

Reflective self-attention: A more stable predictor of connection to nature than mindful attention.

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Abstract

There is much to be gained from understanding the individual differences that predict our connection to nature, as those that are more connected tend to be more caring towards the environment and benefit from better well-being. Study 1 (n=137) found that reflective self-attention and mindful attention significantly predicted connection to nature, while anxious self-attention had a borderline significant negative association. With the introduction of personality measures, study 2 (n=161) found that reflective self-attention and openness had a stronger relationship to nature connection than mindful attention. Study 3 (n=99) found reflective self-attention, rather than mindful attention, to be associated with an increase in connection to nature. A pre-reflective and intentional self-attention account of nature connectedness is proposed with intentional self-reflection being a stronger factor than mindful attention.

Keywords: Connectedness to nature, self-attention, mindfulness, personality.

1. Introduction

With the current state of nature (e.g. Barnosky et al., 2011) and drive for environmental responsibility there is much to be gained from understanding how we connect with nature. Understanding the individual differences that predict connection to nature is important as those that are more connected tend to be more mindful of the environment (Mayer & Frantz, 2004; Nisbet & Zelenski, 2011) and benefit from better well-being (Capaldi, Dopko & Zelenski, 2014); with a similar effect size to established variables such as income, education (Capaldi et al., 2014). Connection to nature is related to concepts of the self and an ecological-self that encompasses the natural world around us. Indeed, Hartig et al., (2011)'s review identified a need for further research into concepts such as the self and connectedness to nature. To this end, the current research considers how self-directed thought, the reflective thinking that can lead to better self-knowledge, relates to a connection to nature. This is considered alongside existing predictors of nature connectedness (NC), firstly mindful attention in study 1, before taking a broad personality based approach to predicting our connection to nature in study 2. Given the current international campaign focus on improving connection to nature (e.g. RSPB, 2013), a third study examines how reflection and mindful attention relates to improvements in connection to nature.

1.1 Connectedness to Nature

The concept of connectedness to nature is complex, being comprised of an experiential and affective sense of belonging to the natural world (Mayer & Frantz, 2004), with affective, cognitive and experiential factors being identified as important individual differences in a connection to nature (Zelenski & Nisbet, 2012). Although complex and dependent on measures, connection to nature is concerned with an individual's sense of self (Schultz, 2000), where nature and humanity are one. The

sense of expanded identity which encompasses a reciprocity between nature and self has been termed as the ecological-self (Bragg, 1996) or environmental identity (Naess, 1973). These terms relate to a person's understanding of interconnectedness with nature or their sense of inclusion in nature (Nisbet, Zelenski & Murphy, 2009) and importantly in the current campaign context are key to healing the alienation between humans and nature (Tam, 2013). Further, these concepts of self that have been argued to be fundamental to our connection to nature can be used to nurture conservation behaviour and can be added to models of behaviour in order to allow better prediction of behaviour (Bragg, 1996).

Models in the literature present common dimensions related to examining self and acquiring conceptual self-information, which require higher levels of self-directed thought; with self-knowledge being key to understanding our self (Morin, 2006). It is, therefore, worthwhile considering individual differences related to self-knowledge when exploring people's connection to nature.

1.2 Reflection and Rumination

The self-directed thought introduced above can be of two types; self-rumination or self-reflection (Trapnell & Campbell, 1999). The latter is associated with mental well-being (Joireman, Parrott & Hammersla, 2002) and is characterised by a genuine curiosity about the attitudes, thinking, values and emotions that contribute to the self. Morin (2006) suggests that this aspect of self-directed thinking is the form of attention to self that can lead to improved self-knowledge. It is proposed that this inquiring self-reflection will lead to and therefore predict connection to nature. In contrast, self-rumination is anxious self-attention related to self-worth and fear of failure and, not surprisingly, is negatively associated with psychological well-being (Mor & Winquist, 2002), and does not lead to improved

knowledge of the self. Trapnell and Campbell's identification of 'neurotic self-attentiveness' or rumination motivated by perceived threats and 'intellectual self-attentiveness' or reflection motivated by curiosity in the self is part of the rationale for the development of the Rumination-Reflection Questionnaire (RRQ) which will be used in the present studies.

