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Original Article

The Affective Quality of Human-Natural Environment Relationships

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Abstract: Using a psychometric methodology the present study explored the associations between natural environments and experiential feeling states. The effects of the frequency of participants' ($N = 90$) experience of the natural environment and of the location of their childhood upbringing were also investigated. Ten natural environments mapped on to an orthogonal two-component experiential structure labeled *Eudemonia* (ostensibly positive feelings) and *Apprehension* (ostensibly negative feelings). Generally, the more natural environments tended to be associated with higher eudemonia and higher apprehension, the less natural environments with both lower eudemonia and lower apprehension. In line with expectations, participants from rural childhood locations, compared with urban participants, reported less *Apprehension* and participants with greater experience of the natural environment, compared with participants with less experience, reported greater *Eudemonia* and less *Apprehension*. Results are discussed in relation to environmental experiences and affective psychological wellbeing.

Keywords: biophilia; psychometric; eudemonia; experience; natural environments

Introduction

As a species, we have spent many hundreds of thousands of years living and evolving symbiotically with our natural surroundings. Indeed, humankind may have a particular need to be near nature, in its many forms, in order to remain psychologically healthy: "Cultural beliefs and practices that are inconsistent with our evolutionary constitution and physical environments that stray too far from that in which we evolved may compromise our psychological well-being" (Gullone, 2000, p. 311).

Moreover, from an evolutionary perspective, some environments and characteristics of those environments may be more attractive to us than are others and this may influence, among other things, habitat selection (Heerwagen and Orians, 1993; Orians and

Heerwagen, 1992). It has been argued, for instance, that the African savannah may have been a primary site for mankind's early development, offering optimal features for safety, shelter and subsistence (Orians, 1998). Some research has shown savannah-like landscapes, denoted by open woodland with little undergrowth, to be preferred to other natural environments such as deciduous and coniferous forests (Falk and Balling, 2010) partly as a function of the density of forests and woodlands (Herzog and Kutzli, 2002). As modern urban parks may be reminiscent of savanna-like landscapes (Orians and Heerwagen, 1992), this may be part of the explanation for the positive relationship found between house prices and the proximity to and size of recreational parks (Poudyal, Hodges, and Merrett, 2009). People's motivations to visit inner-city parks may also be partly due to the social interactions that take place there (Burgess, Harrison, and Limb, 1988; Krenichyn, 2004), a research finding which has found support in research focused on the use and benefits of gardens (Bhatti and Church, 2001; Clayton, 2007; Ulrich, 1999). Conversely, other evidence seems to suggest that the restorative potential of urban green spaces, particularly parks, may be due to the relative absence of people (Grahn and Stigsdotter, 2010).

However, there also exists a small body of evidence that seems to suggest preferences for environments other than savanna-like landscapes, particularly for environments comprising bodies of water such as lakes and coastlines (Hartmann and Apaolaza, 2010; Ogunseitan, 2005). In addition to the idea that environments containing bodies of water may be important sites for recreation, sustenance and socializing (Kaplan and Kaplan, 1989; Regan and Horn, 2005; Tuan, 1974), recent research has demonstrated that built environments containing water may evoke equal levels of preference as do green-only environments (White, Smith, Humphryes, Pahl, Snelling, and Depledge, 2010).

There is also tentative evidence to suggest that positive reactions to the natural environment may be a fairly widespread, if not ubiquitous, phenomenon (Korpela, Hartig, Kaiser, and Fuhrer, 2001; Newell, 1997). However, some research has indicated that natural environments may evoke negative reactions (e.g., Staats, Gatersleben, and Hartig, 1997). The aim of the present study was to discover the relationship between different natural environments and different experiential feeling states. Furthermore, the pattern of the relationships between experiential feeling states and the extent of experience of the natural environment was also investigated, in order to gather evidence on how people's depth of experience corresponds with their affective responses to the natural environment.

Biophilia

The biophilia hypothesis proposes that there is a fundamental human need to affiliate with life and life-like processes (e.g., Kahn, 1999). Biophilia has been described as our affective responses to nature and natural environments, each of which has its own "peculiar meaning rooted in the distant genetic past" (Wilson, 1984, p. 113). Biophilia has been loosely defined as "an innate tendency to focus upon life and lifelike forms, and in some instances to affiliate with them emotionally" (Wilson, 2002, p. 134). Affective reactions to certain stimuli can undoubtedly be learned or be derived from conditioning, such as repeated exposure, but importantly allied to the biophilia hypothesis is the idea that "specific sensory cues can elicit...innate affective or emotional meaning" (Blascovich and Mendes, 2000, p. 71). Much evidence is accumulating regarding the affective relationships that may develop with the natural environment in its many forms (e.g., Ulrich, 1993). For

instance, the giving and receiving of flowers can have both short and long term positive effects on mood, social interactions, emotions and memory (Haviland-Jones, Rossario, Wilson, and McGuire, 2005).

