real life' settings. Brooks et al. (2017) found that walking outdoors had a marginally more beneficial impact on emotional responses than walking indoors, although the effect of setting (indoor/outdoor) was not statistically significant. However, of importance here, they did not find any seasonal differences between fall and snowy winter conditions (Brooks et al., 2017). Perkins et al. (2011) found an effect of walking during winter on one of the cognitive indicators they measured, but only when they combined all three experimental groups (nature, urban, suburban). Song et al. (2013) found improved physiological reactivity when comparing walking in an urban park with a city area, although there appeared to be no snow. We do not yet know whether the amount of snow is a relevant factor for restoration, but some published studies may help illuminate this issue. First, one study with female student participants found positive effects on wellbeing from relaxing in a forest with marginal snow cover (Bielinis et al., 2019) and similar results were found in a winter environment without snow, also using a student sample (Bielinis, Takayama, Boiko, Omelan, & Bielinis, 2018). Finally, a pilot study with students showed that viewing a snow-covered forest landscape can be restorative (Bielinis et al., 2021). One qualitative study of winter landscapes found positive outcomes on restoration/wellbeing (e.g. Brooke & Williams, 2020), whereas another found more contradictory results (Finlay, 2018).

There are very few studies *comparing* seasons, one exception is the study by Brooks et al. (2017). Moreover, there is a lack of 'real life' field studies (i.e. using non-student samples) considering outdoor walks across seasons. However, one such study has found larger effects on recovery from both relaxation and park walking in the fall compared to the spring (de Bloom et al., 2017). Therefore, the present study aims to explore the potential restorative effects of a (late) winter environment compared with a summer environment for a sample of working adults. This is especially relevant in subarctic and subantarctic regions, and indeed other areas where nature is only green for half the year.

In the present article, restorative experiences are defined as the experiential aspect of psychologically constructed states referring in large part to the psycho-physical energy levels available to the individual (Rydstedt & Johnsen, 2019). For example, feeling energised could be a restorative experience, and psychological detachment might be a relevant cognitive aspect of this experience. Similarly, the subjective experience of vitality refers to feeling energetic and alive (Ryan & Frederick, 1997). Moreover, environmental conditions influence the psychologically constructed vitalised, restored, or fatigued states (Rydstedt & Johnsen, 2019), for example, people may experience increased energy levels by being outdoors in nature (Ryan et al., 2010).

Research aims of the present study

Restoration and recovery are concepts that originate from two different fields; occupational health psychology has focussed mainly on the concept of recovery, whereas environmental psychology has applied the restoration concept. The traditions have identified different types of causal agents for resource loss as well as remedies to restore wellbeing, and have mainly targeted different outcomes; however, there are also important overlaps between them (Rydstedt & Johnsen, 2019; Zijlstra et al., 2014). Furthermore, recent studies have highlighted the beneficial impact of internal recovery on workers wellbeing (e.g. Steidle et al., 2017), possibly indicating the importance of regulating one's state of activation during the workday. There is reason to believe that combining these findings and approaches could supply a rationale for hypothesising that the type of activity performed during lunch breaks is essential for recovery/restoration, in particular short nature walks might be beneficial for replenishing energetic and mental resources spent during work hours. Accordingly, we wanted office workers from an area with seasonal variation to participate in this study. There are other specific interventions that might be beneficial as well. One example of an alternative way to relax is progressive muscle relaxation (PMR). This approach has been shown to lower perceived stress, state anxiety (see also Rausch, Gramling, & Auerbach, 2006), heart rate and the level of cortisol in saliva (Pawlow & Jones, 2002), and reduce psychological and physiological measures of stress (Toussaint et al., 2021). In addition, using PMR daily over time may reduce stress and increase mood (Gao, Curtiss, Liu, & Hofmann, 2018). As noted above, the impact of the seasonal climate on recovery and restoration has received little focus. Therefore, the purposes of this exploratory experimental field study were:

1. To compare the restorative experiences elicited by a lunch walk outdoors, against following the instructions of a video-based relaxation programme in the office
2. To compare restorative experiences elicited by an outdoor lunch walk in winter with the experience of a lunch walk in summer.

Method

The project was registered with the Norwegian Data Protection Services and evaluated by the psychology department's internal ethical committee. Participants were informed of the project, their right to withdraw their consent to participate at any time without consequences, and that participation was voluntary.

Participants

The participants were recruited from a university college in Norway; however, from different campuses (A-D). Both passive and active recruitment methods were employed to reach out to the target group: (1) a mailout through the university intranet homepage for employees; and (2) directly approaching prospective participants by knocking on their office doors and providing a brief introduction about the study (face-to-face). Consent-forms were obtained from 62 participants; however, only 52 participants filled out the baseline questionnaire (T1). At T1, 36 were female (69%), 15 were male (29%), none (0%) selected the other gender identity option, and one participant did not respond to the gender question. While seven participants were 35 years old or younger, 24 participants were between 36 and 50 years old and 21 participants were 51 years old or older. About 65% were employed in a research/educational position, and 31% in a technical/administrative position.

Some drop-out is expected in longitudinal designs. Out of 52 participants at baseline (T1), 14 participants did not return the winter questionnaire (T2), and 17 did not return the summer questionnaire (T3). Most participated at T1, T2 and T3, however, some only participated at T1 and T2, or T1 and T3, resulting in incomplete data at different time points (Figure 1). Due to the low sample size, all responses were included. Not all returned questionnaires were complete, and we wanted to check whether there was a systematic pattern in missingness. Little's MCAR test (Little, 1988) was not statistically significant, χ^2 (64) $= 79.781$, $p = .088$, indicating that the data was missing completely at random, which means that there is no systematic pattern in missingness.

