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**Authors**

Petersen, Evi  
Fiske, Alan Page  
Schubert, Thomas W

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# The role of social relational emotions for human-nature connectedness

Evi Petersen<sup>1\*</sup>, Alan P. Fiske<sup>2</sup>, Thomas Schubert<sup>3</sup>

<sup>1</sup>University of South-Eastern Norway, Norway, <sup>2</sup>UCLA Department of Anthropology, United States,

<sup>3</sup>University of Oslo, Norway

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EP conceptualised and wrote the first draft. AF & TS contributed with advice. All authors revised the final manuscript.

### *Keywords*

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### *Abstract*

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Little is known about the psychological processes that can explain how connectedness to nature evolves. From social psychology, we know that emotions play an essential role when connecting to others. In this article, we argue that social connectedness and connectedness to nature are underpinned by the same emotions. More specifically, we propose that social relational emotions are crucial to understanding the process, how humans connect to nature. Beside other emotions, kama muta (Sanskrit: being moved by love) might play a particular crucial role when connecting to nature. Future research should address the consideration of social relational emotions in a range of areas when investigating the human-nature relationship.

### *Contribution to the field*

A strong connection between humans and nature shows to be essential to sustain both the well-being of the environment as well as human well-being. In this scope, we explicitly propose the relevance of social relational emotions. By analysing underlying psychological-emotional mechanisms, this paper adds explanatory value to understanding human-nature interaction that goes beyond the biophilia hypothesis. Shifting focus towards the understanding of emotions that facilitate and strengthen a sense of nature-connectedness has the potential to inform moves to increase human well-being as well as environmental and pro-environmental behaviour.

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# The role of social relational emotions for human-nature connectedness

1 Evi Petersen<sup>1\*</sup>, Alan Page Fiske<sup>2</sup>, Thomas Schubert<sup>3</sup>

2 <sup>1</sup> Department of Sports, Physical Education and Outdoor Studies, University of South-Eastern  
3 Norway, Bø i Telemark, Norway

4 <sup>2</sup> Department of Anthropology, University of California, Los Angeles

5 <sup>3</sup> Department of Psychology, University of Oslo, Oslo, Norway

6 \* Correspondence:

7 Evi Petersen

8 [evi.petersen@usn.no](mailto:evi.petersen@usn.no)

9 **Keywords:** connectedness to nature<sup>1</sup>, social relational emotions<sup>2</sup>, social connectedness<sup>3</sup>, kama  
10 muta<sup>4</sup>, awe<sup>5</sup>, well-being<sup>6</sup>, sustainability<sup>7</sup>, human-nature relationships<sup>8</sup>.

## 11 Abstract

12 ~~The connection between humans and nature is a topic that receives increasing attention linked to~~  
13 ~~debates on human well-being as well as environmental issues. While the need to provide and improve~~  
14 ~~those relationships is a present issue,~~ Little is known about the psychological processes that can  
15 explain how connectedness to nature evolves. From social psychology, we know that emotions play  
16 an essential role when connecting to others. In this article, we argue that social connectedness and  
17 connectedness to nature are underpinned by the same emotions. More specifically, we propose that  
18 *social relational emotions* are crucial to understanding the process, how humans connect to nature.  
19 Beside other emotions, kama muta (Sanskrit: being moved by love) might play a particular crucial  
20 role when connecting to nature. Future research should address the consideration of social relational  
21 emotions in a range of areas when investigating the human-nature relationship.

22

## 23 1 Introduction

24 “When one tugs at a single thing in nature, he finds it attached to the rest of the world”. John Muir.