It has been argued, however, that the genetic basis to any biophilic predisposition may be a weak one, requiring the addition of learning, culture and *experience* of nature to optimize biophilic tendencies (Kahn, 1999; Kellert, 2002). Dubos (1980) has argued that active engagement with the natural environment rather than passive observation may awaken the dormant genetic, psychological traits that enabled our ancestors to survive in the natural environment, which have been subdued by relatively recent social and cultural forces. Similarly, Orr (1993) has suggested that the reintroduction of humans to nature, particularly in terms of allowing children greater unsupervised play in natural environments, is both necessary to foster biophilia and for what it means to be human.

Indeed, several perspectives have been prominent regarding the importance for psychological wellbeing of contact with the natural environment. Ulrich's functional-evolutionary perspective suggests an importance for humankind to be in contact with the natural environment for a range of cognitive and affective functions, such as problem solving, creativity and stress reduction (e.g., Ulrich, 1993). In addition, Kaplan and Kaplan's (1989) attention restoration theory (ART) proposes that the natural environment may provide a range of important qualities (e.g., 'fascination') that aid recovery from over-exertion of psychological capacities.

Experience of the natural environment and positive reactions

Exposure to the natural environment has been shown to have a range of psychological benefits such as the restoration of cognitive abilities diminished by mental over-exertion, stress reduction and the evocation of positive emotions (Abraham, Sommerhalder, and Abel, 2010; Groenewegen et al., 2006). For example, having views of trees from one's home may positively predict how relaxed and comfortable people feel (Kaplan, 2001) and trees in inner-city and suburban environments may be related to increased feelings of safety (Kuo, Bacaicoa, and Sullivan, 1998). Research indicates that indirect, even subliminal exposure to natural environments (Korpela, Klemetilä, and Hietanen, 2002; Schultz and Tabanico, 2007) tends to elicit largely positive affective reactions (Ulrich, 1993; van den Berg, Koole, and van der Wulp, 2003). Moreover, it has been argued that there is a strong positive relationship between how restorative an environment is perceived to be and preferences for that environment (Korpela et al., 2001; van den Berg, Hartig, and Staats, 2007).

A growing corpus of research and opinion has suggested that childhood experiences of nature may be important for the development of deep and meaningful bonds with the natural environment (Gross and Lane, 2007; Kahn, 1999). For instance, Lohr and Pearson-Mims (2005) found that participants who reported having some minimal childhood experiences of planting trees and the care of indoor plants, compared to those participants who reported never having done these things, were more likely to perceive trees as having a calming effect and as having personal and symbolic meaning.

Furthermore, evidence seems to suggest that elements of some of these natural environments are able to positively affect people's social interactions (Groenewegen, van den Berg, de Vries, and Verheij, 2006). For example, the presence of plants within a

laboratory setting has been shown to elicit both greater generosity in participants than does a laboratory setting devoid of plants (Weinstein, Przybylski, and Ryan, 2009), and, within a naturalistic study of classroom behavior, with children's self-reported levels of friendliness (Han, 2009).

Eudemonic and hedonic wellbeing

Psychological wellbeing may be conceived of as comprising two distinct dimensions (Ryff, Singer, and Love 2005; Waterman, 1993). First, *Hedonism*, typically measured by subjective well-being (SWB), comprises indices to gauge general negative and positive affect and life satisfaction (Schwarz and Strack, 1999). However, the ability of this concept to reflect the more meaningful and to some extent more intrinsic aspects of peoples' well-being (i.e., those that are inherently satisfying rather than based upon external approval) has been challenged (Ryan and Deci, 2001).

Second, *Eudemonia* may be described as living a personally meaningful existence (Ryan and Deci, 2001). There is some indication that the intrinsic values associated with eudemonia may include feelings of inner peace, contemplation, vitality and a deep appreciation of life (Huta and Ryan, 2010; Ryan, Huta, and Deci, 2008). For example, the emotion awe is associated with feelings of reverence, wonder and aesthetic pleasure and can be experienced in response to "natural objects that are vast in relation to the self" (Keltner and Haidt, 2003, p. 310) such as oceans, trees and mountains. Moreover, the experiencing of awe is argued to be the result of primordial or "hard-wired pre-cultural sets of responses that were shaped by evolution" supported by elaborated or culture-specific norms and meanings (Keltner and Haidt, 2003, p. 306).

