



# Naturally! Examining Nature's Role in Workplace Strain Reduction

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## Abstract

In past literature, exposure to nature has been demonstrated to have beneficial, restorative effects on the human body and cognitions. Using a two-wave, full panel design, the present study takes an interdisciplinary approach to extend previous findings and to explore the relationship between exposure to nature at work and workplace strain outcomes. The Attention Restoration Theory was used to describe how nature exposure indirectly reduces strain, through increased employee attention. The sample ( $N = 176$ ) consisted of full-time office employees, working in an urban setting in the United States. Results demonstrated significant relationships between workplace nature exposure, directed attention, and strain outcomes (burn-out, job dissatisfaction, and depressive symptoms). Specifically, directed attention significantly mediated the association between nature exposure and all workplace strain outcomes. The findings of the study provide several practical and theoretical contributions to occupational health science through the consideration of increased exposure to nature as a new, additional job resource. Future research should consider the relevance of workplace nature exposure to stressor-strain theory and the incorporation of nature into stress management interventions.

**Keywords** Nature · Occupational stress · Organizational context · Job resources

Nature is the foundation for human existence, aiding our wellbeing with every breath of air we inhale. However, nature has many more health benefits beyond sustaining our basic physiological processing. In fact, there is reason to believe that nature can have a healing, restorative effect on the human body and that exposure to nature can have a

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positive effect on the mind (Kaplan 1995). This is not a novel idea. Eastern medicine has sought to harness the healing powers of nature for centuries, transcendentalists sought to escape their urban world to find peace and clarity in nature, and in the last century, past U.S. presidents sought to establish and maintain state parks and wilderness areas by espousing the benefits of nature to human life (Nash 1968). In the last couple of decades, nature has been utilized as a tool to improve health, as research has demonstrated that nature has the ability to increase the wellbeing of hospital patients and mental ability in students (Hartig et al. 1991; Ulrich 1984). The present study aims to extend previous research by investigating whether access to nature could be an effective method of reducing psychological strain in a work context.

Access to nature has been shown to aid in medical recovery and to buffer against negative health outcomes. One hospital study found that, when recovering from surgery, patients had a window containing a nature-based view, patients were discharged faster and used fewer pain medications (Ulrich 1984). Another medical intervention demonstrated that cancer patients who participated in nature-based activities displayed faster improvements than patients in a control group (Cimprich 1993). Further, in one experimental study, participants in the experimental group were shown a nature scene, while the control group was shown a blank screen (Tse et al. 2002). As each group watched their respective screens, experimenters determined the participants' relative pain threshold using a modified tourniquet technique. Findings indicated that the group watching the nature scene had a significantly higher pain threshold than the control group. Nature exposure's effect of buffering pain has been demonstrated in other research investigations as well (Diette et al. 2003).

Furthermore, nature exposure has been shown to be a beneficial resource in reducing general strain outcomes. For example, participants reported significantly decreased levels of physiological strain reactions after watching videos of trees (Jiang et al. 2014) and a high prevalence of nature exposure in rural areas significantly correlated with decreases in negative strain outcomes in children (Wells and Evans 2003). More recently, a meta-analysis on nature exposure and mental health demonstrated that increasing exposure to nature can be an effective method of strain reduction (Hartig et al. 2014).

In addition to nature's ability to decrease the prevalence of negative health outcomes, nature exposure can also be beneficial in increasing favorable health outcomes (De Vries et al. 2003; Mitchell and Popham 2008; Park and Mattson 2009). For instance, a recent meta-analysis demonstrated that nature-assisted therapy is extremely beneficial to human health (Annerstedt and Währborg 2011). Nature-assisted therapy utilizes many aspects of nature to act as therapeutic tools, such as gardens and outdoor natural environments. Further, participants in a study with window views of nature in their homes had increased life satisfaction and well-being (Kaplan 2001). These findings were replicated when researchers surveyed participants with either "urban" or "natural" views as well (Velarde et al. 2007). Similarly, in a study on individuals in urban areas, those who sought to spend time in city parks or gardens had increased levels of overall health and well-being (Maller et al. 2006).

Only a few studies have sought to extend nature's strain reduction findings to the workplace. Of these, one demonstrated that increased nature views in windows of employee offices in Sweden correlated with decreased stress and increased "trivsel", a Swedish word conveying overall well-being (Velarde et al. 2007). In Norway, researchers demonstrated that the number of plants in the office negatively related to the number of employees that request sick days (Bringslimark et al. 2007). Similarly, exposure to nature at work in a U.S. based study correlated with increased general health, decreased strain, and decreased days of sickness (Largo-Wight et al. 2011a).

The evidence suggests that exposure to nature can have significant effects on human health and strain outcomes, even in the workplace. Nevertheless, previous literature has not examined the influence of workplace nature exposure on specific occupational health strain outcomes of interest, nor has it sought to measure the mechanisms that underlie the nature exposure – strain relationship. The present study aims to bring the topic of nature in the workplace to the forefront of occupational health research and to examine the mechanism by which exposure to nature at work can reduce occupational strains of burnout, job dissatisfaction, and depressive symptoms.

## Nature as a Job Resource

Given nature's healing abilities, it is likely that exposure to nature while at work acts as a job resource to aid in reducing job strain outcomes. Occupational health literature conceptualizes job resources as "physical, psychological, social, or organizational aspects of the job that are functional in achieving work goals, reduce job demands, and/or stimulate personal growth, learning, and development" (Bakker and Demerouti 2007, p. 311). Not only do job resources have inherent value to employees, but they can also be beneficial in buffering against negative strain outcomes that result from high workplace demands (Bakker and Demerouti 2007). Increased exposure to nature in the workplace will likely act as a job resource when nature augments *physical* aspects of the job and provides employees with improved well-being outcomes and strain reduction.

