



Engagement with natural beauty moderates the positive relation between connectedness with nature and psychological well-being



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ABSTRACT

Prior research has demonstrated that people who are more connected with nature report more subjective well-being. However, guided by the sensitization model of well-being, we expected that the positive relation between connectedness with nature and psychological well-being would only be significant for those who tend to engage in nature's beauty (i.e., experience positive emotional responses when witnessing nature's beauty). In Study 1, we found the positive relation between connectedness with nature and life satisfaction was only significant for individuals higher, and not those lower, on engagement with natural beauty. Study 2 conceptually replicated this finding using self-esteem as an outcome. Moreover, the results were not affected by age, gender, Big Five personality traits (Study 1) or social desirability (Study 2). Thus, the current research extends past literature and demonstrates that connectedness with nature *only* predicts well-being when individuals are also emotionally attuned to nature's beauty.

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"Everybody needs beauty as well as bread, places to play in and pray in, where nature may heal and give strength to body and soul."

- John Muir

1. Introduction

There is now robust evidence demonstrating that exposure to nature has positive psychological benefits. For instance, individuals who were exposed to nature (e.g. nature walks, daily exposure to nature environments and laboratory imageries), compared to urban settings, reported greater vitality (Ryan et al., 2010). Nisbet and Zelenski (2011) found that individuals who participated in a nature walk reported increased positive affect and decreased negative affect compared to participants that had an indoor walk. Further research substantiates the generalizability of these experimental findings. For example, using mobile electroencephalography (EEG) to record the emotional experience of participants, Aspinwall, Mavros, Coyne, and Roe (2013) found that individuals

experienced less frustration, engagement (i.e., alertness), arousal and higher meditation when walking in nature compared to urban environments. In a separate study of more than 10,000 individuals, researchers found that individuals that live in urban areas with greater green space reported greater life satisfaction and lower mental distress, even after accounting for multiple alternative explanations (e.g., income, age, marriage etc; White, Alcock, Wheeler, & Depledge, 2013). Additionally, post-surgery patients that were randomly assigned to a hospital room furnished with foliage and flowers consumed less postoperative pain killers, experienced lower systolic blood pressure, and reported less pain, anxiety, and fatigue than patients in a room without foliage and flowers (Park & Mattson, 2008). Together, these different lines of research converge to support the many psychological benefits of nature.

Current literature on connectedness with nature

Further, recent research has found that individuals vary in the extent to which they feel connected with nature (Mayer & Frantz, 2004). Mayer and Frantz (2004) developed the connectedness with nature scale that assessed people's belief about their connection to the natural world as an important part of their sense of self. Prior research has demonstrated its usefulness in understanding the human and nature relation. For instance, people who are more connected with nature reported greater

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environmentalism (e.g., “Environmental concerns outweigh all other concerns in my life”), ecological behaviors (e.g., “Turn off the lights when a room is vacant”) and dispositional perspective taking (Mayer & Frantz, 2004). In a separate study, farmers in Australia who felt connected to nature reported greater actions to protect the local vegetation (e.g., “Reduce stocking to encourage regeneration of plants”) and this effect was mediated by greater biospheric concerns (e.g., “Protecting native birds; Gosling & Williams, 2010). Additionally, recent studies have shown that connectedness with nature differs across individuals and is a malleable construct. For instance, individuals who are not environmentally conscious and were induced to feel heightened sense of self-awareness subsequently reported lower level of connectedness to nature (Frantz, Mayer, Norton, & Rock, 2005). Using the implicit association test on a mobile device, Schultz and Tabanico (2007) found that individuals that spent time in an animal park, a hiking trail or beach experienced increase in connectedness with nature. More importantly, however, cross cultural studies in Spain have replicated the internal consistency, convergent, discriminant validity of the connectedness with nature scale and its association with environmental concerns (Olivos, Aragonés, & Amérgio, 2011). Together, this emerging literature has documented the practical value, flexibility and cross-cultural validity of the connectedness with nature scale.

Particularly relevant to the current investigation is research on the link between connectedness with nature and psychological well-being. People who are connected with nature, compared to their less connected with nature counterparts, are more satisfied with life, reported greater happiness and positive affect (Mayer & Frantz, 2004; Tam, 2013). Additional research has shown that connectedness with nature is also associated with social well-being (e.g., social acceptance), mindfulness (Howell, Dopko, Passmore, & Buro, 2011), and meanings in life and vitality (Cervinka, Röderer, & Hefler, 2012). People who were exposed to nature, compared to urban settings, reported greater positive affect and this link was mediated by connectedness to nature (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). More recently, in two separate studies, researchers demonstrated that mindfulness and spirituality mediated the relation between connectedness to nature and well-being (Howell & Passmore, 2013; Kamitsis & Francis, 2013). These results indicated that a dispositional tendency to connect with nature is imperative to individual's psychological well-being.