25 A positive relationship between humans and the natural world shows to be cross-culturally essential  
26 to sustain both human well-being and the well-being of the environment. This claim is supported by  
27 evidence of health-related and emotional well-being benefits from human interaction with nature  
28 (Hartig, Mitchell, De Vries, & Frumkin, 2014; McMahan & Estes, 2015) as well as its effects on pro-  
29 environmental attitude and behaviour to address environmental sustainability issues (Geng, Xu, Ye,  
30 Zhou, & Zhou, 2015; Ives et al., 2018; Rosa, Profice, & Collado, 2018). In this context, there has  
31 developed a substantial body of literature examining the human relationship and orientation towards  
32 nature. Among the conceptualisations are *nature relatedness* (Nisbet, Zelenski, & Murphy, 2009),  
33 *inclusion of nature in self* (Schultz, 2002), *emotional affinity toward nature* (Kals, Schumacher, &  
34 Montada, 1999) and *connectedness to nature* (Mayer & Frantz, 2004). Some of these concepts tap  
35 into cognitive appreciation of being embedded in nature, while others focus on the emotional

36 attachment or address material dependence on nature (Ives et al., 2017). Despite their differences, all  
 37 of the concepts seem to agree on same core phenomenon: a relatively permanent connection to nature  
 38 on the individual level (Capaldi, Dopko, & Zelenski, 2014; Tam, 2013). Psychometric scales used to  
 39 measure this, such as the *nature relatedness scale* (Nisbet et al., 2009) or the *connectedness to nature*  
 40 *scale* (Mayer & Frantz, 2004), are all highly correlated with one another (Tam, 2013). Accordingly,  
 41 we will not distinguish between the different concepts in this paper, and we will refer to *nature*  
 42 *connectedness* as an umbrella term. A growing demand to provide and improve a positive human-  
 43 nature relationship has led to an interest among diverse scientists to conceptualise this phenomenon.  
 44 Today, a variety of concepts such as nature relatedness (Nisbet, Zelenski, & Murphy, 2009),  
 45 inclusion of nature in self (Schultz, 2002), emotional affinity toward nature (Kals, Schumacher, &  
 46 Montada, 1999) and connectedness to nature (Mayer & Frantz, 2004) offer frameworks for  
 47 describing and evaluating different aspects of the human-nature relationship. Despite differences in  
 48 focus, all concepts characterise a relatively permanent feeling of connectedness to nature (Tam,  
 49 2013), which is the term we will continue to refer to.

50 Nature connectedness has recently been identified-shown to be a predictor for human well-being  
 51 (Capaldi et al., 2014), as well as pro-environmental attitude and behavior (Mackay & Schmitt, 2019).  
 52 Explanations addressing the general question of why humans connect to nature are for the most part  
 53 theoretically rooted in the Biophilia Hypothesis. First coined as a term by Fromm (1964) and later  
 54 expanded by (Wilson, 1984), the Biophilia Hypothesis originates from the evolutionary notion that  
 55 humans depend on their natural environment. It is claimed that this dependence evolved into a  
 56 predisposition to be cognitive and emotionally attracted to nature and to affiliate with it (Kellert &  
 57 Wilson, 1993). In this sense, the Biophilia Hypothesis provides a basis for an interdisciplinary  
 58 research agenda to understand the general motivation of humans connecting to nature. However, it  
 59 leaves the question open how such feelings of connectedness to nature are instantiated.

## 60 **2 Knowledge gap and aim of the paper**

61 We need to understand and investigate the specific pathways that lead to nature connectedness in  
 62 order to provide possibilities for it to occur. In this scope, psychological mechanisms have been  
 63 stated to be central when examining the routes to nature connectedness (Lumber, Richardson, &  
 64 Sheffield, 2017; Zylstra, Knight, Esler, & Le Grange, 2014). While research from social  
 65 psychology demonstrates that connecting to others is closely tied to emotional processes (Fiske,  
 66 Seibt, & Schubert, 2019), but little attention has been is known-given to about the emotional  
 67 mechanisms that presumable enable and mediate connecting to nature (Milton, 2002). Consequently,  
 68 the present paper adds explanatory value to understanding human-nature interaction by proposing  
 69 stressing that specific emotionsnal processes play an important role for connectedness to nature rather  
 70 than being a side-effect or outcome. To the best of our knowledge, this is the first paper to suggest  
 71 that social relational emotions have an important role to play in the process of connecting to  
 72 nature. We specifically suggest that social relational emotions are crucial in the process of connecting  
 73 to nature.

