

Nature Involvement Increases Hedonic and Eudaimonic Well-Being: A Two-Week Experimental Study

Holli-Anne Passmore* and Andrew J. Howell

Department of Psychology, MacEwan University, Edmonton, Canada.

*Present address: Department of Psychology, University of British Columbia, Kelowna, Canada.

Abstract

Given experimental evidence of enhancement of well-being as a result of brief exposure to nature, we sought to study the effect of ongoing nature involvement on well-being. Undergraduate participants (N = 84) were randomly assigned to either a nature intervention condition or a control condition. Results indicated that, at the end of 2 weeks, net-positive affect and feelings of elevation were significantly higher, and meaning was marginally higher, in the nature intervention condition relative to the control condition. Self-concordant motivation was also higher for the nature condition, suggesting that the nature intervention was perceived as intrinsically pleasant. Levels of trait connectedness to nature did not moderate the impact of the nature intervention on well-being, suggesting that nature involvement is beneficial among a variety of individuals. High levels of nature involvement were voluntarily sustained throughout the 2 weeks of the study. For the most part, participants engaged in simple activities involving nature close to home, indicating that drastic life changes need not be made in order to improve positive functioning and feelings. This research provides important empirical groundwork for future research concerning daily nature involvement as an effective positive psychology intervention.

Key Words: Nature–Nature connectedness–Well-being–Elevation–Meaning–Affect.

[As] psychologists we have heard but little about gardens, about foliage, about forests and farmland....Perhaps this resource

for enhancing health, happiness, and wholeness has been neglected long enough. (Kaplan & Kaplan, 1989, p. 189)

Theoretically, it has been suggested that our experiences with nature can increase our well-being by helping to address existential anxieties such as those concerning happiness and meaning in life (Passmore & Howell, in press). For example, involvement with nature may increase happiness by presenting us opportunities to satisfy our basic psychological needs of competence, relatedness, and autonomy (Clayton, 2003; Kellert, 1997). By eliciting awe and feelings of transcendence, experiences in nature can help us change our perspective and find meaning in life (Cohen et al., 2010).

Extant research supports these notions (for reviews, see Howell & Passmore, 2013; Russell et al., 2013). Contact with nature and feelings of nature connectedness are associated with increased life satisfaction (Mayer & Frantz, 2004); positive affect (Herzog & Strevey, 2008); happiness (Zelenski & Nisbet, 2014); psychological, social, and emotional well-being (Cervinka et al., 2012; Howell et al., 2011); meaning in life (Cervinka et al., 2012; Howell et al., 2013); and vitality (Zelenski & Nisbet, 2014).

Although some psychologists are successfully incorporating elements of nature into their therapeutic work with distressed clients (Berger, 2008; Berger & McLeod, 2006; Burns, 1998; Buzzell & Chalquist, 2009; Hasbach, 2012), nature involvement is underutilized as a lifestyle intervention aimed at promoting flourishing in clients (Walsh, 2011). A possible reason for the limited incorporation of nature into professional practices is that, to date, the bulk of experimental research examining the nature–well-being equation focuses upon relatively brief exposures to nature (e.g., Mayer et al., 2009; Ryan et al., 2010). For example, single exposures to nature for periods of 5 and 50 minutes have been shown to increase endorsement of intrinsic goals (Weinstein et al., 2009) and heighten general mood (Berman et al., 2008).

Given evidence of positive functioning following brief exposure to nature, we sought to examine the effect of longer-term nature involvement. Specifically, we examined whether participants who spent time in nature over a 2-week period experienced enhanced well-being in comparison with participants who spent time in an alternative activity. We hypothesized that, compared to participants in the control condition, participants in the nature intervention condition would, at the end of the 2-week period, report higher levels of net-positive affect, elevation (an emotion composed of feelings of warmth, openness, and inspiration; Haidt, 2003; Huta, 2013), and meaning. Research points to a connection between nature experiences and awe (an emotion closely connected to elevation; Keltner & Haidt, 2003; Shiota et al., 2007), meaning in life (Howell et al., 2013; O'Connor & Chamberlain, 1996), and positive affect (Berman et al., 2008, 2012). Therefore, in the current study, we examined the effect of nature involvement on both eudaimonic aspects (i.e., elevation and a sense of meaning) and hedonic aspects (i.e., positive affect) of well-being. We also examined daily mood ratings over the 2-week period; we hypothesized that daily net-positive affect would be higher for participants who engaged in a nature activity than for participants who engaged in the control activity.