Current approach on engagement with nature's beauty

Although the connectedness with nature literature has demonstrated the importance of connecting the self with the natural world, recent philosophical approaches have advocated for the need to also engage with nature's beauty. Some theorists have argued that being attuned to the beautiful elements of nature may have evolutionary roots and adaptive values (Etcoff, 2011). For instance, Dutton (2009) has suggested that the ability to experience beauty enhances survival chances because beautiful natural environments signaled a nourishing food source in our evolutionary history. Others have underscored a link between beauty and virtue. In *The Sovereignty of Good over Other Concepts*, the philosopher Iris Murdoch (1967) reasoned that beauty can lead to what she called *unselfing* – a process that motivates the individual to transcend self-interest and become more generous and kind. While these theorists suggest that observing natural beauty may lead to positive psychological benefits, the literature lacked an individual difference measure that reliably assesses people's dispositional tendency to perceive nature's beauty. Consequently, Diessner, Solom, Frost, Parsons, and Davidson (2008) developed the Engagement with Beauty Scale, which contains a subscale that measures the degree to which individuals perceive natural beauty and be emotionally

aroused by nature's beauty. Diessner et al., (2008) found the four items scale internally consistent ($\alpha \leq .80$) and demonstrated a strong test–retest correlation of .84. More recently, there is an emerging line of research that points to a positive relation between individual's tendency to perceive natural beauty and well-being. For instance, individuals who perceive nature's beauty reported greater life satisfaction, gratitude, and less materialism (Diessner et al., 2008). Additionally, perceiving nature's beauty is correlated with extraversion and gratitude (Diessner, Iyer, Smith, & Haidt, 2013), two of the strongest predictors of subjective well-being (DeNeve & Cooper, 1998; Zhang & Howell, 2011). These evidences suggest that individuals prone to perceiving natural beauty also tend to experience higher well-being.

Distinguishing connectedness with nature from engagement with nature's beauty

On the basis of the domain similarity between the two scales (both on the topic of nature), it is expected that they will be strongly positively correlated. Nevertheless, important distinctions between the two scales can be found at the item level. For instance, Perrin and Benassi (2009) conducted a content analysis of the connectedness with nature items and showed that they do not focus on emotional connection but rather is a cognitive assessment of people's belief about their connection to nature. That is, even though the connectedness with nature scale uses the word *feel* in some of the items, it does not actually measures emotional states. In comparison, the engagement with natural beauty scale refers to the emotional and physiological arousals in response to the perception of beauty in the natural world (Diessner et al., 2008). For instance, the core items of the scale examine whether people felt bodily changes (e.g., lump in my throat), emotions associated with nature (e.g., awe, wonder etc) and common humanity (e.g., love of the entire world) when they perceive natural beauty. One study has provided some initial results that engagements has unique predictive validity. In a survey study of 846 community adults, Zhang, Piff, Iyer, Koleva, and Keltner (2014) found that connectedness with nature and engagement with nature's beauty are positively correlated ($r = .64$). However, they were both significant independent predictors of agreeableness, perspective taking and empathic concern.

In sum, connectedness with nature and engagement with natural beauty are conceptually different at the item level and some initial findings have delineated their empirical distinctiveness. However, both are robustly linked to well-being, such that endorsing greater connectedness with nature and engaging with natural beauty are both associated with psychological well-being. These findings, then, presents two disparate hypothesis that individual's well-being is either predicted by the tendency to connect with nature or perceive nature's beauty. In the present research, we integrate these two lines of research and present a rival hypothesis that the relation between connectedness with nature and well-being is moderated by engagement with natural beauty. That is, rather than viewing them as independent predictors, we expected them to augment each other's role in enhancing individual's psychological well-being. Specifically, we predicted that individuals who are more connected with nature will report more life satisfaction (Study 1) and self-esteem (Study 2) *only if* they also engage with natural beauty as well. This hypothesis falls in line with Bem and Funder's (1978) argument that individuals respond to those features of a situation that are important to one's disposition (e.g., what they called “template matching”) and the sensitization model of well-being. As described by Reis, Sheldon, Gable, Roscoe, and Ryan (2000), individuals high on various trait-level constructs will show the strongest association with similar traits and well-

being. For instance, in one study, individuals higher on psychological need satisfaction (e.g., relatedness and autonomy) and life satisfaction reported greater momentary (hour by hour ratings) happiness than individuals higher on psychological need satisfaction and lower on life satisfaction (Howell, Chenot, Hill, & Howell, 2011). Guided by these findings, we hypothesize that the positive relation between connectedness with nature and well-being will be most pronounced for individuals prone to perceiving natural beauty.