Eigner (2001) found that for some people, being in close proximity to the natural environment produced "an amazing feeling of happiness" and an "inner sort of calm" (Eigner, 2001, p. 191). Eigner suggests that the well-being associated with direct engagement with the natural environment may be a qualitatively different, 'higher quality', well-being than the more hedonistic type of well-being characterized by the ease and comfort of modern lifestyles. Whilst there have been attempts at measuring, with various instruments, some indication of these sorts of experiences with nature (e.g., of a sense of connectedness), other aspects of people's experiences (e.g., feeling alive and contemplative) have apparently not so readily lent themselves to empirical assessment (e.g., Mayer and Frantz, 2004).

Negative affective reactions to the natural environment

Of course, not all reactions to the natural environment are entirely positive (e.g., Bixler, Carlisle, Hammitt, and Floyd, 1994; Herzog and Kutzli, 2002): *biophobia* is the negative and largely innate 'biological preparedness' response to natural stimuli such as snakes and heights (Orians, 1998; Ulrich 1993). One suggestion is that negative reactions to the natural environment, specifically in relation to wilderness-type environments, can involve terror because of the apparent feelings of mortality that such encounters might engender (Koole and van den Berg, 2005). In particular, it has been argued that the absence of human influence, such as the lack of buildings and people, within wilderness environments leads people to be confronted "with their own finitude" (Koole and van den Berg, 2005, p. 1026) which people may be buffered against while they are located in

largely synthetic and human-controlled modern (and chiefly western) habitations. Similarly, overly dense forests with little accessibility may engender feelings of foreboding (Herzog and Kutzli, 2002; Staats et al, 1997), whilst other environments may be perceived as not providing adequate safety and sustenance (Orians, 1998).

Ambivalent affective reactions to the natural environment

Beyond the simple dichotomous categories of either positive or negative reactions to the natural environment, there is the possibility the natural environment may instill both positive and negative reactions, even simultaneously (cf. Bonnes, Passafaro, and Carrus, 2011). Early western experiences with mountains, for example, have elicited what might be described as an affective ambivalence: great fear but also heightened positive emotions (MacFarlane, 2003). In particular, MacFarlane (2003) cites John Dennis's 1688 description of crossing the Italian Alps as "a delightful horror, a terrible joy" (p. 73). These sentiments have been echoed by other nature writers in other less precipitous natural environments: Emerson (1836/1982), for instance, describes his emotions during a night-time crossing of a common in winter: "I have enjoyed perfect exhilaration. I am glad to the brink of fear" (p. 38). Some evidence of these types of reactions has recently been found in empirical research. For example, in one study it emerged that different types of environmental encounters seemed to elicit ambivalent emotional states involving combinations of fear, awe, respect, and happiness (van den Berg and ter Heijne, 2005).

Urban and rural living

Some evidence indicates that physical-demographic variables, such as distance of residence from an outdoor recreation area, have little relationship with people's sense of the psychological restoration provided by the natural environment (Hartig, Kaiser, and Strumse, 2007). The same study also indicated that female participants were more likely than male participants to perceive the natural environment as more positive (restorative). Conversely, there is a body of evidence which suggests that rural living, in comparison to urban living, may engender more positive reactions towards the natural environment (Berenguer, Corraliza, and Martín, 2005; Hinds and Sparks, 2008). For example, Hinds and Sparks (2009) found that people from rural childhood locations, compared to those from urban childhood locations, reported more positive affective wellbeing and stronger environmental identities. After controlling for a multitude of variables (e.g., physical health, access to a car, employment, age, gender, marital status, ethnicity, overcrowding, structural housing problems, and income based socioeconomic status), rural people, in comparison to urban people, have reported significantly lower rates of depression and anxiety (Weich, Twigg, and Lewis, 2006). Other research has found that people living in rural areas, compared to people living in urban areas, exhibit less negative affect (e.g., depression, boredom, and loneliness) in their lives and tend to be more satisfied with their lives (Paúl, Fonseca, Martín, and Amado, 2003). Moreover, some research has indicated that there may be little effect of selective migration on the physical health differences often found between rural and urban populations, where rural populations often report fewer health problems (Verheji, van de Mheen, de Bakker, Groenewegen, and Mackenbach, 1998).

The present study

In addition to the indicators of general positive responses towards the natural environment, the research reviewed above has also suggested that there are likely to be different emotional reactions to different types of natural environment. Using the psychometric method (e.g., Slovic, Fischhoff, and Lichtenstein, 1980) several studies have sought to illustrate diagrammatically the general structural relationship among all combinations of two sets of variables (Böhm, 2003; McDaniels, Axelrod, and Slovic, 1996; White and Dolan, 2009) The present study is a unique application of the psychometric approach concerned with examining the relationship between (a) different types of natural environments and (b) a broad range of positive and negative affect-based experiential states. We were also interested in how experiential states associated with natural environments may be associated with frequency of experience of the natural environment and childhood location.