Design

The research design in this experimental study included two experimental activities: relaxation exercise and outdoors walk (see Figure 1). The participants reported lunch break experiences at

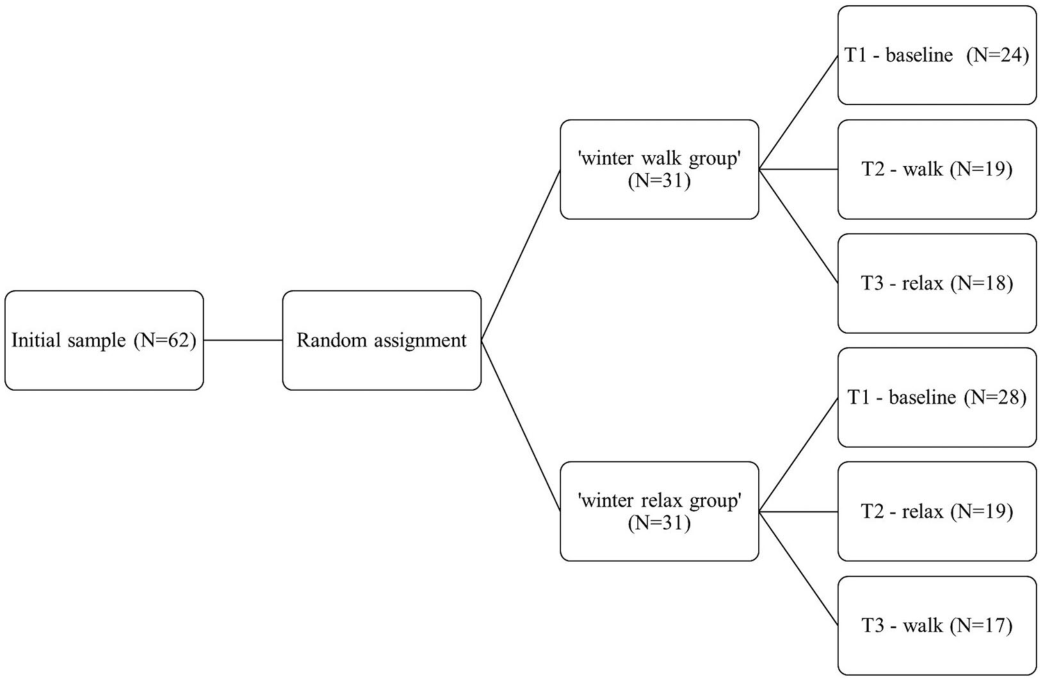

Figure 1. Illustration of the research design. *Note*. T1 is the baseline pre-test questionnaire, T2 is the winter session, T3 is the summer session.

three time points: at baseline (during winter, T1), after the winter experimental session (T2), and after the summer experimental session (T3). After informed consent was obtained from those who wanted to participate in the study, the participants were randomised into two groups; one group would walk in winter and one group would walk in summer. During a lunch break in winter, one group walked outdoors (i.e. 'winter walk group'), and the other group performed a relaxation exercise (i.e. 'winter relax group'). Then during a lunch break in summer, the 'winter walk group' did the relaxation exercise and the 'winter relax group' walked outdoors. After randomisation there were 62 participants, 31 in each group. The participants were then asked to complete the baseline questionnaire (T1). At this point there were 52 participants, 24 in the 'winter walk group' and 28 in the 'summer walk group'. At T2 there were 38 participants, 19 in each group. At T3 there were 35 participants, 18 in the 'winter walk group' and 17 in the 'summer walk group'.

This region in which the data was collected is characterised by a continental climate, with warm summers and cold, snowy winters. The winter session (T2, see Figure 1) took place in March 2019 ($N = 38$). The last participant walked April 1st. The temperature on the campuses averaged between −1.9 and 0 degrees Celsius in March 2019. During the last week of March 2019, the temperature was higher than earlier in the month, and the snow had begun to melt at campus A, so the roads may have been clear from snow even if the surroundings were snowy. See Table 1 for qualitative descriptions of the walking environments. During this period (T2), participants sampled to walk during the summer session did a relaxation exercise by following instructions given on an online video of a standard method for progressive muscle relaxation (Jacobson, 1938). The summer session (T3, see Figure 1) took place in May/June 2019 ($N = 35$), and the temperatures on the different campuses averaged about 7.5–15 degrees Celsius.

There were participants from several campuses. Campus A, B and D are rural, while campus C is urban (Table 1). The area where most of the participants worked (campus A) was rural with some farmed fields and a forested area in the vicinity, and closer there was a park with lawn and trees, but also areas with tarmac for parking. We indicated a route that the participants

Table 1. The participants' qualitative descriptions of the outdoor walking environment.

