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Abstract

Here, we sought to replicate previous work showing a relationship between connectedness to nature and body appreciation, and extend it by examining associations between exposure to natural environments and other body image-related variables. An online sample of 399 U.S. women and men (M_{age} = 34.55 years) completed measures of body appreciation, connectedness to nature, nature exposure, appearance investment, sociocultural attitudes toward appearance, and self-esteem. Path analysis showed that nature exposure and connectedness to nature, respectively, were associated with body appreciation in women and men, both directly and indirectly via self-esteem. Connectedness to nature also mediated the link between nature exposure and body appreciation. In men, but not women, the link between connectedness to nature and body appreciation was also mediated by appearance investment and internalisation of a muscular ideal. These results may point to novel methods for promoting more positive body image in adults through engagement with nature.

Keywords: Body appreciation; Body image; Connectedness to nature; Nature exposure; Self-esteem

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There is now ample and credible evidence demonstrating that exposure to natural environments (i.e., time spent in, and engagement with, nature-rich environments) has health-promoting qualities (for a review, see Russell et al., 2013). For example, one meta-analysis reported significant, moderate-sized reductions in negative emotions, such as anger, anxiety, and sadness (Hedges' g = 0.35-0.66), and large-sized improvements in energy (Hedges' g = 0.76) following exposure to natural environments (Bowler, Buyung-Ali, Knight, & Pullin, 2010). Similarly, in a study of over 10,000 British respondents, it was reported that individuals living in urban areas with more green space had significantly lower mental distress and higher life satisfaction compared to individuals living in urban areas with less green space (White, Alcock, Wheeler, & Depledge, 2013). Experimental studies have also shown that simply viewing images of nature (Berman, Jonides, & Kaplan, 2008) or looking at natural environments (Raanaas, Patil, & Hartig, 2012; Tsunetsugu et al., 2013) has positive physiological and psychological effects.

According to Psychophysiological Stress Recovery Theory (Ulrich, 1983), these positive effects arise because natural environments help people to recover emotionally and physiologically from the stresses of everyday (and particularly urban) life. That is, natural environments can aid, and increase the speed of, emotional restoration by reducing negative emotions – a finding that has been demonstrated through experimental (e.g., Ryan et al., 2010; Ulrich, 1981), survey-based (e.g., Korpela, Ylén, Tyrväinen, & Silvennoinen, 2010), and prospective studies (e.g., Barton & Pretty, 2010). Likewise, Attention Restoration Theory (Kaplan, 1995) postulates that interactions with natural environments can help to restore depleted cognitive resources (e.g., attention and memory), which in turn promotes effective cognitive functioning (Bratman, Daily, Levy, & Gross, 2015). Emotional and cognitive

restoration through exposure to natural environments are inter-related (Ulrich, 1983), but the clear conclusion of both theories is that exposure to natural environments has positive effects on multiple aspects of well-being.

These are not the only routes through which exposure to nature can promote psychological well-being. Direct exposure to nature may also facilitate social contact and cooperation with others (e.g., by focusing attention on collective benefits or increasing other-focused prosocial tendencies; Zelenski, Dopko, & Capaldi, 2015; Zhang, Piff, Iyer, Koleva, & Keltner, 2014) and provide unique opportunities for personal development and a sense of purpose or meaning (e.g., by promoting reflection on personal problems; Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). In addition, research findings have also suggested that individuals vary in the extent to which they feel connected to nature (i.e., the degree to which they experience a "sense of oneness with the natural world"; Mayer & Frantz, 2004, p. 504). People who have a higher degree of connectedness to nature not only report greater pro-environmental behaviour (e.g., Gosling & Williams, 2010), but are also more satisfied with life and have higher happiness and positive affect (Mayer & Frantz, 2004; Tam, 2013). Importantly, the link between exposure to natural environments and well-being may be mediated by connectedness to nature (Mayer et al., 2009), although the link between connectedness to nature and well-being has itself been found to be mediated by constructs such as mindfulness (Howell, Dopko, Passmore, & Buro, 2011), meaning in life (Howell, Passmore, & Buro, 2013), and spirituality (Kamitsis & Francis, 2013; Trigwell, Francis, & Bagot, 2014).

