

A positive relationship between nature appreciation, emotional functioning, and perception of work value

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Previous research has noted potential emotional benefits of being in nature. This study examined whether nature appreciation is also positively related to perception of work-value. Frequency of nature appreciation and a number of variables related to emotion, well-being, and perceived work value were analyzed using hierarchical regression techniques with a publicly available data set, consisting of a large sample of middle-aged and older adults. Nature appreciation was significantly associated with certain emotional outcomes including increased positive affect, well-being, as well as reduced perceived stress. Nature was also associated with increased epinephrine, implying a complex relationship between nature and emotion regulation. Nature offers numerous benefits for individuals across the spectrum of psychological functioning. The findings are relevant for psychologists in promoting the well being of workers.

Work in the modern era is commonly characterized by cognitive demands, which can lead to stress and increased errors due to sustained mental effort (Hancock, 2009). Prior research indicated that exposing people to nature can remediate the negative performance effects of these work-related cognitive demands. For instance, after being exposed to nature environments, participants demonstrated improved performance on tasks that required controlled attention and executive function (Berman, Jonides, & Kaplan, 2008).

Environmental psychologists have noted that observing nature scenery results not only in improved performance on cognitively demanding tasks, but may also remedy negative affect, including mental fatigue and stress (Kaplan, 1995). It has also been found to contribute to increased vitality (Ryan, Weinstein, Bernstein, Brown, Mistretta, & Gagné, 2010). This is significant because negative affect is associated with decreased productivity and an increased risk for developing psychological disorders (Oswald, Proto, & Sgroi, 2009; Tannen, 2001). The effectiveness of nature appreciation in limiting negative affect has been previously established (Maller, Townsend, Pryor, Brown, & Leger, 2006; Ryan, et al., 2010). For example, the availability of a good window view in an office reduced psychological discomfort (Aries, Veitch, & Newsham, 2010). The beneficial effects of nature for cognitively demanding tasks and affective states might be due to the need for sufficient cognitive resources for both high performance (Wickens & Hollands, 2000) and positive affect (Hockey, 1997). Humans have an inherent interest for nature scenery due to a hypothesized instinctual preference for green environments (Frumkin, 2001). This interest allows people to attend to the features of nature without expending mental effort, allowing diminished attentional resources to recuperate (Kaplan 1995). Alternatively, humans may be attuned to sensory variability (Fontanini & Katz, 2008), which is provided by complex green environments (Heerwagen, 2009).

Well-being and Work Value

Beyond alleviating negative affect, researchers and employers may want to consider employees' general well-being (life-satisfaction) as well as the meaningfulness workers

perceive in their profession. This may be relevant because well-being as measured by life satisfaction contributes significantly to job satisfaction (Judge & Watanabe, 1993). Increased general well-being and work seen as valuable and meaningful (work value) have been related to work satisfaction, and increased work satisfaction has been linked to improved work productivity (Judge, Thoresen, Bono, & Patton, 2001). Also, perceived work value has been linked to increased work engagement and reduced burnout (Schaufeli, Baker, & Salanova, 2006). Nature appreciation could therefore not only influence affective states like depression and stress, but also positively impact well-being (White, Alcock, Wheeler, & Depledge, 2013) as it may provide the needed mental vitality to allow individuals to potentially consider and cognitively reappraise both the evaluation of their life circumstances along with the value of their work.

Goals of the Current Study

The goals for the current study were twofold. The first goal was to replicate and extend the previously established relationships between nature appreciation and increased positive affect and reduced stress, given the previously mentioned theoretical or empirical support for these relationships. This was investigated with related questionnaires and biochemical measures.

The second goal was to determine whether nature appreciation is related to both well-being and perceived work value, respectively, because nature might aid in cognitively reappraising the value of one's occupation. Understanding the impact of nature appreciation on well-being and work value is relevant because prior research has indicated a positive association between life and work satisfaction with improved work behavior (Judge, Thoresen, Bono, & Patton, 2001). There is a reasonable distinction to be made between positive affect and evaluated well-being, the latter being a more cognitive judgment of life satisfaction (Kahneman & Riis, 2005). In the current study, the term well-being should be taken to refer specifically to this cognitive evaluation of well-being, not an estimation of the degree of positive affect, although both elements ultimately comprise overall happiness in life. Well-being here is measured by a scale on life-

satisfaction and by scale measuring the tendency to experience gratitude. Gratitude is strongly related with well-being via mechanisms not directly associated with positive affect, such as dominant mental or cognitive schemata that filters how grateful individuals interpret events (Wood, Fro, & Geraghty, 2010).