## Nature and Burnout

One strain outcome that exposure to nature has the potential to significantly reduce is workplace burnout. Workplace burnout is extremely pervasive in the United States and has serious effects on employees (Halbesleben and Buckley 2004). Burnout is a psychological condition that results from persistent workplace stressors and has been operationalized as an extreme expression of long-term fatigue (Schaufeli et al. 1995). Burnout often occurs when employees experience high work volumes, low job recognition, poor work relationships, low job fairness, or when employees differ strongly in workplace values (Salysers et al. 2011). Burnout has also been linked to many negative organizational outcomes, including decreased levels of employee job performance,

general health, organizational commitment, and increased turnover (Leiter and Maslach 1988; Maslach et al. 2001).

Employee burnout has two core features: exhaustion and disengagement (Demerouti et al. 2002), indicating that burnout will occur when employees experience both chronic exhaustion and disengagement. Experiences of exhaustion are characterized by feeling generally overextended and depleted of cognitive and emotional resources. The second subscale, disengagement, is composed of items measuring employees' levels of monotony and satiation. Monotony is defined as "a state of reduced activation", occurring when an employee performs the same task(s) repeatedly and experiences drowsiness, a lack of responsiveness, and weariness (Demerouti et al. 2002, p. 425). Satiation is defined as "a state of nervously unsettled, strong emotional rejection of a (structurally) repetitive task", occurring when an employee feels they are "not getting anywhere" and have an aversion to their work (Demerouti et al. 2002, p. 425).

At present, there is no empirical evidence on the relationship between exposure to nature at work and burnout. However, several studies have examined the relationships between nature exposure and psychological constructs that are closely related to burnout. A recent qualitative review on the benefits of human interaction with nature demonstrated that exposure to nature is significantly and negatively related to the psychological, physiological, and cognitive outcomes of mental fatigue, poor mood, frustration, low self-esteem, elevated cortisol levels, headaches, general stress, and low productivity (Keniger et al. 2013). The aforementioned literature review provides some evidence to suggest that exposure to nature may reduce experiences of employee burnout.

*Hypothesis 1:* Exposure to nature in the workplace will be negatively related to employee levels of (a) exhaustion and (b) disengagement.

## **Nature and Job Dissatisfaction**

Job dissatisfaction occurs when employees perceive that their job does not fulfill their personal job values. Employees may hold a range of values regarding their work, including valuing work that is interesting, fair, significant, in an environment that is physically attractive, promotes personal growth, and/or provides fair compensation (Henne and Locke 1985). Job dissatisfaction will result in decreased life satisfaction, mental health, and physical health (Henne and Locke 1985). Additionally, employee dissatisfaction is a major concern for organizations as it increases turnover intentions and absenteeism, and decreases organizational commitment and job performance (Henne and Locke 1985; Judge et al. 2001; Porter et al. 1974).

Exposure to nature has been indicated to increase job satisfaction in several previous studies. Lottrup et al. (2013) found that increased access to greenery is related to decreased general strain and increased positive workplace attitudes. Similarly, employees with office plants and window views experienced increased job satisfaction and general life quality

(Dravigne et al. 2008). These findings were replicated in two other studies examining exposure to nature through office windows (Lottrup et al. 2015; Sop Shin 2007). Thus, the following hypothesis is proposed:

*Hypothesis 2:* Exposure to nature at work will be negatively related to employee levels of job dissatisfaction.

## Nature and Depressive Symptoms

Employees' depressive symptoms reflect experiences "of reduced mood and interest that persist for at least 14 days" (Bonde 2008, p. 439). According to the World Health Organization, in any given twelve month period, approximately 6.4% of employees in the United States experience major depression (Bonde 2008; Demyttenaere et al. 2004, p. 291). It is likely that many more employees experience depressive symptoms, with reported rates as high as 23% of employees (Hakanen and Schaufeli 2012). A high rate of employees experiencing depressive symptoms is negatively related to organizational functioning. A recent systematic review and meta-analysis on depressive symptoms in the workplace demonstrates that employees with high scores on depressive symptom inventories are more likely to report job insecurity, effort reward imbalances, low workplace support, a lack of procedural and relational justice, restricted skill discretion, and conflicts with both superiors and colleagues (Theorell et al. 2015).

Exposure to nature may be an effective resource for reducing depressive symptoms, as the literature suggests that depressive symptoms are heavily influenced by workplace environmental factors (Theorell et al. 2015). Thus, a more natural environment at work may alleviate experiences of depression. Recently, a group of biologists explored the relationship between exposure to nature and depressive symptoms. Such inquiry is important given that 50% of Americans now reside in urban areas, and that urban areas are associated with increased mental illness (Bratman et al. 2015). Furthermore, the percentage of people in the United States dwelling in urban areas is likely to reach 70% by the year 2050 (Bratman et al. 2015; Dye 2008), suggesting that the importance of depression will continue to rise. Bratman et al. (2015) also discovered that the presence of nature is associated with decreased rumination and reduced neural activity in the area of the brain (the subgenual prefrontal cortex) that is linked to risk for mental illness. Similarly, a recent study from the public health domain examined neighborhood green spaces and mental illness. Researchers found that individuals with a high level of nature access also had significantly lower depressive symptoms (Beyer et al. 2014). This indicates that exposure to nature may have beneficial effects on levels of depressive symptoms.

*Hypothesis 3:* Exposure to nature at work will be negatively related to employee levels of depressive symptoms.

