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The effect of humanising nature

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Humans may have an innate need to affiliate with nature; this need has been termed biophilia. Humanising nature may connect to biophilia. An experimental design with 167 participants tested the hypothesis that a humanised description of the functioning of trees that focused on similarities between tree and human functioning would have a greater impact than a description of purely biological functions of trees. Participants randomly assigned to the humanising nature condition had higher mean scores for positive affect and empathy related to the target aspect of nature as well as greater pro-environmental intention. A MANOVA showed that the humanising nature condition had a significantly greater overall impact than the control condition. Positive affect and empathy were significantly different between groups. A serial mediation analysis found that positive affect and empathy connected the intervention with pro-environmental intention. Humanising nature holds promise as an approach to meeting biophilia needs. The findings may be globally relevant to the interaction of humans with nature.

Keywords: Biophilia; Empathy; Humanising nature; Nature; Positive affect.

As Mayer et al. (2009) pointed out, exposure to nature has a number of impacts. For example, across experimental studies involving exposure to nature, contact with nature resulted in greater feelings of connectedness to nature (Barragan-Jason et al., 2022). Meta-analyses by Gaekwad et al. (2022) and Yao et al. (2021) found that across numerous experimental studies, exposure to nature resulted in significant increases in positive affect. Exposure to nature can also result in greater generosity (Weinstein et al., 2009), attention in educational settings (Barbiero et al., 2021) and ability to reflect (Mayer et al., 2009). Some of these beneficial effects, such as increases in positive affect (Schutte et al., 2017) and reflection (Mayer et al., 2009), can occur in response to virtual presentations of nature as well as actual nature.

Edward Wilson (1984a) proposed that humans have an innate need to affiliate with nature and termed this need biophilia. The biophilia need encompasses connection or affiliation with different aspects of nature, including animals and plants. Biophilia may have a biological basis and may have been shaped by evolutionary processes encouraging humans' desire to affiliate with nature (Barbiero & Berto, 2021). Fulfilling biophilia-based needs can result in improved physical and mental health (Barbiero & Berto, 2021). In relation to the proposed benefits of biophilia-based affiliation with nature, a number of studies have shown that exposure to nature leads to increases in feelings of connection to nature (Barragan-Jason et al., 2022; Mayer et al., 2009). In turn, stronger feelings of connectedness to nature are associated with more general empathy (Di Fabio & Kenny, 2021), pro-environmental behaviours (Barragan-Jason et al., 2022), better physical health (Martin et al., 2020) and greater positive affect (Pasca et al., 2022).

In conjunction with evolutionary processes that may underlie biophilia needs, the broaden and build theory (Fredrickson, 2013) may help explain the links between nature exposure and beneficial outcomes found in previous research. This theory posits that the experience of positive affect, involving emotions such as joy, curiosity and interest, expands individuals' awareness and broadens their behaviour and thinking through encouraging processes such as exploration and interaction with others. Over time, the broadening helps build an expanded behavioural repertoire of personal competencies, skills and relationships.

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Experimental research focused on increasing positive affect has provided support for the broaden and build theory. For example, Fredrickson et al. (2008) assigned participants to a loving kindness meditation condition or a control condition and subsequently assessed participants' positive emotions, mindfulness, purpose in life, social support, life satisfaction and symptoms of depression. The loving kindness intervention resulted in increases in positive affect, and this increase in positive affect was linked to more mindfulness, purpose in life, social support, and life satisfaction and fewer symptoms of depression. Using the same loving kindness intervention in an 8-week experimental study, Schutte (2014) found that after the intervention, participants in the intervention condition, compared to those in the control condition, had increased positive affect, more general self-efficacy, greater work satisfaction and better mental health. The change in positive affect was connected to changes in self-efficacy and the other outcomes, and increases in self-efficacy, in turn, were connected to increases in work satisfaction, relationship satisfaction and improved mental health.

As exposure to nature has been found to increase positive affect (Yao et al., 2021), nature contact may have a broadening effect similar to that found in the studies by Fredrickson et al. (2008) and Schutte (2014). For example, positive affect stimulated by exposure to nature may result in a broadening of perspective regarding nature. Such a broader perspective regarding nature may facilitate reactions such as empathy for aspects of the natural environment and pro-environmental intentions or behaviours.