To summarise, the research presented in the preceding sections on self, nature and self-directed thinking suggests some mutuality between connection to nature and self-reflection, but not rumination. Furthermore, as self-reflection brings a curiosity about the attitudes, thinking, values and emotions that contribute to the self, thereby improving self-knowledge, it is proposed that self-reflection will lead to a better understanding of a shared place in the natural world and increased connection to nature.

1.3 Mindfulness and Mindful Attention

In a similar way to reflection, mindfulness has been linked to theories of self-consciousness (Brown, Ryan, & Creswell, 2007), attention and nature connectedness (e.g. Howell, Dopko, Passmore, Buro, 2011). However, although it has been linked with internal state awareness such as private self-consciousness, it is thought to have little, if any, relation to self-reflection as mindfulness is a "pre-reflexive" perceptual function that enhances awareness of, and attention to, current experience (Brown & Ryan, 2003). Whereas self-reflection is a conscious, non-perceptual, self-directed thinking or introspection that can lead to improved self-knowledge.

One consequence of mindful consciousness is that it is suggested to bring about self-other continuity (Bai & Scutt, 2009). In the current context mindfulness has been found to enhance the impact of experience in nature thereby strengthening nature connectedness (Howell et al., 2011) as it is about the open experience of what

is there (Brown & Ryan, 2003). Further, Brown and Ryan note that while other forms of reflective consciousness have been associated with poorer well-being, mindfulness has a positive impact on mental state. To this end, there is applied interest in mindfulness practice in natural settings (e.g. Ambrose-Oji, 2013) with examples of therapeutic practice involving mindfulness-based approaches in nature, for example mindful attention to sounds in the forest (Kim, Lim, Chung, & Woo, 2009), as opposed to reflective attention to self and one's relationship to nature.

In summary, it is suggested that a connection to nature is associated with both pre-reflective mindful attention and intentional self-reflection, yet it is mindfulness that is most commonly acknowledged as a potential route to nature connectedness and well-being (e.g. Howell et al., 2011). Accordingly in study 1, the relationships between self-reflection, pre-reflective mindful attention, and NC were examined

2. Study 1

2.1 Method

2.1.1 Participants

Following an invitation sent to campus and online students of the University of Derby (UK) and circulation by social media, 137 participants responded. The sample comprised of 105 females and 32 males with an age range of 18 to 58 years, mean age of 34.9 years ($SD = 10.6$).

2.1.2 Design and Procedure

This study used a cross-sectional survey design. Following approval by the local Research Ethics Committee, messages and emails were sent out requesting participants with a link to a participant information sheet. A survey website was used to obtain informed consent and administer the questionnaires. After submitting their answers, participants were presented with a debriefing message.

2.1.3 Materials

Measures were taken using a set of psychometrically validated scales. The first page consisted of a statement of consent. The second page contained demographics questions. Scales were then completed in the order below before a short debrief statement.

Mindful Attention Awareness Scale (MAAS) – This 15-item scale assess individual differences in mindful state frequency, a unique quality of consciousness associated with enhanced self-awareness (Brown & Ryan, 2003). In order to assess individual differences in mindful state frequency the scales has items such as ‘I find myself doing things without paying attention’ and ‘I could be experiencing some emotion and not be conscious of it until sometime later’. A reliability analysis showed the scale was reliable ($\alpha = 0.89$).

Connectedness to Nature Scale (CNS). The CNS is designed “to tap an individual’s affective, experiential connection to nature” (p. 504), through asking respondents about feelings, such as sense of kinship with plants and animals, sense of oneness with the natural world, and sense of equality between nature and the self (Mayer & Frantz, 2004). The scale has been used in numerous studies, including many that reveal the association between well-being and connection to nature (e.g. Cervinka et al., 2011). Rather than emotional connections, Perrin and Benassi (2009) suggested CNS measures the beliefs people hold about their connection to nature. However, CNS has been found to measure a latent construct of connection to nature in comparison with other scales, performs better than cognitive measures of NC and predicts many of the benefits associated with positive affect, such as well-being associated with nature connectedness (Tam, 2013).