2. The current research

As reviewed above, prior research has consistently found that connectedness with nature is associated with psychological well-being (Mayer & Frantz, 2004). Given that the main goal of the current research is to test the moderation of this specific relation, we assessed connectedness with nature using Mayer and Frantz's (2004) scale. To test our interaction hypothesis, we administered the engagement with natural beauty scale developed by Diessner et al. (2008) to assess an individual's dispositional tendency to be emotionally aroused by nature's beauty. To the best of our knowledge, this is the only validated measure that assesses people's emotional response to perceiving nature's beauty. Prior research has found positive relation between perceiving nature's beauty with a number of psychological outcomes (e.g., fairness, justice reasoning, Diessner, Davis, & Toney, 2009). To increase the generalization of our results, we administered two different well-being outcomes that included satisfaction with life (Study 1; Diener, Emmons, Larsen, & Griffin, 1985) and self-esteem (Study 2; Robins, Hendin, & Trzesniewski, 2001), an approach that is consistent with prior research (Cervinka et al., 2012; Howell, Dopko, et al., 2011; Howell & Passmore, 2013; Kamitsis & Francis, 2013). Further, we controlled for the Big Five personality traits (Study 1; John & Srivastava, 1999, pp. 102–138) and social desirability (Study 2; Stöber, 2001) as well as other demographic variables (i.e., age and gender) in an attempt to rule out alternative explanations.

3. Study 1

3.1. Method

3.1.1. Participants and procedures

Study 1 contained 1108 ($M_{age} = 41.08, SD = 16.56, range = 18–88; 44.4\% \text{ female}; 74.8\% \text{ Caucasian}$) adult volunteers residing in the US. Participants completed one or more surveys from a list of about 15–20 surveys from the website Yourmorals.org. For this study, we only examined people who completed the Connectedness with Nature, Perception of Natural Beauty, and Satisfaction with Life Scales as well as the Big Five Inventory. It is important to note that the YourMorals website provides an alternative to traditional sample populations and has served as the data source for a number of recent empirical articles (e.g., Glenn, Koleva, Iyer, Graham, & Ditto, 2010; Graham et al., 2011; Koleva, Graham, Haidt, Iyer, & Ditto, 2012; Zhang et al., 2014). Similar to previous studies using opt-in methodology, our sample is relatively diverse in terms of age, gender, and ethnicity.

4. Measures

All means, standard deviations, and reliability coefficients are shown in Table 1.

Table 1
Zero order correlations.

Study 1	M	SD	α	Age	Gender	Openness	Conscientiousness	Extraversion	Agreeableness	Neuroticism	Connectedness to nature	Engagement of natural beauty	Life satisfaction
Age	41.08	16.56	—	—	—	—	—	—	—	—	—	—	—
Gender	—	—	—	-.09**	—	—	—	—	—	—	—	—	—
Openness	4.11	0.61	.86	.11***	-.04	—	—	—	—	—	—	—	—
Conscientiousness	3.45	0.74	.83	.27***	.10**	.03	—	—	—	—	—	—	—
Extraversion	2.98	0.88	.80	.17***	.09**	.22	.15***	—	—	—	—	—	—
Agreeableness	3.54	0.69	.75	.27***	.03	.17***	.22***	.26***	—	—	—	—	—
Neuroticism	2.84	0.89	.78	-.19***	.13***	-.12***	-.32***	-.28***	-.35***	—	—	—	—
Connectedness to nature	3.59	0.83	.89	.28***	.19***	.31***	.16***	.14***	.31***	-.09**	—	—	—
Engagement with natural beauty	5.53	1.31	.83	.18***	.17***	.32***	.06	.14***	.29***	-.04	.62***	—	—
Life satisfaction	4.31	1.54	.90	.11**	.04	.05	.24***	.27***	.26***	-.46***	.12***	.15***	—

Note. N = 1108. Gender (Male = 1, Female = 2). * $p < .05$; ** $p < .01$; *** $p < .001$.

4.1. Connectedness with nature

The Connectedness to Nature Scale (Mayer & Frantz, 2004) is a 14-item questionnaire that measured participants' sense of oneness with the natural world (e.g., "I often feel a sense of oneness with the natural world around me"), their sense of kinship with animals and plants (e.g., "I recognize and appreciate the intelligence of other living organisms"), and their sense of equality between the self and nature (e.g., "When I think of my life, I imagine myself to be part of a larger cyclical process of living"). Participants responded on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher score indicate a person is more connected to nature.

4.2. Tendency to perceive natural beauty

The Engagement with Natural Beauty scale (Diessner et al., 2008) measures an individual's self-reported tendency to perceive natural beauty (e.g., "I notice beauty in one or more aspects of nature") on a 7-point scale (1 = *strongly disagree*; 7 = *strongly agree*). The predictive, convergent, and discriminant validity of this measure has been demonstrated before ($\alpha \leq .80$, test–retest $\leq .84$; Diessner, Rust, Solom, Frost, & Parsons, 2006; Diessner et al., 2008). Higher score means a person is more likely to perceive natural beauty.

4.3. Big Five Inventory

We assessed individual differences in personality traits with the 44-item Big Five Inventory (John & Srivastava, 1999, pp. 102–138). Participants indicated how much they agree with specific phrases that describe personality characteristics on a 5-point scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*). An example for extraversion: "is outgoing, sociable"; agreeableness: "is generally trusting"; conscientiousness: "does a thorough job"; neuroticism: "gets nervous easily"; and openness: "has an active imagination".

4.4. Life satisfaction

Participants completed the 5-item Satisfaction with Life Scale (Diener et al., 1985) which measures participants' perceived satisfaction with life (e.g., "In most ways my life is close to my ideal") on a 7-point Likert-type scale from 1 (*strongly disagree*) to 7 (*strongly agree*).

