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Exposure to Natural Environments, and Photographs of Natural Environments, Promotes More Positive Body Image

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**Abstract**

Five studies were conducted to understand the impact of nature exposure on body image. In three studies using different designs and outcome measures, British university students were exposed to photographs of natural or built environments. Results indicated that exposure to images of natural, but not built, environments resulted in improved state body image. In Study 4, British community participants went on a walk in a natural or built environment, with results indicating that the walk in a natural environment resulted in significantly higher state body appreciation, whereas the walk in a built environment resulted in significantly lower scores. In Study 5, British participants were recruited as they were entering a designed green space on their own volition. Results indicated that spending time in the green space led to improved state body appreciation. These results indicate that exposure to isomorphic or in-situ natural environments has positive effects on state body image.

**Keywords:** Body image; Natural exposure; Natural environment; Body appreciation; Nature

**1. Introduction**

*Positive body image*, as distinct from negative body image, can be defined as a multi-faceted construct that includes holding favourable opinions of the body, respecting the body, rejecting prescriptive ideals of appearance, inner positivity influencing outer demeanour, and a broad conceptualisation of beauty (Tylka & Wood-Barcalow, 2015a). To promote and develop positive body image, researchers have focused on *embodying activities* through which individuals gain a sense of connection with their bodies, feel empowered in relation to their bodies, are able to voice their bodily desires, and are attuned to the self-care needs of their bodies (Menzel & Levine, 2011; Piran, 2002, 2015, 2016). A number of such embodying activities have been identified in the literature, including participation in sports (e.g., Abbott & Barber, 2011), dance (e.g., Swami & Harris, 2012; Tiggemann, Coutts, & Clark, 2014), yoga (Mahlo & Tiggemann, 2015), and life drawing (Swami, 2016, 2017; Swami & Shaw, 2017). Research on the effects of natural environments holds out promise as a complementary method of promoting positive body image, but studies on this topic remain limited. To develop this body of work, a series of experimental studies were conducted to examine the impact of natural environments on positive body image.

***1.1 Natural Environments and Well-Being***

The surrounding environment can be viewed as a continuum between wild nature through designed natural environments (e.g., green spaces, parks, and gardens) to built-up, urban landscapes (Abraham, Sommerhalder, & Abel, 2010). In particular, the broad distinction between natural and urban environments is important because a wealth of evidence suggests that time spent in, and engagement with, natural environments has wide-ranging benefits in terms of health and well-being. For example, reviews of the literature and meta-analyses (Abraham et al., 2010; Bowler, Buyung-Ali, Knight, & Pullin, 2010; Grinde & Patil, 2009; Russell et al., 2013; Sandifer, Sutton-Grier, & Ward, 2015) consistently indicate that exposure to natural environments is associated with improved physiological (e.g., better general and perceived health, reduced mortality rates, and faster healing from trauma), psychological (e.g., improved well-being, higher self-esteem, more positive mood, and increased vitality), and social well-being (e.g., increased social interaction and greater social empowerment).

Two prominent and co-existing frameworks have been advanced to explain the relationships between exposure to natural environments and positive outcomes (Hartig, 2005; Hartig, Böök, Garvill, Olsson, & Gärling, 1996). First, the Psychophysiological Stress Recovery Theory (Ulrich, 1981, 1983) suggests that human beings have an evolutionary preference for surroundings with depth, complexity, and structure. Exposure to such environments is thought to reduce stress by restricting negative thoughts, eliciting positive emotions, and supporting parasympathetic nervous system activity. Second, Attention Restoration Theory (Kaplan, 1995; Kaplan & Kaplan, 1989) provides a cognitive framework concerned with recovery from directed attention fatigue. In this view, restorative environments such as natural landscapes allow individuals to rest inhibitory mechanisms on which directed attention depends and thus facilitate speedier recovery from mental fatigue. Both explanatory frameworks suggest that natural environments contain intrinsic qualities that offer emotional and cognitive restorative advantages over urban environments.

Several other mechanisms may explain the association between exposure to natural environments and well-being (e.g., de Vries, Verheij, Groenewegen, & Spreeuwenberg, 2003; Ward Thompson & Aspinall, 2011). First, natural environments offer vital spaces for social interaction and promote opportunities for social contact, which in turn can promote a sense of community and feelings of safety (Wood & Giles-Corti, 2008; Zhang, Piff, Iyer, Koleva, & Keltner, 2014), as well as better mental health outcomes (Maas, van Dillen, Verheij, & Groenewegen, 2009). In addition, greater access to natural environments may mean that individuals spend a larger part of their time being physically active outdoors (Addy et al., 2004), which in turn promotes improved physical and mental outcomes (de Vries et al., 2003; Maas, Verheij, Spreeuwenberg, & Groenewegen, 2008). Finally, nature exposure also promotes greater feelings of connectedness to nature, which is independently associated with more positive psychological outcomes (Mayer & Frantz, 2004; Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009).

***1.2 Natural Environments and Body Image***

Looking beyond psychological well-being in general, it is also plausible that spending time in natural environments is an activity that promotes positive body image. For example, based on the notion that natural environments are restorative, it is possible that exposure to nature helps to restrict negative appearance-related thoughts, limits the influence of internalised negative appearance-based stereotypes, and promotes speedier recovery from threats to body image (Swami, Barron, Weis, & Furnham, 2016). Time spent in natural environments (or “being away” from routine activities and thoughts; Kaplan, 1995) may also allow individuals to distance themselves both physically and mentally from societal contexts that are heavily appearance-focused (Hennigan, 2010; see also Scott, 2010), which in turn provides a space to develop faculties to critically appraise appearance ideals and engage in behaviours that are body-protective (Swami, Barron, et al., 2016). Changes in self-perception as a result of nature exposure may also lead to behavioural changes, such as a relinquishing of impression management rituals, which are experienced as empowering and embodying (Holloway, Murray, Okada, & Emmons, 2014). Finally, access to nature may also mean that individuals spend more time outdoors engaging in embodying activities that focus one’s attention on the body’s functionality rather than its aesthetics.

In short, spending time in nature may be an experience that promotes more positive body image, but to date only a handful of studies have directly tested these assumptions. In a study of adults from the United States, Swami, Barron, and colleagues (2016) found that self-reported exposure to natural environments was significantly and positively associated with greater body appreciation in both women and men. Using path analysis, these authors also reported that the association between nature exposure and body appreciation was mediated by self-esteem and feelings of connectedness to nature, respectively. An earlier study also reported that greater connectedness to nature was both directly, and indirectly via self-esteem, associated with more positive body image in British women (Swami, von Nordheim, & Barron, 2016). Qualitative research also supports the notion that spending time in nature promotes more positive body image by allowing women to distance themselves from prescriptive societal standards of appearance (Hennigan, 2010).

These studies would seem to support the hypothesis that nature exposure is associated with more positive body image, but the available evidence is limited by a reliance on cross-sectional data. This is important because it limits the types of causal conclusions that can be drawn about uncovered relationships and leaves open the possibility of alternative explanations. For example, rather than nature exposure leading to greater body appreciation, it is possible that individuals with higher body appreciation are more likely to seek out and spend time in natural environments. As noted by Tylka (2012), individuals with positive body image may engage in activities that further enhance their positive body image. As such, it is not possible to conclude, on the basis of existing data, that nature exposure promotes positive body image. The most straightforward way of investigating this issue is through experimental studies that carefully unpick the impact of nature exposure on indices of positive body image.