Specifically, we (i) sought to explore the structure of people's experience of different types of natural environments, (ii) expected that participants from rural childhood locations, in comparison to participants from urban childhood locations, would report more positive, and less negative, experiential states associated with being in the natural environments, and (iii) expected that participants reporting greater experience of the natural environment, compared to those reporting less experience, would report more positive, and less negative, experiential states associated with being in the natural environment.

Despite some debate about whether any environment in the present day can be described as truly natural (e.g., Cronon, 1996; McKibben, 2003), we chose to retain 'natural environment' and operate a working definition similar to that employed by Abraham et al.'s (2010) study of landscape preference: "a continuum between 'wild' nature and designed environments such as urban and rural forests, green spaces, parks, gardens, waters, and neighbourhood areas" (p. 59).

Method

Participants

Participants ($N = 90$; female = 82; male = 8) were a sample of undergraduate social science students at the University of Sussex, UK. Their mean age was 21.1 years ($SD = 5.23$; range 18-41).

Materials

All participants received a questionnaire assessing, among other variables, the relationship between (i) being in different natural environments and (ii) different experiential states. All responses were recorded along fully anchored Likert-like scales.

Childhood location. Following questions relating to age and gender, participants were asked to indicate the type of location in which they grew up: "In what sort of location did you spend the majority of your childhood?" with three possible responses: *Urban* ($n = 24$), *Suburban* ($n = 50$), and *Rural* ($n = 15$).

Environments and experiential states. Ten environments were derived from a

discussion between the authors retaining those likely to be found in the UK (*forest, mountain, garden, beach, valley, woodland, hill, river, farmland field, and park*). These environments were rated in terms of 14 experiential states by asking participants “To what extent would you expect to feel each of the following” (*relaxed, a sense of awe, a sense of freedom, refreshed, connectedness, isolated, anxious, alive, contemplative, talkative, sense of fun, empathy, loneliness, and serenity*). These experiential feeling states were derived from previous exploratory research ($N = 75$) which used the working definition of the natural environment as ‘any areas and settings produced by nature, such as woodland, hills, lakes, moorland, valleys, coastal areas, heathland, mountains, rivers and forests’. Participants were asked to “Please list all the words or short phrases that *you* would associate personally with *being in* the natural environment”.

Using methods to elicit participant feelings about place that have been utilized elsewhere (e.g., Hartig, Korpela, Evans and Gärling, 1997), the present study asked participants to, for example: “Imagine yourself being in a garden environment. To what extent would you expect to feel each of the following?” (*not at all* [1] to *extremely* [7]).

Frequency of experience of the natural environment. Frequency of experience of each environment was measured by the item: “Please indicate how often you are actually in each of the following types of environment.” Responses were recorded on 5-point scales ranging from 1 (*very often*) to 5 (*never*) and reversed coded for analysis. Frequency of Experience was computed by mean-averaging the frequency of experience across all ten environments for each participant. These were then converted by median split procedure (retaining the median category, viz. ‘2’) into a three level grouping variable: Low experience ($n = 40$), Median experience ($n = 12$) and High experience ($n = 38$).

Procedure

Participants were presented with a questionnaire listing natural environments and were asked to rate each environment on ten experiential feeling states by imagining being in each one – no visual stimulus was utilized to elicit responses.

Results

Experiential state structure

A principal components analysis (with varimax rotation) of the mean scores of each combination of experiential state and environment was carried out, producing a two component solution accounting for 89.35% of the variance (see Table 1). Based on Stevens’ (1992) criterion for sample size ($N < 100$), only component loadings above .512 are included.

The first component (58.75%) was labeled *Eudemonia* with the following variables loading heavily: *serenity, a sense of awe, contemplation, empathy, alive, a sense of freedom, connectedness, and refreshed*. The second component was labeled *Apprehension* (30.60%) with *isolated, lonely, and anxious* loading heavily and positively and with *a sense of fun, talkative, and relaxed* loading heavily and negatively. The means and standard deviations for each environment for each feeling state are presented in Table 2.