5. Data analysis

Standard parametric assumptions were tested and all assumptions were met. Pearson product moment correlation coefficients were computed to assess the relations between demographics, Big Five personality, connectedness with nature, engagement with nature's beauty, and life satisfaction. In addition, we conducted a hierarchical regression analyses by regressing life satisfaction on demographic variables, Big Five personality, connectedness with nature and engagement with nature's beauty. In the last step of the regression model, we entered the connectedness with nature and engagement with nature's beauty interaction. These analyses were carried out to test the hypothesized connectedness with nature and engagement with nature's beauty interaction predicting life satisfaction after controlling for the unique effects explained by the Big Five personality and demographic variables.

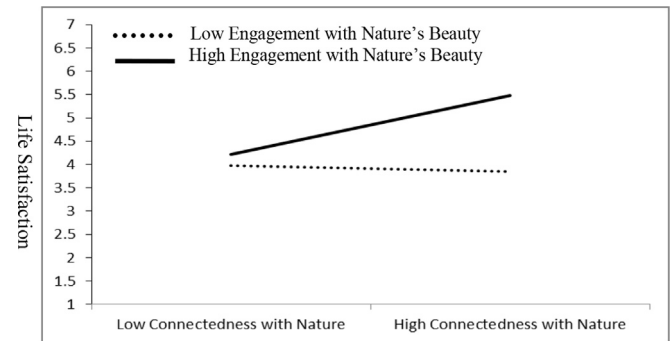


Fig. 1. CNS by ENB interaction predicting life satisfaction in Study 1. Connectedness with nature predicted greater life satisfaction for individuals higher, but not lower, on engagement with natural beauty.

6. Results

6.1. Correlations

The results in Table 1 displayed the intercorrelations between the variables in the current study. First, the intercorrelations between demographics and the Big Five personality traits are consistent with past research (Goldberg, 1990; John & Srivastava, 1999, pp. 102–138). Further, the correlations between the Big Five personality traits and life satisfaction were also similar to past research (Zhang & Howell, 2011).

Next, we examined how the demographic variables and personality characteristics correlated with the two nature variables. In this study (see Table 1), older and female participants reported more connectedness with nature and perceive nature's beauty. Also, connectedness with nature and perceive nature's beauty were both positively correlated with openness, extraversion, and agreeableness. However, only connectedness with nature was positively correlated with conscientiousness and negatively correlated with neuroticism. Most importantly, perceiving nature's beauty ($r = .15$, $p < .001$) and connectedness with nature ($r = .12$, $p < .001$) were both positively correlated with life satisfaction.

6.2. Hierarchical regression predicting life satisfaction

Because connectedness with nature and perceive nature's beauty were positively correlated ($r = .62$), we examined multicollinearity statistics. Though the two constructs were highly correlated, the tolerance levels were above 0.20 and the variance inflation factors were below 5.00 (O'Brien, 2007)—this indicates that both variables can be both entered into regression models. Furthermore, we tested whether connectedness with nature and perceive nature's beauty are distinct scales using exploratory factor analysis (principle component extraction) with varimax rotation. First, a two-factor solution was suggested by the scree test (Cattell, 1969). The first factor accounted for 29.04% (connectedness with nature) and the second factor accounted for 19.59% (perceive nature's beauty). These findings reduced the concern of the high correlation between connectedness to nature and perceive nature's beauty will influence the interaction model.

To test our hypothesized connectedness with nature by perceiving nature's beauty interaction, we standardized all variables, formed an interaction term, and entered demographic (step 1), personality (step 2), nature variables (step 3), as well as the interaction term (step 4) into a hierarchical regression model predicting life satisfaction (see Table 3). There was a main effect of perceiving nature's beauty ($b = .15$), though there was not a main

effect of connectedness with nature ($b = .01$) in predicting life satisfaction. Importantly, however, the connectedness with nature by perceiving nature's beauty interaction was significant ($b = .08$, $t = 2.46$, $p = .014$, 95% CI: .017, .151). Decomposing this interaction (Aiken & West, 1991; see Fig. 1) revealed that connectedness with nature significantly predicted greater life satisfaction at one standard deviation above the mean on perceiving nature's beauty ($b = .21$, $t = 3.75$, $p < .001$). However, connectedness with nature did not predict life satisfaction at one standard deviation below the mean on perceiving nature's beauty ($b = .03$, $t = 0.78$, $p = .43$). Importantly, the simple slopes are replicated at two standard deviations above and below the mean on perceive nature's beauty.

In sum, there is no relation between connectedness with nature and life satisfaction for individuals who are not attuned to nature's beauty. These results suggest that individuals who are more connected with nature reported more life satisfaction *only if* they also engage with natural beauty as well. Lastly, the results held even after controlling for demographics and Big Five personality traits.