***1.3 The Present Studies***

The present studies were designed to test the causal impact that nature exposure has on positive body image using experimental techniques that help to establish the direction of causation. First, a series of laboratory studies were conducted to examine whether exposure to photographic images of nature, as opposed to images of urban environments, promote more positive body image (Studies 1-3). Second, Study 4 was designed to compare the effects on positive body image of spending time in a natural environment versus an urban environment. Finally, using a more naturalistic design, Study 5 examined the effects on positive body image of spending time in a natural environment in a sample of individuals who had opted to do so on their own volition.

Throughout these studies, our focus was on indices of state, rather than trait, body image. A large body of work supports the conclusion that body image is a cross-situational and stable trait (e.g., Tiggemann, 2001). However, levels of body image also fluctuate across time and situational contexts, suggesting that it may have a dynamic, “state” component (e.g., Cash, Fleming, Alindogan, Steadman, & Whitehead, 2002). Given our interest on the degree to which exposure to natural environments affect fluctuations in body image (i.e., the degree to which experimental factors affect body image), our focus on state body image is warranted. Across all five studies, we hypothesised that nature exposure would be lead to elevated state positive body image. Taken together, these studies offer the most direct tests to date of the hypothesis that nature exposure leads to more positive body image.

**2. Study 1**

 To begin the present exploration, Study 1 examined the impact of exposure to photographic images of nature and urban environments on state body image. Photographic stimuli have been widely used in previous studies, particularly as images of natural environments were rated as more restorative than images of built environments (e.g., Hartig, Korpela, Evans, & Gärling, 1997; Herzog, Maguire, & Nebel, 2003). In these studies, it is assumed that exposure to a natural environment simulated in photographs is isomorphic in nature (de Kort, Meijnders, Sponselee, & IJsselsteijn, 2006); that is, exposure to simulated natural environments should result in similar restorative outcomes as exposure to real natural environments. Consistent with this perspective, studies have variously found that viewing images of nature, as compared to viewing images of urban (built) environments, had positive effects on attention restoration and recovery from mental fatigue, positive mood, vitality, and psychophysiological health (e.g., Berman, Jonides, & Kaplan, 2008; Berto, 2005; Chang, Hammit, Chen, Machnik, & Su, 2008; Herzog, Black, Fountaine, & Knotts, 1997; Ryan et al., 2010; Ulrich, 1981). As an extension to this research, Study 1 examined the impact of viewing images of natural and urban environments on state positive body image.

***2.1 Method***

***2.1.1 Design***

Study 1 used a prospective design in which participants completed a brief questionnaire immediately before and after being exposed to images of either natural or built environments.

***2.1.2 Participants***

 A power analysis was conducted using G\*Power based on Ryan et al. (2010, Study 3). To detect a medium-sized effect (*f*2) at α = .05, a total sample of 42 participants was needed. In order to ensure that sex differences could be examined (cf. Swami, von Nordheim et al., 2016), a total sample of 63 women and 61 men was recruited. Thus, the present study exceeded the minimum sample size requirements calculated based on the power analysis. All participants were undergraduates at a university in Cambridge, United Kingdom. Participants ranged in age from 18 to 36 years (*M* = 21.37, *SD* = 2.67) and in self-reported body mass index (BMI) from 17.57 to 39.96 kg/m2 (*M* = 24.07, *SD* = 3.55). The majority of participants were of British White ancestry (83.1%).

***2.1.3 Development of Stimulus Materials***

The stimulus used in Study 1 were developed following the methods outlined by Berto (2005). First, a set of 100 colour images of different types of environment was collated from various online sources. These images depicted a wide variety of natural (e.g., lakes, woods, forests, hills, mountains) and human-made, built settings (e.g., city streets, industrial buildings, factories, social housing), but included no people or animals and did not depict affectively-imbued content (e.g., academic buildings). A sample of undergraduate students (total *N* = 40, 50% women, age *M* = 19.53, *SD* = 2.31) were then invited to rate the images that had been collated. Participants were first shown two practice images on a 19-inch screen to familiarise themselves with the task (the same two images were always used with all participants and were not included in the set of 100) and with the instructions (see below). Next, participants were shown 10 images in random sequence; the speed of transition between images was controlled by participants and ratings were made on a paper-and-pencil questionnaire. After 10 images had been presented, participants completed a brief distraction task (counting backwards in sevens, from 100 to 0) before they were presented with 10 new images in randomised order. Each participant, therefore, rated a total of 20 images.

 Participants were asked to rate each image using the short form of the Perceived Restorativeness Scale (PRS; Korpela & Hartig, 1996; short form: Berto, 2005; Peron, Berto, & Purcell, 2002). The short form of the PRS includes five items that assess five restorative qualities (being-away, fascination, coherence, scope, and compatibility), which were rated on an 11-point scale (0 = *Not at all*, 10 = *Completely*). Instructions were taken verbatim from Berto (2005, p. 251). The short form of the PRS has been shown to have adequate internal consistency (Berto, 2005; Peron et al., 2002) and, in the present study, Cronbach alpha was .81. Finally, an overall score for each image was calculated as the mean of all five items. Based on these means scores, the 25 items with the highest restorativeness scores (all scores ≥ 6.76) and the 25 items with the lowest restorativeness scores (all scores ≤ 2.91) were selected for use in Study 1. All images high in restorativeness depicted nature scenes and all images low in restorativeness depicted built environments.

***2.1.4 Materials***

***2.1.4.1 Image set***

The set of 25 high-restorativeness and 25 low-restorativeness images as described above were used in Study 1.

***2.1.4.2 State body image***

At both time-points, participants completed the Body Image States Scale (BISS; Cash et al., 2002). This is a 6-item scale that measures current body image experiences at a particular point in time. Items were rated on a 9-point scale with different anchors. Three items were reverse-coded prior to analysis and an overall score was computed as the mean of all items, such that higher scores reflect more positive state body image. Cash et al. (2002) reported that BISS scores have adequate internal consistency coefficients and good evidence of construct and convergent validity. In the present study, Cronbach’s α for this scale was .81 at pre-viewing and .80 at post-viewing.

***2.1.4.3 Demographics***

Participants were asked to provide their demographic details, consisting of sex, age, ethnicity, height, and weight. Height and weight data were used to compute self-reported BMI as kg/m2.

***2.1.5 Procedure***

 Ethics approval for Study 1 was obtained from the departmental ethics committee at Anglia Ruskin University. For this study, participation was solicited through flyers placed in on-campus areas of congregate activities. In order to mask the study hypotheses, the project was advertised as a study on the effects of personality on aesthetic preferences. Participants who agreed to be involved in the study were invited to a laboratory setting, where they provided informed consent and were provided brief information about the study task (i.e., that they would be asked to complete a questionnaire and rate a series of images). All participants took part on a voluntary basis, were tested individually in a private cubicle, and were paid £2.00 for participation. All data collection took place between September and November 2016. First, participants completed a paper-and-pencil questionnaire that included the BISS, a request for demographic information, and filler scales (the 20-item Mini-International Personality Item Pool, the 8-item Flourishing Scale, and the 36-item Desire for Aesthetics Scale) included to mask the study protocol. All filler scales are trait measures and data generated were discarded prior to analyses.

 Following completion of the pre-test questionnaire, participants were seated in front of a 19-inch computer screen. To ensure that participants were focused on the screen, the room was dimly lit and there were no distractions near the computer or on the walls of the cubicle. An experimenter explained that participants would be shown a series of images. Following Berman et al. (2008), participants were asked to rate using a keyboard how much they liked each image on a scale of 1 (*Dislike very much*) to 3 (*Like very much*). Each image was displayed for 7 seconds, followed by a rating interval that lasted until the participant provided a keyed response. Participants were randomly assigned to view either images of high-restorativeness/nature or low-restorativeness/built environment scenes. Following completion of this task, the cubicle light was turned on and participants were asked to complete the same scales as before. Finally, the experimenter verbally questioned participants about the study hypotheses (i.e., “Now that you have completed the study, are you able to guess what our aims or hypotheses might be?”); none were able to correctly guess the hypotheses or study aims. All participants were provided with written debrief information.