The 13-item state, rather than trait, version was used owing to previous findings relating public and private self-awareness to state CNS (Mayer, et al. 2009), although the items remain very similar, for example “At this moment, I’m feeling a kinship with animals and plants” and “Right now, I feel that all inhabitants of Earth, human and nonhuman, share a common life force”. A reliability analysis showed the scale was reliable ($\alpha = 0.87$).

Rumination-Reflection Questionnaire (RRQ) - This scale measures heightened attention to self with two different motives: rumination accounting for self-attentiveness motivated by perceived threats to self (e.g. ‘I always seem to be "re-hashing" in my mind recent things I've said or done’) and reflection being self-attentiveness motivated by curiosity in the self (e.g. ‘I love to meditate on the nature and meaning of things’) (Trapnell & Campbell, 1999). A reliability analysis showed the scale was reliable for Rumination and Reflection ($\alpha = 0.94$ and $\alpha = 0.90$, respectively).

2.1 Results

Means and standard deviations of the scale scores are presented in table 1. Correlational analysis of CNS to the included scales revealed a series of significant relationships between the scales; mindfulness and reflection were positively related to CNS whereas rumination was negatively related, see table 2.

To explore the relationship between CNS, MAAS, reflection and rumination further, multiple regression analysis was used. The independent variables (IVs) or predictors were MAAS and the rumination and reflection results from RRQ. As MAAS has previously been found to be associated with CNS (the DV) and is pre-reflective it was entered in the first block (Howell et al., 2011). Reflection was

entered in the second block and rumination the third as it was not predicted to be part of the model.

The results summarized in table 3 show that the model including MAAS alone accounted for 11.6% of the variance in CNS, with $R=0.34$ and Adjusted $R^2=0.11$, $F(1,136)=17.64$, $p < 0.01$. With the addition of reflection, the model gave $R=0.46$ and Adjusted $R^2=0.20$, $F(2,136)=17.77$, $p < 0.01$, with the R^2 change figure suggesting that 9.4% of the variance in CNS was related to an increase in reflection, $F(1, 134) = 15.95$, $p < 0.001$. With the addition of rumination, the model gave $R=0.48$ and Adjusted $R^2=0.21$, $F(3,136)=13.23$, $p < 0.01$, with the R^2 change figure suggesting that 2.0% of the variance in CNS was related to an increase in rumination, $F(1, 133) = 3.48$, $p = 0.06$.

In the final model MAAS and reflection were found to be significant predictors of CNS at the $p=0.05$ level, with rumination bordering significance, $p = 0.06$. Standardized regression coefficients for each task variable suggested higher CNS was associated with an increase in MAAS and reflection, and a borderline decrease in rumination, see table 4. There were no collinearity concerns (Durbin-Watson = 2.195).

2.3 Discussion

As predicted, the results suggest that both the pre-reflective perceptual function of mindful attention and intentional self-directed curiosity are associated with an emotional connection to nature. There was also a relationship between rumination and CNS, with greater attentiveness motivated by perceived threats to self being associated with a lower connection to nature.

Regression analysis revealed that reflection and, to lesser extent, rumination were related to CNS independent of mindful attention. With regards to reflection, this

may be due to a focus on the more positive self-directed thinking that leads to improved self-knowledge (McCrae, 1987), whereas rumination could be a barrier owing to less resource or even a perceived threat of nature. Given the need for replication, and previous research indicating associations between NC, aspects of self-directed thought, and personality (e.g. curiosity and openness; Tam, 2013), a second study was conducted to include the big-five personality traits to ascertain whether self-reflection was an independent predictor of NC within a broader range of individual difference measures.