Affiliation or relatedness needs have often been studied in the context of humans' need to feel connected to other individuals or groups (Montoya et al., 2008). A meta-analysis by Montoya et al. (2008) found that perceived similarity was strongly associated with attraction, which may indicate a wish to affiliate. If affiliation with nature follows a similar pattern in relation to feeling part of nature, then similarity between the self and aspects of nature can likewise be associated with the wish to affiliate. Thus, when nature shows qualities that mirror human qualities, the impact of nature may be greater (Williams et al., 2021).

Social identity theory has examined the need for human connectedness to other individuals through perceived ingroup (the group to which one identifies with) and outgroup (the group to which one does not identify with) membership perceptions (Tajfel, 1978; Tajfel & Turner, 1979). Specifically, social identity theory posits that an individual's social identity and connectedness is partly based on perceived similarities with the "ingroup" and perceived differences with the "outgroup" (Tajfel & Turner, 1986). These social identities are said to create intergroup dynamics which can result in positive and negative outcomes, such as ingroup favouritism (including the promotion of empathy and prosocial behaviours towards ingroup members). Thus, based on the premise of perceived similarities and differences, humans would typically not affiliate with nature nor consider nature as part of the ingroup. Therefore, increasing the perceived similarities between humanity and nature could connect nature more to the ingroup (humanity), lead to increased identification and affiliation with nature and in turn promote positive outcomes related to nature.

In a systematic review of studies, Williams et al. (2021) found that a general tendency to anthropomorphise or humanise nature was correlated with pro-environmental variables in a number of studies. Some of these correlational studies examined actual behaviours and others assessed intent towards pro-environmental behaviours based on the theory of planned behaviour. In reviewing several experimental studies examining the impact of anthropomorphising nature, such as by comparing reaction to texts in which "Mr. Nature" versus simply "Nature" was mentioned, Williams et al. (2021) found mixed results across these studies.

Thus, satisfaction of biophilia-based needs (Barbiero & Berto, 2021) in combination with processes described by the broaden and build theory (Fredrickson, 2013) and social identity theory (Tajfel, 1978; Tajfel & Turner, 1979) may be a foundation for outcomes such as positive affect, empathy for aspects of nature and pro-environmental intentions. Figure 1 shows the proposed theoretical foundation for the indicators examined in the present study.

Aim of the present study

The aim of the present study was to examine the impact of reflection on aspects of nature that may be perceived as similar to human functioning. These functions included the wish to survive, communication with others and protection of offspring. The selected target aspect of nature was the functioning of trees.

Hypotheses

The hypotheses were as follows:

1. An intervention using random assignment to an experimental condition encouraging reflection of aspects of tree functioning that are similar to human functioning compared to a control condition just describing general functioning of trees would result in (a) more positive affect, (b) more empathy towards the target aspect of nature, and (c) more pro-environmental intention.

This hypothesis was based on previous research linking nature exposure to affect, empathy and intentions towards the environment as well as the lenses of the

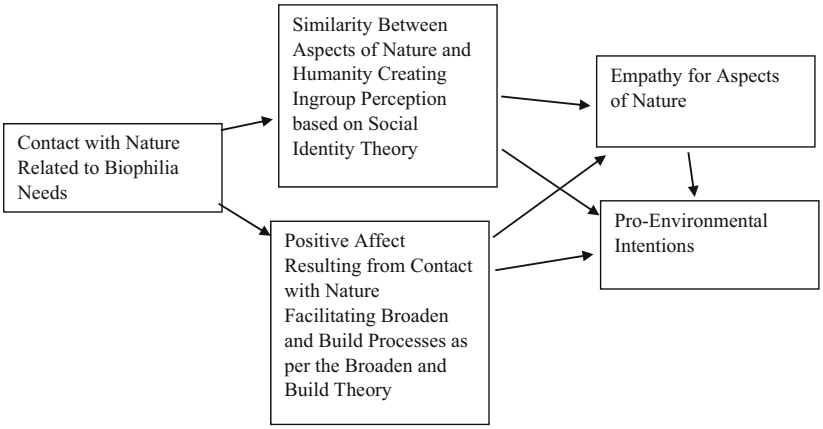

Figure 1. Diagram showing the proposed theoretical underpinnings of the present study.

broaden and build theory and social identity theory in considering the impact of nature exposure when nature functioning is framed similarity to human functioning.