74 In the next sections, we firstly discuss the relationship between social connectedness and  
 75 connectedness to nature and explain why both concepts are most likely underpinned by the same  
 76 emotional mechanisms. We then describe the function of emotions for the process of connecting to  
 77 social others, and highlight the potential of social relational emotions in this scope. In the third  
 78 paragraph of the paper, we present the current specific research examples on the role and impact of  
 79 these emotions in the scope of connecting to nature. We conclude by addressing the significance and  
 80 implications of social relational emotions within future research.

### 81 3 Connectedness to nature and social connectedness

82 Humans are social beings and therefore have a fundamental need to ~~relate~~belong (Baumeister &  
83 Leary, 1995; Dunbar & Shultz, 2007; Fiske, 2018). This need ~~isto belong gets~~ often satisfied by  
84 socially connecting to others such as the partner, family or friends. However, we know that people  
85 also socially relate to animals, deceased ancestors, deities, abstract entities such as countries,  
86 humanity as a whole, or even imagined collectivities in order to meet their need ~~to relate for~~  
87 belonging (Fiske, 2004; McFarland, Webb, & Brown, 2012). Likewise, ecopsychologists have  
88 pointed out that the need to ~~belong relate~~ can be satisfied by feeling connected to nature (Baxter &  
89 Pelletier, 2018; Schultz, 2002).

90 While social psychology has mainly focused on connections between humans, ecopsychology has  
91 tried to understand the connection between humans and the natural world. Although little research  
92 has specifically investigated the relationship of these two concepts, the literature points to the  
93 conceptual similarities between social connectedness and connectedness to nature. First, Kals et al.  
94 (1999) and Mayer, Frantz, Bruehlman-Senecal, and Dolliver (2009) demonstrated that similar to ~~how~~  
95 humans ~~establish~~ connections with other humans, positive experiences with nature can lead to an  
96 emotional affinity and cognitive identification with nature. Second, both relationships ~~involve have~~  
97 similar basic features-modes of actions, such as commitment (Davis, Green, & Reed, 2009) and  
98 inclusion of the other (nature or other human beings) in the self-concept (Schultz, 2002). Third,  
99 several studies have found relations between measures of social connectedness and connectedness to  
100 nature. For instance, Howell, Dopko, Passmore, and Buro (2011) and Howell, Passmore, and Buro  
101 (2013) found significant positive correlations between *social connectedness*, framed as social well-  
102 being (Keyes, 1998) and the *connectedness to nature scale* by Mayer and Frantz (2004), the *nature*  
103 *relatedness scale* by Nisbet et al. (2009) and the *allo-inclusive identity nature subscale* by Leary,  
104 Tipsord, and Tate (2008). Finally, the notion of *being connected* itself is a psychological one, which  
105 is mediated by culture, context, and experiences (Mesquita, Boiger, & De Leersnyder, 2016).  
106 Therefore, it is plausible to hypothesise that connecting to other human beings and connecting to  
107 nature are underpinned by the same general psychological mechanisms, which include cognitive,  
108 emotional, and behavioural processes. We focus here on specific emotions that play an essential role  
109 in connecting to others.