Participant	Season	Campus	Description
1	Winter	A	Along streets on spring-bare roads in business park.
2	Winter	A	Around the college on asphalt. Fresh air. Some noise from traffic.
3	Winter	A	Walked the recommended route.
4	Winter	A	Assigned route, but a bit lengthened.
5	Winter	A	The snow has melted and a bit wet on the ground.
6	Winter	A	
7	Winter	B	Park-like, snow, low noise-level.
8	Winter	C	Residential streets in city, snow, sun, spring-like, a bit activity from cars, humans etc., but little noise.
9	Winter	A	Quiet hike-road, natural surroundings, little noise, melting snow.
10	Winter	A	Snow, by car-road biggest part around campus.
11	Winter	A	Park-like, walked up rural road, dirty snow, quiet.
12	Winter	A	Snow, bare asphalt, pathway, some traffic, birds chirping.
13	Winter	A	City, snow, noise, cold, no wind, sun, many people.
14	Winter	A	Streets, snow.
15	Winter	A	Snow, city environment, low noise level.
16	Winter	A	Quiet, idyllic, farm road with snow on the trees.
17	Winter	A	A bit slippery, starting to become bare, some noise from the main road, rural, sun.
18	Winter	A	Snow – winter – sun – some places slippery – was noise.
19	Winter	A	Sun, spring, gave a lot of energy, walked a little up the old road in rural surroundings.
20	Summer	B	Rural with forest and water around. No noise, I walked on a path.
21	Summer	D	Forest.
22	Summer	A	Park-like, agricultural area.
23	Summer	A	Cloudy, rainy, cold, super-green and lush nature :-) quiet – no traffic.
24	Summer	A	Park-like, green, little noise
25	Summer	A	Park-like, little noise, green, some traffic.
26	Summer	A	Gravel road with fields on the sides, trees, bushes, birds, chain saws in the distance
27	Summer	A	Parking lot, green, pathway along road
28	Summer	A	Green, some car-traffic
29	Summer	A	Green, some noise from cars, sun
30	Summer	A	Park-like along road, some noise from gardening (tractor and similar) and traffic
31	Summer	A	Some noise from county road 50. Partly park-like. Green …
32	Summer	A	Sidewalk, some cars on the road, but pretty quiet, Green and nice.
33	Summer	A	Outdoors at work. Quiet.
34	Summer	A	Cultural landscape, residential houses and agricultural buildings, big fields, forest
35	Summer	A	Park, green, cloudy, quiet
36	Summer	B	Agricultural area, cultivated land, green, trees, birdsong.

could follow for the walk, but did not check whether they followed it, except for asking them to give a brief description of the environment (Table 1). There were several equivalent options of walking routes. The participants were only instructed to walk outdoors during their lunch break and not to walk a particular route.

Questionnaire and measures

The questionnaires distributed for each session (i.e. baseline, winter, summer) were similar and consisted of five validated recovery and restoration scales, as well as three single-item constructs measuring the subjective concepts of the emotions happy, sad and tense. All questions were adapted to a lunch break setting (e.g. 'during my lunch break … '). To control for the possibility of social effects, participants were asked whether they performed the activity alone, in pairs, or in groups. Moreover, they were asked about length of walking time when it was appropriate, and the participants were asked to describe the environment they walked in. They were also asked about job characteristics (i.e. job title, daily working hours, and regular lunch break duration) and demographics (i.e. age group and gender), which were obtained at baseline. The Norwegian translations can be obtained by contacting the second author.

Trait-like measures

The baseline questionnaire consisted of the trait versions of the positive and negative affect schedule (PANAS, Watson, Clark, & Tellegen, 1988) and the affective subscale of the Work-Related Rumination Questionnaire (WRRQ, Cropley, Michalianou, Pravettoni, & Millward, 2012). PANAS was rated on a 1–5 Likert-type scale ranging from *very little* to a *great deal*, and the WRRQ was rated on a 1–5 Likert-type scale ranging from *very seldom/never* to *very often/always*. These scales scored high on internal consistency; Cronbach's alpha was $\alpha = 0.91$ for PA, $\alpha = 0.75$ for NA, and $\alpha = 0.85$ for WRRQ.

Measures of psychological state

Four scales measured participants' psychological state at present. These were the psychological detachment subscale of the Recovery Experience Questionnaire (REQ, Sonnentag & Fritz, 2007), ego restoration (Johnsen, 2013), a short version of the subjective vitality scale (Ryan & Frederick, 1997; short version: Kawabata, Yamazaki, Guo, & Chatzisarantis, 2017; Liu & Chung, 2019), as well as the state version of PANAS (i.e. after activity sessions) (Watson et al., 1988). Psychological detachment was rated on a 1–5 Likert-type scale, ranging from *I do not agree at all* to *I fully agree*. Both ego restoration and subjective vitality were measured on a 1–7 Likert-type scale, ranging from *strongly disagree* to *strongly agree*. All scales scored high on internal consistency; Cronbach's alpha was $\alpha = 0.79$ for psychological detachment, $\alpha = 0.95$ for ego restoration, $\alpha = 0.92$ for subjective vitality. The ego restoration scale consisted of three items: 'I have gained more willpower', 'I have gained more self-control', 'I feel more able to resist temptations should I want to'. Moreover, participants were asked to indicate on a Likert-type scale from 1 to 7 how they felt in the present (i.e. happy, sad, tense), ranging from *not at all* to *extremely/very much.*

Analysis strategy

This study applied several dependent variables to capture restorative experiences. Given this, multivariate analysis of variance (MANOVA) was deemed appropriate. First, baseline differences between groups were investigated. Then MANOVAs were conducted to compare relaxation with outdoor walk, for winter and then summer. To investigate any effects of change from baseline, a repeated measures MANOVA was conducted to analyse a mixed between-within model. To investigate seasonal effects on the individual dependent variables Bonferroni-adjusted *post-hoc* tests were conducted. With these results, the analysis then proceeded with repeated measures ANOVAs to investigate simple within-group main effects of walking compared with baseline, and group-time interaction for any dependent variables showing an effect in the multivariate analysis. In addition, correlations were calculated between the dependent variables and duration of the walk, in case there was an effect of time spent walking.

Results

There were no significant correlations between the dependent variables and the duration of the intervention for any of the groups (*ps* >.05). As shown initially in Table 2, there were no significant differences at baseline between the participants in the two conditions in any of the outcome variables. Most people performed the activities alone, one in summer and five in winter reported company of one other. In order to conduct a preliminary investigation of whether there were any group differences between relaxation exercise and outdoor walking in summer or winter on any of the variables, two multivariate analyses of variance (MANOVA) were performed, for winter and summer respectively. As further shown in Table 2 there were no significant differences between the groups on any of the variables.