2. The connection between the intervention and pro-environmental intention would be that more positive affect would connect the intervention to empathy for the aspect of nature described, and that empathy would then link positive affect to more pro-environmental intention.

This hypothesis was based on the broaden and build theory proposition that positive affect can lead to a broadening of perspective, which may facilitate feelings of empathy for aspects of nature, connected to ingroup perceptions of nature, which may encourage pro-environmental intentions.

METHODS

Participants

Participants were 176 mature-aged students studying introduction to psychology as a component of various tertiary courses. The sample consisted of 131 females (74%), 42 males and 3 participants not selecting a designation of male or female. The participants had a mean age of 35.77 ($SD = 11.97$).

Procedure

The study received institutional approval after ethics review. Participants completed the study via the Qualtrics™ (Provo, UT) on-line research platform. The 167 participants who continued in the study after completing the demographic information were randomly assigned to either the experimental or control condition,

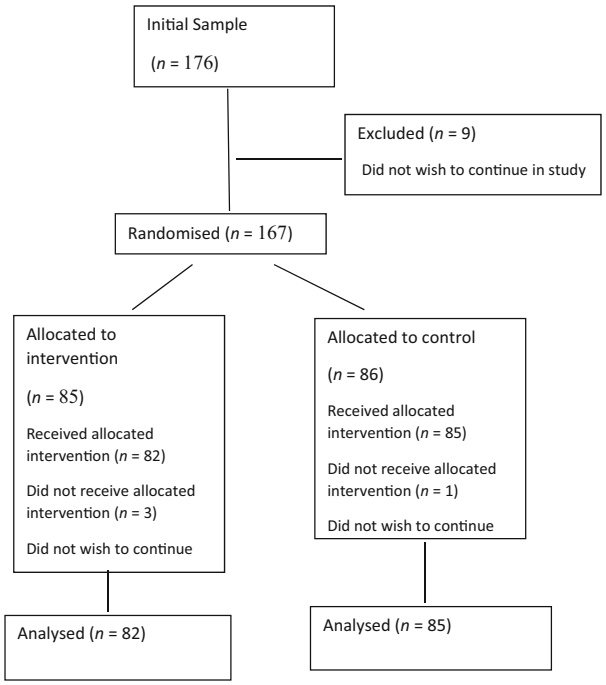

Figure 2. CONSORT diagram showing the flow of participants through the study.

with 85 in the experimental condition and 86 in the control condition. In the experimental condition, 82 participants continued and completed all measures and in the control condition 85 participants continued and completed all measures (see Figure 2).

Participants in the experimental intervention condition were asked to read and reflect on excerpts from the book *The Hidden Life of Trees: What They Feel, How They Communicate – Discoveries from a Secret World* (Wohlleben, 2016). This book presents research relating to the functioning of trees as well as the author's observations relating to the survival of individual trees,

communication between trees, and protection of offspring. Examples of excerpts include: "What I had stumbled upon were the remains of an enormous ancient tree stump … the tree must have been felled at least four or five hundred years earlier. But how could the remains have clung on to life for so long?" (p. 2), "The fungal connections transmit signals from one tree to the next, helping the trees exchange news about insects, drought, and other dangers" (p. 10) and "… acorns and beechnuts fall at the feet of large 'mother trees' … These trees pass their legacy on to the next generation and exert their influence in the upbringing of the youngsters" (p. 33). Participants were asked to reflect on the text excerpts for 10 minutes.

Participants in the control condition were asked to read and reflect on excerpts from the book *The Growing Tree* (Wilson, 1984b). This book presents information regarding the general functioning of trees, with no specific parallels to human functioning. Excerpts from this book were selected to provide a control condition that also focused on the same aspect of nature as the excerpts used in the experimental condition, but did not include the humanising information. Examples of excerpts include: "We can view a complex tree as a simple system with relatively few types of structures" (p. 2), "As the tree grows taller, it needs more and more photosynthate for energy and building materials. To have more photosynthesis in trees that have relatively small leaves, the tree has to produce more leaves; the leaves cannot simply grow bigger" (p. 11), and "Trees in most regions need to survive occasional hard times … Most of these hard times occur annually at fairly regular seasons. Trees usually start preparations before the hard times actually arrive" (p. 121). Participants in this condition were also asked to reflect on the text excerpts for 10 minutes.