***2.2 Results and Discussion***

 Missing data accounted for < 0.3% of the total dataset and were missing completely at random (MCAR), as determined by Little’s (1988) MCAR analysis. We, therefore, inputted missing values using the mean replacement technique. Preliminary analyses sought to determine whether there were any significant differences between the groups that viewed images of nature (*n* = 61) and built environments (*n* = 63) in terms of basic demographics. Chi-squared tests showed that there were no significant differences between groups in the distribution of participant sex, χ2(1) = 0.52, *p* = .471, and ethnic groups, χ2(3) = 1.35, *p* = .716. Independent-samples *t*-tests indicated no significant between-group differences in terms of participant age, *t*(122) = 1.53, *p* = .130, *d* = 0.27, and self-reported BMI, *t*(122) = 0.68, *p* = .506, *d* = 0.12. These results suggest that the process of random allocation to groups was successful at minimising pre-existing group differences, at least in terms of basic demographics. Next, a 2 × 2 × 2 mixed analysis of variance (ANOVA) was conducted, with testing session entered as within-subjects variable (pre- versus post-viewing images), and group (nature versus built environment) and participant sex (women versus men) entered as between-subjects variables. BISS scores were entered as the dependent variables. Descriptive statistics are reported in Table 1.

 The ANOVA results indicated that the three-way (testing session × group × sex) interaction was not significant, *F*(1, 120) = 0.74, *p* = .393, ηp2 < .01. There were also no significant two-way interactions between testing session and sex, *F*(1, 120) = 0.06, *p* = .813, ηp2 < .01, or between group and sex, *F*(1, 120) = 0.86, *p* = .355, ηp2 < .01. The only interaction that reached significance was that between group and testing session, *F*(1, 120) = 17.97, *p* < .001, ηp2 = .13. Paired-samples *t*-tests showed that, in participants who viewed built environment images, there was no significant change in BISS scores between the first and second testing sessions, *t*(62) = 1.71, *p* = .092, dependence-corrected (Borenstein, 2009) *d* = 0.15. In contrast, in participants who viewed the nature images, there was a significant increase in BISS scores between the first and the second testing sessions, *t*(60) = 4.64, *p* < .001, dependence-corrected *d* = 0.27 (see Table 1). Finally, there was no significant main effect of testing session, *F*(1, 120) = 1.88, *p* = .173, ηp2 = .02, but there were significant main effects of group, *F*(1, 120) = 13.91, *p* < .001, ηp2 = .10, and participant sex, *F*(1, 120) = 17.45, *p* < .001, ηp2 = .13.

 The results of Study 1 suggest that viewing images of natural environments resulted in significantly more positive state body image post-viewing compared to pre-viewing. In contrast, viewing images of built environments had no significant effect on state body image scores. Additionally, the results of Study 1 indicate that the effects of viewing images of nature as opposed to built environments was similar for both women and men. That is, men had significantly more positive body image than women overall (which is consistent with previous work using the BISS; Cash et al., 2002), but the positive impact of viewing images of nature was the same irrespective of viewer sex. These findings hint at the positive effects of viewing images of nature on body image, but it should be noted that the effect size of the elevation in body image scores in the group that viewed images of nature was small. One concern with a small effect size is that it may reflect a spurious finding with little real-world impact.

**3. Study 2**

 Aside from the importance of replicating the findings of Study 1 in order to ascertain the magnitude of the impact of viewing images of nature, a second limitation of Study 1 concerns the measure of body image that was used. Although the BISS is a widely-used measure of state body image, it was not specifically designed to measure aspects of positive body image. Recently, Homan (2016) adapted the Body Appreciation Scale-2 (BAS-2; Tylka & Wood-Barcalow, 2015b) to be used as a state measure of positive body image. This state measure of positive body image was not available when Study 1 was begun and, as such, Study 2 was conducted using this alternative dependent variable. This is important particularly as it is possible larger effects may be accrued when state positive body image is measured more specifically and directly. Thus, Study 2 was a direct replication of the first study, but used the State Body Appreciation Scale-2 (SBAS-2; Homan, 2016) in place of the BISS.

***3.1 Method***

***3.1.1 Design***

Study 2 used a prospective design in which participants completed a brief questionnaire immediately before, and after, being exposed to images of either natural or built environments.

***3.1.2 Participants***

 The participants of Study 2 were 54 women and 52 men, all of whom were undergraduates at a university in Cambridge, United Kingdom. Participants ranged in age from 18 to 44 years (*M* = 20.92, *SD* = 4.40) and in self-reported BMI from 14.87 to 27.64 kg/m2 (*M* = 20.67, *SD* = 2.81). In terms of ethnicity, the majority of participants self-reported as being of British White ancestry (82.1%).

***3.1.3 Materials***

***3.1.3.1 Image set***

This study used the same set of 25 high-restorativeness and 25 low-restorativeness images as described in Study 1.

***3.1.3.2 State body image***

At both time-points, participants completed the SBAS-2 (Homan, 2016). This is an adaptation of the 10-item BAS-2 (Tylka & Wood-Barcalow-2015b), with items reworded to reflect transient mood states; that is, the SBAS-2 measures state body appreciation (i.e., acceptance of one’s body regardless of imperfections, respect for the body, and body-protection from unrealistic appearance ideals). All items were rated on a 5-point scale, ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*), with higher scores reflecting more positive state body appreciation. Homan (2016) reported that SBAS-2 scores have a one-dimensional factor structure, satisfactory convergent and incremental validity, and adequate internal consistency. Homan (2016) also reported that SBAS-2 scores were significantly and positively correlated with BISS scores in both women (*r* = .77) and men (*r* = .83). In the present study, Cronbach’s α for this scale was .90 during pre-viewing and .87 during post-viewing.

***3.1.3.3 Demographics***

Participants provided their demographic details, consisting of sex, age, ethnicity, height, and weight. Height and weight data were used to compute self-reported BMI as kg/m2.

***3.1.4 Procedure***

 Ethics approval for Study 2 was obtained from the departmental ethics committee at Anglia Ruskin University and all participants provided informed consent. All procedural details were identical to that reported in Study 1, with the exception that participants were not eligible if they had taken part in the previous study. Data collection for Study 2 took place between January and February 2017.

***3.2 Results and Discussion***

Missing data accounted for < 0.2% of the total dataset, were MCAR (Little, 1988), and were inputted using the mean replacement technique. First, demographic differences between the groups that viewed images of nature (*n* = 52) and built environments (*n* = 52) were examined. There were no significant differences in the distribution of participant sex, χ2(1) = 0.04, *p* = .849, nor ethnic groups, χ2(3) = 1.54, *p* = .673. There were also no significant between-group differences in mean age, *t*(104) = 1.47, *p* = .145, *d* = 0.29, nor in mean BMI, *t*(104) = 1.36, *p* = .178, *d* = 0.27. Next, the same ANOVA as in Study 1 was conducted, but using SBAS-2 scores as the dependent variable (see Table 2 for descriptive statistics). Results indicated that the three-way testing session × group × sex interaction was not significant, *F*(1, 102) = 0.17, *p* = .684, ηp2 < .01, nor were the interactions between testing session and sex, *F*(1, 102) = 0.82, *p* = .369, ηp2 < .01, and between group and sex, *F*(1, 102) = 0.11, *p* = .747, ηp2 < .01. Conversely, the interaction between testing session and group was significant, *F*(1, 102) = 18.23, *p* < .001, ηp2 = .15. Paired-samples *t*-tests showed that, in participants who viewed built environment images, there was no significant change in SBAS-2 scores between the first and second testing sessions, *t*(51) = 1.86, *p* = .068, dependence-corrected *d* = 0.10. On the other hand, in participants who viewed the nature images, there was a significant increase in body appreciation between the first and the second testing sessions, *t*(51) = 3.84, *p* < .001, dependence-corrected *d* = 0.26 (see Table 2). The ANOVA results also showed that there were significant main effects of testing session, *F*(1, 102) = 5.23, *p* = .024, ηp2 = .04, and sex, *F*(1, 102) = 4.13, *p* = .045, ηp2 = .04, but not of group, *F*(1, 102) = 3.36, *p* = .070, ηp2 = .03.

