DOI: 10.13135/2384-8677/3380

Self-reported nature exposure and its association with well-being as measured with affect and cognition

Curtis M. Craig, Brittany N. Neilson, Martina I. Klein, Randy W. Overbeek

Utilizing the publicly available MIDUS II Refresher datasets (Ryff et al., 2017) with hundreds of respondents across the United States, the authors attempted to (1) replicate and (2) extend their previous findings with the original MIDUS II data on the relationship between self-reported frequency of nature exposure and well-being, the latter holistically measured by emotional, physiological and cognitive variables (Craig, Menon, & Klein, 2015; Craig, Neilson, & Overbeek, 2016).

In the original published research, Craig and colleagues (2015) first observed an association between a 3-pt scale in which middle-aged participants reported the frequency that they appreciated nature and other reported questionnaire measures. These measures included subscales of the Mood Affective Symptoms Questionnaire (MASQ), the Perceived Stress Scale, and scales measuring well-being constructs such as life satisfaction and gratitude. This was followed up with a second study, which found an observed relationship between reported nature exposure with a 7-pt scale and measured physiological variables relevant to emotion and cognition, specifically asymmetrical EEG and eye-blink startle response (Craig et al., 2016). However, the prior research was exploratory and correlational in nature, which many would argue necessitates replication.

The original MIDUS II datasets used in the previous investigations (Ryff & Davidson, 2010; Ryff, Seeman, & Weinstein, 2010) were recollected by the original team with a new cohort (Ryff et al., 2017), allowing for a nearly direct replication of the previous analyses (Craig et al., 2015; 2016). Because positive effects associated with nature exposure may be a function of both exposure frequency and degree of appreciation, the first set of analyses replicating and extending the results of Craig and colleagues (2015) used an averaged composite score of two 3-pt scale questions measuring both frequency and degree of nature appreciation, instead of only frequency of nature appreciation as conducted in the original analysis. The second set of analyses that attempted to replicate Craig and colleagues (2016) used the original 7-pt nature exposure scale.

For the replication (goal 1), controlling for factors such as age, gender, exercise, and education, multiple regression analyses with the new datasets replicated the association between nature exposure and positive emotions, perceived stress, and metrics such as gratitude and perception of work value. However, there were mixed results for depressive affect, and the previously observed correspondence between nature exposure and emotional reactivity measures, such as eyeblink startle response and epinephrine, did not replicate.

For extending the original research (goal 2), exploratory analyses were conducted to explore (1) previously unanalyzed variables related to well-being, and (2) previously unanalyzed cognitive variables. There was an observed and potentially beneficial relationship between self-reported nature exposure, sleep quality, self-control, and low-frequency (.04 - .15 Hz) heart-rate variability. A follow-up analysis focusing on cognitive test batteries including the CANTAB and BTACT mostly did not observe any associations between self-reported frequency of nature exposure and cognitive performance. However, a tentative relationship was noted between nature exposure and category fluency, which should be tested with future research.

To clearly demonstrate the effects of nature on general well-being, an exploratory principle components analysis was conducted on 18 measures presently observed to be significantly associated with nature exposure, with a varimax rotation and the extraction based on the Kaiser criterion. Of five identified factors, one appeared to capture a construct akin to well-being (e.g., positive affect, reduced stress, gratitude, cognitive control, anger management, sleep score, work value). Therefore, a single well-being composite variable was computed (regression-weighted) based on the observed factor loadings after standardizing the component variables. A regression of the well-being composite score on the standardized nature exposure composite score ($n = 788$) was found to be significant, $R2 = .095$, $F(1,786) = 82.81$, $p < .001$.

One of the limitations of this study is nature exposure was measured with a single variable, and the type of exposure (nature trails, window scenery) and type of nature (green vs. blue nature) was not explored. Also, the current analysis looked at a large set of survey data and produced relatively small effect sizes, which is understandable given the large number of potentially intervening variables and the imprecision of the survey measurements. Further, the findings here are correlational and precise design recommendations are not warranted, but there may be several avenues to implement nature in and around built spaces. With

careful design, even urban scenery designed with components akin to nature could be helpful in improving well-being. Future research could assess whether the amount of time in nature may lead to greater improvement.

Variables and questionnaires

Variables	Related to Nature Exposure	Significant Subscales
Replication Goal		
Mood Affective Symptoms Questionnaire	Partial	Positive Affect and Loss of Interest subscales
Perceived Stress Scale	Yes	
Satisfaction with Life Scale	Yes	
Gratitude Scale	Yes	
Work Value Composite	Yes	
Epinephrine	No	
Eye Blink Startle Response Magnitude	No	
Extension Goal		
Spielberger Anger Expression Inventory	Partial	Anger Control and Adjustment subscales
Center for Epidemiologic Studies Depression Scale	Partial	Positive Affect subscale
Singelis Self-Construal Scale	Partial	Interdependence subscale
Self-Control Scale	Partial	Cognition and Emotion Control subscales
Minimalist Well-Being	Partial	Gratitude subscale
Pittsburgh Sleep Quality	Partial	Global sleep score and sleep quality
High Frequency HRV	No	
Low Frequency HRV	Yes	
Brief Test of Adult Cognition by Telephone (BTACT)	Partial	Category Fluency measure
CANTAB Cognitive Assessment	No	

Table 1.

References

Craig, C., Menon, C. V., & Klein, M. I. (2015). A positive relationship between nature appreciation, emotional functioning, and perception of work value. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 59*(1), 1061–1065. doi: 10.1177/1541931215591298

Craig, C., Neilson, B., & Overbeek, R. W. (2016). An Association between Nature Exposure and Physiological Measures of Emotion and Cognition. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 60*(1), 1369–1373. doi: 10.1177/1541931213601316

Ryff, C., Almeida, D.M., Ayanian, J., Carr, D.S., Cleary, P.D., Coe, C., Davidson, R., Krueger, R.F., Lachman, M.E., Marks, N.F., Mroczek, D.K., Seeman, T., Mailick Seltzer, M., Singer, B.H., Sloan, R.P., Tun, P.A., Weinstein, M., Williams, D. (2017). Midlife in the United States (MIDUS Refresher), 2011-2014. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2017-11-20. doi: 10.3886/ICPSR36532.v3

Ryff, C.D., & Davidson, R. (2010). National Survey of Midlife Development in the United States (MIDUS II): Neuroscience Project [Computer file]. ICPSR28683-v1. Ann Arbor, MI: Interuniversity Consortium for Political and Social Research [distributor], 2010-09-24. doi: 10.3886/ICPSR28683.v1

Ryff, C.D., Seeman,T., & Weinstein, M. (2010). National Survey of Midlife Development in the United States (MIDUS II): Biomarker Project, 2004-2009 [Computer file]. ICPSR29282-v1. Ann Arbor, MI: Interuniversity Consortium for Political and Social Research [distributor], 2010-09-24. doi: 10.3886/ICPSR29282.v1