3. Study 2

3.1 Personality and Nature Connectedness

There are several concepts within the construct of connection to nature and one consideration when predicting nature connectedness is personality. There is a small amount of research that considers the super-ordinate “Big-5” traits (Costa & McCrae, 1992) associated with NC. Tam (2013) found moderate correlations between agreeableness, openness to experience, conscientiousness and CNS, although these were used to reveal convergence between seven connection to nature measures, rather than predicting NC per se. Similarly, Nisbet et al. (2009) found NC, as measured by the Nature Relatedness (NR) scale, to moderately correlate with agreeableness and openness to experience, and more weakly, but significantly, to extraversion and conscientiousness. Given these results, it can be predicted that openness, conscientiousness and agreeableness will be predictors of CNS. Further, common similarities with curiosity, suggest that there is good reason to expect intentional self-directed thinking and mindful attention to mediate the relationship between the super-ordinate trait of openness and nature connectedness.

3.2 Method

3.2.1 *Participants*

161 participants were recruited following an invitation sent to campus and online students of the University of Derby and circulated by social media. The sample comprised of 129 females and 32 males with an age range of 18 to 66 years, mean age of 35.5 years (SD = 10.9).

3.2.2 *Design and Procedure*

This study presented a cross-sectional survey design. Following the approval by the Research Ethics Committee of the University of Derby, messages and emails were sent out requesting participants for the study with a link to a participant information sheet. A survey website was used to administer the questionnaires after providing consent to participate by ticking an appropriate box. After submitting their answers, participants were presented with a debriefing message.

3.2.3 *Materials*

The materials in Study 1 were repeated with addition of a Big-5 personality scale and, given the comparison to personality traits, the trait, rather than state, version of CNS.

Big Five Inventory (BFI)—Developed by John and Srivastava (1999), the BFI is a 44-item inventory that measures an individual on the Big Five Factors (dimensions) of personality (Costa & McCrae, 1992). It has good discriminant and convergent validity, and good reliability and factorial structure across multiple word regions, having being used in a wide range of research including nature connectedness research (Zhang, Howell & Iyer, 2014). A reliability analysis showed the scale was reliable (Extraversion $\alpha = 0.89$, Agreeableness $\alpha = 0.77$, Conscientiousness $\alpha = 0.81$, Neuroticism $\alpha = 0.88$, Openness $\alpha = 0.83$).

3.3 Results

Means and standard deviations of the scale scores are presented in tables 5 and 6. Correlation analysis of CNS to the included scales revealed a series of significant relationships which were explored using regression analysis.

The model including the big-5 personality traits accounted for 26.4% of the variance in CNS, with $R=0.51$ and Adjusted $R^2=0.24$, $F(5,160)=11.11$, $p < 0.01$. With the addition of MAAS, the model gave $R=0.53$ and Adjusted $R^2=0.25$, $F(6,160)=9.96$, $p < 0.01$, with the R^2 change figure suggesting that 1.6% of the variance in CNS was related to an increase in MAAS, $F(1, 154) = 3.37$, $p = 0.068$.

With the addition of reflection, the model gave $R=0.57$ and Adjusted $R^2=0.30$, $F(7,160)=10.56$, $p < 0.01$, with the R^2 change figure suggesting that 4.6% of the variance in CNS was related to an increase in reflection, $F(1, 153) = 10.48$, $p < 0.01$.

With the addition of rumination, the model gave $R=0.57$ and Adjusted $R^2 = 0.29$, $F(3,136)=13.23$, $p < 0.01$, with the R^2 change figure suggesting that 0.4% of the variance in CNS was related to an increase in rumination, $F(1, 152) = 0.86$, $p = 0.36$.

In the final model openness and reflection were found to be significant predictors of CNS at the $p = 0.05$ level, with MAAS and neuroticism bordering significance, $p = 0.06$ and $p = 0.07$ respectively. Standardized regression coefficients for each task variable suggested higher CNS was associated with an increase in openness and reflection, see table 7 for details. There were no collinearity concerns (Durbin-Watson = 2.047).

3.3.1 Mediation results

Owing to the predicted mediation effects and some variation in the significant predictors between the four models mediation analysis was conducted. In a series of tests the relationship between the two significant super-ordinate and fundamental traits, Openness and Neuroticism, and connection to nature was mediated by

conscious self-reflection, mindful attention and rumination, see table 8.

3.4 Discussion

As predicted, openness was a significant predictor of connectedness to nature, and self-reflection, as the stronger factor from study 1, was a significant predictor alongside it. Although it wasn't a significant predictor, the mediation analysis showed that mindful attention and rumination remained part of the wider explanation of NC, along with the unexpected inclusion of neuroticism.