Participants in both conditions were then asked to complete measures of positive affect, empathy for the aspect of nature described, and pro-environmental intention.

Measures

Demographics

Participants were asked to provide information on their gender, age and whether their work or study focused on the natural environment or agriculture, which would involve more contact with nature.

Positive affect

State positive affect in regard to reflection on the text excerpts was assessed using Landmann's (2020) taxonomy of environmentally relevant emotion types, which has some evidence of validity through connections with appraisals and action tendencies. The positive affect measure consists of 12 emotion descriptors including, for example, joy, gratitude, and awe. Participants were asked to report the extent to which they experienced the emotions while they read and reflected on the text excerpts on a 5-point scale. Internal consistency as assessed by Cronbach's alpha was .94 for the present sample.

Empathy

The empathy measure used in the present study was created using two subscales from the Davis (1980) Interpersonal Reactivity Inventory. Empathic concern and empathic perspective taking items were reworded to focus on participants' experiences of reflecting on trees and measured on a 5-point scale. Empathic concern and empathic perspective taking have been found to be the most beneficial aspects of empathy (Davis, 1980) and the original scale has evidence of validity (Davis, 1980). Example items used in the present study include: "I tried to understand the processes affecting trees' functioning" and "I felt protective towards the trees described." Internal consistency for the six items assessing empathy as assessed by Cronbach's alpha was .85 for the present sample.

Pro-environmental intent

This six-item measure was created for the present study based on the theory of planned behaviour (Ajzen, 1991) as a step preceding taking action. Participants were asked to rate the likelihood that they would engage is six environment related behaviours in the next month using a 5-point scale. Example items used in the present study include "Seek out information about sustainable tree planting in my area" and "Participate in a vegetation restoration effort by assisting with planting." Though based on the theory of planned behaviour, this measure has no previous evidence of validity. Internal consistency for the six items as assessed by Cronbach's alpha was .87 for the present sample.

Analysis plan

Test of Hypothesis 1

To examine the overall impact of the experimental intervention and because examining multiple outcomes separately can result in alpha inflation, a multivariate analysis of variance (MANOVA) with bootstrapping first tested the impact of the intervention on positive affect, empathy regarding the target aspect of nature, and pro-environmental intent. The impact of the intervention on each of the specific outcomes was then examined.

Test of Hypothesis 2

To examine the proposed path of connections between positive affect, empathy and pro-environmental intent as prompted by the intervention, model 6 of the PROCESS macro for SPSS (Hayes, 2022) with bootstrapping tested the paths between the intervention, through positive affect and empathy to pro-environmental intention.

RESULTS

Test of hypothesis one

To test the hypothesis that an intervention using random assignment to an experimental condition encouraging reflection of aspects of tree functioning that are similar to human functioning compared to a control condition just describing general functioning of trees would result in (a) more positive affect, (b) more empathy towards the target aspect of nature and (c) more pro-environmental intention, a MANOVA, with 5000 bootstraps, examined the overall impact of the intervention. In this analysis, condition was the independent variable and positive affect, empathy towards the target aspect of nature and pro-environmental intention were the dependent variables. Wilks' Lambda, as an omnibus test of the impact of the intervention on the outcomes of positive affect, empathy towards the target aspect of nature and pro-environmental intention was significant, $F(3,163) = 9.08$, $p = .001$, partial eta squared = .14.

Participants in the intervention condition reported more positive affect, greater empathy and more pro-environmental intentions than participants in the control condition. Table 1 shows the mean scores and standard deviations for each group. Univariate comparisons showed that the difference between groups for positive affect, as well as greater empathy was significant, but the difference between groups in pro-environmental intentions was not significant. Univariate test results for differences between groups were as follows: positive affect, $F(1,165) = 22.55$, $p = .001$, partial eta squared = .12; empathy, $F(1,165) = 18.86$, $p = .001$, partial eta squared = .11; and intentions, $F(1,165) = .92$, $p = .34$, partial eta squared = .006.

Test of Hypothesis 2

To test Hypothesis 2, regression-based PROCESS model 6 (Hayes, 2022), using 95% bias-corrected bootstrapping based on 5000 replications examined the serial paths between the intervention condition through positive affect and empathy to pro-environmental intention. Even though the direct effect of condition on intention was not significant, when there is no such direct effect, it is still useful to examine indirect effects (O'Rourke & MacKinnon, 2015).