Participants in the current study completed a measure of self-concordant motivation (SCM), which predicts sustained interest and effort in any given activity (Sheldon & Lyubomirsky, 2006). Our hypotheses with regard to SCM were that participants assigned to the nature condition would report a higher level of SCM to engage in the assigned activity than would those in the control group and that SCM would predict engagement with the assigned activity as measured by the number of days and number of minutes per day that participants completed their activity.

In order to demonstrate that nature involvement is impactful for a wide variety of individuals, we examined the relationship between individual levels of connectedness to nature (i.e., an individual's sense of unity with the natural world; Mayer & Frantz, 2004) and resultant effects of nature involvement on well-being. We tested whether level of trait connectedness to nature moderated the effect of nature involvement on well-being.

Lastly, to help gain insight into the kinds of activities and settings that participants in the nature condition chose of their own accord, we examined participants' descriptions of their daily nature activities. We did so by coding participants' Daily Activity Report comments into a standardized format of words relating to activity and setting, social factors, nouns, and adjectives and adverbs detailing and describing their daily nature experiences. We report on the type

and frequency of various nature experiences engaged in by participants in the nature condition.

Method

Participants

Eighty-six undergraduate students participated in return for partial credit in their introductory psychology course. Two participants were dropped from the analysis because they did not complete the daily activity at all over the course of the study. Of the remaining 84, 73 were female, and 11 were male. The average age of participants was 20.96 ($SD = 4.53$) with a range of 18–45. Seventy-six participants identified English as their first language.

Measures

Motivation. In order to assess participants' motivation for their assigned activity, we adopted questions used by Sheldon and Lyubomirsky (2006) to measure SCM. The measure consists of 4 items outlining reasons for engaging in an activity: external motivation (e.g., because somebody else wants me to); introjected motivation (e.g., because I would feel ashamed, guilty, or anxious if I don't do it); identified motivation (e.g., because I value and identify with doing it); and intrinsic motivation (e.g., because I will really enjoy doing it). Participants rated the extent to which they would be engaging in their assigned activity in terms of the reason described by each item, using a Likert scale ranging from 1 (*not at all for this reason*) to 9 (*completely for this reason*). We calculated an aggregate SCM score by averaging the intrinsic and identified ratings and subtracting the averaged external and introjected ratings. Validity for this measure was demonstrated in numerous studies across a wide range of individuals (e.g., Sheldon & Lyubomirsky, 2006).

Well-being. Three aspects of well-being were assessed: positive and negative affect, elevation, and meaning. Watson, Clark, and Tellegen's (1988) Positive and Negative Affect Scale (PANAS) is a 20-item scale which lists 10 words pertaining to positive feelings and emotions (e.g., interested, proud) and 10 words pertaining to negative feelings and emotions (e.g., afraid, irritable). Respondents rated the extent to which they experienced each emotion over the past 2 weeks (for pre- and post-intervention assessments) or the extent to which they experienced the emotion that particular day (for daily assessments). A 5-point Likert scale ranging from 1 (*very slightly or not at all*) to 5 (*extremely*) was utilized. In order to provide an overall assessment of mood, a single index of affect balance, net-Positive Affect (netPA), was calculated by subtracting the sum of the negative affect items from the sum of the positive affect items (Baumeister et al., 2013; Sheldon et al., 2002). The

PANAS has been validated on both student and psychiatric inpatient samples. Watson et al. (1988) reported that Cronbach's α ranged from .84 to .90 (α in the current study was .77).

Huta and Ryan's (2010) Elevating Experience Scale is a 13-item scale in which items are either words or phrases that describe feelings related to elevation (e.g., inspired, morally elevated). Respondents rated each item using a 7-point Likert scale with endpoints 1 (*not at all*) and 7 (*extremely*), according to the degree to which each item described how they typically felt during the past 2 weeks. The Elevating Experience Scale was validated on samples of undergraduate students; principal component analyses showed that elevating experience was a distinct aspect of well-being (Huta & Ryan, 2010). Huta and Ryan reported a Cronbach's α of .93 (α in the current study was .92). In order to avoid cross-contamination between measures, we removed three items in this scale that pertained to a sense of meaning.