Recently, scholars have begun examining associations between nature-related variables and specific aspects of well-being, such as body image. Although details of this relationship are only just beginning to be investigated (Swami, von Nordheim, & Barron, 2016), the presumed link is based on research showing that exposure to the natural world

decreases negative states (e.g., anxiety) and increases positive states (e.g., affect; Mayer et al., 2009). That is, it has been hypothesised that nature is beneficial because it is restoring – an idea that is common in environmental psychology (Gifford, 2014) – and that those effects may extend to body image specifically (Swami et al., 2016). In particular, it is possible that greater exposure to nature focuses an individual's attention on eudaimonic aspects of well-being; that is, time in nature and strong subjective connections with nature may promote feelings that one is part of a larger ecosystem requiring concern and protection (Mayer & Frantz, 2004; Schultz, 2000; Tam, 2013). Looked at from a different point-of-view, immersion in nature and a sense of connectedness to nature may shift attention away from hedonistic aspects of well-being, including immediate and narrow self-interest (e.g., a focus on one's appearance; Swami et al., 2016).

Greater immersion in nature and a subjective connectedness to nature may also promote an equalitarian worldview. For example, Holloway, Murray, Okada, and Emmons (2014) have discussed how a sense of connection to nature may help women identify commonalities between their gender and wider ecosystems (e.g., by confirming a parallel between the subordination of women and the destruction of nature) and, in turn, develop a change in self-perceptions. The latter may include a critical appraisal of negative stereotypes and ideals of appearance and a relinquishing of impression management rituals, which in turn is experienced as corporeal empowerment (Holloway et al., 2014). In other words, it is possible that exposure to nature and a perceived connection to nature provide some individuals with tools to better appraise and cope with threats to body image, or foster embodying experiences that promote respect and appreciation of the body as a part of a wider ecosystem (Hennigan, 2010; Holloway et al., 2014; Swami et al., 2016). Thus, engagement with nature may provide opportunities for individuals to gain ownership over, and compassion for, their physical selves, which in turn may promote healthier body image.

To date, only a handful of studies have directly tested these assumptions. Using a qualitative design, one study of working- and middle-class individuals found that spending time in nature improved body image by allowing women to distance themselves from the wider cultural context, increasing embodying experiences, and supporting connection to nature (Hennigan, 2010). Experimental work has also shown that greater self-objectification and internalisation of a feminine ideal resulted in lower connectedness to nature in women (Scott, 2010). Finally, a study of British adults found that connectedness to nature was directly associated with body appreciation – operationalised using the Body Appreciation Scale (BAS; Avalos, Tylka, & Wood-Barcalow, 2005), a measure of positive body image – in women (r = .32) but not in men (r = .10; Swami et al., 2016). In explanation, the authors suggested that connectedness to nature may provide unique, gendered opportunities for developing more positive body image (cf. Holloway et al., 2014). In addition, Swami et al. (2016) found that self-esteem fully mediated the relationship between connectedness to nature and body appreciation in women.

Although this work suggests a link between a nature-related variables and body image, Swami et al. (2016) have called for further research into these issues. For one thing, the BAS has recently been revised in line with developments in the conceptual understanding of body appreciation (BAS-2; Tylka & Wood-Barcalow, 2015a, 2015b). It is possible, therefore, that the null effect in the relationship between connectedness to nature and body appreciation in men reported by Swami et al. (2016) was an artefact of measurement issues. More broadly, while the focus of previous research has been on an aspect of positive body image (i.e., body appreciation), associations between connectedness to nature and broader aspects of body image have not been fully examined. This is important because, as Swami et al. (2016) have noted, there may be complex associations between connectedness to nature and multidimensional aspects of body image. In a similar vein, a broader perspective in terms

of multiple components of body image may also help to uncover alternative mechanisms of causation between nature-related variables and body image (e.g., by protecting against prescriptive, societal standards of beauty).