Repeated-measures mixed model MANOVA

To investigate the effects of time (i.e. baseline, winter, and summer), intervention (i.e. relaxation and walk) and the interaction between time and intervention, a repeated-measures mixed within-between MANOVA was performed. Shapiro–Wilk's tests were applied to check for multivariate normality, indicating that scores for subjective vitality, affective rumination, PA and psychological detachment were normally distributed at all points in time ($p > .05$); however, normality cannot be assumed for ego restoration in summer nor for NA at baseline and in winter ($p < .05$). PA and NA were not included in the following analyses because the trait-versions were used at baseline.

The repeated measures mixed model MANOVA was constructed with the following variables: subjective vitality, affective rumination, psychological detachment, and ego restoration (Table 3). Equality of the variance/covariance matrices were tested, indicating significant differences: Box's $M = 194.85$, $p = .04$. Mauchly's test indicated sphericity only for ego restoration, $p = .02$, all other $ps > .20$. The assumption of equality of error variances was held, as assessed by Levene's test ($p > .05$).

Table 2. Descriptive statistics and MANOVA statistics, comparing groups for all constructs: baseline, winter and summer measurements.

Measure	Relax *M* (*SD*)	Walk *M* (*SD*)	*F*-value	*p*-Value	N_{Relax}	N_{Walk}
	Baseline[a]				28	24
PA[b]	3.43 (0.75)	3.26 (0.61)	0.76	.386		
NA[b]	1.54 (0.58)	1.80 (0.53)	2.96	.091		
Vitality	3.86 (1.43)	3.67 (1.17)	0.27	.605		
Rumination	2.14 (0.74)	2.48 (0.65)	3.06	.086		
Detachment	2.91 (0.97)	2.84 (0.74)	0.08	.783		
Ego restoration	4.12 (1.44)	4.11 (1.24)	0.00	.983		
	Winter				19	17
PA	2.89 (1.04)	3.00 (0.73)	0.12	.727		
NA	1.35 (0.36)	1.35 (0.45)	0.00	.964		
Vitality	4.04 (1.43)	4.68 (1.27)	1.99	.168		
Rumination	2.31 (0.86)	2.40 (0.85)	0.11	.741		
Detachment	3.16 (0.99)	3.32 (1.02)	0.23	.632		
Ego restoration	3.25 (1.39)	4.00 (0.85)	3.74	.061		
	Summer				18	17
PA	2.73 (0.76)	3.18 (0.85)	2.79	.104		
NA	1.44 (0.75)	1.32 (0.51)	0.31	.580		
Vitality	4.42 (1.09)	4.59 (1.17)	0.20	.656		
Rumination	2.49 (0.86)	2.01 (0.61)	3.57	.067		
Detachment	3.25 (1.08)	3.54 (0.82)	0.82	.372		
Ego restoration	3.72 (1.06)	3.96 (1.47)	0.31	.584		

Note. [a]No intervention, groups are eq. to relax winter, walk winter; [b]Trait version.

Table 3. MANOVA results showing main effects of time and group, and their interaction for all dependent variables.

	Recovery Measures		
Source	*F*-value	*p*-Value	η^2
Time effect	4.85	.002	0.65
Group effect	0.95	.452	0.13
Group × time	0.60	.770	0.19

Table 4. Bonferroni adjusted *post-hoc* comparisons of subjective vitality and psychological detachment for different time periods.

Recovery measures	Comparison		Mean difference	*p*-value	95% CI
Subjective vitality	Baseline	Summer	0.88	.001	0.33–1.44
		Winter	0.71	.004	0.20–1.23
	Summer	Winter	−0.17	1.00	−0.62–0.29
Psychological detachment	Baseline	Summer	0.70	.001	0.29–1.12
		Winter	0.46	.010	0.09–0.82
	Summer	Winter	−0.24	.642	−0.73–0.24

There was no significant multivariate effect of group on the measures (between subjects), Wilks' $\lambda = 0.868$, $F(4,25) = 0.95$, $p = .45$, partial $\eta^2 = 0.13$. The interaction between time and group was not significant: Wilks' $\lambda = 0.815$, $F(8,21) = 0.60$, $p = .77$, partial $\eta^2 = 0.19$. However, there was a significant multivariate effect of time on the measures: Wilks' $\lambda = 0.351$, $F(8,21) = 4.85$, $p = .002$, partial $\eta^2 = 0.65$.

Post-hoc differences for subjective vitality and psychological detachment

Pairwise comparisons between different times (i.e. baseline, winter, summer) were conducted, using Bonferroni adjustment for multiple comparisons, see Table 4 (mean differences are calculated for left column – right column). All mean differences for ego restoration and affective rumination were non-significant ($ps > .05$). For subjective vitality, there was a significant mean difference between summer and baseline, and a significant difference between winter and baseline ($ps < .05$); however, there was no significant difference between summer and winter ($ps > .05$). Similarly, there was a significant mean difference between winter and baseline, as well as between summer and baseline for psychological detachment ($ps < .05$), however; the difference between summer and winter was non-significant ($ps > .05$).