Sense of meaning was assessed with Huta and Ryan's (2010) Sense of Meaning Scale. This scale's 12 items are either words or phrases that pertain to elements of meaning and purpose in life (e.g., meaningful, full of significance). Using a 7-point Likert scale with endpoints of 1 (*not at all*) to 7 (*extremely*), respondents rated the degree to which each item described how they typically felt about their activities and experiences over the past 2 weeks. Huta and Ryan's principal component analyses showed that a sense of meaning was a distinct aspect of well-being. They reported a Cronbach's α of .94 (α in the current study was .95) and demonstrated convergent validity against related measures.

Nature connectedness. Nature connectedness was measured via Mayer and Frantz's (2004) trait Connectedness to Nature Scale (CNS). The CNS is composed of 14 items (e.g., "I often feel a sense of oneness with the natural world around me") rated on 5-point scales with endpoints 1 (*strongly disagree*) and 5 (*strongly agree*). Mayer and Frantz reported a coefficient α of .84 for the total score (α in the current study was .94). They validated their measure against a number of related measures.

Procedure

Our study was approved by the Research Ethics Board at MacEwan University. All participants were required to provide, by signature, their informed consent. This was done at the initial in-person session.

Participants reported to a group session where they were informed that the study consisted of three parts: the current session, wherein they would complete an information package and be randomly assigned to one of two conditions; a "take-home" part that would entail, for the next 2 weeks, a daily activity and subsequent completion of a daily record sheet; and a third part in which they would report

back to a group session where they would return their take-home packets and complete a series of post-intervention measures. Participants were then randomly assigned to either the experimental ($n=43$) or the control condition ($n=41$).

In order to verify that the experimental group and the control group were equivalent on netPA prior to their engagement in the study's daily activities, participants first completed the PANAS measure. Participants then answered demographic questions. Next, participants read instructions of their assigned activity. Instructions for the nature intervention group detailed that, for 2 weeks, they were to engage in a nature activity (i.e., "Whenever you can, and as often as you can, immerse yourself in a nature activity"). Instructions for the control group were similar, except that participants were asked to engage in the solving of anagram puzzles (i.e., "Whenever you can, and as often as you can, take the time to solve a set of anagrams"). Anagram puzzles consisted of scrambled words, phrases, or letters that, when rearranged, generate the answer to the clue provided. Ten sets of anagram puzzles were included in the take-home packages for participants in the control group; each set contained 10 puzzles.

Participants then completed the SCM measure. Lastly, participants read a sample "Daily Mood and Activity Recording Sheet" in order to familiarize themselves with the daily requirements of the 2-week study. Participants' take-home package contained 14 of these sheets, each consisting of a daily PANAS measure and a Daily Activity Recording Sheet on which they were to indicate if they had or had not engaged in their assigned activity that day, to provide a brief description of the activity (if applicable), and to indicate the time of day and length of time spent engaged in the activity.

At the end of the 14 days, participants attended another group session where they returned their take-home Daily Mood and Activity Recording Sheets and completed the post-intervention assessment measures of affect, elevation, meaning, and connectedness to nature. Participants were fully debriefed at the final in-person session.

Results

Preliminary analyses

We first examined pre-intervention netPA as a function of condition. As expected (due to random assignment), no significant differences were found in mood between the two groups (nature condition: $M=13.12$, $SD=9.20$; control condition: $M=12.24$, $SD=9.16$), $t(82)=0.44$, $p=.66$, $d=0.10$.

Hypothesis tests

To test our hypothesis that participants in the nature condition would report higher levels of post-intervention well-being, we

conducted a MANOVA using condition (nature vs. control) to predict elevation, sense of meaning, and post-intervention netPA. There was a significant effect of condition, Wilk's $\Lambda = .90$, $F(3, 80) = 2.87$, $p = .04$, partial $\eta^2 = .10$. Subsequent follow-up t tests revealed that elevation was significantly higher in the nature condition ($M = 34.72$, $SD = 11.34$) than in the control condition ($M = 27.68$, $SD = 10.94$), $t(82) = 2.89$, $p = .01$, $d = 0.63$. There was a trend in the direction of meaning being higher in the nature condition ($M = 46.23$, $SD = 14.99$) than in the control condition ($M = 40.78$, $SD = 14.87$), $t(82) = 1.67$, $p = .10$, $d = 0.37$. Post-intervention netPA was significantly higher in the nature condition ($M = 15.30$, $SD = 11.58$) than in the control condition ($M = 10.24$, $SD = 10.01$), $t(82) = 2.14$, $p = .04$, $d = .47$.