## Attention Restoration Theory

Nature's ability to function as a job resource can be understood through the Attention Restoration Theory (Kaplan 1995). The Attention Restoration Theory presents a model which delineates the relationships between directed attention, fatigue, and attention restoration. Directed attention, generally defined, is the ability to concentrate and place cognitive resources into a present task or activity. Directed attention demands high effort and self-regulation to prevent distraction and is essential in achieving focus (Kaplan 1995). Mental fatigue occurs when levels of directed attention have been high and prolonged, so much so that the individual experiences mental exhaustion. Lastly, the model presents that attention restoration is the ability to overcome mental fatigue and once again be able to engage in directed attention.

Attention Restoration Theory maintains that attention restoration can occur when individuals take steps to engage in experiences that provide the mindset of being away, fascination, extent, and compatibility (Kaplan and Kaplan 1989). *Being away* captures an individual's ability to gain psychological distance from day-to-day schedules and anxieties, *fascination* addresses an individual's ability to be positively drawn to and engaged in considering environmental elements, *extent* addresses the environment's ability to provide opportunity for psychological exploration, and *compatibility* addresses the degree to which there is a match between the individual's interests/desires and their present environment (Korpela et al. 2001).

Kaplan (1995) declares that nature contains all of the elements that are necessary for and contribute to attention restoration. Viewing nature allows the individual to feel that they are "getting away" from their present situation; nature is said to be fascinating; nature can provide a sense of extent; and nature is highly compatible with human experience (Kaplan 1995). For example, consider the natural experience of lying on a blanket in the grass, in a large public park. This would likely provide an experience of *being away* from modern-day life and feel highly *compatible* with individual needs to be in close proximity to nature. Additionally, there would likely be many elements of nature that could lend to experiencing *fascination*, such as viewing a fluttering butterfly or swaying leaves. Lastly, this natural experience could also lend itself to a high level of *extent*, such as staring up at the sky and clouds and pondering the meaning of life. A number of studies have cited nature's attention restoration abilities as the mechanism that underlies a number of psychological outcomes, including increasing individuals' general health, directed attention, and positive affect (Bowler et al. 2010; Hartig et al. 1991; Raanaas et al. 2011).

The present study posits that exposure to nature reduces workplace strain outcomes by providing employees with an increased ability to engage in directed attention. Exposure to nature has exhibited the effect of restoring attention and decreasing mental fatigue across a multitude of studies. In one study, researchers asked participants to engage in a proofreading task in either an urban setting or a nature-based setting. The participants who completed the task in the nature-based setting performed significantly better than those in the urban setting (Hartig 1991). Another study examined the effect of undergraduate students' nature views from dorm windows in relation to attention. The study found that students with highly natural window views scored significantly higher on attention tests (Tennessen and Cimprich 1995). A similar study mirrored these findings, indicating that attention was improved when participants walked in natural environments or viewed nature photos (Berman et al. 2008). Lastly, in

comparison to rural areas, urban settings aggravate emotions of anger and decrease levels of attention (Ulrich 1979).

Given that the majority of jobs in the United States are extremely cognitively and emotionally demanding (Bakker and Demerouti 2016), maintaining directed attention is vital to successful performance in the workplace. This necessitates that employees' daily work requires a large amount of directed attention, subsequently causing employees to experience high levels of mental fatigue (Akerstedt et al. 2004). However, when employees have a high level of exposure to nature in the workplace, they will have an increased ability to engage in attention restoration, resulting in higher levels of directed attention.

*Hypothesis 4:* Exposure to nature at work will be positively related to employees' levels of directed attention.

### **Directed Attention as a Mediator of the Nature – Strain Relationship**

Attention Restoration Theory provides a rationale for understanding the nature – strain relationship. If employees are unable to engage in attention restoration, then they will remain in a state of elevated mental fatigue. When exposure to nature facilitates directed attention, employees will subsequently experience decreased levels of work-related strain. In other words, nature will reduce employee experiences of burnout, job dissatisfaction, and depressive symptoms, indirectly through increased directed attention.

The exhaustion subscale of burnout is attributed directly to high mental fatigue. Increased exposure to nature in the workplace will provide a resource for reducing chronic, workplace mental fatigue. Attention restoration would aid in reducing an employee's mental fatigue and provide the individual with the cognitive and emotional capacities, as well as, the energy to complete their work tasks once again.

Comparably, the subscale of disengagement will be reduced when restorative experiences reduce the occurrence of monotony and satiation. When individuals are experiencing an inability to engage in directed attention, they will be unable to maintain focus and work tasks will likely feel repetitive and monotonous. Additionally, a lack of attention will also lead to perceived satiation, when employees are frustrated by the inability to successfully complete job tasks due to circumstances of distraction and poor concentration. Exposure to nature will alleviate both negative mental states through attention restoration. While nature exposure reduces *exhaustion* through increasing employees' cognitive and emotional capacities required to engage in work performance, nature exposure reduces *disengagement* by addressing the motivational elements involved when performing and focusing on a job task. In other words, enhanced cognitive functioning, facilitated by high levels of nature exposure, will allow employees to be more engaged when on the job. Therefore, exposure to nature will indirectly decrease both exhaustion and disengagement, through the mechanism of attention restoration.

With regard to job dissatisfaction, the benefits of exposure to nature in the workplace can be understood through an examination of the relationship

between job satisfaction and mental fatigue. Employees that experience a high level of mental fatigue on the job have been shown to have significantly higher levels of job dissatisfaction (Khaleque et al. 1992). This is due to the fact that mental fatigue is cognitively taxing and leads to elevated feelings of irritability (Griffin et al. 1986; Kuo and Sullivan 2016; Thackray et al. 2007). It is likely that high levels of mental fatigue and irritability will lead employees to perceive that their job does not fulfill their values, thus increasing job dissatisfaction. Since nature exposure has demonstrated the ability to restore attention in mentally fatigued individuals, it is likely that job dissatisfaction will be reduced when exposure to nature is high.