7. Study 2

The previous study showed that individuals who feel greater connectedness with nature and also engage with natural beauty tend to report greater life satisfaction. In Study 2, we aim to replicate this interaction with a different sample (students) and outcome, namely self-esteem. Past research has shown that self-esteem is associated with greater life satisfaction, positive affect, and optimism (Robins et al., 2001), suggesting that self-esteem is important for the experience of psychological well-being. Further, given researcher's concern for social desirable responding in survey research (Paulhus, 1984), we controlled for social desirability (Stöber, 2001). Following the results of the previous study, we predicted that individuals who are more connected with nature will report more self-esteem *only if* they also engage with natural beauty.

8. Method

8.1. Participants and procedures

Participants were 151 ($M_{age} = 21.39$, $SD = 6.94$, range = 18–78; 73.1% female; 37.7% Caucasian) students from a large public university in the West Coast who participated in exchange for extra credit. Participants accessed the study through an online server, provided implied consent, and completed measures of connectedness with nature, perception of nature's beauty, social desirability and self-esteem in randomized order. Finally, they completed a demographic questionnaire, were debriefed, and were thanked for their participation.

9. Measures

All means, standard deviations, and reliability coefficients are shown in Table 2.

Table 2
Zero order correlations.

Study 2	M	SD	α	Age	Gender	Social desirability	Connectedness to nature	Engagement of natural beauty	Self-esteem
Age	21.39	6.94	–	–					
Gender	–	–	–	–.01	–				
Social desirability	1.47	0.18	.67	.14	–.04	–			
Connectedness to nature	4.54	0.88	.83	.29***	–.01	–.05	–		
Engagement with natural beauty	4.81	1.37	.80	.12	.01	.02	.50***	–	
Self-esteem	3.14	1.07	–	.16	–.08	–.02	.24**	.17*	–

Note. $N = 151$. Gender (Male = 1, Female = 2). * $p < .05$; ** $p < .01$; *** $p < .001$.

9.1. Connectedness with nature

The Connectedness with Nature Scale (Mayer & Frantz, 2004) that was used in Study 1 was administered for the current study.

9.2. Tendency to perceive natural beauty

The Engagement with Natural Beauty scale (Diessner et al., 2008) that was used in Study 1 was administered for the current study.

9.3. Social desirability

Participants completed the 17-item Social Desirability Scale (SDS; Stöber, 2001). The SDS asked for agreement to statements that assess the degree to which participants may be motivated to appear overly positive (e.g., "I sometimes litter;" 1 = true, 2 = false).

9.4. Self-esteem

The one-item self-esteem scale was administered to measure self-esteem (Robins et al., 2001). Participants were asked to respond to the statement "I have high self-esteem" from 1 (*not very true of me*) to 5 (*very true of me*).

10. Results

10.1. Correlations

Data analysis for this study was similar to the previous study. The results in Table 2 displayed the intercorrelations between the variables in the current study. First, age was positively correlated with connectedness with nature and not perceives nature's beauty. Gender and social desirability did not correlate with other variables. Most importantly, perceive nature's beauty ($r = .17$, $p < .05$) and connectedness with nature ($r = .24$, $p < .05$) were both positively correlated with self-esteem.

10.2. Hierarchical regression predicting self-esteem

Because perceive nature's beauty and connected with nature were positively correlated ($r = .50$, $p < .001$), we examined multicollinearity statistics. Though the two constructs were highly correlated, the tolerance levels were above 0.20 and the variance inflation factors were below 5.00 (O'Brien, 2007)—this indicates that both variables can be both entered into regression models. Furthermore, we tested whether connectedness to nature and perceive nature's beauty are distinct scales using exploratory factor analysis (principle component extraction) with varimax rotation. First, a two-factor solution was suggested by the scree test (Cattell, 1969). The first factor accounted for 29.84% (connectedness with nature) and the second factor accounted for 15.75% (perceive nature's beauty). These findings reduced the concern of the high

Table 3
Hierarchical regression models predicting life satisfaction.

IVs	Life satisfaction							
	Step 1		Step 2		Step 3		Step 4	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
Age	.11**	.005, .016	-.02	-.008, .002	-.04	-.01, .001	-.04	-.009, .002
Gender	.05	.037, .425	.07*	.098, .447	.05	.032, .388	.05	.025, .38
Openness	–	–	-.04	-.149, .023	-.08*	-.207, -.026	-.07*	-.206, -.025
Conscientiousness	–	–	.07*	.037, .222	.07*	.039, .223	.07*	.033, .217
Extraversion	–	–	.12***	.124, .307	.12***	.123, .304	.12***	.127, .308
Agreeableness	–	–	.09*	.043, .226	.06	.001, .188	.06	.007, .194
Neuroticism	–	–	-.40***	-.693, -.503	-.40***	-.705, -.516	-.40***	-.699, -.51
Connectedness to nature	–	–	–	–	-.01	-.112, .096	.01	-.099, .109
Engagement with natural beauty	–	–	–	–	.12***	.078, .286	.15***	.121, .344
CNS*ENB	–	–	–	–	–	–	.08*	.017, .151
	ΔR^2 .014		ΔR^2 .239***		ΔR^2 .011**		ΔR^2 .005*	

Note. Step 1: $F = 8.70, p < .001$; Step 2: $F = 52.37, p < .001$; Step 3: $F = 42.99, p < .001$; Step 4: $F = 39.49, p < .001$; Gender (Male = 1, Female = 2). ENB is engagement with natural beauty. CNS is Connectedness to Nature Scale. ΔR^2 is the variance accounted for by the model. * $p < .05$; ** $p < .01$; *** $p < .001$.

correlation between connectedness to nature and perceive nature's beauty will influence the interaction model.