Within-group differences for psychological detachment and subjective vitality

Repeated measures ANOVAs were conducted in order to investigate the simple main effects (within group) on psychological detachment and subjective vitality. First, the data was analysed for any interaction effects between group and time (i.e. baseline winter and baseline summer) for subjective vitality and psychological detachment. For these tests, Box's *M* and Levene's tests were non-significant ($ps > .05$), unless otherwise noted. Firstly, there was a statistically significant interaction between group and time for subjective vitality in winter, $p = .02$ (see Table 5); however, there was no significant interaction for the summer time point, $p = .45$. Secondly, there were no significant interactions for psychological detachment in winter or summer, ($ps > .05$).

The simple main effects of indoor relaxation exercise and outdoor walking during both summer and winter were investigated (Table 5). There was no significant main effect of relaxation on subjective vitality in winter; yet, there was a significant main effect of an outdoor walk in winter. Moreover, there was a significant main effect of walking outdoors and indoor relaxation during summer on subjective vitality. Furthermore, there was a significant effect of walking outdoors during winter on psychological detachment; however, there was no significant effect of indoor

Table 5. Results of repeated measures ANOVA's of effects (including simple main effects).

	Winter			Summer		
Measure	*F*-value	η^2	dfs	*F*-value	η^2	dfs
	Walk					
Subjective vitality	19.26**	0.52	(1,18)	13.85**	0.46	(1,16)
Psychological detachment	8.26*	0.32	(1,18)	18.14**	0.53	(1,16)
	Relax					
Subjective vitality	0.18	0.01	(1,18)	6.28*	0.27	(1,17)
Psychological detachment	2.97	0.14	(1,18)	3.50	0.17	(1,17)
	Interactions (Group*Time)					
Subjective vitality	6.58*	0.16	(1,36)	0.58	0.02	(1,33)
Psychological detachment	0.72	0.02	(1,36)	0.95	0.03	(1,33)

*$p<.05$; **$p<.01$.

relaxation in winter on psychological detachment. Walking outdoors during summer had a significant effect on psychological detachment; however, there was no significant main effect of indoor relaxation on psychological detachment.

Discussion

The purpose of this study was to explore the effects of walking outdoors during a lunch break in summer and winter compared to performing a progressive muscle relaxation exercise indoors. This study is one of very few comparing seasonal effects (see for example de Bloom et al., 2017 and Brooks et al., 2017), and with the exception of de Bloom et al. (2017) the only study to compare restorative experiences of a sample of working adults across seasons. The winter environments seem to have been mostly snowy (see Table 1), although it was late in the season. The summer environments appear to have been green and/or park-like (Table 1). In this study, we also used scales to measure psychological experiences rather than the more common approach of using single-item measures in this type of study; the latter may be more convenient but is also a less reliable measure of psychological state.

Based on the multivariate results reported in this article, it cannot be concluded that performing a relaxation exercise is different from taking a walk outdoors on overall restorative experiences. That is, both lunch break activities performed by the participants appeared to have an effect on self-reported restorative experiences (compared with a normal lunch break at baseline). Comparing both intervention groups, in either winter or summer, no group differences in restorative experiences were found, which would indicate that the participants had similar experiences, irrespective of intervention. One previous study also found effects of lunch-break relaxation interventions on perceived energy levels (Steidle et al., 2017).

In this study, the participants served as their own controls (i.e. comparing interventions to a normal lunch break). Pairwise comparisons to investigate any significant changes in experiences between baseline, summer and winter were conducted. There were no significant findings for the variables measuring affective rumination and ego restoration; however, for subjective vitality and psychological detachment there were statistically significant changes between baseline and summer, as well as between baseline and winter. Therefore, we chose to conduct further analyses focussing on subjective vitality and psychological detachment.

For subjective vitality in wintertime, there was a statistically significant interaction between group and time. This indicates that walking outdoors during winter increased the vitality of the participants more effectively than the relaxation exercise. Moreover, the participants reported heightened subjective vitality by walking outdoors both during summer and winter; the change from baseline was statistically significant for both seasons. During summer, the participants also appeared to experience heightened vitality due to indoor relaxation, although this effect was smaller than the vitalising effect of walking outdoors, both in winter and in summer. Indoor relaxation did not have any effect on psychological detachment, irrespective of season. However, there were effects of walking outdoors both in winter and summer on psychological detachment, and these were of comparable size.

To conclude, walking outdoors may have an effect on energy available to self during winter, whereas both walking outdoors and relaxing (to a smaller extent) may have an effect in summer. Thus, outdoor walks in winter may be a better strategy for increasing energy levels than relaxing indoors. Exposure to both winter and summer environments may be effective strategies to detach from work during lunch break. However, relaxation may not be a particularly good strategy for achieving psychological detachment from work during work hours.

It seems relevant to consider energy dynamics in relation to both movement and properties of the physical environment. During winter, the environment is demanding, which may have caused the office workers in this study to increase their energy levels to handle the environment. For modern humans with easy access to high-energy foods, this should not be a problem. During summer, walking outdoors may be less demanding, but we should perhaps expect a stronger effect from exposure to greenery. While de Bloom et al. (2017) found seasonal differences (spring-fall), Brooks et al. (2017) did not (winter-summer). Some studies indicate that winter conditions can be restorative (e.g. Bielinis et al., 2019; Song et al., 2013), but one qualitative study highlights the ambiguity of winter (Finlay, 2018). It seems possible that different seasons could have differential psychological effects, for example, that summer environments may heighten some positive emotions, but as of yet, there is too little research to conclude.