Lastly, depressive symptoms are often linked to poor attentional abilities, especially due to cognitive distraction (i.e., heightened rumination; Lynn et al. 2010). Thus, many interventions aimed at alleviating depressive symptoms will utilize activities that seek to improve the individual's ability to shift and more intentionally focus their attention (Lynn et al. 2010; Papageorgiou and Wells 2000). As such, it is likely that nature will be a beneficial source of attention restoration in the workplace and will aid in reducing subsequent depressive symptoms.

*Hypothesis 5:* Directed attention will be negatively related to employee levels of exhaustion (a), disengagement (b), job dissatisfaction (c), and depressive symptoms (d).

*Hypothesis 6:* Directed attention will mediate the relationship between exposure to nature at work and exhaustion (a), disengagement (b), job dissatisfaction (c), and depressive symptoms (d) Fig. 1.

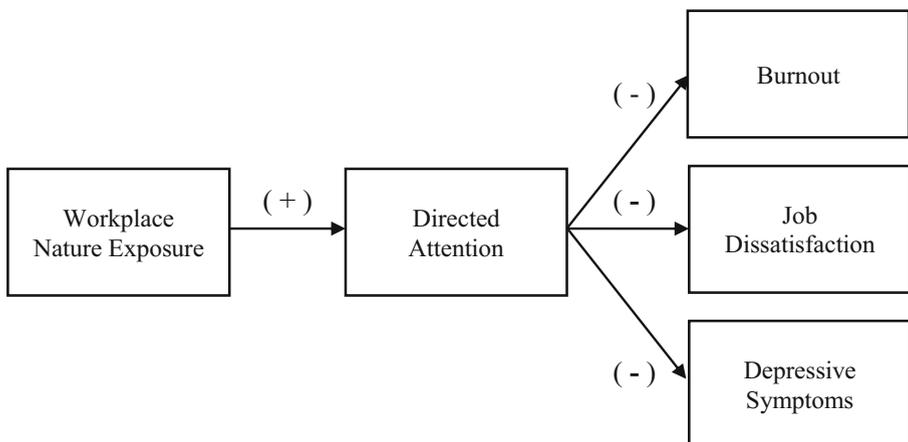


Fig. 1 Model of Nature Exposure and Strain at Work

## Methods

### Sample and Procedure

Exposure to nature at work is most beneficial to employees who do not otherwise access nature during their workday, as the benefit of nature exposure is dependent on whether or not the employee has frequent exposure to nature as a condition of their present employment (Lottrup et al. 2012). Similarly, holding employment in a rural area reduces the importance of an office's exposure to nature, as the employee is benefiting from nature at other times throughout the week (Wells and Evans 2003; Ulrich 1979). Therefore, the present study examined those individuals who worked in an urban office setting, as the literature indicates that these employees will have the most to gain from increased exposure to nature in the workplace. To be included in the study, participants were required to be over the age of 18, work in the USA, and spend at least 90% of their working hours in an urban office space. The sample excluded individuals who worked from home. Lastly, participants were required to pass at least 4 of 5 total attention checks to ensure high data quality (i.e. "Please select 'Neither agree nor disagree'").

The study consisted of a two-wave panel design, with a time lag of three to four weeks between survey 1 and survey 2. While 225 participants met eligibility requirements at Time 1, data were captured from only 176 participants at Time 2, due to attrition. Participants who only responded at Time 1 were not used in analyses. For both surveys, data were collected online via Qualtrics survey. Participants were identified through convenience and snowball sampling methods. Participants received a \$10 e-gift card for successful survey completion at each time point.

The sample ( $N = 176$  matched pairs) was composed of predominately female (81.8%) employees, with a mean age of 31.9 ( $SD = 8.8$ ). The majority of the sampled employees held at least a bachelor's degree (56.8%) and worked an average of 43.8 h a week ( $SD = 6.0$ ), with an average company tenure of 3.8 years ( $SD = 4.6$ ). Participants reported a wide range of ethnic/racial backgrounds (45.5% Caucasian, 33.0% Hispanic/Latino, 10.5% African American, 4.8% Asian, 1.4% Arab, and .5% Native American).

All measures were collected at Time 1 and Time 2, with the exception of demographic variables. Logistic regression analyses were conducted to examine whether any of the study's variables (measured at Time 1) predicted participants' membership in the Time 1 only or full panel data groups (Goodman and Blum 2016). Analyses indicated that Time 1 Only participants ( $M = 4.78$ ,  $SD = 1.20$ ) had significantly higher levels of depressive symptoms than the individuals that participated in both waves ( $M = 3.78$ ,  $SD = 1.14$ ;  $Wald = 5.45$ ,  $p < .05$ ).

### Measures

*Workplace Exposure to Nature* was measured through the Nature Contact Questionnaire. This empirically-validated questionnaire assesses employees' exposure to nature

in the workplace (Largo-Wight et al. 2011a, b). The questionnaire included subscales of outdoor nature contact, indoor nature contact, and indirect nature contact. The outdoor nature contact subscale (4 items) assessed employees' exposure to nature outdoors while at work; a sample item was "Last week (Monday-Friday), how many days did you spend a morning or afternoon work break outside?" Participants had 6 response options of: 0, 1, 2, 3, 4, 5+ days. The indoor nature contact subscale (6 items) captured employees' exposure to nature indoors while at work; a sample item was "Last week (Monday-Friday), how many live plants or flower arrangements did you have in your primary work space?", with the response options of: 0, 1, 2, 3, 4, 5+. Lastly, the indirect nature contact subscale (3 items) assessed employees' exposure to nature indirectly while at work; a sample item was "In your primary work space last (Monday-Friday), what percentage of the time did you have sunlight lighting your space?" Participants responded on the following time percentage scale: 0%, 1–20%, 21–40%, 41–60%, 61–80%, 81–100%. An overall nature exposure score was calculated by averaging the mean scores from all three subscales (Largo-Wight et al. 2011a, b). This scale is considered a causal indicator scale, at both the item and scale level, as employees' exposure to the numerous sources of nature contact at work are not expected to be highly related. For instance, although an employee may choose to display a photo of nature, they might not have the ability to view nature outside an office window.