 As in Study 1, the results of Study 2 indicated that viewing images of nature had a positive effect on state positive body image. In Study 2, participants who viewed images of nature had significantly higher state body appreciation post- compared to pre-viewing, whereas there was no significant change in body appreciation scores in participants who viewed images of built environments. An additional finding of Study 2 was that men had significantly higher state body appreciation than women overall – which is consistent with past work (Homan, 2016) – but participant sex did not influence the effects of exposure to natural or built environments on body image. Nevertheless, it was notable that the effect size of the difference in participants who viewed images of nature was again small and comparable to the effect size reported in Study 1.

**4. Study 3**

The results of Studies 1 and 2 suggest that viewing images of nature, as opposed to images of built environments, does elevate state positive body image, but that the magnitude of the elevation is small. The small effect size is unlikely to be an outcome of the dependent variable that is used, as the results of Studies 1 and 2 were consistent when different measures of body image were used. A different explanation for the small magnitude of the effect may hinge on the brief interval between test and retest. To determine the extent to which this was a limiting issue, a third study was conducted using a within-subjects design, in which participants completed the SBAS-2 before and after viewing the image set. The SBAS-2 was selected for use in this study because it most directly taps the construct that was of interest to us, namely a facet of positive body image. In this case, however, participants viewed both sets of images two weeks apart. A completely within-subjects design has been used previously to examine the impact of viewing images of nature and built environments on attention restoration (e.g., Berman et al., 2008).

***4.1 Method***

***4.1.1 Design***

Study 3 used a prospective design in which participants completed a brief questionnaire immediately before viewing images of natural or built environments. Two weeks later, they performed the same procedure, but viewed the complementary set of images. Because the results of both Studies 1 and 2 indicated that participant sex did not influence the effects of image-viewing on body image, participant sex was not included as a factor in Study 3.

***4.1.2 Participants***

 A power analysis based on Berman et al. (2008, Expt. 2) suggested that a minimum sample of 36 participants was required to detect a medium-sized effect (*f*2) at α = .05. However, as the dependent variable in Berman et al. (2008) may not be comparable to body image, a larger sample was recruited to ensure that Study 3 was adequately powered. Thus, a total of 50 undergraduates was recruited from a university in London, United Kingdom, but seven did not complete both testing sessions, leaving a final sample of 23 women and 20 men. Participants ranged in age from 18 to 25 years (*M* = 22.73, *SD* = 2.10) and in self-reported BMI from 19.60 to 36.50 kg/m2 (*M* = 24.71, *SD* = 3.54). The majority of participants were of British White ancestry (95.6%).

***4.1.3 Materials***

***4.1.3.1 Image set***

Study 3 used the same set of 25 high-restorativeness and 25 low-restorativeness images as described in Study 1.

***4.1.3.2 State body image and demographics***

At both testing sessions, participants completed the SBAS-2 (Homan, 2016) and provided their demographic details, as described in Study 2. In this present study, Cronbach’s α for the SBAS-2 scale was .89. and .91 when viewing images of nature and .92 and .91 when viewing images of urban settings.

***4.1.4 Procedure***

 Ethics approval for Study 3 was obtained from the departmental ethics committee at University College London. In March 2017, participation was invited through flyers placed on campus locations for a study examining the effects on aesthetic preferences. Participants who agreed to take part provided written informed consent. All participants took part on a voluntary basis, were tested individually in a private cubicle, and were paid £2.00 for participation. Participants were randomly assigned to receive either the nature images (*n* = 23) or built environment (*n* = 20) during the first testing session. During each session, participants first completed a paper-and-pencil questionnaire that included the SBAS-2, a request for demographic information, and a filler scale (the 36-item Desire for Aesthetics Scale). Next, participants viewed pictures of natural or built settings. All other procedural details were identical to Study 1, with participants completing the SBAS-2 and the filler scale after viewing the images. Two weeks later, participants returned to the lab and completed the same procedure, but viewed the complementary set of images. Nominal codes were used to link participants’ data across testing sessions and were destroyed prior to analyses. All participants were provided with written debrief information.

***4.2 Results and Discussion***

Missing data accounted for < 0.5% of the total dataset, were MCAR (Little, 1988), and were inputted using the mean replacement technique. To analyse the data, we used a 2 × 2 repeated measures ANOVA, with image type (nature versus built environment) and test period (before versus after viewing the images), with SBAS scores as the dependent variables. The results indicated significant main effects of image type, *F*(1, 42) = 4.44, *p* = .041, ηp2 = .10, and test period, *F*(1, 42) = 11.24, *p* < .001, ηp2 = .21. Importantly, there was also an interaction between image type and test period, *F*(1, 42) = 4.71, *p* = .038, ηp2 = .10, so follow-up paired-samples *t*-tests were computed. Results indicated that, when participants viewed images of built environments, there was no significant difference between pre-viewing (*M* = 3.40, *SD* = 0.87) and post-viewing scores (*M* = 3.42, *SD* = 0.95), *t*(42) = 0.36, *p* = .719, dependence-corrected *d* = 0.06. On the other hand, when participants viewed images of nature, there was a significant increase from pre-viewing (*M* = 3.42, *SD* = 0.80) to post-viewing scores (*M* = 3.66, *SD* = 0.61), *t*(42) = 3.91, *p* < .001, dependence-corrected *d* = 0.40.

The results of Study 3 provide support for the earlier studies in suggesting that viewing images of nature had a positive effect on positive body image. More specifically, when participants viewed images of nature, there was an elevation in their state body appreciation, whereas no corresponding elevation was found when the same participants viewed images of built environments. The magnitude of the effect in Study 3 was larger than in the two previous studies, although it would still be considered small by Cohen’s (1988) standards. On the basis of Studies 1-3, therefore, it might be concluded that viewing images of nature does seem to have a positive effect on state body image, although the effects appear to be small. Across our three studies, we have assumed that exposure to images of natural environments is isomorphic, which is consistent with previously-reported explanations (e.g., Berman et al., 2008; Berto, 2005; de Kort et al., 2006). However, it is also possible that there are limits to this isomorphism – or, to put it differently, that viewing images of natures is a poor substitute for real immersion in nature – which may explain the small effect sizes reported here. To examine this possibility, we explored how interactions with real environments affected state body image in Study 4.