Considering the five-factor model of personality alone, neuroticism and openness were significant predictors of NC, with extraversion close to significance. The association of openness and nature connectedness replicates previous findings (Tam, 2013; Nisbet, Zelenski, & Murphy, 2009). Therefore we conclude that those who value artistic experience and who are disposed to curiosity, imagination, reflection and deep thinking have a stronger subjective connection to nature. However, the non-significance of agreeableness and significance of neuroticism as predictors was not in-line with previous findings (e.g. Tam, 2013). Although when one considers that neuroticism reflects depression, tension and anxiety (John & Srivastava, 1999) it is not surprising to find a negative relationship with CNS, which has been associated with wellbeing and positive affect (Mayer, Frantz, Bruehlman & Dolliver, 2009).

As proposed, nature connectedness is associated with pre-reflective mindful attention and, more directly, self-reflection, even when a broader range of fundamental individual difference measures are introduced.

4. Study 3

4.1 Introduction

As predicted, the first two studies demonstrate cross-sectional correlations between

pre-reflective mindful attention and self-reflection. Given the current identified need and campaigns to increase connection to nature, it would be beneficial to understand the relationship between pre-reflective mindful attention and self-reflection to increases in CNS. Simple exposure to images of nature have previously been found to increase CNS compared to control images (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). Given the results of study 2, it can be predicted self-reflection will be related to increases in CNS, whereas mindful attention and rumination will not be associated with CNS change.

4.2 Method

4.2.1 Participants

99 participants were recruited following an invitation sent to campus and online students of the University of Derby and circulated by social media. The sample comprised of 66 females and 33 males with an age range of 18 to 66 years, mean age of 31.6 years (SD = 10.1).

4.2.2 Design and Procedure

A pre-post design used exposure to images of nature to increase CNS (c.f. Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). As the aim of the study was to examine the relationship between the independent variables and change in the dependent variable (CNS), a control group wasn't required as no comparisons were being made; e.g. the ability to manipulate CNS was not being tested. The approach can be compared to research examining predictors of change in more involved interventions which don't include comparisons to a control group, e.g. Muris, Mayer, den Adel, Roos, & van Wamelen (2009). The previously used measures of reflection, rumination and mindfulness were administered before the intervention. As it is more sensitive to change, state CNS was measured before and after the intervention. During

the intervention participants were instructed to ‘view twenty-three photographs of an area of countryside’, each for 15 seconds as used by Berto (2005). The viewing process took approximately 6 minutes.

Following the approval by the Research Ethics Committee of the University of Derby, messages and emails were sent out requesting participants for the study with a link to a participant information sheet. A survey website was used to administer the questionnaires and photographs after providing consent to participate by ticking an appropriate box. The study was completed in July 2014. After submitting their answers, participants were presented with a debriefing message.

4.2.3 Materials

The materials in Study 1 were repeated with the addition of 23 photographs of countryside scenes taken by the lead author and presented at 800 by 533 pixels. These were taken in the agricultural landscape around Staffordshire, UK. This rural landscape is characterized by a rolling plateaus ranging from 50 to 110 meters above sea level and two wide alluvial valleys. Rather than wide-angle landscape scenes of pasture and arable land divided by rectilinear hedgerow patterns, the photographs typically showed closer woodland scenes with some ponds, streams and rivers.

4.3 Results

Means and standard deviations of the data are presented in table 9. A paired samples t-test confirmed that the manipulation of CNS was successful, with a statistically significant increase from pre-intervention baseline CNS to post-intervention CNS, $t(98) = -7.20$, $p < 0.001$, $d = 0.40$. Subsequent analysis associated with the aims of the study could therefore be pursued. Correlation analysis of CNS change to the included scales revealed two significant relationships, see table 10.