We conducted an ANCOVA in order to examine differences in post-intervention netPA, controlling for pre-intervention netPA. ANCOVA is the recommended method for analyzing pre-post data in randomized designs (Dimitrov & Rumrill, 2003; Huitema, 2011). ANCOVA not only helps reduce error variance, it also provides a more sensitive and informative analysis than does the often-used repeated measures ANOVA. Using pre-intervention netPA as the covariate, post-intervention netPA remained significantly higher in the nature condition, $t(81) = 2.12$, $p = .04$, $d = .47$.

We compared the average daily-netPA of participants between the two conditions on those days on which they did and did not engage in their respective activity. Results supported our hypothesis; on those days on which participants engaged in their respective activity, participants' average daily-netPA was significantly higher in the nature condition ($M = 15.05$, $SD = 7.98$) compared to the control condition ($M = 8.67$, $SD = 7.59$), $t(82) = 3.76$, $p < .001$, $d = 0.82$. On those days on which participants did not engage in their respective activity, there was no significant difference in participants' average daily-netPA between conditions (nature condition: $M = 4.49$, $SD = 7.04$; control condition: $M = 3.08$, $SD = 7.01$), $t(82) = 0.92$, $p = .36$, $d = .20$.

With regard to SCM, our prediction was supported; the nature condition evoked in participants significantly greater feelings of SCM than did the control condition (nature condition: $M = 2.81$, $SD = 5.71$; control condition: $M = -1.80$, $SD = 5.64$), $t(81) = 3.70$, $p < .001$, $d = 0.81$. We had hypothesized that feelings of SCM would predict actual engagement with the assigned activity. This hypothesis was partially supported. The number of days participants engaged in their assigned activity did not correlate significantly with SCM scores, $r(83) = .04$, $p = .73$. However, SCM scores did predict length of time (average number of minutes per day) that participants spent engaging in their assigned activity: $r(83) = .35$, $p < .001$. Therefore, we examined length of time as a function of condition. The average number of minutes spent per day engaging in the assigned activity was significantly greater in

the nature condition ($M = 92.40$, $SD = 40.09$) compared to the control condition ($M = 21.88$, $SD = 7.07$), $t(39.36) = 10.68$, $p < .001$, $d = 3.22$.

Connectedness to nature

We examined whether individual differences in nature connectedness moderated the effect of the nature intervention on well-being. Regression analyses were used to predict elevation and positive affect by experimental condition, trait connectedness to nature, and their interaction (CNS scores were standardized for this analysis). In the prediction of elevation, the overall equation was significant, $F(3, 79) = 11.40$, $p < .001$, $R^2 = .30$, adjusted $R^2 = .28$. Experimental condition ($\beta = -.28$, $p < .001$) and trait connectedness to nature ($\beta = .79$, $p = .01$) were significant predictors of elevation, but their interaction was not ($\beta = -.37$, $p = .20$). In the prediction of post-intervention netPA, the overall equation was significant, $F(3, 79) = 5.85$, $p < .001$, $R^2 = .18$, adjusted $R^2 = .15$. Experimental condition ($\beta = -.22$, $p = .04$) and trait connectedness to nature ($\beta = .78$, $p = .02$) were significant predictors of post-intervention netPA, but their interaction was not ($\beta = -.49$, $p = .13$). Therefore, the effect of nature involvement on well-being was not dependent upon level of nature connectedness.