By considering positive affect, well-being, and perceived work value, this study aims to clarify whether nature may play a positive role in the work environment beyond simple alleviation of negative affect.

Method

The research team utilized publicly available data sets from the second national survey of Midlife Development in the U.S. (MIDUS II; <http://midus.wisc.edu/>). The specific data set was the MIDUS II Biomarker dataset (Ryff, Seeman, & Weinstein, 2010). This project was designed to delineate multiple factors influencing middle-age health. For brevity, the current authors restricted the analyses to variables relevant to the present questions concerning nature appreciation, affect, well-being, and work value (Table 1). Research subjects participated at the University of Wisconsin – Clinical and Translational Research Core (UW-CTRC).

The Biomarker dataset. The Biomarker dataset assessed variables of interests at an on-site session (see Table 1) as well as question 10a: “Over the past month, how often did you spend time appreciating nature?” The following three answer options were given: 1) Never; 2) 1-6 times; and 3) 7+ times. Participants were 333 men and 420 women, with ages ranging from 35 to 64 years (M = 51.93 years, SD = 7.48). Participants over 65 were eliminated from the analyses to focus on a non-retired sample. This dataset also contains extensive neuroendocrine data; the current study analyzed the amount of epinephrine and norepinephrine assessed for each participant given their importance to negative emotion, stress, and the “fight or flight” response, as higher elevation of these catecholamines is associated with increased emotional reactivity to fearful and stressful events (Wong et al., 2012).

Procedure

Participants were contacted by MIDUS II staff by mail, and were contacted with a follow-up call to allow participants to ask any questions about the study. Individuals who decided to take part in the study then traveled to the facility and stayed overnight. Data collection took place over two days (see MIDUS II documentation at <http://midus.wisc.edu/> for more details). The first day, participants filled out the questionnaires listed in Table 1 and began urine collection for the purpose of collecting neuroendocrine data. The participant first voided at a specified time (this sample was not used). Then each time the participant needed to void over the night, these samples were saved for analysis, culminating in a final sample collected at a specified time the next morning. Samples were processed on site using standardized procedures and then shipped to the MIDUS Biocore Lab for analysis in 15 ml aliquots.

Table 1
Variables and Questionnaires of Interest

Variables	Reference
Mood Affective Symptoms Questionnaire	Clark & Watson, 1991
Depressive Symptoms subscale	
Anxious Symptoms subscale	
Loss of Interest subscale	
Anxious Arousal subscale	
High Positive Affect subscale	
Perceived Stress Scale	Cohen, Kamarck, & Williamson 1983
Satisfaction with Life Scale	Pavot & Diener, 1993
Gratitude Scale	McCullough, Emmons, & Tsang, 2002
Work Value Composite ^a	Gardner, Csikszentmihalyi, & Damon, 2001
Epinephrine ^b	Hansen, Garde, Christensen, & Netterstrøm, 2001
Norepinephrine ^b	

^a extracted from Good Work subscale in Biomarker dataset

^b adjusted for creatinine ((Catecholamine ug/dL) / (Urine Creatinine mg/d * .001)) .

Development of the work-value composite score. The biomarker questionnaire dataset included a “good work” subscale (for a detailed description and psychometric information on the scale, please see Ryff, Seeman, & Weinstein, 2010). The authors of the present study made use of the original MIDUS II Biomarker Project data pertaining to the good work subscale and conducted a principle components analysis with varimax rotation. Utilizing the Kaiser criterion, four of the five questions on the good work subscale exclusively loaded on the same factor. A representative question asks for the degree of agreement on a statement such as “My work makes the world a better place.” Responses on these four questions were averaged together (unit-weighted) into a single composite measure to assess general perceived value of work and willingness to volunteer and contribute to work tasks. The good work subscale question “I think about the harm my work might do to other people” was excluded from the composite on the basis of the factor analysis, as it did not weigh on the same factor as the other questions did in the composite. The original subscale had a Cronbach’s alpha of 0.53, while the new scale used in the following analyses had an alpha of 0.69, making the new one more suitable for use.