*Directed Attention* was measured with a 7-item scale of effective attention, drawn from the Attentional Function Index (Cimprich et al. 2011). An example attentional item is: "At this time, how well do you feel you are able to do things that take time and effort". Participant responses were measured on a 5-point scale ranging from 1 = not at all to 5 = extremely well.

*Burnout* was measured through the subscales of exhaustion (4 items) and work disengagement (9 items) from the Job Demands-Resources Questionnaire (Bakker and Demerouti 2016). A sample item of exhaustion is: "After my work, I usually feel worn out and weary", and responses were measured on a 4-point scale from strongly disagree to strongly agree. Work disengagement was measured by reverse coding individuals' scores on work engagement. A sample item was: "In my job, I feel strong and vigorous." Responses were measured on a 7-point scale from 0 = never to 6 = always.

*Job Dissatisfaction* was assessed through the reverse coding of participants' responses to the 3-item, job satisfaction subscale of the Michigan Organizational Assessment Questionnaire (Cammann et al. 1979). A sample item was: "All in all, I am satisfied with my job." Responses were measured on a 5-point Likert type scale with higher scores representing higher levels of job dissatisfaction.

*Depressive Symptoms* were measured with Dormann and Zapf's (2002) shortened version of Mohr's (1986) depressive symptoms scale (3 items). Participants were asked to indicate how often they experienced a variety of depressive symptom indicators, such as: "I feel alone even when I am with others." Individuals' responses were rated on a 7-point scale from 1 = strongly disagree to 7 = strongly agree.

*Demographics* included participants' gender, age, ethnicity, education level, employment contract, occupational tenure, and number of hours worked per week.

## Statistical Analysis

The PROCESS macro for SPSS version 2.6.13 (Hayes 2013) was used to test the mediated model of exposure to nature on strain outcomes, through directed attention. As exposure to nature provides nearly immediate attention restoration experiences, both workplace exposure to nature and directed attention were drawn from participant data captured at Time 1. Statistical analyses were conducted with employee strain levels at Time 2 as the criterion variable (i.e., exhaustion, disengagement, job dissatisfaction, and depressive symptoms).

## Results

Visual inspection of the scatter plots for the relations among exposure to nature, directed attention, and strain outcomes (exhaustion, disengagement, job dissatisfaction, and depressive symptoms) indicated that all relations were linear. Hypothesis 1(a) and 3 (see Table 1) were not supported, given that exposure to nature (Time 1) was not significantly related to exhaustion or depressive symptoms (Time 2;  $r = -.04$  and  $-.11$ , respectively,  $p > .05$ ). However, exposure to nature was significantly and negatively related to the strains of disengagement and job dissatisfaction (Time 2;  $r = -.22$ , and  $-.19$  respectively,  $p < .05$ ), indicating support for hypotheses 1(b) and 2. When the cross-sectional correlations between variables of Time 1 nature exposure and Time 1 strains were examined, the correlations ranged from  $r = -.18$  to  $-.10$  (see Table 1). Hypothesis 4 was also supported, indicating that Time 1 exposure to nature was significantly and positively related to employees' levels of Time 1 directed attention,  $r = .16$ ,  $p < .05$ .

Further, in reference to hypothesis 5(a-d), directed attention (Time 1) was negatively and significantly related to (a) exhaustion ( $r = -.40$ ,  $p < .05$ ), (b) disengagement ( $r = -.45$ ,  $p < .05$ ), (c) job dissatisfaction ( $r = -.38$ ,  $p < .05$ ), and (d) depressive symptoms ( $r = -.32$ ,  $p < .05$ ), as predicted. Similarly presented in Table 1, the cross-sectional correlations between Time 1 directed attention and Time 1 strains ranged from  $r = -.52$  to  $-.40$ .

Next, the PROCESS Macro on SPSS was used to test the direct and indirect relationships between nature, directed attention, and the strain outcomes of interest. Specifically, directed attention was tested as a potential mediator of the association between exposure to nature and the strain outcomes of: exhaustion, disengagement, job dissatisfaction, and depressive symptoms. The PROCESS macro utilized an indirect effect approach to determine if there was a significant difference between path  $c$  (nature – strain) and path  $c'$  (nature – strain, while controlling for directed attention). This difference was estimated by “ $ab$ ” and was considered statistically significant when confidence intervals did not include zero. The mediation path analyses utilized bootstrapping methodology (1000 bootstrapped samples), which yielded a sampling distribution of indirect effects from which standard errors and bias-corrected 95% confidence intervals (CIs) were calculated (Preacher and Hayes 2008). The mediation models for each strain outcome are shown in Table 2.