In addition, although previous work has hinted at the relationship between exposure to nature and body image (Hennigan, 2010), there is a need to test this relationship more robustly. Although one might expect similar outcomes for connectedness to nature and nature exposure *vis-à-vis* body image given their domain similarity, there may be important distinctions between the two variables (cf. Perrin & Benasi, 2009). For example, previous work has reported that the correlation between exposure to nature and connectedness to nature tends to be moderate-to-strong (e.g., Kamitsis & Francis, 2013; Zhang, Howell, & Iyer, 2014), suggesting that, although there is some measurement overlap, the constructs are sufficiently different to have independent effects on outcome measures (Zhang, Piff, et al., 2014). More broadly, identifying independent associations between connectedness to nature and nature exposure, respectively, and body image may highlight different routes to leveraging therapeutic benefits (e.g., spending time in nature versus promoting connectedness to nature).

The Present Study

The present study had a number of inter-related aims. First, we sought to replicate the findings of Swami et al. (2016) with respect to the positive association between connectedness to nature and body appreciation. We did so using a more conceptually valid measure of body appreciation (i.e., the BAS-2 as opposed to the BAS) and in a new, but culturally-similar, population (i.e., community adults in the U.S., as opposed to the United Kingdom). Second, we examined direct associations between nature exposure and body appreciation. That is, we sought to establish the extent to which nature exposure, independent of connectedness to nature, is associated with positive body image. Based on the above

review of the literature, we hypothesised that nature exposure and connectedness to nature, respectively, would be positively associated with body appreciation in women and (given the possible measurement issues associated with the BAS in Swami et al., 2016) in men.

Third, following Swami et al. (2016), we examined whether self-esteem would mediate the relationship between the nature-related variables and body appreciation. We included self-esteem because it is possible that the links between nature and body image are indirect. That is, based on the Psychophysiological Stress Recovery Theory (Ulrich, 1983), it was hypothesised that nature exposure and connectedness to nature provide opportunities for emotional restoration that includes healthier self-esteem, and that it is more positive self-worth that drives higher body appreciation. As further discussed by Swami et al. (2016), this indirect link is conceptually plausible given evidence that exposure to nature has been found to be associated with higher self-esteem (Maller, 2009; Pretty et al., 2007) and, separately, that higher self-esteem is associated with higher body appreciation (Avalos et al., 2005; Swami & Ng, 2015; Swami, Ng, & Barron, 2016; Swami, Stieger, Haubner, & Voracek, 2008).

Finally, we also explored associations between connectedness to nature and nature exposure, respectively, and a broader set of body image-related variables. First we focused on investment in physical appearance, which refers to beliefs and assumptions about the importance, meaning, and influence of appearance in one's life (Cash, Melnyk, & Hrabosky, 2004; Jarry & Cash, 2011). More specifically, it refers to the degree to which individuals believe that their physical appearance influences their personal or social worth and sense of self, and their belief that it is important to appear attractive and to manage their appearance. Based on the view that greater nature exposure focuses an individual's attention on eudaimonic, as opposed to hedonistic, aspects of well-being, we predicted negative relationships between connectedness to nature and nature exposure, respectively, and

investment in appearance. In turn, we expected that higher investment in appearance would be associated with lower body appreciation.

Second, the Tripartite Influence Model of body image and disordered eating (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999) proposes that individuals experience pressure from three dominant social agents (i.e., peers, family, and the media) to adhere to sociocultural ideals of appearance, which emphasise the importance of thinness for women and muscularity for men. In turn, these social pressures are posited to lead individuals to internalise appearance ideals and compare their bodies against these ideals, which lead to the development of body dissatisfaction (Schaefer et al., 2015). Based on the idea that exposure and connected to nature would allow for a critical evaluation of appearance ideals and the sources of those ideals (Holloway et al., 2014), we predicted that the nature-related variables would be negatively associated with perceived pressure to conform to sociocultural ideals of appearance, resulting in negative relationships with each of the three sources of pressure. In addition, we expected that connectedness to nature and nature exposure, respectively, would be negatively associated with internalisation of appearance ideals. In turn, we expected that higher perceived pressure and greater internalisation would be associated with lower body appreciation.