Limitations and recommendations for future research

Several methodological limitations of the present study merit some caution concerning the conclusions. We chose to exclude the single-item measures and PANAS from the analyses and used four dependent variables in the present study, subjective vitality, rumination, ego restoration, and psychological detachment. Scales were preferred over single items to measure state, and the PANAS was only available as the trait version at baseline. One reason for using several scales is the lack of comparative studies on how to measure recovery/restoration. However, using multiple dependent variables can complicate both statistical analyses, interpretations, and conclusions. The sample size was small, with only 35 participants in the summer session. Moreover, the sample size available for statistical analysis decreased due to dropout from winter to summer. The longitudinal nature of the study and use of a somewhat lengthy questionnaire may have contributed to missing data, decreasing power as well as introducing potential bias in the results. There is also an overrepresentation of female white-collar workers with high levels of education in the current sample, which limits the potential for generalising the findings to the general population and/or more heterogeneous groups including males and blue-collar workers. Moreover, the participants only performed the recovery activities one time (they relaxed in winter and walked in summer or vice versa); there might be other effects with multiple exposures. Although our findings lend some support to the hypothesis that walking outdoors has a greater effect on internal recovery than systematic relaxation indoors, the activities may influence different aspects of recovery. However, we did measure several recovery-related constructs partly for this reason. For example, it is possible that the relaxation exercise depleted self-regulatory resources (Muraven & Baumeister, 2000); this might explain the large difference between groups on the ego restoration measure in winter. Had the participants received training in the relaxation exercise, the effect of the activity might have been larger on recovery/restoration. Furthermore, the relaxation exercise was performed in the regular work environment, and we did not assess the actual potential confounding effect of this setting (e.g. Evensen, Raanaas, Hägerhäll, Johansson, & Patil, 2015). Some of the null-findings reported here might be due to low power. Sample size was mostly determined by practicality, estimating expected effect sizes of nature exposure to establish sample size is possible, but there is little research on internal recovery and no research on cold winter environments that could be used for comparison to perform power calculations. The study design also yields some limitations, such as the lack of a non-intervention control group and comparisons with baseline rather than before and after the activity. Future studies should include an intervention control as well as fewer variables, although it should be noted that selecting which measures to use is an important methodological issue that also warrants further research.

This study is one of a limited number of studies comparing the restorative effects of outdoor walks across seasons. There is a need for more research on this specific topic; especially since several areas, i.e. in the northernmost and southernmost parts of the world have substantial seasonal variations with four distinct seasons. Indeed, psychological research on snowy environments is generally lacking. Both in the lab and in the field, the impact of snow remains underexplored. Therefore, future studies should investigate the seasonal effects of recovery/restoration in nature, and specifically the impact of cold winters.

The subjective experience of fatigue and restoration/recovery may refer to psychologically constructed mental states based on several processes (Rydstedt & Johnsen, 2019), it can be a complex task to measure the dynamics of these subjective experiences, however, based on the results in the present study, psychological detachment and subjective vitality appear to capture important aspects of the constructive process.

Conclusion

Theoretical frameworks from occupational health psychology and environmental psychology have been incorporated to give a more nuanced assessment of recovery and restoration effects of outdoor walking and progressive muscle relaxation during lunch breaks. In conclusion, these findings suggest that outdoor walks are recommended over relaxation to increase energy available to self during the workday, especially in the winter season. Taking a lunchtime walk also appears to be a better strategy than relaxation to mentally disengage from work during work hours, both in winter and summer. However, these conclusions are tentative and further research across seasons is called for.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Notes on contributors

Svein Åge Kjøs Johnsen is an associate professor at the Department of Psychology, Inland Norway University of Applied Sciences. He is interested in basic and applied research on affect, emotions, and the environment. Svein Åge has done research on a variety of topics, for example: values, emotion regulation, organisational climate, personality traits and individual differences.

Marin Kristine Brown is a PhD candidate in environmental psychology and innovation at Inland Norway University of Applied Sciences, Department of Psychology. The core of her research centres on psychological issues in organisations, such as sustainability and (green) organisational change, recovery/restoration and well-being, innovation, and collaborative networks between organisations.

Leif W. Rydstedt is a senior professor in work and organisational psychology at the Department of Psychology, Inland School of Business and Social Sciences, Inland Norway University of Applied Sciences, Lillehammer. Among

his research interests are process of work recovery, along with integration of the recovery and restoration concepts. Furthermore, he has been involved in studies on lingering cognitive reactivity after the offset of stress exposure.

ORCID

Svein Åge Kjøs Johnsen http://orcid.org/0000-0002-9294-875X
Marin Kristine Brown http://orcid.org/0000-0002-1883-5466
Leif Werner Rydstedt http://orcid.org/0000-0001-7293-349X

References

Adamsson, M., Laike, T., & Morita, T. (2018). Seasonal variation in bright daylight exposure, mood and behavior among a group of office workers in Sweden. *Journal of Circadian Rhythms*, *16*, 2. doi:10.5334/jcr.153

Berman, M. G., Jonides, J., & Kaplan, S. (2008). The cognitive benefits of interacting with nature. *Psychological Science*, *19*(12), 1207–1212. doi:10.1111/j.1467-9280.2008.02225.x

Beute, F., & de Kort, Y. A. W. (2018). The natural context of wellbeing: Ecological momentary assessment of the influence of nature and daylight on affect and stress for individuals with depression levels varying from none to clinical. *Health Place*, *49*, 7–18. doi:10.1016/j.healthplace.2017.11.005.

Bielinis, E., Janeczko, E., Takayama, N., Zawadzka, A., Słupska, A., Piętka, S., … Bielinis, L. (2021). The effects of viewing a winter forest landscape with the ground and trees covered in snow on the psychological relaxation of young Finnish adults: A pilot study. *PLoS One*, *16*(1), e0244799. doi:10.1371/journal.pone.0244799.