The retained factor scores for each environment from the PCA were then used as

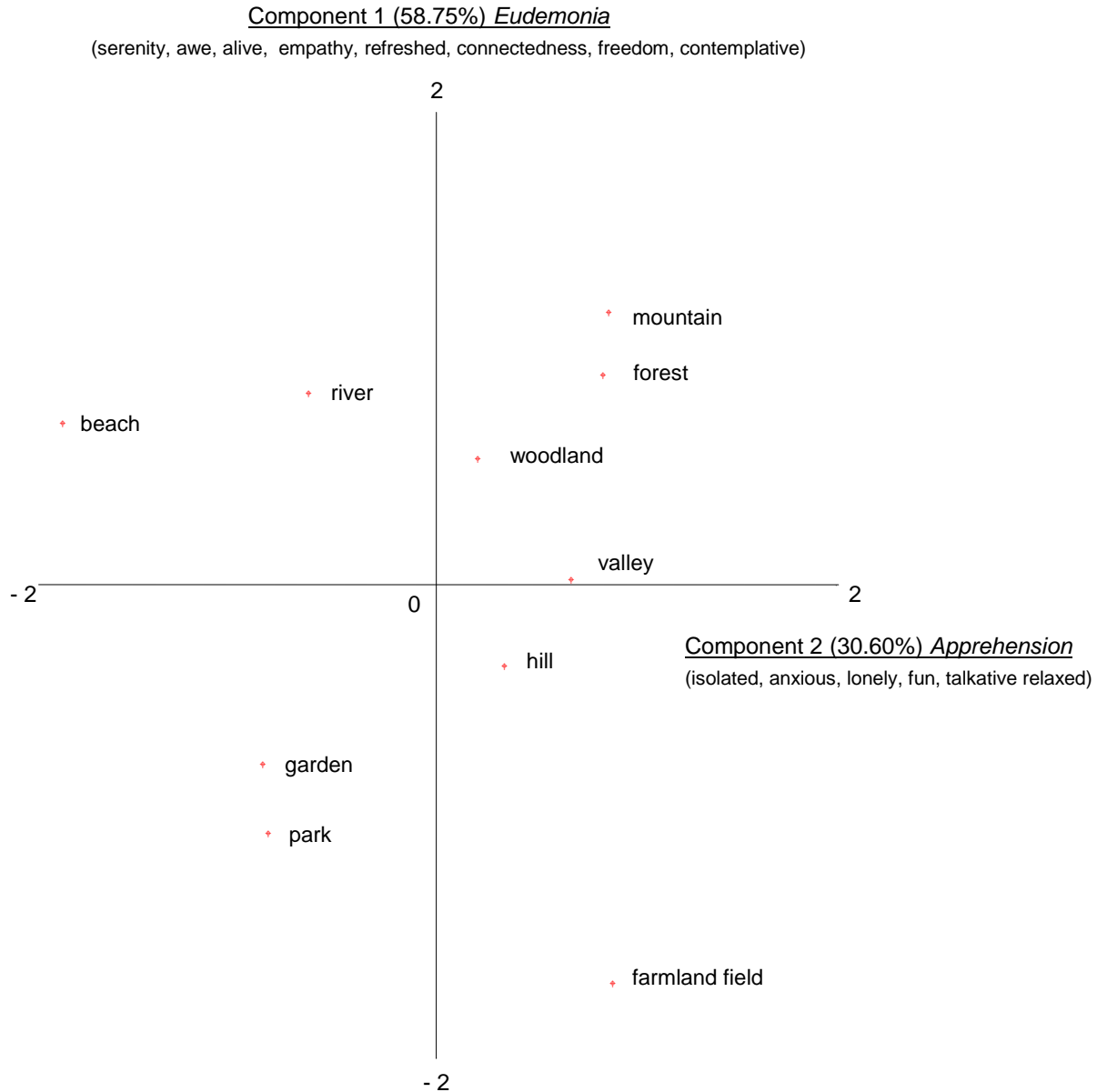
indices to map each environment relative to each other about the axis of the two-factor solution, namely *Eudemonia* and *Apprehension*. The two component space (see Figure 1) shows, for example, that *mountain*, *forest*, *woodland*, and *valley* are located relatively highly on the *Eudemonia* component as well as being relatively high on the *Apprehension* component; *beach* and *river* are located relatively high on the *Eudemonia* component and relatively low on the *Apprehension* component; *hill* and *farmland field* are located relatively low on the *Eudemonia* component and relatively high on the *Apprehension* component; *garden* and *park* score low on the *Eudemonia* component and relatively low on the *Apprehension* component. This analysis provides an overall picture of the relationship between different environments and different experiential states at an aggregated level. We were also interested however, in more fine-grained analyses of the experiential states associated with individual environments.

Table 1. Principal component analysis loadings of the mean ratings of environment associated experiential states

Experiential states	Components	
	<i>Eudemonia</i> (58.75%)	<i>Apprehension</i> (30.60%)
Refreshed	.99	
Connectedness	.96	
Contemplative	.95	
Serenity	.95	
Alive	.94	
A sense of awe	.90	
A sense of freedom	.87	
Empathy	.82	
Talkative		-.85
A sense of fun		-.83
Relaxed		-.81
Lonely	.55	.81
Isolated	.56	.81
Anxious	.54	.78

Human-natural environment relationships

Figure 1. Environments represented within a two-component experiential state space. Axis scale and environment positioning were determined by PCA factor scores.