To test these different hypotheses, we used path analysis to develop a conceptual integration of the possible predictors of body appreciation. Based on previous research (Mayer et al., 2009), our initial hypothesised model (see Figure 1) included nature exposure as an exogenous variable with connectedness to nature as a less distal exogenous variable. To this model, we added self-esteem as a more distal endogenous variable and body appreciation as the endogenous variable. This allowed us to test for both direct and in-direct (via self-esteem) links between the nature-related variables and body appreciation. Finally, investment in appearance, pressure from the tripartite sources, and internalisation (of the thin ideal for

women and the muscular ideal for men) were included as more distal endogenous variables at the same level as self-esteem. This allowed us to examine the utility of these variables as mediators of the relationships between nature-related variables and body apprecation; mediational pathways are possible given that these variables can be conceptualised as antecedents of body appreciation, and because they maybe directly impacted by nature-related factors. In addition, because of the possibility of sex-specific effects (Swami et al., 2016), model fit was assessed separately for women and men. Furthermore, to achieve a parsimonious representation of our data, we planned to trim paths that were not significant. Finally, within these models, we tested for mediation effects for self-esteem, perceived pressure, internalisation of ideals, and appearance investment, respectively, between nature-related variables and body appreciation.

Method

Participants and Procedure

All data collection was conducted online via Amazon's Mechanical Turk (MTurk) website, a crowdsourcing Internet marketplace. MTurk samples are more demographically-diverse than standard Internet samples and the site is considered to be a source of high-quality data for social science research generally (Buhrmester, Kwang, & Gosling, 2011) and body image research specifically (Gardner, Brown, & Boice, 2012). We placed an advert on the site in January 2016, requesting participation in a study about body image from MTurk workers who had achieved at least a 98% approval rate and completed at least 1,000 hits. In addition, because of known cross-cultural differences in body image (e.g., Swami et al., 2010, 2015), we limited participation to MTurk workers from the U.S. After providing informed consent, participants were directed to the measures described below, which were presented in an anonymous form and in random order via the randomisation function with Qualtrics (Snow, 2012), which hosted the survey. In exchange for completing the survey, participants

were paid $1.50. Fifteen participants with large amounts of missing data (i.e., missing more than 10% of the total data across all measures; Parent, 2013) were excluded from the dataset prior to analyses. All participants received debriefing information at the end of the survey.

The final sample consisted of 199 women and 200 men, ranging in age from 19 to 76 years (M = 34.55, SD = 10.89) and in self-reported body mass index (BMI) from 16.60 to 49.53 kg/m^2 (M = 26.62, SD = 5.73), reflecting a sample that was slightly overweight. The majority of participants self-reported their race as White (81.7%), with smaller groups self-identifying as Black or African American (7.0%), Asian (5.3%), mixed race (3.5%), American Indian or Alaskan Native (0.8%), or other (1.8%). Of the total sample, 29.3% had completed high school, 50.0% had an undergraduate degree, 16.3% had a postgraduate degree, 2.5% were still in full-time education, and 1.8% had some other qualification. In terms of marital status, 42.6% of the sample were single, 17.3% were cohabiting but unmarried, 34.8% were married, 5.0% were divorced or separated, and 0.3% had another status.