110 ~~From this point of view, it is plausible to hypothesise that connecting to other human beings and~~  
111 ~~connecting to nature are underpinned by the same general psychological mechanisms, which include~~  
112 ~~cognitive, emotional and behavioural processes. In this scope, research from social psychology~~  
113 ~~shows that there exist specific emotions that play an essential role in connecting to others.~~

### 114 4 Social relational emotions – their function for social connectedness

115 In this paragraph, we discuss what kind of emotions facilitate social connectedness and how.  
116 Emotions, in general, play a crucial role in our daily life as they influence how we think and behave  
117 (Ekman & Davidson, 1994; Scherer & Ekman, 2014). Emotions can be defined as rather short-lived,  
118 object-directed and high in intensity in contrast to state of moods, and for the purpose of this paper  
119 are best described by the approach of appraisal theory (Moors, 2010; Moors, Ellsworth, Scherer, &  
120 Frijda, 2013). Typically, humans experience emotions more strongly when events are relevant to  
121 their current needs, aims, motives, values, norms, attachments, beliefs, or expectations (Frijda, 1986;  
122 Lazarus, 1991; Scherer, 2005). Furthermore, emotions can ~~impact make~~ experiences ~~to be~~ more  
123 memorable (Reisberg & Heuer, 1992). In this sense, emotions are functional, guiding us in adaptive  
124 responses to social relational opportunities and challenges (Fiske, 2002, 2010). For instance, although

125 often perceived as negative, the primary function of ~~anger~~, shame, grief, guilt and embarrassment is  
 126 to establish, regulate, and maintain social relationships and social positions relative to others (Bastin,  
 127 Harrison, Davey, Moll, & Whittle, 2016, p. 457). Due to the specific underlying function of  
 128 establishing, regulating and maintaining relationships, these emotions can be categorised as *social*  
 129 *relational emotions*.

130 More recently, emotions with positive valences have as well received scientific attention. These  
 131 emotions are awe (Keltner & Haidt, 2003; Shiota, Keltner, & Mossman, 2007), admiration (Onu,  
 132 Kessler, & Smith, 2016), gratitude (Ma, Tunney, & Ferguson, 2017; McCullough, Kilpatrick,  
 133 Emmons, & Larson, 2001), compassion (Nussbaum, 1996) and moral elevation (Haidt, 2003; Pohling  
 134 & Diessner, 2016). All these emotions seem capable of boosting a sense of connection with others  
 135 and can, therefore, be categorised as *positive social relational emotions*. For instance, Stellar et al.  
 136 (2017) highlighted that emotions like awe, gratitude, and compassion are powerful proximal  
 137 determinants of prosocial action. According to the authors, it is through prosocial tendencies, that  
 138 these emotions (termed by the authors as *self-transcendent emotions*) bind individuals to others.  
 139 ~~within social collectives.~~

140 In this context, we highlight the potential of one specific positive emotion, namely kama muta,  
 141 (Sanskrit: being moved by love; Fiske et al., 2019; Seibt et al., 2017; Zickfeld et al., 2019), which  
 142 may be the most crucial social relational emotion in connectedness. Holding a new-born baby in your  
 143 arm, surprisingly seeing a loved one again after a long time, or unexpectedly receiving a great  
 144 kindness are typical example of moments in which people experience kama muta. In vernacular  
 145 English, kama muta is often described as being moved or touched, while the elicitors may be called  
 146 heart warming (Fiske et al., 2019). The primary appraisal involved in kama muta is experiencing a  
 147 sudden intensification of communal sharing. A number of studies suggest that kama muta has  
 148 evolved (biologically and culturally) to regulate communal sharing relations (Schubert, Zickfeld,  
 149 Seibt, & Fiske, 2018; Seibt et al., 2017). Communal sharing, one out of four relationships humans  
 150 use to coordinate their social interactions, is the foundation of relationships in which people feel  
 151 shared identity, are motivated by unity, share resources according to need and ability or signal and  
 152 commit to being one by assimilating each other's bodies (see: Relational Models Theory: Fiske,  
 153 1991; 1992; 2004). While kama muta is often evoked by the perception of a sudden intensification of  
 154 a communal sharing relationship with another human being, the theory is not restricted to it. It  
 155 explicitly suggests that encounters could occur with another being such as an animal, deity or even an  
 156 abstract entity such as the earth or the cosmos. Therefore, this theory-based emotion offers particular  
 157 potential for investigating its meaning for nature connectedness.