Effects of environmental exposure on experiential states

Eudemonia ($\alpha = .97$) was computed by taking the means of the scores of the experiential states that loaded heavily on that component (viz. *serenity, a sense of awe, contemplation, empathy, alive, a sense of freedom, connectedness, and refreshed*) for all the environments. Likewise, a measure of *Apprehension* ($\alpha = .91$) was computed by taking the means of the scores of the experiential states that loaded heavily on that component (viz. *isolated, lonely, anxious, a sense of fun* [reverse coded], *talkative* [reverse coded], and *relaxed* [reverse coded] scores) for all the environments.

Human-natural environment relationships

To investigate the effect of childhood location and experience of the natural environment on experiential states, a 3 (Childhood Location: urban vs. suburban vs. rural) x 3 (Frequency of Experience: low vs. medium vs. high) MANOVA of both *Eudemonia* and *Apprehension* was carried out using Roy's largest root (λ_{largest}) as the determining P value. Both Levene's test of equality of error variance (*Eudemonia*, $F(7,81) = 1.29$, $p = .27$); *Apprehension*, $F(7,81) = 1.44$, $p = .20$) and Box's test of equality of covariance ($M = 16.98$, $p = .65$) were non-significant and assumptions of normality were thereby satisfied.

Multivariate analyses revealed a significant main effect of Frequency of Experience, $\lambda_{\text{largest}} = .15$, $F(2,81) = 6.17$, $p = .003$, $\eta^2 = .13$, and of Childhood Location, $\lambda_{\text{largest}} = .11$, $F(2,81) = 4.35$, $p = .016$, $\eta^2 = .10$.

Univariate analyses revealed that for Frequency of Experience there was a significant effect on *Eudemonia* $F(2,81) = 5.51$, $p = .006$, $\eta^2 = .12$, and a marginally significant effect on *Apprehension* $F(2,81) = 2.98$, $p = .056$, $\eta^2 = .07$. For Childhood Location there was a significant effect on *Apprehension* $F(2,81) = 3.82$, $p = .026$, $\eta^2 = .09$, but not on *Eudemonia* $F(2,81) = 0.34$, $p = .72$, $\eta^2 = .01$. There were no interaction effects between Frequency of Experience and Childhood Location for either *Eudemonia* $F(3,81) = 0.20$, $p = .90$, $\eta^2 = .01$, or *Apprehension* $F(3,81) = 1.15$, $p = .33$, $\eta^2 = .04$.

Table 2. Means and standard deviations (in parentheses) for each environment and experiential state

	Relaxed	Awe	Freedom	Refreshed	Connected	Isolated	Anxious	Alive	Contemplate	Talkative	Fun	Empathy	Lonely	Serene
Forest	4.4 (1.6)	4.6 (1.7)	5.0 (1.6)	5.0 (1.5)	4.1 (1.7)	3.7 (1.6)	2.8 (1.7)	4.8 (1.3)	4.7 (1.5)	2.7 (1.3)	3.9 (1.5)	3.1 (1.6)	3.0 (1.7)	4.8 (1.5)
Mountain	4.2 (1.7)	5.8 (1.3)	5.5 (1.4)	5.4 (1.4)	4.1 (1.7)	4.0 (1.7)	3.2 (1.6)	5.3 (1.2)	4.7 (1.5)	2.9 (1.4)	4.2 (1.6)	2.9 (1.4)	2.9 (1.5)	4.8 (1.5)
Garden	5.2 (1.3)	2.5 (1.4)	3.1 (1.4)	3.8 (1.4)	3.3 (1.7)	1.7 (1.1)	1.2 (0.5)	3.5 (1.3)	3.6 (1.7)	4.3 (1.5)	4.1 (1.4)	2.6 (1.3)	1.6 (0.9)	3.8 (1.6)
Beach	5.6 (1.4)	4.0 (1.8)	4.9 (1.5)	5.2 (1.5)	3.9 (1.8)	1.7 (1.0)	1.5 (0.8)	4.9 (1.5)	3.9 (1.7)	4.7 (1.4)	5.7 (1.1)	2.6 (1.4)	1.7 (1.0)	4.2 (1.6)
Valley	4.3 (1.3)	4.5 (1.4)	4.5 (1.4)	4.6 (1.4)	3.6 (1.6)	3.2 (1.7)	2.2 (1.2)	4.1 (1.2)	3.9 (1.5)	3.4 (1.6)	3.4 (1.4)	2.8 (1.3)	2.7 (1.5)	4.3 (1.5)
Woods	4.5 (1.5)	4.1 (1.6)	4.6 (1.4)	4.8 (1.5)	4.1 (1.6)	3.1 (1.6)	2.3 (1.4)	4.4 (1.2)	4.4 (1.3)	3.5 (1.4)	4.2 (1.4)	3.0 (1.4)	2.7 (1.4)	4.4 (1.5)
Hill	4.1 (1.5)	3.7 (1.8)	4.4 (1.5)	4.3 (1.7)	3.6 (1.6)	2.5 (1.4)	1.9 (1.1)	4.1 (1.4)	3.7 (1.6)	3.4 (1.5)	3.6 (1.5)	2.6 (1.5)	2.2 (1.2)	3.9 (1.6)
River	5.1 (1.5)	4.2 (1.6)	4.6 (1.5)	5.2 (1.5)	4.3 (1.6)	2.3 (1.4)	1.8 (1.0)	4.6 (1.4)	4.2 (1.6)	3.7 (1.5)	4.2 (1.5)	3.1 (1.5)	2.0 (1.2)	4.8 (1.5)
Farmland	3.4 (1.7)	2.4 (1.5)	3.7 (1.7)	3.1 (1.7)	2.8 (1.5)	2.4 (1.4)	2.0 (1.3)	3.5 (1.4)	2.8 (1.4)	3.7 (1.5)	3.5 (1.7)	2.4 (1.3)	2.1 (1.2)	2.8 (1.3)
Park	4.3 (1.5)	2.4 (1.4)	3.7 (1.5)	3.7 (1.5)	2.9 (1.4)	1.6 (1.0)	1.5 (0.9)	3.7 (1.5)	3.2 (1.3)	5.0 (1.4)	5.0 (1.4)	2.6 (1.4)	1.6 (0.9)	2.9 (1.4)