Measures

Body appreciation. Participants completed the Body Appreciation Scale-2 (BAS-2; Tylka & Wood-Barcalow, 2015b), a 10-item measure of an individual's positive body image related to favourable opinions of the body, body acceptance, bodily respect, and a protective cognitive style that rejects unrealistic ideals (sample item: "I respect my body"). All items were rated on a 5-point scale, ranging from 1 (*Never*) to 5 (*Always*) and an overall score was computed as the mean of all 10 items, so that higher scores reflect greater body appreciation. Tylka and Wood-Barcalow (2015b) reported that, in college and community samples of U.S. adults, BAS-2 scores had a one-dimensional factor structure, were invariant across sex, had good test-retest reliability after 20 days, and good patterns of construct validity. In the present study, Cronbach's α for this scale was .96 for both women and men.

Investment in appearance. To measure investment in appearance, we used the short form of the Revised Appearance Schemas Inventory (ASI-R; Cash et al., 2004). This is a 20-item scale that measures investment in one's appearance along two dimensions. Self-Evaluative Salience of Appearance consists of 12 items and measures an individual's belief that their physical appearance influences their personal or social worth and sense of self (sample item: "When I see good-looking people, I wonder about how my own looks measure up"). Motivational Salience of Appearance consists of eight items and measures the extent to which an individual attends to their appearance and engaged in appearance-management behaviours (sample item: "I often check my appearance in a mirror just to make sure I look okay"). All items were rated on a 5-point scale, ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*). Subscale scores were computed as the mean of items associated with each factor, following reverse-coding of six items, so that higher scores reflect greater investment in appearance. Cash et al. (2003) reported that, in U.S. adults, the ASI-R had good psychometric properties. In the present study, Cronbach's α for both subscales was acceptable (Self-Evaluative Salience, women = .85, men = .82; Motivational Salience women = .88, men = .81).

Sociocultural attitudes toward appearance. Participants were asked to complete the Sociocultural Attitudes Toward Appearance Questionnaire, now in its fourth iteration (SATAQ-4; Schaefer et al., 2015). The SATAQ-4 is a 22-item scale that measures an individual's perceived pressure to conform to ideals of appearance emanating from family (four items; sample item: "I feel pressure from family members to look thinner"), peers (four items; sample item: "My peers encourage me to get thinner"), and media (four items; sample item: "I feel pressure from the media to decrease my level of body fat"). The SATAQ-4 also measures an individual's tendency to internalise that pressure to attain thinness or low body fat (five items; sample item: "I want my body to look very thin") or a muscular, athletic

appearance (five items; sample item: “It is important for me to look athletic”). All items were rated on a 5-point scale ranging from 1 (*Definitely disagree*) to 5 (*Definitely agree*). Subscale scores were computed as the mean of items associated with each factor, so that higher scores reflect greater perceived pressure or greater internalisation. In samples of predominantly college-aged U.S. women and men, Schaefer et al. (2015) provided evidence for the 5-factor dimensionality of the SATAQ-4 using exploratory and confirmatory factor analysis. They also reported that SATAQ-4 scores demonstrated excellent reliability and good convergent validity with measures of body image, eating disturbance, and self-esteem. In the present study, internal consistency for the subscales was acceptable, with all Cronbach’s $\alpha \geq .78$ for women and men.

Connectedness to nature. We included the 14-item Connectedness to Nature Scale (CNS; Mayer & Frantz, 2004) to measure participants’ affective and experiential connection to nature (sample item: “I often feel part of the web of life”). Items were rated on a 5-point scale, ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*), and an overall score was computed as the mean of all items (higher scores reflect greater connectedness to nature). Mayer and Frantz (2004) reported that the scale has a one-dimensional factor structure, and estimates support the psychometric properties of its scores in U.S. college and community samples. In the present study, Cronbach’s α was .86 for women and .83 for men.

Nature exposure. Nature exposure was measured using the Nature Exposure Scale (NES; Kamitsis & Francis, 2013). This is a 4-item scale that measures an individual’s level of exposure to nature in everyday life and activities and levels of exposure to nature outside of everyday environments (sample item: “How much do you notice the natural environments in your everyday life?”). Response anchors varied depending on the item, but all included 5-point scales. An overall score of nature exposure was computed as the mean of all four items, so that higher scores reflect greater nature exposure. Kamitsis and Francis (2013) reported

that the NES had acceptable internal consistency and was significantly and positively correlated with connectedness to nature, but did not report on the scale's factorial validity[1]. In the present study, internal consistency coefficients were acceptable for women (α = .70) and men (α = .72).