The total indirect effect of the serial mediation model was significant, with an effect of −.79, $SE = .49$, 95% CI [−2.90, −.91]. As shown in Figure 3, the indirect path of condition to positive affect, to empathy to intent was significant as indicated by the confidence intervals. The path from condition through positive affect to intent was significant, but the path from just empathy to intent was not significant.

DISCUSSION

The aim of the present study was to examine the effect of humanising nature through encouraging reflection on aspects of nature that may be perceived as similar to human functioning. Participants randomly assigned to read text that mentioned aspects of tree functioning, such as the drive for survival of individual trees, communication between trees and protection of offspring reported greater positive affect when engaging with the text, more empathy towards trees and more pro-environmental intentions than participants assigned to read text that provided general information regarding the biology of trees. The overall effect of the humanising condition on these outcomes was significant. Examination of the specific outcomes showed that the humanising of trees condition only significantly affected participants' positive affect and empathy.

These results suggest that exposure to humanised nature can have an impact on perception of and response to nature. Congruent with results reported by Gaekwad et al. (2022) and Yao et al. (2021) regarding the impact of exposure to actual nature or virtual nature, exposure to text-based humanised nature resulted in increased positive emotions. Exposure to nature can also result

TABLE 1
Means and *SD*s for intervention and control conditions for positive affect empathy, and pro-environmental intentions

	Intervention condition (n = *82*)		*Control condition* (n = *85*)	
Outcome	*M*	*SD*	*M*	*SD*
Positive affect	39.26	10.65	30.96	11.86
Empathy	24.01	3.55	21.02	5.12
Intention	17.58	5.48	16.76	5.59

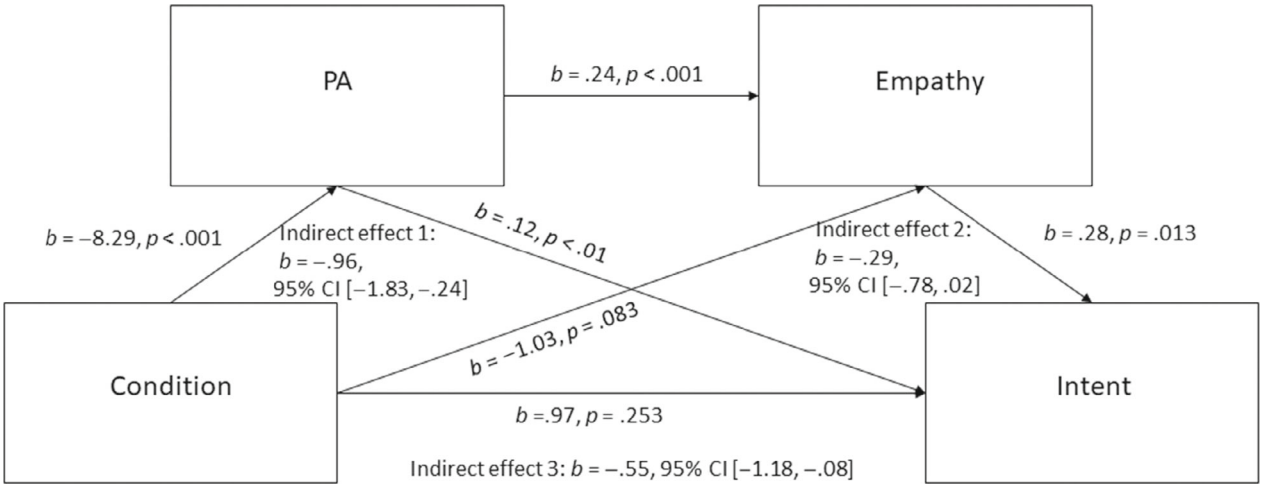

Figure 3. Paths between condition, positive affect (PA), empathy and intent.
Note: PA = positive affect. Indirect effect key: Ind1 = Cond → PA → Intent; Ind2 = Cond → Empathy → Intent; Ind3 = Cond → PA → Empathy → Intent.

in more pro-social reactions, such as greater generosity (Weinstein et al., 2009). In the present study, exposure to humanised nature resulted in greater empathy for nature, which adds to findings regarding the effects of exposure to nature on pro-social tendencies.