Qualitative analysis

Participants in the nature condition provided brief descriptions of their daily nature activities and the settings in which these occurred. In order to compare activities, settings, and experiences, we standardized descriptive words and categorized them into activity, setting, social factors, nouns, and adjectives and adverbs (see Table 1 and Fig. 1). Overwhelmingly, the activity most engaged in was walking (e.g., "walked to school through a park with lots of trees and bushes"), which was listed almost three times as often as any other activity. Other popular activities included studying (e.g., "studied in my backyard"), playing, eating (e.g., "picnic at the park"), and yard work/gardening (e.g., "watered my mom's flowers"). The two most popular nature-activity settings were the neighborhoods and backyards of participants, which together were listed approximately five times more often than any other setting; other popular settings listed were parks and the river valley. Solitary activities were mentioned more than twice as often as activities involving other people (e.g., "trails were empty and I was alone"). Natural objects (e.g., "watching the clouds," "smelling the grass," "listening to the rain," "skipped rocks") were mentioned over four times as often as were built objects (e.g., sporting goods, sprinkler); additionally, animals were often mentioned (e.g., "watched the squirrels fight," "listened to the birds chirp very pretty songs," "played with puppy," "many mosquitoes"). A wide variety of adjectives and adverbs were used to describe the sights, sounds, and emotions that

spending time in nature regardless of the degree to which they felt connected to nature, suggesting some generalizability of nature involvement as an effective intervention for increasing well-being.

As with all research, our study had limitations. Our sample consisted of a narrow age range of Canadian, and primarily female, undergraduate students, possibly limiting the extent to which our findings apply to other populations. However, many positive psychology interventions have been validated on student populations (Bolier et al., 2013; Sin & Lyubomirsky, 2009). Additionally, it is estimated that between 30% and 40% of North American college students experience elevated psychological distress or mental disorder (Adlaf et al., 2001; Svanum & Zody, 2001). Thus, coupled with previous research reporting beneficial effects on well-being of brief nature involvement with non-student populations (Berman et al., 2012), there are strong indications that the current study's findings are likely to generalize to wider groups of individuals.

A second possible limitation of our study concerned the control group activity of solving anagram puzzles, an activity that requires mental effort. Participants in the control group only had a choice of which puzzle to solve, while participants in the nature condition were able to choose from a range of activities to satisfy the study requirements. Alternative activities for the control group (e.g., taking photographs of non-natural elements, playing a relaxing video game), or a control condition akin to a waiting list, wherein participants do not alter their regular activities, should be considered in future research. Because solving anagrams does not preclude being outside or engaging with nature at other times, it would be helpful in future research to measure the amount of time that participants in the control group spend engaged in nature-related activities. Solving puzzles is less inherently active than are many of the nature activities the experimental group engaged in, such as walking. This may have given the experimental group an inadvertent advantage, given evidence suggesting that activity alone increases well-being (Mazzucchelli et al., 2010). Previous research, however, has demonstrated that even with equal levels of activity, involvement with nature substantially increases well-being (Berman et al., 2008, 2012; Mayer et al., 2009; Ryan et al., 2010). Moreover, even if part of the effectiveness of nature involvement on well-being reflects general behavioral activation, the role of nature involvement as a route to behavioral engagement is an important finding in and of itself.

The use of primarily post-intervention measurements is an additional possible limitation of the current study. Analyses of between-condition differences of net-positive affect at post-intervention, controlling for pre-intervention, suggest that differences also would be found with other indices of well-being, given that there were

medium to large effect sizes on meaning and elevation between conditions. It may prove beneficial to utilize a full complement of pre-post measures in follow-up studies examining the effect of nature involvement over a prolonged period of time.

Despite its limitations, the current demonstration of an increase in both hedonic and eudaimonic well-being following prolonged involvement in nature activities provides important empirical groundwork for establishing daily nature involvement as an effective well-being intervention. Follow-up research involving a more in-depth daily diary methodology would be beneficial, particularly if a qualitative analysis was combined with a time-lagged analysis to examine if nature involvement on one day predicted higher well-being not only on that day but also on the next day. Growth curve analyses could also be utilized in such a study to examine individual patterns of changes in well-being as a response to nature involvement. Research involving controlled "dosages" of nature involvement is warranted to examine possible moderator effects. It is also important that future experimental research involving longer-term nature involvement utilize expanded sample populations, such as individuals suffering from depression.

Author Disclosure Statement

No competing financial interests exist for either author of the paper.

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Address correspondence to:
Holli-Anne Passmore
 Department of Psychology
 University of British Columbia
 UBC Okanagan Campus
 ART 280H
 3333 University Way
 Kelowna, BC
 V1Y 1V7
 Canada

E-mail: PassmoreH@alumni.ubc.ca

Received: March 10, 2014

Accepted: May 17, 2014