To explore the relationship between CNS change, MAAS, reflection and rumination further, multiple regression analysis was used. The independent variables (IVs) or predictors were MAAS and the rumination and reflection results from RRQ. The regression model accounted for 4.6% of the variance in the increase in CNS, with $R=0.22$ and Adjusted $R^2=0.02$, $F(3,98)=1.54$, $p = 0.21$. Standardized regression coefficients suggested that change in CNS was associated with greater level of reflection alone ($p < 0.05$), see table 11. There were no collinearity concerns (Durbin-Watson = 1.712).

4.4 Discussion

As predicted, participant's level of reflective self-attention was associated with the increase in CNS, with frequency of mindful attention, measured by MAAS, not being associated with the change in CNS. Therefore, it is possible to conclude that those who tend to take part in intentional self-reflection report greater increases in CNS when exposed to natural scenes; whereas those who demonstrate greater mindful attention did not. The low level of variance in CNS change accounted for by reflection is an indication of the multitude of factors involved, but also that the intervention of viewing scenes of nature is the active component in the change.

5. General Discussion

The data from the three studies supports a pre-reflective and intentional self-attention route to nature connectedness, with intentional reflective self-attention alone associated with increases in connection to nature. As reflection is associated with curiosity about the attitudes, thinking, values and emotions that contribute to the self, there is an indication that by looking inward one can develop improved self-knowledge (Morin, 2006) which may lead to an understanding of a greater unity with the outer world. This takes place in a wider context where the perceptual function of

mindful attention provides an enhanced experience of nature (Howell et al., 2011) upon which to reflect.

Both reflection and openness share aspects of curiosity, and the mediation analysis demonstrates that the relationship between openness and CNS is positively mediated by tendency for self-reflection, with the more negative side of self-directed thought, rumination, acting as a barrier. The importance and entwined nature of the relationship between pre-reflective and intentional self-attention is further highlighted by the mediating role of MAAS, mindful state frequency. These relationships are also repeated for neuroticism so that it can be concluded that the associations between the more distal super-ordinate personality traits and nature connection are moderated by self-directed and mindful attention.

If reflective and mindful attention can be practiced (Anderson et al., 2007) and are more malleable than super-ordinate personality traits, there are implications for applied practice when embarking on interventions to connect people to nature, which could also deliver associated well-being benefits. Similarly, therapeutic practice can also be informed, with activities related to reflective self-attention. Currently, such practice in natural settings can involve increasing mindful attention to nature, rather than the self. The results present evidence of a potential route to nature connection and well-being through nature, especially as time in nature itself facilitates and increases self-reflection (Mayer, Frantz, Bruehlman & Dolliver, 2009).

The discussion above leads us to propose a pre-reflective and intentional self-attention (PRISM) model of nature connectedness, see figure 1. Within the model, there are various ways in which aspects of nature, represented by the tree, can be interpreted by people (represented by the figure). The triangular dispersive prism represents the various components of the human-nature relationship involved in

nature connectedness. Thus, the image of the tree has a pre-reflective perceptual input to the person, while the tree can also be part of a two-way relationship through intentional self-attention and reflection. Openness is included as a personality trait of the person taken into the natural world, thus acting on the human-nature relationship. Finally, the factors with a negative relationship to nature connection, such as the anxious self-attention or rumination, are placed on the prism wall as barriers. While the representation of the PRISM model is a potentially useful concept for summarizing the results of the present paper, it is acknowledged that other subjective (e.g. Zhang, Howell & Iyer, 2014), cognitive (Mayer & Frantz, 2004), affective and experiential (e.g. Zelenski & Nisbet, 2012) factors are involved in the wider explanation of nature connectedness.

Although the personality trait findings differ in some respects to previous work, there is good reason for confidence in the role of mindful attention, reflection and rumination given the replication of these relationships from study one to two. With study three highlighting self-reflection being a trait worthy of greater consideration and research focus, as has been seen with mindfulness. Future research in this area should focus on both applied and theoretical considerations. With regard to application, the pre-reflective and intentional self-attention route nature connectedness could be used to inform interventions, for example, those that encourage reflection. From a theoretical perspective, the proposed pathways should be confirmed and refined, for example establishing causality towards nature connectedness, rather than an as outcome of connection. Further studies should also attempt to unpick the content of the improved self-knowledge and whether it is a realization of a truth about our shared place as biological beings in a wider ecology. Finally, the reciprocity of reflection as both a pathway and outcome of connection to

nature (Mayer, Frantz, Bruehlman-Senecal & Dolliver, 2009) should be considered.