To test our hypothesized connectedness with nature by perceive nature's beauty interaction, we standardized all variables, formed an interaction term, and entered demographic (step 1), social desirability (step 2), nature variables (step 3), as well as the interaction term (step 4) into a hierarchical regression model predicting self-esteem (see Table 4). There was no main effect of perceiving nature's beauty ($b = .11$) and no main effect of connectedness with nature ($b = .16$) in predicting self-esteem. Importantly, however, the connectedness with nature by perceives nature's beauty interaction was significant ($b = .17, t = 2.04, p = .042, 95\% \text{ CI}: .005, .29$). Decomposing this interaction (Aiken & West, 1991; see Fig. 2) revealed that connectedness with nature significantly predicted greater self-esteem at one standard deviation above the mean on perceive nature's beauty ($b = .35, t = 3.22, p = .002$). However, connectedness with nature did not predict self-esteem at one standard deviation below the mean on perceive nature's beauty ($b = .05, t = .044, p = .66$). These findings were also replicated using two standard deviations above and below the mean on perceive nature's beauty.

The results extended the previous study and documented that individuals who are more connected with nature reported more self-esteem *only if* they also perceive natural beauty as well. Lastly, the results held even after controlling for demographics and social desirability.

11. General discussion

Prior research has demonstrated that connectedness with nature is associated with greater psychological well-being (Howell, Chenot, et al., 2011; Howell, Dopko, et al., 2011; Howell & Passmore, 2013; Mayer & Frantz, 2004; Mayer et al., 2009; Tam, 2013). The current research extends these prior studies by showing that the tendency to engage with natural beauty moderates the positive relation between connectedness with nature and well-being (i.e., life satisfaction and self-esteem). These results support both Bem and Funder's (1978) template matching hypothesis and the sensitization model of well-being. Thus, individuals who were more emotionally attuned to natural beauty (i.e., those who perceive nature's beauty) appear to reap the most positive benefits from being connected with nature.

11.1. Implications and future research

Previous research has not examined the boundary conditions of the relation between connectedness with nature and psychological well-being. The current investigation extends this literature and suggests that connectedness with nature is only associated with greater well-being for individuals who are emotionally inspired by nature's beauty. These findings are consistent with prior research and yet indicate a need for future research to explore the conditions in which greater connectedness with nature predicts positive psychological outcomes. For instance, moving beyond well-being, past research has also consistently linked greater connectedness with nature with environmental concerns (Brugger, Kaiser, & Roczen, 2011; Gosling & Williams, 2010; Mayer & Frantz, 2004; Olivos et al., 2011). It will be interesting to ascertain whether individuals higher on connectedness with nature are more likely to display ecological behaviors towards certain natural environments as a function of how much they are emotionally attuned to its beauty. Given that past research has shown individuals who are emotionally attuned to nature's beauty are more likely to show appreciation and recognize the existence of goodness in the environment (Güsewell & Ruch, 2012), we speculate that greater engagement with nature's beauty will enhance the tendency for individuals that are connected with nature to show more protection for the environment.

It is important to point out that prior research has also considered aesthetic beauty from a landscape perspective. For instance, Brown and Raymond (2007) revealed that residents and visitors of the Otways region in Victoria (Australia) ranked aesthetic value (e.g., "I value these places for the attractive scenery, sights, smells, or sounds") as the most important value associated with relative to 11 other values (e.g., spiritual, heritage etc). However, the valuation of aesthetic beauty in the region predicted less place identity ("refers to the mixture of feelings about specific physical settings, including how these settings provide meaning and purpose to life"; $p. 90$) and place dependence ("refers to connections based specifically on activities that take place in a setting, reflecting the importance of a place in providing conditions that support an intended use"; $p. 90$). This work, in conjunction with our own findings, points to several intriguing possibilities. For instance, while greater valuing of aesthetic beauty predicted less place identity, we speculate that perceiving and being emotionally aroused by nature's beauty may buffer this relation. Prior research has demonstrated that

Table 4
Hierarchical regression models predicting self-esteem.