**5. Study 4**

 Previous studies have suggested that real-time interactions with natural environments have positive effects on attention restoration, mood, vitality, and psychophysiological health. For example, several early studies indicated individuals who had views of natural elements (e.g., green roofs) through windows performed better on tests of directed attention (Tennessen & Cimprich, 1995; see also Lee, Williams, Sargent, Williams, & Johnson, 2015) and felt more relaxed and less distracted (Kaplan, 2001). Other studies have used a design first implemented by Hartig, Mang, and Evans (1991), in which participants were asked to walk in natural or built environments. Hartig et al. (1991) reported that those who walked in natural environments performed significantly better on a subsequent proofreading task, whereas other scholars have reported similar effects on cognitive performance (Berman et al., 2008, 2012), attention (Taylor & Kuo, 2009), stress (Tyrväinen et al., 2014), and affect (Bratman, Daily, Levy, & Gross, 2015; Hartig, Evans, Jamner, Davis, & Garling, 2003; Ryan et al., 2010). In Study 4, therefore, we used a similar experimental design to test the hypothesis that walking in a natural environment would result in significantly elevated state body appreciation (we again elected to focus on state body appreciation because it was the construct that appeared to be most directly relevant to our study aims), whereas walking in a built environment would have no significant effect on state body appreciation.

***5.1 Method***

***5.1.1 Design***

 Study 4 employed a prospective, between-groups design in which participants completed a measure of state body appreciation before walking in either a natural or built environment, and completing the same measure of body appreciation at the end of the walk.

***5.1.2 Participants***

 A power analysis was conducted using G\*Power based on Bratman et al. (2015). To detect a medium-sized effect (*f*2) at α = .05, a total sample of 76 participants was needed. In order to account for possible sex differences and for drop-out, we aimed for a total sample of 180. In the event, 17 participants were excluded due to inclement weather conditions on the day of testing or because they failed to show up at the designated time. The former exclusion criterion was based on Bratman et al. (2015) and helped to ensure that the dosage of environmental exposure was consistent across participants in terms of weather. Following these exclusions, the final sample consisted of 84 women and 79 men. All participants were recruited from the community in London, United Kingdom, and ranged in age from 18 to 65 years (*M* = 33.52, *SD* = 10.92) and self-reported BMI from 17.30 to 45.96 kg/m2 (*M* = 25.02, *SD* = 5.06). The majority of participants were of British White ancestry (92.6%) and, in terms of educational qualifications, 12.3% had completed their General Certificate of Secondary Education (GCSEs; a secondary education award in the United Kingdom), 39.3% had an Advanced Level qualification (A-Levels; a school-leaving qualification), 32.5% had an undergraduate degree, 11.0% had a postgraduate degree, 3.1% were in full-time education, and 1.8% had some other qualification.

***5.1.3 Procedure and Materials***

Once ethics approval was obtained from the departmental ethics committee at Anglia Ruskin University, we solicited participation for a study ostensibly focused on health and mobility (in order to mask the study hypothesis). Flyers were placed in areas of congregate activities in various public locations in Hampstead, north London, and interested individuals were asked to contact the corresponding author for further information. Potential participants had to be resident in the United Kingdom, of adult age, and able to walk unassisted for approximately 30-45 minutes. Once participation was agreed, participants provided digital informed consent and were asked to attend a testing session at a starting point location, as described below. Upon arrival at this location, participants were met by two research assistants and asked to complete a paper-and-pencil questionnaire that included the SBAS-2 (see Study 2 for details; Cronbach’s α = .91 for those in the nature walk and .94 for those in the build environment group), along with 30 items based on that were collated from various measures of habitual physical activity (Shepard, 2003) that were included to mask the study hypothesis. All testing took place between April and September 2017, when weather permitted (i.e., the weather was typically clear and warm), on weekdays, and at times during which the locations were relatively uncongested.

 Upon completion of the questionnaire, participants were provided with a pedometer (to mask the study hypothesis) and told that they would be going on a 30- to 35-minute walk. Participants were randomly assigned to take a walk in a predefined natural setting (*n* = 43 women and 39 men) or built environment (*n* = 41 women and 40 men) that were equated in total length (2.5 km). Participants were given a map of the route they were to take and were told that they would be accompanied by a research assistant, who would remain silent until the end of the walk. The first route was through a natural environment in Hampstead Heath, a 790-acre green space in north London, encompassing ponds, woodlands, hills and landscapes, grassy open spaces, and refuges for wildlife. The walk closely followed the circular Parliament Hill and the Tumulus Trail, mainly along a dirt path that runs past a chain of ponds, green spaces, a pine-topped tumulus, woodlands, and hills. The second route began at the same starting point but went through a medium-density built environment encompassing high-rise housing blocks, offices and garages, small shops, parking lots, and other residential housing. This walk followed sidewalks along roads of varying size, carrying medium-density traffic, with minimal landscaped areas and with some hilly sections. Both walks involved similar levels of physical exertion and ended up at the starting point.

 Upon completion of the walk, participants were asked to complete a second paper-and-pencil that included the SBAS-2 (Cronbach’s α = .94 for those in the nature walk and .93 for those in the build environment group) along with the filler items, and asked to provide their demographic details. Following this, they were verbally debriefed by the research assistant, who also asked participants to guess the study hypothesis (none of the participants were able to do so). The questionnaires were anonymous and, at both testing sessions, were completed in private and returned to the research assistant in sealed envelopes. Nominal cues were used to link participants’ data across testing sessions and were destroyed prior to analyses. All participation was voluntary and participants were eligible for entry into a raffle for a £50 gift voucher. Participants were also provided with a written debrief sheet that contained further information about the study, as well as the contact information of the corresponding author.

***5.2 Results and Discussion***

Missing data accounted for < 0.3% of the total dataset, were MCAR (Little, 1988), and were inputted using the mean replacement technique. We conducted preliminary analyses to check for between-group differences in terms of basic demographics. We found no significant between-group differences in the distribution of sex, χ2(1) = 0.05, *p* = .816, ethnic groups, χ2(4) = 2.96, *p* = .565, and educational qualifications, χ2(5) = 4.18, *p* = .523. In addition, independent-samples *t*-tests indicated that there were no significant between-group differences in mean age, *t*(161) = 0.66, *p* = .511, *d* = 0.10, and mean BMI, *t*(161) = 1.71, *p* = .089, *d* = 0.27. These preliminary analyses indicate that the randomisation procedure was successful in terms of these demographic variables. Next, we ran a 2 × 2 × 2 mixed ANOVA, with testing session entered as a within-subjects variable (pre- versus post-walk), and group (natural versus built environment) and participant sex (women versus men) entered as between-subjects variables. State body appreciation scores were entered as the dependent variable. Descriptive statistics for this analysis are reported in Table 3.

The results showed that the three-way testing session × group × sex interaction was not significant, *F*(1, 159) = 1.66, *p* = .200, ηp2 = .01. Likewise, the two-way interactions between testing session and participant sex, *F*(1, 159) = 2.34, *p* = .128, ηp2 = .02, and participant sex and group, *F*(1, 159) = 1.62, *p* = .205, ηp2 = .01, did not reach significance. On the other hand, the two-way interaction between group and testing session was significant, *F*(1, 159) = 38.10, *p* < .001, ηp2 = .19. Paired-samples *t*-tests showed that, in participants who walked along the built environment route, there was a significant decline in state body appreciation scores post- compared to pre-walk, *t*(80) = 3.58, *p* = .001, dependence-corrected *d* = 0.44. Conversely, in participants who walked along the nature route, there was a significant increase in state body appreciation scores post- compared to pre-walk, *t*(81) = 5.24, *p* < .001, dependence-corrected *d* = 0.61. The ANOVA results also showed that there was no significant main effect of either testing session, *F*(1, 159) = 0.42, *p* = .522, ηp2 < .01, group, *F*(1, 159) = 1.86, *p* = .175, ηp2 = .01, or participant sex, *F*(1, 159) = 1.99, *p* = .160, ηp2 = .01.