158 ~~According to the Relational Models Theory (Fiske, 1991, 1992, 2004), humans coordinate and~~  
 159 ~~organise social interactions based on four relational models. These four forms of relationships are~~  
 160 ~~Communal Sharing, Authority Ranking, Equality Matching and Market Pricing. For instance,~~  
 161 ~~holding a newborn baby in your arm, surprisingly seeing a loved one again after a long time or~~  
 162 ~~unexpectedly receiving a great kindness of someone are examples of communal sharing relationships~~  
 163 ~~(Fiske, 1991, 1992). In these moments, people experience kama muta (Sanskrit, "being moved by~~  
 164 ~~love" Fiske et al., 2019; Seibt et al., 2017; Zickfeld et al., 2019). Although many researchers are still~~  
 165 ~~unfamiliar with the concept of this particular social relational emotion, kama muta might be one of~~  
 166 ~~the most relevant social relational emotions in the contexts of social connectedness. Kama muta is~~  
 167 ~~often evoked by the perception of a sudden intensification of a communal sharing relationship with~~  
 168 ~~another human being. However, the theory explicitly suggests that these encounters could occur with~~  
 169 ~~another being such as an animal, deity or even an abstract entity such as the earth or the cosmos.~~

170 65 The role of social relational emotions –their role in nature experiences

171 In this section, we are raising awareness for the fact that aspects of social relational emotions have  
 172 been associated with psychological inspired research on nature experiences since the last 50 years,  
 173 but rarely empirically. By pointing to some current empirical research in this field, we highlight the  
 174 potential that social relational emotions offer for understanding the gateways to nature-connectedness  
 175 and the associated outcome variables such as well-being.

176 Although not explicitly termed like this, social relational emotions have a long time been  
 177 recognised strongly associated with in the philosophical literature on in environmental ethics. Naess  
 178 (1977), who builds his theoretical considerations regarding deep ecology upon the ideas of Spinoza,  
 179 views emotions to be fundamental to the complex inter-relationships that the natural world exists of.  
 180 Early philosophically inspired researchers looking into psychological aspects of connecting  
 181 experiences in nature tended to ascribe emotional characteristics to into the overall nature  
 182 experiences without separating them from other aspects of the experience. For instance, based on the  
 183 concept of *peak experiences* by Maslow (2013, p. 59), a study with a sample of 1000 Americans  
 184 showed that 82% of the participants indicated that they had responded to have experienced the beauty  
 185 of nature in a deeply moving way (Wuthnow, 1978). A study by DeMares (2000) found similar  
 186 emotional responses. According to the informants of the interview based study interview respondents,  
 187 the encounter with cetaceans led to feeling connecting with the animal, and was sometimes described  
 188 as a life-changing peak experiences. Expanding on the concept of peak experiences, the  
 189 ecopsychologist Davis (1998) proposed the term *transpersonal experiences in nature*, which includes  
 190 the experience of peace, joy, love, support, inspiration and communion. According to the author,  
 191 those are aspects of nonreligious spirituality. Later, Trigwell, Francis, and Bagot (2014) identified  
 192 such non-religious spirituality as a mediator of the nature connectedness and eudaimonic well-being.  
 193 Additionally, Marshall (2005) refers to *mystical experiences in which people feel, when describing*  
 194 that the natural world evokes brings a sense of unity, knowledge, self-transcendence, eternity, light,  
 195 and love. The notion of emotions as part of some form of spirituality have taken a wide-ranging place  
 196 in the literature when trying to explain processes of nature connectedness. However, a more recently  
 197 published paper by Lumber et al. (2017), investigated whether the nine values of the Biophilia  
 198 Hypothesis, which represent a combination of different values and emotions, mediate nature-  
 199 connectedness. Through two online surveys (n= 321) and one walking intervention (n=72) findings  
 200 indicate they found that contact to nature, emotion, meaning, compassion and beauty are pathways to  
 201 improving nature connectedness. Another recent paper research project by Anderson, Monroy, and  
 202 Keltner (2018) used daily diary methods to look at distinct emotions and their mediating role in  
 203 nature experience for the outcome of well-being. In theira first study, they found that awe  
 204 experienced by 72 military veterans and 52 young people from underserved communities while  
 205 white-water rafting, above other positive emotions measured, predicted increases changes in well-  
 206 being and reduction of stress-related symptoms after one week. In the second study, they could  
 207 showed that the nature experiences that of 115 undergraduate students had during their everyday  
 208 lives led to more awe, which mediated the effect of nature experience on improvements in well-  
 209 being. Moreover, gratitude, in addition to awe, also mediated the effect of nature experience on daily  
 210 life satisfaction. Additionally, gratitude and awe each mediated the effect of nature experience on  
 211 daily life satisfaction.