IVs	Self-Esteem							
	Step 1		Step 2		Step 3		Step 4	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
Age	-.08	-.001, .049	-.08	.000, .05	-.07	-.01, .041	-.07	-.013, .038
Gender	.16	-.588, .195	.16	-.593, .192	.09	-.58, .193	.08	-.562, .203
Social desirability	–	–	-.04	-.214, .135	-.22	-.196, .149	-.01	-.184, .158
Connectedness to nature	–	–	–	–	.16	-.025, .378	.16	-.023, .375
Engagement with natural beauty	–	–	–	–	.08	-.112, .278	.11	-.076, .317
CNS*ENB	–	–	–	–	–	–	.17*	.005, .29
	ΔR^2		ΔR^2		ΔR^2		ΔR^2	
	.031		.001		.044*		.026*	

Note. Step 1: $F = 2.35$, $p = .098$; Step 2: $F = 1.62$, $p = .18$; Step 3: $F = 2.38$, $p = .041$; Step 4: $F = 2.73$, $p = .015$; Gender (Male = 1, Female = 2). ENB is engagement with natural beauty. CNS is Connectedness to Nature Scale. ΔR^2 is the variance accounted for by the model. * $p < .05$; ** $p < .01$; *** $p < .001$.

engagement with natural beauty is associated with greater spiritual transcendence, gratitude (Diessner et al., 2008), and appreciation of the environment (Güsewell & Ruch, 2012). Thus, we predict that people who are highly emotionally attuned to nature's beauty might show a greater tendency to instill a sense of purpose and meaning in specific natural environments, leading to greater place identity. In a similar line of research, Kaltenborn and Bjerke (2002) demonstrated that individual's sense of attachment to specific natural settings is associated with whether they are attracted and fascinated by the natural environments. This finding suggests that one possible mediator of our interaction may be that one reason why people who are connected with nature and perceive nature's beauty report greater well-being, is because they are more likely to experience a sense of awe and wonder from the natural world. Past research has argued that awe is an emotion that is central to the experience of nature (Keltner & Haidt, 2003) and people often mention nature experiences as an elicitor of awe (Shiota, Keltner, & Mossman, 2007). Further, features of narratives about beautiful experiences tend to include nature as one of the main causes (Cohen, Gruber, & Keltner, 2010). Importantly, individuals that are higher on engagement with natural beauty reported greater dispositional awe (Güsewell & Ruch, 2012). Given that people who are made to feel awe, compared to a neutral task, reported greater life satisfaction (Rudd, Vohs, & Aaker, 2012), we speculate that awe may be particularly relevant in understanding the association between connectedness with nature, perception of natural beauty and greater well-being. In sum, research that investigate landscape preferences and attachments, as well as research that examines individual differences in connection and perception of natural

environments are currently detached from each other. Future research should ask questions that connect both literatures.

Many great writers and thinkers of the past and present have long advocated the benefits of spending time around natural environments (e.g., John Muir, Ralph Emerson etc; Louv, 2005; Wilson, 1984). Recent empirical evidences have largely supported their claim. Reasonably, many public organizations have developed policy plans that aim to connect people of all ages with their natural environments in the hopes promoting mental health (e.g., environmental education classes; adding outdoor play into school curriculum; media campaign; White, 2008). According to our findings, however, policies that encourage the public to frequent natural environments should simultaneously aim to cultivate an individual's emotional engagement with their natural surroundings. For instance, in one recent study, participants that were instructed to actively immerse themselves in a nature environment (e.g., pay attention to the different aspects of the environment) reported greater intrinsic aspirations (e.g., greater willingness to develop enduring relationships) compared to less immersed individuals (Weinstein, Przybylski, & Ryan, 2009). One way that policy makers can ensure greater participation and engagement in nature can adapt from the notion of the Rule of Thirds in photography (i.e., imaginary lines cut the image horizontally and vertically each into three parts). Prior research has found that images that use the Rule of Thirds enhance the objects aesthetic beauty and pleasantness (Datta, Joshi, Li, & Wang, 2008). For instance, when promoting the public's interest to visit nature environments, campaigns efforts can embed the Rule of Thirds in their poster or video advertisements of various natural settings. In this case, we speculate that it would generate greater fascination with the specific natural settings, as well as more willingness to connect and perceive nature's beauty. A second approach that policy makers can do is to improve the architectural designs of natural landscapes. For instance, prior research has found that landscapes that contain greater elements of water, depth of field, and vegetation are often perceived as more beautiful and aesthetically pleasing than landscape that contain less of these characteristics (Dutton, 2009; Herzog, 1985; Kaltenborn & Bjerke, 2002; Ulrich, 1993). With this in mind, to increase individual's motivation to participate in nature activities, it may be pertinent that we organize aspects of the landscape that enhance the overall visual attractiveness of the natural environments. According to a recent study conducted by the Royal Society for the Protection of Birds (2013) of 1200 children in the United Kingdom found that only 21% of children felt connected with nature. Thus, improving the connection of children and all individuals is vital. We have presented two possibilities that await future empirical validation as applied researchers may wish

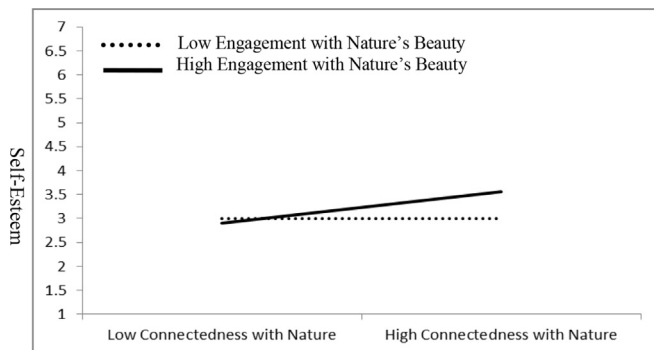


Fig. 2. CNS by ENB interaction predicting self-esteem in Study 2. Connectedness with nature predicted greater self-esteem for individuals higher, but not lower, on engagement with natural beauty.

to explore the idea that promoting engagement with natural beauty can enhance connection with nature.