 The results of Study 4 add to earlier studies showing that walking in natural environments has a positive effect on a range of outcomes (e.g., Berman et al., 2008, 2012; Bratman et al., 2015; Hartig et al., 1991, 2003; Ryan et al., 2010). More specifically, the results of this study showed that walking in a natural environment had a positive effect on state body appreciation. Indeed, it is notable that the effect size in Study 4 would be considered medium by Cohen’s (1988) guidelines and was larger than the effect sizes reported in Studies 1-3. One conclusion that might be drawn on the basis of these results is that exposure to a real natural environment has a stronger positive impact on state body image than exposure to photographs of natural environments. However, one unexpected finding in Study 4 was the decline in state body appreciation scores in participants who complete a walk in a built environment. This result is difficult to explain in the absence of further data, although it might be speculated that elements of the built environment (e.g., billboards, advertising) activated negative appearance-related thoughts or focused attention on the body’s appearance. Nevertheless, one concern with Study 4 is that the artificiality of the design may have had an impact on our results in unexpected ways. For example, although we followed previous work in having a research assistant accompany participants on the walk (Ryan et al., 2010, Study 2), in everyday life it is perhaps uncommon to be accompanied on walks by a relative stranger who remains silent throughout. In consideration of this issue, we conducted a separate study in which we examined the impact of exposure to a natural environment in a sample of individuals who had opted to do so on their own.

**6. Study 5**

 The results of Study 4 suggest that spending time in a natural environment, as opposed to a built environment, has a positive impact on state body appreciation, with larger effects than exposure to images of nature (i.e., Studies 1-3). To help determine the extent to which the results of Study 4 are robust, we conducted a separate study in which we recruited participants who had elected on their own to spend time in a natural environment. More specifically, we opportunistically recruited participants as they entered a park (i.e., a designed green space) and asked them to complete a measure of state body appreciation (selected as the construct of interest to mirror that of Study 4). We sought to recruit the same participants as they left the park to determine the extent to which spending time in the green space had a positive impact on state body image. To our knowledge, no previous study has utilised this specific methodology, but we expected that spending time in the park would elevate state body appreciation. In addition, we also conducted a preliminary investigation of whether the amount of time spent in the green space and the type of activity undertaken therein had an impact on state body appreciation.

***6.1 Method***

***6.1.1 Design***

Study 5 used a prospective design in which participants completed a brief questionnaire immediately before entering a park and again as they were leaving the park.

***6.1.2 Participants***

 A power analysis suggested that a minimum sample of 54 participants was required to detect a medium-sized effect (*f*2) at α = .05. The initial pool of participants consisted of 168 individuals, but following drop-out the final sample consisted of 43 women and 59 men. Participants ranged in age from 18 to 60 years (*M* = 32.02, *SD* = 10.66) and in BMI from 16.09 to 37.67 kg/m2 (*M* = 24.54, *SD* = 4.66). In terms of ethnicity, 66.7% self-reported as being of British White descent, 13.7% as being of African Caribbean, 7.8% as Asian, and 11.8% as of another ethnic background. In terms of educational qualifications, 27.5% had completed 19.6% had completed their GCSEs, 35.3% had completed their A-Levels, 21.6% had an undergraduate degree, 14.7% had a postgraduate degree, 6.9% were in full-time education, and 2.0% had some other qualification.

***6.1.3 Research Site and Pilot Study***

 Study 5 was conducted in Primrose Hill, a designed green space that is part of (but separated from) the larger Regent’s Park in London. The space contains a grassy hill offering views over London, open green spaces, playing fields, walking paths, and some built facilities (washrooms, a children’s playground, and a green exercise area). The space has five large entrances and one small entrance. In May 2017, we conducted a pilot study to ascertain the types of activities that visitors used the park for. An opportunistic, random sample of 48 park visitors (29 women, 19 men; age *M* = 32.73, *SD* = 7.10) were approached as they were entering or exiting Primrose Hill and asked to complete a brief questionnaire. The questionnaire contained a request for each participant’s age and an open-ended question that asked participants about activities they would undertake or had undertaken when they had visited Primrose Hill. The use of an open-ended question allowed participants to express their opinions without being influenced by the researcher and increased the likelihood of discovering responses that we may not have considered *a priori* (Schuman & Presser, 1996). Data generated from the open-ended question were analysed using qualitative content coding analysis, which allows for the development of a coding scheme through comparison of participant responses to categories (Neuendorf, 2002). The first author (a male professor of psychology with expertise in qualitative content coding) began by reviewing the responses several times and generated a coding scheme in consultation with the second author (a male psychology researcher with expertise in qualitative data analysis). New codes were generated when any text did not fit with existing categories and analysis proceeded until all 48 transcripts had been analysed. Examples of each code were discussed and any discrepancies were resolved through consensus. Content codes were only included based on manifest content (i.e., based on what participants wrote and not on what could be inferred). Examples of each code were discussed to develop items for use in the final questionnaire. Inter-rater agreement, measured using Cohen’s Kappa (κ), was .96, indicating substantial agreement (Krippendorf, 1980).

***6.1.4 Materials***

***6.1.4.1 State body image***

When entering and leaving Primrose Hill, participants completed the SBAS-2 (Homan, 2016), as described in Study 2. In Study 5, Cronbach’s α for the SBAS-2 scale was .95 when entering the park and .93 when leaving the park.

***6.1.4.2 Park activities***

When leaving the park, participants were presented with six park activities (*Spending time with friends or family*; *Sports or exercise*; *Leisure walk*; *Dog-walking*; *Relaxation, mindfulness, or taking a break*; *Other activity*) and asked to select the activity that best represented the activity they had undertaken during that particular visit to Primrose Hill. The six items were generated based on the results of the pilot study described above.

***6.1.4.3* *Time spent in park***

When leaving the park, participants were asked to estimate the amount of time they had spent in Primrose Hill on that particular visit to the nearest hour.

***6.1.4.4* *Demographics***

On the entry questionnaire, participants were asked to provide their sex, age, ethnicity, educational qualifications, height, and weight. Height and weight data were used to compute self-reported BMI as kg/m2.

***6.1.5 Procedures***

 Ethics approval for Study 5 was obtained from the departmental ethics committee at Anglia Ruskin University. Over a weekday in August 2017 when weather permitted (i.e., the weather was clear and warm), research assistants were stationed at three of the main entrances to Primrose Hill between 10am and 4pm. Potential participants were approached as they were entering the park between 10am and 1pm, and if they met inclusion criteria (i.e., of adult age and resident in the United Kingdom) were invited to complete a questionnaire ostensibly on green space use. Participants were given brief information about the nature of the task (i.e., that they would be asked to complete a brief questionnaire), but not provided any further information about the content of the questionnaire. Of a total of 200 invitations made, 168 participants agreed participation and provided written informed consent (because of the nature of the approach – that is, at busy times as people were entering and leaving the park – it was not feasible to solicit information about reasons for declining invitations). These participants then completed a paper-and-pencil questionnaire containing the SBAS and demographic information. Nominal codes were generated to link participants’ data across testing sessions (destroyed prior to analyses) and participants were asked, where feasible, to leave the park by one of the exits with research assistants and to identify themselves upon exit. A total of 123 participants did so during the time when research assistants were present, but 21 individuals declined to complete the exit questionnaire, primarily citing a lack of time. A further 45 participants did not leave the park during the period when research assistants were present or left via a different exit, leaving a final sample of 102. Participants who agreed to complete the exit questionnaire were presented with a paper-and-pencil version containing the SBAS and the items pertaining to park activities and time spent in the park. All participants took part on a voluntary basis and were not remunerated for participation. Participants who exited the park during the period when research assistants were present, whether they agreed to participate in the exit survey or not, were provided with written debrief information.