Table 3. Means and standard deviations for childhood location and frequency of experience by the experiential state components *Eudemonia* and *Apprehension*

		Experiential State Components	
		<i>Eudemonia</i> M (SD)	<i>Apprehension</i> M (SD)
Childhood Location	Urban	3.73 (0.76)	3.37 (0.53) ^a
	Suburban	4.00 (0.67)	3.00 (0.44)
	Rural	4.05 (1.20)	2.80 (0.54) ^a
Frequency of Experience	Low	3.67 (0.77) ^c	3.24 (0.53) ^b
	Median	3.96 (0.60)	3.03 (0.33)
	High	4.20 (0.82) ^c	2.90 (0.51) ^b

Note: Means with the same superscript are significantly different from each other: ^{a,b} $p < .05$; ^c $p < .01$

Planned contrasts for frequency of experience and childhood location

All contrast means and standard deviations are presented in Table 3. Participants reporting High frequency of experience reported greater *Eudemonia* than did participants reporting Low frequency of experience ($p = .001$; 95% CI -1.90 – -0.27). In addition, participants reporting High frequency of experience compared to participants reporting Low frequency of experience were more likely to report less *Apprehension* ($p = .017$; 95% CI 0.06 – 0.57). Rural childhood participants compared to urban childhood participants tended to report lower *Apprehension* ($p = .014$; 95% CI 0.90 – 0.79).

Discussion

Our psychometric analysis of experiential states associated with various natural environments revealed an interesting pattern of relationships. Notable was the tendency for the more natural or wild environments, such as forests and mountains, to be associated with higher levels of *Eudemonia* than were the less natural environments, such as farmland field and parks. Moreover, some of the more natural environments also seemed to engender feelings of isolation and loneliness, such that mountains, forests and woodland elicited high scores not only on *Eudemonia* but also on *Apprehension*. The pattern of results described here is consonant with the idea of ambivalent attitudes to the natural environment found empirically (e.g., van den Berg and ter Heijne, 2005) and those mentioned anecdotally (e.g., MacFarlane, 2003).

However, one relationship that may challenge this interpretation of ambivalence is that between *Eudemonia* and the items *lonely*, *isolated* and *anxious*. Although these three items loaded strongly on what we have called the *Apprehension* component, they also

loaded positively on the *Eudemonia* component. In other words, one possible interpretation of this finding could be that being *lonely*, *isolated* and *anxious* in some environments is experienced positively (cf. Grahn and Stigsdotter, 2010).

Garden, *park*, *beach* and *river* environments were more likely to elicit reported feelings of fun, relaxation and talkativeness than were other environments. It has been suggested elsewhere that gardens, parks (Bhatti and Church, 2001; Burgess et al., 1988) and waterscapes (Ogunseitán, 2005; Tuan, 1974) may be important places for social interactions and the maintenance of positive affective states (Regan and Horn, 2005). The affective states associated with such social interactions may also be qualitatively different from the affect associated with exposure to the natural environment.