Bielinis, E., Łukowski, A., Omelan, A., Boiko, S., Takayama, N., & Grebner, D. L. (2019). The effect of recreation in a snow-covered forest environment on the psychological wellbeing of young adults: Randomized controlled study. *Forests*, *10*, 827. doi:10.3390/f10100827.

Bielinis, E., Takayama, N., Boiko, S., Omelan, A., & Bielinis, L. (2018). The effect of winter forest bathing on psychological relaxation of young Polish adults. *Urban Forestry & Urban Greening*, *29*, 276–283. doi:10.1016/j.ufug.2017.12.006

Brooke, K., & Williams, A. (2020). Iceland as a therapeutic landscape: White wilderness spaces for well-being. *GeoJournal*, *86*, 1275–1285. doi:10.1007/s10708-019-10128-9.

Brooks, A. M., Ottley, K. M., Arbuthnott, K. D., & Sevigny, P. (2017). Natural-related mood effects: Season and type of nature contact. *Journal of Environmental Psychology*, *54*, 91–102. doi:10.1016/j.jenvp.2017.10.004

Cropley, M., Michalianou, G., Pravettoni, G., & Millward, L. J. (2012). The relation of post-work ruminative thinking with eating behaviour. *Stress Health*, *28*(1), 23–30. doi:10.1002/smi.1397.

Cropley, M., Rydstedt, L. W., & Andersen, D. (2020). Recovery from work: testing the effects of chronic internal and external workload on health and well-being. *Journal of Epidemiology and Community Health*, *74*(11), 919–924. doi:10.1136/jech-2019-213367.

de Bloom, J., Sianoja, M., Korpela, K., Tuomisto, M., Lilja, A., Geurts, S., & Kinnunen, U. (2017). Effects of park walks and relaxation exercises during lunch breaks on recovery from job stress: Two randomized controlled trials. *Journal of Environmental Psychology*, *51*, 14–30. doi:10.1016/j.jenvp.2017.03.006

Ejlertsson, L., Heijbel, B., Ejlertsson, G., & Andersson, I. (2018). Recovery, work-life balance and work experiences important to self-rated health: A questionnaire study on salutogenic work factors among Swedish primary health care employees. *Work*, *59*(1), 155–163. doi:10.3233/WOR-172659.

Evensen, K., Raanaas, R., Hägerhäll, C., Johansson, M., & Patil, G. (2015). Restorative elements at the computer workstation: A comparison of live plants and inanimate objects with and without window view. *Environment and Behavior*, *47*(3), 288–303. doi:10.1177/0013916513499584

Finlay, J. M. (2018). 'Walk like a penguin': Older Minnesotans' experiences of (non)therapeutic white space. *Social Science & Medicine 198*, 77–84. doi:10.1016/j.socscimed.2017.12.024

Gao, L., Curtiss, J., Liu, X., & Hofmann, S. G. (2018). Differential treatment mechanisms in mindfulness meditation and progressive muscle relaxation. *Mindfulness*, *9*(4), 1268–1279. doi:10.1007/s12671-017-0869-9

Geurts, S. A., & Sonnentag, S. (2006). Recovery as an explanatory mechanism in the relation between acute stress reactions and chronic health impairment. *Scandinavian Journal of Work, Environment & Health*, *32*(6), 482–492. doi:10.5271/sjweh.1053

Hadlow, N. C., Brown, S., Wardrop, R., & Henley, D. (2014). The effects of season, daylight saving and time of sunrise on serum cortisol in a large population. *Chronobiology International*, *31*(2), 243–251. doi:10.3109/07420528.2013.844162.

Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., & Gärling, T. (2003). Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology*, *23*(2), 109–123. doi:10.1016/S0272-4944(02)00109-3

Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American Psychologist*, *44*(3), 513–524. doi:10.1037/0003-066X.44.3.513