Results

Multiple regression analyses were conducted to examine the predictive value of nature appreciation on the following variables consistent with (Goal 1): the scales of the Mood Affective Symptoms Questionnaire, the Perceived Stress Scale, epinephrine, and norepinephrine. Regarding the second goal, hierarchical regression analyses were conducted

to examine the predictive value of nature exposure on the following scales: Lie Satisfaction, Gratitude, and the Work Value Composite. For each of these regressions, the following served as control variables: age, gender, education level, and exercise frequency. Exercise frequency assessed regular exercise for 20 minutes or more at least 3 times a week, measured on a categorical yes or no scale. The control variables were entered as the first step, while frequency of nature appreciation was used as the primary predictor variable in the second step. For brevity, we only report the full results for the second step. In summary, when entered as a second step in the regression for the affective variables (Goal 1), nature appreciation frequency significantly predicted responses on the MASQ Depressive Symptoms, Positive Affect subscales, the Perceived Stress scale, and epinephrine. In contrast, when entered as a second step, nature appreciation did not significantly predict MASQ Anxious Symptoms, MASQ Loss of Interest, MASQ Anxious Arousal subscale scores, and norepinephrine.

When entered as a second step in the regression for the well-being and work value variables (Goal 2), nature appreciation frequency significantly predicted responses on the Satisfaction with Life and Gratitude scales, as well as the work value composite factor, see Table 3.

Discussion

The goals of this study were as follows: 1) to replicate and extend the relationships between frequency of nature appreciation, affect, and stress; and 2) to assess whether increased nature appreciation would positively influence estimated well-being and higher perceived work value. In a sample of middle-aged and older adults, results indicated that frequency of nature appreciation positively predicted positive affect and reduced perceived stress. Frequency of nature appreciation also negatively predicted depressive symptoms, but positively predicted epinephrine.

Similarly, frequency of nature appreciation was significantly and positively related to well-being constructs including life satisfaction and gratitude. Finally, frequency of nature appreciation positively predicted the perception of work value; this relationship was partially mediated by the degree of positive affect experienced by individuals during exposure to nature.

Nature, positive affect and stress

Frequency of nature appreciation was strongly related to positive affect and reduced depressive symptoms. This is of particular significance to those interested in increasing positive experience and creative thinking styles typical of those experiencing positive affect (e.g., broadening of attention; see Fredrickson & Branigan, 2005). Creativity is linked to both productivity and sustainability in complex work environments (Lukersmith & Burgess-Limerick, 2013).

Table 2

Regression analysis predicting affect variables

Predicted and Predictor		R ²	ΔR ²	B
MASQ - Depressive Symptoms				
Step 1		.024***	.024***	
Step 2		.033***	.008**	
	Nature Exposure			-.094*
MASQ - High Positive Affect				
Step 1		.034***	.034***	
Step 2		.070***	.036***	
	Nature Exposure			.193***
Perceived Stress Scale^a				
Step 1		.049***	.049***	
Step 2		.066***	.017***	
	Nature Exposure			-.131***
Epinephrine^b				
Step 1		.017*	.017*	
Step 2		.023*	.006*	
	Nature Exposure			.077*

* $p < .05$, ** $p < .01$, *** $p < .001$

^a n = 751; ^b n = 739

Table 3

Regression analysis predicting well-being variables

Predicted and Predictor Variables		R ²	ΔR ²	B
Satisfaction with Life Scale^a				
Step 1		.025***	.025***	
Step 2		.039***	.014***	
	Nature Exposure			.121***
Gratitude Scale^a				
Step 1		.025***	.025***	
Step 2		.043***	.017***	
	Nature Exposure			.133***
Work Value Composite^b				
Step 1		.038***	.038***	
Step 2		.055***	.018**	
	Nature Exposure			.135***