Significant indirect effects were supported across all four strains. The results indicated that exposure to nature had a significant indirect effect on (a) exhaustion (indirect  $ab$  effect =  $-.02$ ,  $CI_{95} = -.054$  to  $-.001$ ,  $R^2 = .16$ ,  $c'$  effect =  $.01$ ,  $p = .70$ ), (b) disengagement (indirect  $ab$  effect =  $-.04$ ,  $CI_{95} = -.083$  to  $-.001$ ;  $R^2 = .22$ ,  $c'$  effect =  $-.08$ ,  $p < .05$ ), (c) job dissatisfaction (indirect  $ab$  effect =  $-.03$ ,  $CI_{95} = -.085$  to  $-.002$ ,  $R^2 = .16$ ,  $c'$  effect =  $-.08$ ,  $p = .06$ ), and (d) depressive symptoms (indirect  $ab$  effect =  $-.03$ ,  $CI_{95} = -.076$  to  $-.002$ ,  $R^2 = .10$ ,  $c'$  effect =  $-.04$ ,  $p = .41$ ) through directed attention, in full support of hypothesis 6(a-d).

## Discussion

This study tested the indirect effect of workplace exposure to nature on employee strain outcomes, through directed attention, using panel data at two time points. The results demonstrated that exposure to nature in the workplace does indeed act, indirectly, as a job resource to aid in reducing the strain outcomes of burnout, job dissatisfaction, and depressive symptoms. Specifically, nature exposure acts as a job resource to decrease strain by increasing employees' abilities to engage in attention restoration. Results demonstrated that as exposure to nature in the workplace increased, so did employees' directed attention. In turn, employees who were able to successfully engage in directed attention experienced less work-related strain (across all four strain outcomes).

The contributions of this study are two-fold. Firstly, this research investigation serves as the first study to introduce the benefits of nature exposure to the occupational health psychology literature. Therefore, this investigation aims both to converge literature across diverse disciplines and to further explore the restorative abilities of nature exposure in a work-based setting. Hence, bringing attention to a novel and beneficial resource in the study of job strains. We provide the first in-depth examination of the relationships between workplace exposure and unique occupational health strain outcomes.

Explicitly, this study is the first study to examine the relationships between exposure to nature at work and employees' reported strain levels on the variables of burnout, job dissatisfaction, and depressive symptoms. While several previous research investigations have examined nature in relation to general strain outcomes (Keniger et al. 2013), few have examined nature exposure in the workplace, and next to none have examined specific strain outcomes. This study aims to fill this gap in literature and provide a foundation for which to understanding the nature exposure – strain relationship.

Secondly, the present study is the first to investigate the mechanism by which nature exposure alleviates employee strain. While the Attention Restoration Theory has been widely utilized as theoretical framework for understanding nature exposure's relationship to wellbeing, no studies have tested the underlying mechanism of directed attention in relation to strain outcomes. Thus, not only does the study demonstrate that nature exposure can be successfully utilized to reduce specific strain outcomes related to occupational health research, but it is also the first to provide data to help to explain the "why" as well.

However, it should be noted that the non-significant direct relationships between exposure to nature and the strains of exhaustion and depressive symptoms were unexpected in light of previous support for nature's ability to reduce mental fatigue and improve life satisfaction (Annerstedt and Währborg 2011; Berman et al. 2008; Bowler et al. 2010; Keniger et al. 2013; Tennessen and Cimprich 1995). These results may be due to a weakness in our measurement of nature exposure at work, given its limited conceptualization of the construct. Specifically, while the measure focused on the quantity of natural elements at work, perhaps the quality of the nature exposure is most relevant in strain reduction. Quality may be added to the quantity of an individual's nature exposure, according to past greenspace planning literature, through the three mechanisms of: being aesthetically pleasing, stimulating physical activity, or by facilitating social experiences (van Dillen et al. 2012). Future investigations should seek to measure exposure to nature at work more comprehensively.

### Theoretical Implications and Future Research

The present study carries important theoretical implications for the development of stressor-strain literature and for the consideration of nature exposure as a job resource. This study presents data indicating that exposure to nature may be a beneficial job resource for strain reduction in office-based workplaces (functioning indirectly through the mechanism of directed attention). Future research should expand on the findings of the present study, so as to replicate and extend findings to other strain outcomes.

For instance, a future strain outcome that could be explored in relation to nature exposure is sleep. There has been a high level of interest in sleep by occupational health researchers, as accumulating evidence suggests that many employees suffer from poor sleep outcomes, related to both sleep quality and quantity (CDC 2018; Litwiller et al. 2017). There is a clear need for additional resources to alleviate employee sleep disturbances and nature exposure may be one solution. Unsurprisingly, there is a lack of research directly relating nature exposure to employee sleep. However, some researchers argue that nature can be utilized as an alternative to pharmaceutical medication use, and that the absence of sleep-disrupting side effects from medication can likely improve sleep outcomes (Faber Taylor and Kuo 2011; Taylor et al. 2001). Nature exposure has also been linked to improved sleep outcomes in dementia patients (Bossen 2010). Therefore, there are some indications that increased exposure to nature at work may improve employee sleep outcomes as well.

Further, given the present findings that suggest that nature exposure acts as a job resource, future studies could examine whether exposure to nature in the workplace could be incorporated into existing occupational health theory. For example, workplace nature exposure has the potential to act as a job resource to significantly buffer the relationship between workplace demands and strain outcomes. As such, nature exposure could be explored as an additional resource to be integrated in the Job Demands-Resource (JD-R) model (Bakker and Demerouti 2007). Similarly, future research would benefit from the consideration of how nature-based strain reduction might impact other organizational

outcomes of interest, particularly job performance. Due to nature's ability to restore attention, it is likely that nature exposure may aid in task performance by reducing mental fatigue and by improving directed attention (Kaplan 1995; Keniger et al. 2013; Tennessen and Cimprich 1995).