The present study found waterscapes, such as *river* and *beach*, to be high in terms of *Eudemonia*. In other words, waterscapes seemed to elicit a broad array of positive experiential states (high *Eudemonia*), high levels of fun, relaxation and talkativeness but little in the way of negative experiential feeling states (low *Apprehension*). Therefore, it may be suggested from the pattern of results that although the more natural environments tend to elicit more *Eudemonia*, some are also perceived as more fun (e.g., waterscapes) and some as more lonely and isolating (e.g., forests and mountains) (see Staats et al., 1997). These findings have some degree of resonance with an evolutionary perspective of human appreciation of natural environments (Orians and Heerwagen, 1992; Tuan, 1974).

The expectation that rural participants would report more positive experiential states in connection with the various natural environments was not supported, although the pattern of means was in the expected direction. This unanticipated finding may reflect a widespread positive appreciation of the natural environment (e.g., Hartig et al, 2007; Newell, 1997). However, participants with a rural childhood location, compared to participants with an urban childhood location, reported less *Apprehension* in relation to being in the environments. Therefore, one hypothesis meriting consideration is that growing up in a rural childhood location may have a larger role to play in the avoidance of the feelings of anxiety, loneliness and isolation that urban childhood participants associate with the natural environment, than it does in accentuating positive experiential states.

It was also found, as expected and in line with previous research (e.g., Hinds and Sparks, 2009), that participants reporting greater experience of the natural environment, compared to participants reporting less experience, tended to report greater *Eudemonia* in relation to the natural environments. This finding may be seen as reinforcement of the idea that biophilic, and to some extent biophobic, predispositions may be awakened or enhanced through experience of the environment (Kahn, 1999; Kellert 2002).

It could be argued quite reasonably that people who enjoy the natural environment more are likely to be motivated to engage with it more frequently. It may also be the case that people who have greater experience of the natural environment tend to experience more positive experiential states, although there may be other additional explanations for this. For instance, certain personality types may be more inclined both towards greater frequency of experience of the natural environment and to experiencing (and / or reporting) certain affective experiential states. Undoubtedly, these possibilities may interact to shape people's behavior and affective responses. However, given the evidence from previous experimental research that positive responses towards the natural environment may be

elicited through simple exposure (e.g., Korpela et al., 2002; van den Berg et al., 2003), the present study's findings are at least congruent with the idea that greater experience of natural environments can stand as a causal antecedent of more positive experiential states.

Having said this, the present findings would benefit from further substantiation from future research employing methods to examine actual natural environmental encounters. Such research could, for example, quantify and describe the duration and nature of those experiences. This would obviate the reliance (evident in the present study) on participants' subjective accounts of their frequency of experience of the natural environment. In a similar vein, participants could be asked to provide examples of the environments they respond to in order to determine if there is some degree of consensus of their subjective understandings of those environments.

It must also be acknowledged here that the sample used for the present research was disproportionately female which may have biased results towards positive responses towards the natural environment (cf. Hartig et al., 2007). Moreover, the sample was relatively small and homogenous, thus inhibiting the generalizability of the findings to broader populations. Additionally, there may be problems with identifying exactly what constitutes urban or rural categories (e.g., Weich et al., 2006). Urban and rural groups may also differ on how they perceive different environments (Berenguer et al., 2005). Therefore, despite the present study finding support for similar research using this particular method of collecting rural / urban data (e.g., Hinds and Sparks, 2008), these differences should be treated tentatively, awaiting further research employing more objective methods to elicit rural and urban classifications.

In summary, the present findings suggest that there may be a diverse pattern of experiential states associated with different natural environments. However, what is also apparent is the significant role that *Eudemonia* plays in reactions to the majority of those environments. Although previous research has identified the importance of affective factors in evaluations of the natural environment (Korpela, et al., 2002), the present research has been able to show how some environments (e.g., mountains) may be associated with particular experiential states (e.g., indicating *Eudemonia*), and others (e.g., parks) seem to elicit other positive experiential states (e.g., fun and relaxation). Additionally, the role of *Apprehension* seems to be more strongly associated with the more natural environments such as mountains, and negligibly associated with both (some) waterscapes and other, less natural, environments such as parks.

Given the increasing need for a more engaged, pro-environmental, population, the findings presented here highlight the potential of experience of the natural environment for effecting more positive affective reactions towards the natural environment. Additionally, there is the suggestion that early experience of the natural environment, measured here as childhood location, may be conducive to the avoidance of negative experiential states associated with those environments.

The present study provides a novel perspective on the relationship between affective experiences and the natural environment. In particular, it is the quality of positive affect associated with eudemonic well-being that represents a rather novel insight into that relationship. Certainly, the quantitative investigation of eudemonic well-being and its association with natural environment experiences has received little published research

attention to date. Our research also shows that different environments elicit different affective responses, thereby adding to the broader body of knowledge regarding human relationships with specific natural environments. Finally, the work described here lends support to the growing body of evidence pointing to the importance of direct experience of the natural environment as a contributor to psychological well-being.

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