Jacobson, E. (1938). *Progressive Relaxation* (2nd ed.). Oxford, England: Univ. Chicago Press.
Johnsen, S. Å. K. (2013). Exploring the use of nature for emotion regulation: Associations with personality, perceived stress, and restorative outcomes. *Nordic Psychology*, *65*(4), 306–321. doi:10.1080/19012276.2013.851445
Kaplan, S. (1995). The restorative benefits of nature: Towards an integrative framework. *Journal of Environmental Psychology*, *15*(3), 169–182. doi:10.1016/0272-4944(95)90001-2
Kawabata, M., Yamazaki, F., Guo, D. W., & Chatzisarantis, N. L. D. (2017). Advancement of the subjective vitality scale: Examination of alternative measurement models for Japanese and Singaporeans. *Scandinavian Journal of Medicine & Science in Sports*, *27*(12), 1793–1800. doi:10.1111/sms.12760
Little, R. J. A. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association*, *83*(404), 1198–1202. doi:10.1080/01621459.1988.10478722.
Liu, J. D., & Chung, P. K. (2019). Factor structure and measurement invariance of the subjective vitality scale: Evidence from Chinese adolescents in Hong Kong. *Quality of Life Research*, *28*(1), 233–239. doi:10.1007/s11136-018-1990-5
McDonald-Yale, E., & Birchall, S. J. (2021). The built environment in a winter climate: Improving university campus design for student wellbeing. *Landscape Research*, *46*(5), 638–652. doi:10.1080/01426397.2021.1881768
McMahan, E. A., & Estes, D. (2015). The effect of contact with natural environments on positive and negative affect: A meta-analysis. *The Journal of Positive Psychology*, *10*(6), 507–519. doi:10.1080/17439760.2014.994224.
Meijman, T. F., & Mulder, G. (1998). Psychological aspects of workload. In P. J. D. Drenth & H. Thierry (Eds.), *Handbook of Work and Organizational Psychology* (2nd ed., pp. 5–33). Hove, UK: Psychology Press.
Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin*, *126*(2), 247–259. doi:10.1037/0033-2909.126.2.247.
Olafsdottir, G., Cloke, P., Schulz, A., van Dyck, Z., Eysteinsson, T., Thorleifsdottir, B., & Vögele, C. (2020). Health benefits of walking in nature: A randomized controlled study under conditions of real-life stress. *Environment and Behavior*, *52*(3), 248–274. doi:10.1177/0013916518800798
Pawlow, L. A., & Jones, G. E. (2002). The impact of abbreviated progressive muscle relaxation on salivary cortisol. *Biological Psychology*, *60*(1), 1–16.
Perkins, S., Searight, H. R., & Ratwik, S. (2011). Walking in a natural winter setting to relieve attention fatigue: A pilot study. *Psychology*, *02*(08), 777–780. doi:10.4236/psych.2011.28119
Persson, R., Garde, A. H., Hansen, Å. M., Österberg, K., Larsson, B., Ørbaek, P., & Karlson, B. (2008). Seasonal variation in human salivary cortisol concentration. *Chronobiology International*, *25*(6), 923–927. doi:10.1080/07420520802553648.
Rastad, C., Sjödén, P.-O., & Ulfberg, J. (2005). High prevalence of self-reported winter depression in a Swedish county. *Psychiatry and Clinical Neurosciences*, *59*(6), 666–675. doi:10.1111/j.1440-1819.2005.01435.x
Rausch, S. M., Gramling, S. E., & Auerbach, S. M. (2006). Effects of a single session of large-group meditation and progressive muscle relaxation training on stress reduction, reactivity, and recovery. *International Journal of Stress Management*, *13*(3), 273–290. doi:10.1037/1072-5245.13.3.273.
Ryan, R. M., & Frederick, C. (1997). On energy, personality, and health: Subjective vitality as a dynamic reflection of well-being. *Journal of Personality*, *65*(3), 529–565.
Ryan, R. M., Weinstein, N., Bernstein, J., Brown, K. W., Mistretta, L., & Gagné, M. (2010). Vitalizing effects of being outdoors and in nature. *Journal of Environmental Psychology*, *30*(2), 159–168. doi:10.1016/j.jenvp.2009.10.009.
Rydstedt, L. W., & Johnsen, S. Å. K. (2019). Towards and integration of recovery and restoration theories. *Heliyon*, *5*(7), e02023.
Song, C., Joung, D., Ikei, H., Igarashi, M., Aga, M., Park, B. J., … Miyazaki, Y. (2013). Physiological and psychological effects of walking on young males in urban parks in winter. *Journal of Physiological Anthropology*, *32*(1), 18. doi:10.1186/1880-6805-32-18
Sonnentag, S. (2012). Psychological detachment from work during leisure time: The benefits of mentally disengaging from work. *Current Directions in Psychological Science*, *21*(2), 114–118. doi:10.1177/0963721411434979
Sonnentag, S., & Fritz, C. (2007). The Recovery Experience Questionnaire: Development and validation of a measure for assessing recuperation and unwinding from work. *Journal of Occupational Health Psychology*, *12*(3), 204–221. doi:10.1037/1076-8998.12.3.204.
Sonnentag, S., & Fritz, C. (2015). Recovery from job stress: The stressor-detachment model as an integrative framework. *Journal of Organizational Behavior*, *36*(S1), S72–S103. doi:10.1002/job.1924
Steidle, A., Gonzalez-Morales, M. G., Hoppe, A., Michel, A., & O'shea, D. (2017). Energizing respites from work: A randomized controlled study on respite interventions. *European Journal of Work and Organizational Psychology*, *26*(5), 650–662. doi:10.1080/1359432X.2017.1348348
Stevenson, M. P., Schilhab, T., & Bentsen, P. (2018). Attention restoration theory II: a systematic review to clarify attention processes affected by exposure to natural environments. *Journal of Toxicology and Environmental Health Part B, Critical Reviews*, *21*(4), 227–268. doi:10.1080/10937404.2018.1505571
Stout, M., Collins, D., Stadler, S. L., Soans, R., Sanborn, E., & Summers, R. J. (2018). Celebrated, not just endured:" Rethinking winter cities. *Geography Compass*, *12*(8), e12379. doi:10.1111/gec3.12379

Toussaint, L., Nguyen, Q. A., Roettger, C., Dixon, K., Offenbächer, M., Kohls, N., … Siorois, F. (2021). Effectiveness of progressive muscle relaxation, deep breathing, and guided imagery in promoting psychological and physiological states of relaxation. *Evidence-Based Complementary and Alternative Medicine*, *2021*, 5924040. doi:10.1155/2021/5924040.

Ulrich, R. S. (1993). Biophilia, biphobia, and natural landscapes. In S. R. Kellert & E. O. Wilson (Eds.), *The Biophilia Hypothesis* (pp.73–137). Washington, DC: Island Press.

Velarde, M. D., Fry, G., & Tveit, M. (2007). Health effects of viewing landscapes: Landscape types in environmental psychology. *Urban Forestry & Urban Greening*, *6*, 199–212.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*(6), 1063–1070. doi:10.1037/0022-3514.54.6.106

Winthorst, W. H., Bos, E. H., Roest, A. M., & de Jonge, P. (2020). Seasonality of mood and affect in a large general population sample. *PLOS One*, *15*(9), e0239033. doi:10.1371/journal.pone.0239033.

Zijlstra, F. R. H., Cropley, M., & Rydstedt, L. W. (2014). From recovery to regulation: An attempt to reconceptualize 'recovery from work. *Stress and Health*, *30*(3), 244–252.