Another stream of occupation health research that may benefit from the inclusion of nature exposure is workplace ostracism. Ostracism is highly pervasive within work contexts and results in a number of negative organizational outcomes, ranging from reduced job performance to increased withdrawal and workplace deviance (Robinson et al. 2013). However, interestingly, a recent study found that nature exposure was able to moderate the relationship between feelings of ostracism and subsequent levels of aggression (Poon et al. 2016). Therefore, future research should explore whether exposure to nature can act as a resource and buffer the relationship between ostracism and aggression/ strain in a work context.

It would also be beneficial to examine the role of individual differences when studying nature exposure at work. For instance, an individual's preference for nature has been measured with scales of "emotional affinity towards nature" or "nature-relatedness" (Kals et al. 2016; Nisbet et al. 2008). One future research avenue is the exploration of individual preferences for nature exposure in relation to strain reduction. For instance, the benefits derived from nature at work may be dependent upon an employee's level of nature-preference. This is just one example of the individual differences that could be explored as moderators of the nature – strain relationship, to further inform the role of nature exposure in the workplace.

Additionally, future research should consider the role that nature exposure could play in the stress management intervention literature, as the present study indicates that nature exposure can aid in reducing negative workplace strain outcomes. As such, future research should consider the use of nature exposure as a method of providing secondary prevention for strain outcomes, through the use of a nature-based stress management training. For example, employees experiencing strain could be provided with a stress management training that incorporates time for restoration in local parks, nature reserves, or possibly a rooftop garden or greenhouse, if the organization has access to such a location. In such an intervention, exposure to nature may act as a job resource to buffer the relationship between workplace demands and strain outcomes.

Lastly, the present nature at work measure assessed a wide variety of ways in which employees might come into contact with nature outdoors, indoors, and indirectly in the workplace (Largo-Wight et al. 2011a, b). Future studies should examine the varying types of nature exposure at work and how each might differentially impact the nature exposure – strain relationship. For example, it is possible that exposure to sunlight during the workday provides significantly more strain reduction than direct exposure to nature during break periods. This is an important future area of investigation, as it will enable more tailored interventions and strain prevention strategies to be implemented. However, to examine these research questions, we believe that additional targeted experimental research investigations will be necessary.

## Practical Implications

In addition to providing an empirical foundation for future occupational health, nature-based research, this study has many exciting practical implications for the incorporation of nature in the workplace. The present study's results demonstrate that increased exposure to nature in the workplace has the potential to be an incredible resource for preventing and relieving employee strain in practice, through its ability to increase employee attention.

On an organizational level, companies should consider how the physical work environment could be designed to maximize employees' access and exposure to nature during the workday. This could involve taking preemptive actions, such as selecting workspaces based in biophilic architecture (Soderlund and Newman 2015). For instance, organizations can select spaces that feature numerous windows, rooftop gardens, or outdoor meeting spaces. Or, organizations could even decide to headquarter in cities that promote natural urban spaces and parks, specifically designed with citizen health in mind (Dye 2008; Panagopoulos et al. 2016).

However, organizations, which would have difficulty making any significant changes to existing headquarters, can also increase the amount of plants and natural elements that exist in the current workspace. Natural elements could be added to offices, break rooms, hallways, conference rooms, etc. This would be especially advantageous as literature suggests that adding nature to shared areas may even increase their use (Coley et al. 1997). Lastly, organizations could also encourage employees to take short breaks in natural spaces, promote the practice of scheduling walking meetings outdoors, and otherwise capitalize on any nature-based areas that are currently being underutilized.

This study also has practical implications for individuals within organizations, especially those with traditional office jobs and working in urban settings. Individuals should be encouraged to maximize their own exposure to nature. This could include employees bringing aesthetically-pleasing potted plants or cacti into their office space, hanging pictures of nature scenes on the walls, opening any window blinds for increased sunlight, and taking the initiative to spend lunches or breaks at nearby parks or nature-based areas.

## Limitations

This research is limited by the fact that the sample was gathered via convenience sampling methods. Ideally, participants would have been randomly selected from our population of interest to minimize bias and sampling error. There may exist particular, unidentifiable characteristics of the individuals who agreed to partake in the study that differ from those who chose not to participate. However, the participants in the sample displayed a wide range of response variability with regard to nature exposure, directed attention, strain outcomes, affective variables, industry type, and demographic characteristics. This range of responses indicates that the convenience sampling was likely sufficient to capture individual variability within the target population.

Another potential limitation of this study is the length of time between the Time 1 and Time 2 data collections. One of the primary benefits of utilizing a two-time point, full panel

design is the ability to capture the lagged effects of nature exposure and directed attention on employee strain outcomes. It is possible that 3 to 4 weeks is inadequate for full strain reduction. However, given that there is no academic standard or evidence to establish the time lag that is necessary for the causal variables to influence the causal variables of interest (Taris and Kompier 2003), a window of 3 to 4 weeks was deemed as sufficient for measuring these lagged effects.

An additional limitation of this investigation is the concern that the present study may be subject to common method variance, as all of the measures were gathered via self-report. However, the use of self-report scales may not, in actuality, pose concerns to internal validity. Spector (1999, 2016) demonstrates that measuring stressor-strain variables through self-report (such as perceived job demands and perceived strain outcomes) likely does not inflate the obtained correlational values. Further, Spector (2016) maintains that self-report measurement is often the most suitable method of capturing the internal states and attitudes measured by stressor and strain variables. Further, the self-reported directed attention measure did not utilize instructions that were tailored to be specific to participants' workplace context. While this question followed other measures in the survey questionnaire which asked the participant to consider the workplace context specifically, this presents another limitation of the self-reported measures used in this study.