212 Summarising the reviewed literature, In sum, research on social relational emotions and nature-  
 213 connectedness presents itself as relativity vague, Research on states of nature connectedness  
 214 showed to include and apparently includes a mix of social relational emotions, often labelled as  
 215 *spiritual* aspects. Such a theoretical framing makes it difficult-challenging to scientifically investigate



216 emotional processes. ~~However, English-speakers' descriptions of experiences as *deeply moving* or~~  
 217 ~~*even love* might represent instances of the kama muta emotion. However, descriptions of *deeply*~~  
 218 ~~*moving* or *even love* might represent aspects of the emotion kama muta, as this emotion is often~~  
 219 ~~*described as being moved by English speakers.*~~ Moreover, despite some weaknesses in the  
 220 methodology, single empirical examples reveal that emotions in general, and compassion  
 221 specifically, could be important for the sense of nature connectedness. Furthermore, the literature  
 222 suggests that social relational emotions such as awe and gratitude play a direct role for well-being  
 223 that result from contact to nature.

## 224 76 Conclusion and implications for future research

225 ~~The issue of nature connectedness is a complex one. Shifting focus towards the~~ Understanding ~~theof~~  
 226 emotions that facilitate and strengthen a sense of nature-connectedness has the potential to inform  
 227 moves to increase human well-being ~~as well as and to foster~~ pro-environmental ~~attitudes~~ and ~~pro-~~  
 228 ~~environmental~~ behaviour. ~~In Social-relational emotions, especially kama muta, seem to be salient in~~  
 229 ~~experiences of connection with nature. This has five implications. this scope, we have explicitly~~  
 230 ~~proposed the relevance of social relational emotions and. In the following, we highlight five areas of~~  
 231 ~~further investigation and mark brief methodological suggestions.~~

232 First, future research should investigate empirically, how single or combinations of social relational  
 233 emotions such as awe, compassion, gratitude, moral elevation, and kama muta effect connectedness  
 234 to nature. Researching emotions and relationships is complex. This and the fact that we propose a  
 235 new area of research invites for multiple methodological approaches. ~~While a phenomenological~~  
 236 ~~psychological approach can be suitable to explore the here and now of lived experience on an~~  
 237 ~~individual level (Merleau-Ponty, 1962), systematic approaches are needed. While systematic~~  
 238 ~~approaches are required to explore the structure of the experienced phenomenon on the individual~~  
 239 ~~level, for instance, by applying the descriptive phenomenological method (Giorgi, 2009), systematic~~  
 240 ~~approaches on a larger scale are essential to allow for generalisation of findings. In this scope,~~  
 241 ~~collecting data through mobile experience sampling method (mESM) could address the fact that~~  
 242 ~~emotional states are momentary experiences at particular moments in time. Applying mESM by~~  
 243 ~~using smartphone technology, is a method enabling continuous recording of people's daily life in real~~  
 244 ~~time to assess emotional states on a within and between level (Pejovic, Lathia, Mascolo, & Musolesi,~~  
 245 ~~2016). In comparison to traditional self-report, ESM method shows to be less subject to biases~~  
 246 ~~introduced by recall and retrieval processes (Shiffman & Stone, 1998; Stone et al., 1998). It is~~  
 247 ~~important to recognise that every experience including its underlying emotions is culturally situated~~  
 248 ~~and culturally informed. In the same way is connectedness to nature fostered by cultural models of~~  
 249 ~~this entity. This fact highlights the importance of cross-cultural research; however, it should also~~  
 250 ~~reminds future research of the need to methodically consider peoples' conceptions of nature when~~  
 251 ~~investigating the role of social relational emotions in the context of nature connectedness. For~~  
 252 ~~instance, the word nature can have different meanings for people from different cultures (Wohlwill,~~  
 253 ~~1983).~~