* $p < .05$, ** $p < .01$, *** $p < .001$

^a n = 751; ^b n = 748

The frequency of nature appreciation was positively related to the amount of epinephrine and not norepinephrine, when controlling for creatinine in urine (see Table 1 footnote). In terms of emotional response, both are associated with elevated arousal and anticipation, with norepinephrine associated more with aggressive states, and epinephrine with

tense, fearful states (Elmadjian, Hope, & Lamson, 1957). Individuals with higher levels of epinephrine exhibit more physiological arousal and negative emotional reactions, particularly to fearful stimuli (Mezzacappa, Katkin, & Palmer, 1999), and epinephrine is elevated in individuals with post-traumatic stress disorder (Kosten, Mason, Giller, Ostroff, & Harkness, 1987). Degree of nature appears to be positively related to epinephrine, while also being related to more positive affect and less perceived stress. This apparent contradiction can be resolved by noting that individuals who are innately more prone to experience heightened negative emotions (indicated here by elevated epinephrine) may actively use nature appreciation as a technique to manage their negative feelings or stress, and improve their emotional state.

Nature, well-being and work perception

There was a significant association between frequency of nature appreciation and perceived work value and volunteered effort, as measured by the work composite factor. When work is perceived as more valuable to the world, one is more willing to behave with integrity and significantly contribute to performing the work (Gardner, Csikszentmihalyi, & Damon, 2001). Being in nature is thought to provide mental vitality and clarity, which in turn promotes reflection and cognitive reappraisal (Staats, 2012). This process of reflection may then allow individuals to reason and clarify the value and meaning in their work and how their work contributes to the larger society. Seeing value in work should also lead to increased work satisfaction, and increased work satisfaction along with decreased stress leads to higher levels of productivity and higher work quality (Halkos & Bousinakis, 2010).

One key rationale for exploring this approach is to increase positive design (nature) into workplaces and products in order to improve quality of life and well-being. As a case in point, one measure in this study directly assessing the general construct of evaluated well-being, the Satisfaction with Life scale, was significantly related with frequency of nature appreciation.

Limitations

One of the limitations of this study is that nature appreciation was measured with one variable and it is difficult to determine what form this appreciation takes, whether it is a nature walk, a camping trip, or admiring scenery from a window. This variability may produce noise in the data, but the presence of significant effects despite this noise can ensure some confidence in its validity.

Further, the current study utilized large-scale survey data and produced significant but small effect sizes. However, because there was a limited range of possible responses for frequency of nature appreciation, the effects may be more relevant than the effect sizes would suggest, because the effects were still significant with a very limited variation of the predictor variable (Prentice & Miller, 1992). Also, recent work by White and colleagues (2013) found small but significant effects between exposure to nature and well-being

for individuals in urban communities, and argued that there is a potential cumulative benefit at larger scales, which in this context includes work organizations and society at large. While the specific types of nature needed to elicit this positive effect were not delineated in this dataset, previous research analyzing the effect of environment on attention and cognition found that environments typical of “green” nature as opposed to other forms of nature (e.g., desert scenes) led to improved outcomes, and even some thoughtfully designed urban environments could replicate this effect (Berto, Baroni, Zainagi, & Bettella, 2010).

Implications

Given that nature appreciation is linked to multiple positive outcomes in terms of well-being and affect, employers may wish to implement nature into the workspace. The present research is correlational and exact design recommendations are not warranted at this point, but some prior work indicates that plants in the office are beneficial for performance (Raanaas et al., 2011). Furthermore, given the established importance of being able to psychologically detach from work during leisure periods for reduced stress and increased engagement (Sonnetag, 2012), ensuring that location of the work environment is in a nature setting could be beneficial. However, this may not be economically feasible for many work organizations. An alternative is to design break rooms to mimic a natural environment, such as in the style of a Japanese garden. Such gardens have been shown to have significant health benefits for certain populations in terms of reduced heart rate and reduced sympathetic nervous system activity (Goto, Park, Tsunetsugu, Herrup, & Miyazaki, 2012).

Conclusion

Besides performance, well-being and happiness have become a significant goal for workspace designers. The present research focused on nature appreciation as a potential tool to promote well-being and good work by engaging in an exploratory analysis using a publically available data set. The frequency of nature appreciation was significantly associated with a number of outcome variables, suggesting a positive benefit for workers. The relationship between nature appreciation and perceived work value was of particular interest. Further research remains to be done to specify the related characteristics and boundary conditions.

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