With regard to limitations it should be noted that the research relied on self-report measures typical of the field, delivered some small effect sizes from a majority of female participants, and no causality can be inferred. However, the three studies together do provide further insight into the concept of nature connectedness, and routes to its improvement, at a time when researchers, conservation bodies and governments are recognising the importance of our connection to nature.

In summary, connection to nature is associated with pre-reflective mindful attention and, more directly, intentional self-reflection; the latter being key within a broader range of individual difference measures. Those who are more reflective and inclined to analyse their self, also have a greater increase in connection to nature when exposed to it. Extending and refining the knowledge of the forms of attention associated with connection to nature can inform interventions to help people realise their place within a wider ecology, and therefore the related benefits to well-being. Open attention to nature while looking inward is a pathway worthy of further investigation.

References

- Ambrose-Oji, B. (2013). *Mindfulness Practice in Woods and Forests: An Evidence Review*. Research Report for The Mersey Forest, Forest Research. Alice Holt Lodge Farnham, Surrey.
- Anderson, N. D., Lau, M. A., Segal, Z. V., & Bishop, S. R. (2007). Mindfulness-based stress reduction and attentional control. *Clinical Psychology & Psychotherapy*, 14, 449–46

- Bai, H., & Scutt, G. (2009). Touching the Earth with the Heart of Enlightened Mind : The Buddhist Practice of Mindfulness for Environmental Education. *Earth*, 92–106.
- Barnosky, A. D., Matzke, N., Tomiya, S., Wogan, G. O .U., Swartz, B., Quental, T. B., Marshall, C., McGuire, J. L., Lindsey, E. L., Maguire, K. C., Mersey, B. & Ferrer, E. A. (2011). Has the Earth’s sixth mass extinction already arrived? *Nature*, 471, 51–57 doi:10.1038/nature09678
- Berto, R. (2005). Exposure to restorative environments helps restore attentional capacity. *Journal of Environmental Psychology*, 25(3), 249-259. doi: 10.1016/j.jenvp.2005.07.001
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, 84(4), 822–848. doi:10.1037/0022-3514.84.4.822
- Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: Theoretical Foundations and Evidence for its Salutary Effects. *Psychological Inquiry*, 18(4), 211–237. doi:10.1080/10478400701598298
- Bragg, E. A. (1996). Towards ecological self: deep ecology meets constructionist self theory. *Journal of Environmental Psychology*, 16(2), 93–108.
- Capaldi C. A., Dopko R. L. & Zelenski J. M. (2014). The relationship between nature connectedness and happiness: a meta-analysis. *Frontiers in Psychology*, 5. doi: 10.3389/fpsyg.2014.00976
- Cervinka, R., Röderer, K., & Hefler, E. (2012). Are nature lovers happy? On various indicators of well-being and connectedness with nature. *Journal of Health Psychology*, 17(3), 379-388. doi: 10.1177/1359105311416873

Costa, P. T., & McCrae, R. R. (1992). *NEO PI-R Professional Manual*. Odessa, FL:

Psychological Assessment Resources.

Hartig, T., Berg, A. E. Van Den, Hagerhall, C. M., Tomalak, M., Bauer, N., Hansmann, R., Ojala, A., Syngollitou, E., Carrus, G., Van Herzele, A., Bell, S., Podesta, M., T. C. and Waaseth, G. In K. Nilsson, M. Sangster, C. Gallis, T. Hartig, S. de Vries, K. Seeland, & J. Schipperijn, Eds, (2011). *Forests, Trees and Human Health*. Dordrecht: Springer. doi:10.1007/978-90-481-9806-1

Howell, A. J., Dopko, R. L., Passmore, H. A., & Buro, K. (2011). Nature connectedness: Associations with well-being and mindfulness. *Personality and Individual Differences, 51*, 166-171. doi:10.1016/j.paid.2011.03.037

John, O. P., & Srivastava, S. (1999). The Big-Five trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (Vol. 2, pp. 102–138). New York: Guilford Press.