254 ~~Second, it is important to recognise that every experience, including its underlying emotions, is~~  
 255 ~~culturally situated and culturally informed. Connectedness to nature is fostered by cultural models of~~  
 256 ~~nature (Wohlwill, 1983). This makes it essential to conduct research across cultures that considers~~  
 257 ~~how cultural conceptions of nature enable, limit, and shape social relational emotions. If theory~~  
 258 ~~should guide practise, future research in this area should accordingly be based on established and~~  
 259 ~~cross-culturally applicable theory-based emotions, such as kama muta, which is labelled with a~~  
 260 ~~Sanskrit term in order to avoid the confusions of vernacular lexemes (Fiske, 2019). Validated~~

261 measures should be used to facilitate comparison among studies as well as the generalisation of  
 262 findings. For instance, for kama muta, there exists the KAMMUS-Two scale developed by Zickfeld  
 263 et al. (2019) across a variety of contexts, in 19 countries and 15 languages. A well-established and  
 264 valid questionnaire for gratitude is the Gratitude Questionnaire-6 (GQ-6) (McCullough, Emmons, &  
 265 Tsang, 2002), and for the emotion awe, the Awe Experience Scale (AWE-S) (Yaden et al., 2019).

266 ~~Second, f theory should guide practise, future research in this area should based on established and~~  
 267 ~~cross-culturally applicable theory based emotions, such as kama muta, which is formulated in~~  
 268 ~~Sanskrit in order to avoid vernacular lexeme labelling (Seibt et al., 2017). Valid measures should~~  
 269 ~~accompany the emotions studied to facilitate the comparison among studies as well as the~~  
 270 ~~generalisation of findings. For instance, for kama muta, we suggest using the KAMMUS-Two. The~~  
 271 ~~scale has been developed by Zickfeld et al. (2019) and successfully validated across a variety of~~  
 272 ~~contexts, 19 countries and 15 languages. A well-established and valid questionnaire for gratitude is~~  
 273 ~~the Gratitude Questionnaire-6 (GQ-6) (McCullough, Emmons, & Tsang, 2002), and for the emotion~~  
 274 ~~awe, we suggest the Awe Experience Scale (AWE-S)(Yaden et al., 2019).~~

275 Third, given Anderson et al.'s (2018) finding that experiencing the emotion of awe in nature predicts  
 276 well-being, it will likely be fruitful to explore whether other social relational emotions mediate the  
 277 effects of nature connectedness with well-being and pro-environmental attitudes and behaviour.  
 278 Positive emotions initiate a broader range of thoughts and actions than negative emotions do, and  
 279 have in general been identified as affording well-being and happiness (Cohn, Fredrickson, Brown,  
 280 Mikels, & Conway, 2009; Diener & Seligman, 2004). However, emotions like grief or guilt about  
 281 injury to the environment or loss of nature may have substantial effects on people's sense of  
 282 responsibility for nature, and may foster care for it. Thus, it would be particularly interesting to  
 283 compare the effects of negatively perceived social relational emotions, such as grief or guilt, with  
 284 positively perceived social relation emotions such as compassion, awe, or gratitude.