***6.2 Results and Discussion***

 Missing data accounted for < 0.9% of the total dataset, were MCAR (Little, 1988), and were inputted using the mean replacement technique. In preliminary analyses, we examined differences between those who completed both the entry and exist questionnaires, those who declined to complete the exit questionnaire, and those who did not complete the exit questionnaire for other reasons. There were no significant between-group differences in the distribution of sex, χ2(2) = 3.06, *p* = .216, ethnicity, χ2(6) = 5.04, *p* = .539, and educational qualifications, χ2(10) = 10.71, *p* = .305. One-way ANOVAs indicated that there were no significant between-group differences in age, *F*(2, 167) = 0.53, *p* = .588, ηp2 < .01, and BMI, *F*(2, 167) = 0.84, *p* = .436, ηp2 = .01. There was also no significant between-group difference in baseline state body appreciation, *F*(2, 167) = 2.15, *p* = .120, ηp2 = .03. For our main analysis, we conducted a paired-samples *t*-test to compare differences in state body appreciation at baseline and at exit. The results indicated that, compared to scores on entry (*M* = 3.40, *SD* = 0.94), scores on exit (*M* = 3.59, *SD* = 0.77) were significantly higher, *t*(101) = 2.89, *p* = .005, dependence-corrected *d* = 0.30. For further analyses, we computed the differences between state body appreciation scores on entry and exit (*M* = 0.20, *SD* = 0.69). There were no significant between-group differences in this score as a function of activity conducted in the park, *F*(5, 101) = 0.86, *p* = .514, ηp2 = .04. We also examined the correlation between this score and time spent in the park, but the relationship did not reach significance, *r* = .03, *p* = .803.

 As opposed to Study 4, where the study design may not have accurately mirrored everyday experiences, Study 5 utilised a sample of participants who elected to spend time in a green space on their own volition. The results of Study 5 indicated that spending time in a green space had a positive impact on state body appreciation. However, it should be noted that the effect size uncovered in Study 5 was small (and smaller than that reported in Study 4). In addition, there were no significant between-group differences in elevated state body appreciation as a function of the type of activity that was conducted in the park. Furthermore, we found no significant impact of time spent in the green space, suggesting that minimal dosage (i.e., a minimum of 1 hour in the present case) may be sufficient to elevate state body appreciation. It should nevertheless be pointed out that our measure of dosage in the present study may have been imprecise, as participants were asked to report the time spent in the park to the nearest hour.

**7. General Discussion**

 We conducted five studies to examine the impact of exposure to isomorphic and real natural environments on state body image. Studies 1-3 showed that exposure to isomorphic natural environments, as opposed to built environments, led to significant improvements in state body image. Indeed, the findings across the three studies were consistent1, given that we used different study designs and different outcomes measures. Study 4 showed that spending time in a real natural environment, as opposed to a built environment, had a positive impact on state body appreciation. Finally, Study 5 showed that, when individuals elected to spent time in a designed green space on their own volition, they experienced elevated state body appreciation. Taken together, the five studies reported here corroborate previous cross-sectional work indicating that self-reported exposure to nature was significantly associated with more positive body appreciation (Swami, Barron, et al., 2016).

 As discussed by Swami, Barron, and colleagues (2016), there may be several reasons why nature exposure is associated with more positive body image. Consistent with both Psychophysiological Stress Recovery Theory (Ulrich, 1981, 1983) and Attention Restoration Theory (Kaplan, 1995; Kaplan & Kaplan, 1989), it is possible that exposure to environments with depth, complexity, and structure helps to restrict negative appearance-related thoughts and supports speedier recovery from external threats to body image. More specifically, natural environments may capture one’s attention in an effective but gentle manner, a process termed by Kaplan and Kaplan (1989) as “soft fascination.” This undramatic fascination is generally accompanied by feelings of pleasure, such as when one is drawn to the sight of a setting sun or green vistas. Such surroundings may be ideal for promoting more positive state body image because they effortlessly hold one’s attention while allowing for simultaneous thought and reflection to occur. The ability to reflect in an environment that does not require effortful attention may provide the observer with a cognitive quiet, which in turn may foster self-kindness, nurturance, and a compassionate view of one’s self and body. In short, exposure to green spaces may help to promote self-compassion (Neff, 2003), which includes being open to, and non-avoidant of, one’s experiences and being caring towards oneself, including in terms of one’s body image (e.g., Braun, Park, & Gorin, 2016; Rodgers et al., 2017), and respecting and appreciating one’s body as part of a wider ecosystem requiring protection and care (Holloway et al., 2014) Alternatively, though not dissimilarly, time spent in natural environments may also provide individuals with a means of distancing themselves from appearance-focused contexts that result in negative body image (see Tylka, Russell, & Neal, 2015).

 Studies 1-3 suggested that the effects of exposure to isomorphic natural environments on state body image was relatively small. On the other hand, the effects of exposure to a real natural environment in Study 4 returned a medium-sized effect, while the final study again suggested that the magnitude of the effect was again small. A number of possible mechanisms could explain the relatively larger effect size uncovered in Study 4, including social desirability and design effects (e.g., as a function of being incentivised to spend time in a green space). Beyond these explanations, it is also possible that our laboratory-based studies placed too much attention on conscious focused attention to features in the images (i.e., intellectual awareness). In contrast, perception of real environments relies on both central and peripheral visual information; the latter, in particular, includes low-spatial frequency information (i.e., atmospheric awareness) that may have impacted our findings (cf. Fortenbaugh, Hicks, Hao, & Turano, 2007; Franchak & Adolph, 2010). Indeed, it is important to note that, when walking, central vision is typically fixated on the goal or destination (Rooney, Condia, & Loschky, 2017; Turano, Geruschat, Baker, Stahl, & Shapiro, 2001); the lack of clear destination in Study 4 given the presence of the researcher may have heightened participants’ focus on ambient features of the environment, which may explain the relatively larger effect size found in Study 4, but also why this study reported a decrease in state body appreciation following the walk through a built environment.

 The discrepancy in effect sizes reported between Studies 4 and 5 may also have to do with the presence of other people. In Study 4, where participants went on a walk with a stranger and encountered few other people, they may have been more likely to attend to salient aspects of the environment. Likewise, in Study 4, participants may have had greater opportunities to reorient their attention following gaze cues of the researcher. Reorienting attention towards gaze cues is largely automatic (Engell et al., 2010; Joseph, Fricker, & Keehn, 2014) and we cannot rule out the possibility that the researcher in Study 4 unintentionally focused on salient aspects of the environment, which influenced the focus of participants. Conversely, in Study 5, although participants entered the green space on their own volition, they shared their green space with many others and the relatively higher density of other people may have attenuated any effect of nature exposure on body image. One reason for this may be that having to share a green space with others triggers feelings of annoyance or frustration (Robin, Matheau-Police, & Couty, 2007), either because task completion is impaired (e.g., being stuck behind other people who are walking slowly) or through negative social encounters (e.g., strangers who may be impolite). The relatively higher density of other people in Study 5 may have also adversely affected participant’s satisfaction of their experiences in the green space (Cole, 2001).

 All things considered, one broad conclusion that might be drawn on the basis of the five studies reported here is that exposure to natural environments – whether isomorphic or real – results in small improvements to state body appreciation. However, the small effect sizes should not be viewed as discouraging; rather, it is quite possible that the short-term effects uncovered in the present study translate into longer-term effects on trait body image. More specifically, repeated exposure to nature may help individuals nurture healthy relationships with the body that, over time, lead to more positive body image. Such nurturance might include greater embodied awareness of the bodily self and engaging in compassionate self- and body-care that are promoted through exposure to natural environments. In addition, as emphasised by a holistic model of positive body image (Wood-Barcalow, Tylka, & Augustus-Horvath, 2010), it is possible that when individuals experience more positive body appreciation, it has reciprocal influences on other corporeal experiences, such as surrounding one’s self with others who promote body acceptance and taking care of one’s health. Even if the boost from nature exposure to positive body image is short-term and does not translate to long-term change, regular nature exposure likely brings other psychological and physical benefits. Thus, nature exposure would be worth pursuing on a regular basis, whether or not the effects on positive body image are limited to the short-term.