Lastly, the study was limited by moderate rates of attrition from Time 1 to Time 2. Although participants who only responded at Time 1 were not used in analyses, it should be noted that this group of *Time 1 Only* participants reported significantly higher levels of depressive symptoms. Individuals facing depression often find it difficult to complete everyday tasks, stemming from low levels of generalized life motivation (Smith 2013). This might help explain the large amount of study drop-out from Time 1 to Time 2 for those individuals with high depressive symptoms. Had this group of individuals participated in Time 2 as well, the addition of these individuals may have impacted the study's finding. It is possible that exposure to nature could have been even more beneficial for this group of participants, as they experienced higher levels of strain to begin with. However, the present findings may not generalize to populations of employees suffering from higher levels of depressive symptoms, clinical depression or other mental illnesses.

## Conclusion

Overall, nature exposure is a fascinating, often free, job resource that has been scarcely investigated in the workplace context. Taking an interdisciplinary approach to occupational health research has enabled the authors to bring the topic of exposure to nature in the workplace to the forefront of the employee wellness literature. The present study discovered that increased exposure to nature at work does indeed provide individuals with indirect strain relief, particularly for the organizational strains of burnout, job dissatisfaction, and depressive symptoms. As such, this restorative ability of nature ought to be studied further and fully harnessed to reduce employee strain outcomes.

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## Appendix

Table 1 Means, standard deviations, and intercorrelations of variables

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12
1. Exposure to Nature <sup>1</sup>	6.32	1.89	**											
2. Directed Attention <sup>1</sup>	3.69	0.61	-0.16*	(.82)										
3. Exhaustion <sup>1</sup>	2.82	0.67	-0.11	-0.50*	(.84)									
4. Disengagement <sup>1</sup>	2.27	0.97	-0.16*	-0.52*	0.48*	(.91)								
5. Job Dissatisfaction <sup>1</sup>	1.32	1.13	-0.18*	-0.46*	0.59*	0.73*	(.93)							
6. Depressive Symptoms <sup>1</sup>	3.78	1.14	-0.10	-0.40*	0.35*	0.38*	-0.34*	(.76)						
7. Exposure to Nature <sup>2</sup>	6.35	2.11	-0.72*	-0.15*	-0.12*	-0.18*	-0.19*	-0.13*	**					
8. Directed Attention <sup>2</sup>	3.64	0.67	-0.21*	-0.56*	-0.40*	-0.44*	-0.38*	-0.34*	-0.27*	(.87)				
9. Exhaustion <sup>2</sup>	2.82	0.70	-0.04	-0.40*	0.69*	0.40*	0.51*	-0.38*	-0.09	-0.43*	(.83)			
10. Disengagement <sup>2</sup>	2.37	1.06	-0.22*	-0.45*	0.51*	0.83*	0.69*	-0.32*	-0.17*	-0.56*	-0.55*	(.94)		
11. Job Dissatisfaction <sup>2</sup>	1.41	1.14	-0.19*	-0.38*	0.59*	0.63*	0.78*	-0.29*	-0.15*	-0.49*	-0.59*	0.77*	(.91)	
12. Depressive Symptoms <sup>2</sup>	3.30	1.19	-0.11	-0.32*	0.22*	0.24*	0.27*	-0.79*	-0.09	-0.38*	-0.38*	0.26*	0.27*	(.80)

*N* = 176. \**p* < .05, two-tailed. \*\*Indicates causal indicator scale. Variables with a <sup>1</sup> superscript indicates Time 1 variable, variables with a <sup>2</sup> superscript indicates Time 2 variable. Alpha coefficients displayed on the diagonal

**Table 2** Directed attention as a mediator of the nature at work – strain relationship

Direct Effects	<i>Exhaustion</i>				<i>Disengagement</i>			
	C	SE	t	p	C	SE	t	p
Constant	3.46*	.16	20.95	.00	3.36*	.16	20.95	.00
Nature → Attention ( $a_1$ )	0.05*	.02	2.12	.04	0.05*	.02	2.12	.04
Model R <sup>2</sup>	.03*				.03*			
Constant	4.48*	.32	13.98	.00	5.60*	.47	12.04	.00
Attention → Strain ( $b_1$ )	-0.47*	.08	-5.80	.00	-0.73*	.12	-6.24	.00
Nature → Strain ( $c'$ )	0.01	.03	0.39	.70	-0.08*	.04	-2.22	.03
Model R <sup>2</sup>	.16*				.22*			
Indirect Effect	Effect	SE	95% CI		Effect	SE	95% CI	
Nature → Attention → Strain ( $ab$ )	-.02	.01	[-.054 to -.001]		-.04	.04	[-.083 to -.001]	
	<i>Job Dissatisfaction</i>				<i>Depressive Symptoms</i>			
Direct Effects	C	SE	t	p	C	SE	t	p
Constant	3.36*	.16	20.95	.00	3.36*	.16	20.95	.00
Nature → Attention ( $a_1$ )	0.05*	.02	2.12	.04	0.05*	.02	2.12	.04
Model R <sup>2</sup>	.03*				.03*			
Constant	0.63	.52	1.21	.23	2.34*	.56	4.16	.00
Attention → Strain ( $b_1$ )	-0.67*	.13	-5.07	.00	-0.60*	.14	-4.22	.00
Nature → Strain ( $c'$ )	-0.08	.04	-1.87	.06	-0.04	.05	-0.83	.41
Model R <sup>2</sup>	.16*				.10*			
Indirect Effect	Effect	SE	95% CI		Effect	SE	95% CI	
Nature → Attention → Strain ( $ab$ )	-.03	.04	[-.085 to -.002]		-.03	.05	[-.076 to -.002]	

$N = 176$ , \*  $p < .05$ . C, Coefficient; SE, Standard error; CI, confidence interval; R<sup>2</sup>, percentage of variance accounted for in job strains by predictors. All analyses used 1000 bootstrapped samples

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