Given that connectedness with nature and engagement with nature's beauty appear similar to each other, it is reasonable to argue that one is simply a proxy of the other. However, our findings revealed that they cannot be empirically combined into one construct (see factor analyses in the result's sections) and augment each other in predicting psychological outcomes. Nevertheless, there is a need for more research to tease them apart. Specifically, one approach that researchers can take is to test whether interventions aimed at increasing people tendency to connect with nature will also increase their tendency to perceive nature's beauty. Given their positive correlation, we speculate that interventions (e.g., nearby nature walk, imageries, hiking excursions; Atchley, Strayer, & Atchley, 2012; Mitchell, 2013; White, Pahl, Ashbullby, Herbert & Depledge, 2013) have the potential to successfully increase individual's well-being both directly and indirectly through greater connectedness with nature and perceived natural beauty in the long run. Therefore, future research should continue to examine these construct together in order to deepen our understanding of their commonality and uniqueness. The results will highlight how these two constructs that measure a similar domain (i.e., nature) may mutually enhance each other's benefits and at the same time have radically different effects with psychological outcomes (e.g., improved memory, decreased stress, well-being etc).

Lastly, motivated by an interactional perspective (Endler & Magnusson, 1976), we hope our interaction findings will stimulate future research on other individual level factors that may moderate the positive benefits of nature. There is a scarcity of published research that has examine individual difference measures (connectedness with nature, nature relatedness, perceive nature's beauty etc; Mayer & Frantz, 2004; Nisbet, Zelenski, & Murphy, 2009; Diessner et al., 2008), as potential moderator(s) of nature's positive benefits (e.g., improved memory, decreased stress, well-being etc). It would be interesting to investigate how individuals higher and lower on these traits measures will react to imageries of nature, a nearby nature walk or participate in nature activities. In one recent study, for instance, people who are more likely to perceive moral beauty (a separate subscale of the Engagement with Beauty scale by Diessner et al., 2008), reported wanting to do good for others when they watched a morally uplifting video compared to less morally uplifting video (Diessner et al., 2013). These findings highlight how emotionally evocative stimuli elicit different responses depending on the dispositional tendencies of the individual (Mischel & Shoda, 1995).

11.2. Limitations

The present research is limited by a few concerns. Although results converged across a community adult sample and a student sample, it will be important to corroborate the current results across diverse communities and populations. For example, it is important to determine if the interaction between perception of natural beauty and connectedness with nature in predicting well-being is moderated by one's access to nature (e.g., do they live far away or close to national parks). Further, given that the nature literature has focused on using convenience samples, the field's knowledge about nature's effect on older adults is limited. Thus, it will also be interesting to test if these findings will be replicated in older adults.

Perhaps, a more stringent test of our hypothesis would be a cross-cultural replication, particularly from cultures in which people endorse different levels of perception of natural beauty and connectedness to nature. For example, Tam (2013) found that connectedness to nature scores were higher for Americans than

Chinese participants. These potential cross-cultural differences can inform us as to whether the interaction between engaging with nature's beauty and feeling connected to nature emerges in settings where neither trait is strongly endorsed.

Lastly, the current research only used the connectedness with nature scale developed by Mayer and Frantz (2004) because prior research has consistently demonstrated a positive relation between this specific measure of connectedness with nature and psychological well-being. Thus, our main goal was to reveal a boundary condition when connectedness with nature is and is not associated with well-being. Nevertheless, Nisbet et al. (2009) recently developed a nature relatedness scale that also taps into a sense of connection with nature (e.g., "My relationship to nature is an important part of who I am"). Some findings have demonstrated a positive relation between nature relatedness and well-being. For instance, nature relatedness was positively associated positive affect, purpose in life and life satisfaction (Nisbet, Zelenski, & Murphy, 2011). Thus, it would be beneficial if future research can extend our findings by generalizing the effects to other measures of nature relatedness. On the basis of prior research which found that connectedness with nature and nature relatedness are highly positively correlated ($r = .76$ & $r = .83$ in two studies) and load into one common factor (Tam, 2013), we speculate that the relation between nature relatedness and well-being would be moderated by engagement with natural beauty as well.

12. Conclusion

The current research represents the first effort to understand how individual differences in peoples' engagement with nature and sense of relation with nature, together, can shape important well-being outcomes. According to our results, we should not only encourage individuals to develop a sense of connection with nature but also encourage them to become attuned to nature's beauty in order to improve their personal well-being.

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