 Of course, further research is necessary before firm conclusions about the impact of nature exposure on body image can be drawn. Across our studies, for example, we cannot entirely rule out experimenter, design, or social desirability effects, and it will be important for other research groups to replicate our findings. Indeed, the studies reported here represent only a small fraction of experimental studies that could be conducted, and it is our hope that our findings stimulate future complementary studies. It should also be noted that the participants of Studies 1-3 were relatively young, university students. If anything, this may have produced conservative effects: meta-analytic work by McMahan and Estes (2015) has suggested that the benefits of nature exposure are larger for older versus younger participants. Nevertheless, future studies should seek to more fully examine the impact of age, educational status, and other participant characteristics on the effects we have reported here.

 Additionally, there are many different types of natural environments, and previous studies have suggested that there may be differences in restorative effects of different environment types (Hartig et al., 1997; Herzog et al., 2003). Given that Studies 4 and 5 were both conducted in designed green spaces, it would be useful for future studies to examine the extent to which the benefits reported here generalise to other natural environments (e.g., wild nature, gardens, etc.). Likewise, green spaces vary along many different dimensions, and it is possible that the effects we found in Studies 4 and 5 were specific to environments these studies were conducted in (e.g., because of unique or idiosyncratic features in these environments) or that exposure to green spaces elsewhere have different effects on body image. In a similar vein, Studies 1-3 were limited to static, photographic images, but future work could extend the present efforts to explore the impact of virtual or videoed natural environments on body image, particularly as the multi-sensory input available in virtual or videoed environments may have stronger effects (for a discussion, see Pearson & Craig, 2014). Nevertheless, it should be noted that reviews of the literature have suggested that photographs can be considered valid representation of real environments (e.g., Stamps, 1990).

 It is also worth noting that the effects reported in Study 5 may have been limited by the relatively blunt tools we used to measure the type of activity conducted, and time spent, in green spaces. For instance, emerging evidence suggests that spending time in a natural environment can affect subjective experiences of time (i.e., participants overestimate time spent in a natural environment compared to a built environment; Davydenko & Peetz, 2017). This aspect of our design could be improved by obtaining more accurate measures of time spent in a natural environment (e.g., by researcher recording of entry and exit times or by explicitly asking participants to record timings). Future studies could also seek to corroborate the present findings by using alternative methodologies, such as a longitudinal design that examines the impact of moving to greener or less urban areas (see Alcock, White, Wheeler, Fleming, & Depledge, 2014). For example, it would be useful to investigate how long the boost to positive body image as a result of nature exposure lasts. Including additional measures that may impact on body image, such as self-esteem (Swami, von Nordheim et al., 2016) and psychophysiological stress, would also be welcome so as to enable researchers to examine possible mediating effects.

 Finally, it may be worth exploring the impact of the imagined or actual presence of others on the relationship between nature exposure and body image. For example, Staats and Hartig (2004) reported that imagining the company of a friend increased the perceived restorative potential of natural settings, but only if participants had concerns about the safety of the setting. More recently, Johansson, Hartig, and Staats (2011) found that participants reported significantly higher self-reported revitalisation when walking with a friend, as compared to walking alone, through a built environment but not through a natural environment. Such findings may help to explain some of the result in Study 5, where spending time with friends or family was not more likely than any other activity to result in greater state body appreciation. Nevertheless, in future research, it will be useful to pay more careful consideration to both the influence of other members of the public, as well as the social context of using green spaces, on body image in natural and built environments.

 Despite these issues, the five methodologically varied studies present here point to consistent effects of nature exposure on positive body image. These effects appear to occur irrespective of whether nature exposure occurs isomorphically via photographs or in-situ. Findings from the present work add to a large body of evidence indicating that exposure to natural environments is associated with improved physiological, psychological, and social well-being outcomes (e.g., Abraham et al., 2010; Bowler et al., 2010; Grinde & Patil, 2009; Russell et al., 2013; Sandifer et al., 2015), and extend available work by suggesting that these benefits may also extend to body image. Our findings may enable practitioners to design future interventions to promote more positive body image that are based on exposure to natural environments. More broadly, we concur with the conclusions drawn by previous researchers that “green space is more than just a luxury” (Maas, Verjeij, Groenewegen, de Vries, & Spreeuwenberg, 2006, p. 591) and that the provision of accessible green space should be allocated greater importance in public health and spatial planning policies. Green spaces should be viewed as an essential component of salutogenetic models aimed at better understanding, and contributing to, improved health and health-related quality of life, including in terms of body image.

**Footnotes**

1 It may also be useful to note that across Studies 2, 4, and 5, baseline SBAS scores were relatively uniform (Study 2 *M* = 3.53; Study 4 *M* = 3.37; Study 5 *M* = 3.40). This suggests that cross-study findings were unlikely to have been affected by baseline state body appreciation, although we also caution that this interpretation should be considered carefully in light of the differences in study design, participant recruitment, and samples across the three studies. Note also that, while Study 3 included the SBAS, it did not include a “baseline” component as such.

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Table 1. *Descriptive Statistics for the Mixed Analysis of Variance in Study 1.*

|  |  |
| --- | --- |
| Testing session | Group |
|  | Nature | Built environment |
|  | Women (*n* = 33) | Men (*n* = 28) | Total (*n* = 61) | Women (*n* = 30) | Men (*n* = 33) | Total (*n* = 63) |
|  | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Pre-viewing | 5.10 | 1.35 | 6.01 | 1.22 | 5.52 | 1.36 | 4.79 | 1.03 | 5.44 | 1.18 | 5.13 | 1.15 |
| Post-viewing | 5.42 | 1.11 | 6.40 | 1.11 | 5.87 | 1.21 | 4.70 | 0.93 | 5.22 | 0.87 | 4.97 | 0.93 |

Table 2. *Descriptive Statistics for the Mixed Analysis of Variance in Study 2.*

|  |  |
| --- | --- |
| Testing session | Group |
|  | Nature | Built environment |
|  | Women (*n* = 26) | Men (*n* = 26) | Total (*n* = 52) | Women (*n* = 26) | Men (*n* = 28) | Total (*n* = 54) |
|  | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Pre-viewing | 3.47 | 0.78 | 3.68 | 0.58 | 3.57 | 0.68 | 3.36 | 0.59 | 3.62 | 0.40 | 3.49 | 0.52 |
| Post-viewing | 3.67 | 0.66 | 3.81 | 0.46 | 3.74 | 0.57 | 3.32 | 0.51 | 3.56 | 0.42 | 3.44 | 0.48 |

Table 3. *Descriptive Statistics for the Mixed Analysis of Variance in Study 4.*

|  |  |
| --- | --- |
| Testing session | Group |
|  | Nature walk | Built environment walk |
|  | Women (*n* = 33) | Men (*n* = 28) | Total (*n* = 61) | Women (*n* = 30) | Men (*n* = 33) | Total (*n* = 63) |
|  | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Pre-walk | 3.25 | 0.70 | 3.28 | 0.55 | 3.27 | 0.63 | 3.49 | 0.93 | 3.09 | 0.92 | 3.29 | 0.94 |
| Post-walk | 3.47 | 0.8 | 3.48 | 0.72 | 3.47 | 0.76 | 3.01 | 0.78 | 3.25 | 0.80 | 3.12 | 0.79 |