These results add to studies mentioned in a systematic review by Williams et al. (2021) who reported somewhat mixed effects overall for the impact of humanising nature, but found a stronger effect for humanising nature studies judged to be of high quality. The present study humanised nature by drawing on aspects of human life most people value, such as survival, communication with others, and protection of off-spring, and illustrating how these aspects of life can also apply to trees. Humanising nature in this way may have an especially strong impact on positive affect and empathy.

The association between humanising nature, positive affect towards nature and empathy with nature can be viewed from several theoretical perspectives. The broaden and build theory (Fredrickson et al., 2008) holds that positive emotions lead to a broader and more inclusive perspective. This broadened perspective may facilitate development of new ideas and skills. Experiencing empathy for aspects of nature may be the results of such broadening. The connections might also be explained through the social identity theory (Tajfel & Turner, 1986) concept of identification with a group (Tajfel & Turner, 1986). Ingroup membership identity is facilitated by perception of similarities (Tajfel & Turner, 1986). Thus, information that illustrates similarities between tree functioning and human functioning may result in a broader perspective on ingroup membership. This more encompassing view of the ingroup would include aspects of nature as well as humans as being part of the ingroup. The result may be more positive emotions regarding nature and more empathy towards nature.

The effect of humanising nature may be related to what Edward Wilson (1984a) termed biophilia, humans' innate need to affiliate with nature. Biophilia-related needs promote seeking out nature and wishing to be immersed in nature (Barbiero & Berto, 2021). Perceptions of similarity between humans and aspects of nature may strengthen this need to affiliate. It is possible that individuals' biophilia needs interact with ingroup identification with aspects of nature.

A world-wide rights of nature movement focuses on the establishment of laws that legally recognise the rights of the natural world (Australian Earth Laws Centre, 2023). A number of countries, including Bolivia, Ecuador, India, New Zealand and the United States, already have such laws and there are international initiatives to create further legal protections related to the rights of nature (Australian Earth Laws Centre, 2023). As awareness of this movement grows, this may enhance people's perceptions of nature as having qualities similar to humans. Typically, legal protections are perceived to apply to humans and extending the perception of such protections to nature may serve to humanise nature.

In the present study, the influence of humanising an aspect of nature on pro-environmental intention was only indirect. Even though the mean pro-environmental intention scores of participants in the humanising trees condition was higher than the mean pro-environmental intention score of participants in the control trees condition, this difference did not reach significance. Examination of pathways from condition to positive affect, positive affect to empathy and empathy to pro-environmental intention showed a significant indirect effect through experience of positive affect and empathy. Positive affect related to nature had the strongest impact in pro-environmental intention. These findings

have implications for approaches to encouraging global preservation of natural environments.

Limitations and future research

Several cautions should be kept in mind when interpreting the results of the present study. First, humanisation of nature focused on one aspect of nature, namely trees. Results might be different when other aspects of nature, such as animals, are humanised. Second, participants in the present study were Australian university students enrolled in an introductory psychology course. Results might differ for other populations. Cautions regarding the measures include lack of validity evidence for the converted empathy scale and the pro-environmental intentions measure, and the possibility of a floor effect for the pro-environmental intentions measure, as for that measure the means for the experimental and control groups were 17.58 and 16.76, respectively, out of a possible high score of 30. Finally, the intervention used was relatively brief; a longer or more multi-faceted intervention may lead to stronger results.

Future research might investigate the impact of humanising nature in different or more comprehensive ways, such as in situ nature or through virtual reality. Future research might also focus on different outcomes. Such outcomes might include other psychological constructs such as gratitude or compassion. Behavioural outcomes related to the environment, such as actual actions taken, could also be examined. Future research might use qualitative methodologies to elicit participants' views on qualities of nature that may mirror human qualities and might use longitudinal designs to investigate the relationships between perception of qualities of nature that are similar to human qualities on the development of pro-environmental behaviours over time.

CONCLUSION

In conclusion, humanising nature holds potential as an approach to meeting what Edward Wilson (1984a) termed people's biophilia needs. Exposure to humanised nature may increase positive emotions related to nature and empathy for aspects of nature. Future intervention programmes might explore optimal ways of humanising nature to facilitate various positive outcomes globally relevant to the interaction of humans with nature.

ETHICAL COMPLIANCE SECTION

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee at the University of New England, Australia and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual adult participants included in the study.

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