Joireman, J. A., Parrott, L. P., & Hammersla, J. (2002). Empathy and the self-absorption paradox: Support for the distinction between self-rumination and self-reflection. *Self and Identity, 1*, 53-65.

Kim, W., Lim, S. K., Chung, E. J., & Woo, J. M. (2009). The effect of cognitive behavior therapy-based psychotherapy applied in a forest environment on physiological changes and remission of major depressive disorder. *Psychiatry investigation, 6*(4), 245-254.

Lau, M. A., Bishop, S. R., Segal, Z. V., Buis, T., Anderson, N. D., Carlson, L., et al. (2006). The Toronto Mindfulness Scale: Development and validation. *Journal of Clinical Psychology, 62*, 1445–1467

- Mayer, F., & Frantz, C. (2004). The connectedness to nature scale: A measure of individuals feeling in community with nature. *Journal of Environmental Psychology, 24*, 503-515. doi:10.1016/j.jenvp.2004.10.001
- Mayer, F. S., Frantz, C. M., Bruehlman-Senecal, E., & Dolliver, K. (2009). Why is nature beneficial? The role of connectedness to nature. *Environment and Behavior, 41*, 607-643.
- McCrae, R.R. (1987). Creativity, divergent thinking, and openness to experience. *Journal of Personality and Social Psychology, 52*(6), 1258-1265.
- Morin, A. (2006). Levels of consciousness and self-awareness: A comparison and integration of various neurocognitive views. *Consciousness and Cognition, 15*(2), 358–71. doi:10.1016/j.concog.2005.09.006
- Mor, N., & Winquist, J. (2002). Self-focused attention and negative affect: A meta-analysis. *Psychological Bulletin, 128*, 638–662.
- Muris, P., Mayer, B., den Adel, M., Roos, T., & van Wamelen, J. (2009). Predictors of change following cognitive-behavioral treatment of children with anxiety problems: A preliminary investigation on negative automatic thoughts and anxiety control. *Child Psychiatry and Human Development, 40*(1), 139-151.
- Naess, A. (1973). The shallow and the deep ecology movements. *Inquiry, 16*, 95-100.
- Nisbet, E. K. & Zelenski, J. M. (2011). Underestimating nearby nature: affective forecasting errors obscure the happy path to sustainability. *Psychological Science, 22*(9), 1101–6. doi:10.1177/0956797611418527
- Nisbet, E. K., Zelenski, J. A., & Murphy, S. A. (2009). The nature relatedness scale: Linking individuals' connection with nature to environmental concern and behaviour. *Environment and Behaviour, 41*, 715-740.
- Perrin, J. L., & Benassi, V. A. (2009). The connectedness to nature scale: A measure

of emotional connection to nature? *Journal of Environmental Psychology*, 29, 434-440.

RSPB. (2013). Giving nature a home. Retrieved September 22, 2013 from <http://homes.rspb.org.uk>

Schultz, P. W. (2000). Empathizing With Nature : The Effects of Perspective Taking on Concern for Environmental Issues. *Journal of Social Issues*, 56(3), 391–406.

Tam, K-P. (2013). Concepts and measures related to connection to nature: Similarities and differences. *Journal of Environmental Psychology*, 34, 64-78.
doi:10.1016/j.jenvp.2013.01.004

Trapnell, P.D., & Campbell, J.D. (1999). Private self-consciousness and the five-factor model of personality: Distinguishing rumination from reflection. *Journal of Personality and Social Psychology*, 76, 284–304.

Zhang, J. W., Howell, R. T., & Iyer, R. (2014). Engagement with Natural Beauty Moderates the Positive Relation between Connectedness with Nature and Psychological Well-Being. *Journal of Environmental Psychology*. Advance online publication. doi:10.1016/j.jenvp.2013.12.013

Zelenski, J. M. & Nisbet, E. K. (2012). Happiness and Feeling Connected: The Distinct Role of Nature Relatedness. *Environment and Behaviour*. Advance online publication. doi:10.1177/0013916512451901