285 ~~Third, Anderson et al. (2018) suggested that experiencing the emotion of awe in nature environment~~  
 286 ~~predicts well-being. Thus, it is possible that some of the shared variance between connectedness to~~  
 287 ~~nature and wellbeing are mediated by the emotions. We suggest investigating whether social~~  
 288 ~~relational emotions mediate downstream consequences such as well-being and pro-environmental~~  
 289 ~~attitude and behaviour. Moreover, it would be particularly interesting to compare negatively~~  
 290 ~~perceived social relational emotions, such as grief or anger with positively perceived social relation~~  
 291 ~~emotions like compassion, awe or gratitude regarding their effects on downstream consequences.~~  
 292 ~~After all, positive emotions initiate a broader range of thoughts and actions than negative emotions~~  
 293 ~~do and have in general been identified as indicators of people's well-being and happiness (Cohn et~~  
 294 ~~al., 2009; Diener & Seligman, 2004). This and the fact that humans are motivated to experience~~  
 295 ~~positive emotions could points to a higher potential of positive social relational emotions concerning~~  
 296 ~~health-related wellbeing, values, attitude and behaviour.~~

297 Fourth, despite the fact that current research emphasises the benefits of direct engagement with  
 298 nature, it simultaneously points to mounting evidence that physical contact with nature is decreasing  
 299 (Rosa et al., 2018). In this context, Chirico, Ferrise, Cordella, and Gaggioli (2018) compared virtual  
 300 exposure to nature and actual contact with nature. The results indicate that while browsing nature  
 301 photographs or watching a nature documentary are likely to improve mood, getting outdoors and  
 302 connecting directly with nature was associated with better well-being benefits. Along with increasing  
 303 use of digital technology, Ffuture research needs to address the question of how to maintain and  
 304 adapt the possibilities for social relational emotions and human-nature connectedness to take place

305 when technology is the medium to provide virtual exposure to nature. Studies in this area can be  
306 realised through experimental settings using virtual reality.

307 Finally, we have argued that social connectedness and connectedness to nature are underpinned by  
308 the same social relational emotions. However, ~~do are~~ these emotions ~~enable to~~ satisfy the human  
309 needs ~~for belonging to relate~~ in the same way ~~or to the same degree when~~ by connecting to nature  
310 compared to connecting to other human beings? In other words, are there social relational emotions  
311 and qualities of ~~relating or~~ belonging that can only or more easily be enabled through ~~experiences in~~  
312 nature, ~~or through experiences with other humans? and vice versa?~~ Future research should address  
313 such questions in order to provide ~~guidance to practical application such as psychological or~~  
314 ~~environmental therapy for attachment disorders, depression, anxiety, and other conditions. guiding~~  
315 ~~theory to fields of practical application such as psychological therapy. Generated knowledge could be~~  
316 ~~used to complement professional counselling regarding, for example, attachment disorders.~~

### 317 7.16.1 Final remarks

318 Above we quoted John Muir, “When one tugs at a single thing in nature, he finds it attached to the  
319 rest of the world”. Grasping any aspect of nature affords possibilities to ameliorate the well-being of  
320 individuals, communities, and the environment – because as we grasp a bit of nature, in turn nature  
321 tugs at our heartstrings.

322 ~~John Muir points in his opening quote to the connectedness of all elements on earth, including~~  
323 ~~humans and nature. He claims that getting in contact with a basic nature element can provide insight~~  
324 ~~into this universal fact. Through this paper, we acknowledge the importance of statement for the~~  
325 ~~well-being of the individual as well as the well-being of the environment. We conclude by stressing~~  
326 ~~the potential that tugging a single thing in nature can have on tugging one’s heartstrings.~~

### 327 97 Conflict of Interest

328 *The authors declare that the research was conducted in the absence of any commercial or financial*  
329 *relationships that could be construed as a potential conflict of interest.*

### 330 108 Author Contributions

331 -EP conceptualised and wrote the first draft and AF & TS contributed with advice. All authors  
332 revised the final manuscript.

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In review