Self-esteem. We used Rosenberg's Self-Esteem Scale (RSES; Rosenberg, 1965), a 10-item measure of a person's overall sense of self-worth (sample item: "I feel that I have a number of good qualities"). All items were rated on a 4-point scale, ranging from 1 (*Strongly disagree*) to 4 (*Strongly agree*), and five items were reverse-coded prior to analyses. An overall self-esteem score was computed as the mean of all 10 items, so that higher scores reflect greater self-esteem. In Western samples of mainly college students, the scale has a one-dimensional factor, and estimates support the internal consistency reliability and construct validity of its scores (Schmitt & Allik, 2005). Cronbach's α for this scale in this study was .88 for women and .89 for men.

Demographics. Participants were asked to provide their demographic details, consisting of sex, age, race, highest educational qualification, marital status, height, and weight. The latter two items were structured so that participants could either enter their height and weight in centimetres and kilogrammes, respectively, or use a converter link to get a metric equivalent. We used this data to compute participants' self-reported BMI as kg/m^2.

Results

Preliminary Analyses

Based on Little's MCAR analyses, missing data were completely at random, so we used the mean replacement technique to estimate missing values. Descriptive statistics (*M* and *SD*) for all variables are reported in Table 1. We first examined sex differences across all variables using independent-samples *t*-tests and, because of the large number of comparisons, we used the Bonferroni-correction to reduce the risk of Type I error, such that $p = .05/13 =$

.004. Of the comparisons, only three reached significance (see Table 1): women compared to men reported significantly higher pressure to conform to media-driven appearance ideals and were significantly more likely to attend to their appearance and engaged in appearance-management behaviours; men, on the other hand, were significantly more likely than women to report internalisation of a muscular or athletic appearance ideal. Although we found null effects for the majority of our comparisons, we nevertheless conducted all subsequent analyses separately by sex because of the possibility of sex-specific effects (Swami et al., 2016).

Bivariate Associations

Correlation coefficients between all variables are reported in Table 2. Of note, in both women and men, body appreciation was significantly and positively associated with both connectedness to nature and nature exposure. Likewise, self-esteem in women and men was significantly and positively associated with both connectedness to nature and nature exposure. However, in both women and men, the ASI-R and SATAQ-4 subscales were generally not significantly correlated with either connectedness to nature or nature exposure. Those associations that did reach significance (in women, a negative correlation between self-evaluative salience and nature exposure; in men, a negative correlation between internalisation of a muscular ideal and connectedness to nature and a negative correlation between motivational salience and connectedness to nature) were weak. In sum, these results suggest that there are significant associations between connectedness to nature, nature exposure, self-esteem, and body appreciation, whereas associations between connectedness to nature and nature exposure, respectively, and the additional body image-related variables were generally null or weak. The broader patterns of correlations were in expected directions.

Path Analysis

Path analysis was used to test the hypothesised model (see Figure 1) using AMOS 23 statistical software with maximum likelihood estimation using the covariance matrix (Arbuckle, 2011). Standard goodness-of-fit indices were selected *a priori*. The normed model chi-square (χ^2_{normed}) is reported with lower values of the overall model chi-square indicate goodness-of-fit. A χ^2_{normed} value of < 3.00 indicates good fit (Hu & Bentler, 1999). The Steiger-Lind root mean square error of approximation (RMSEA) and its 90% confidence interval provide a correction for model complexity. RMSEA values close to .06 indicate a good fit (Hu & Bentler, 1999), with values ranging to .10 representing a mediocre fit (MacCallum, Browne, & Sugawara, 1996). The standardised root mean-square residual (SRMR) is a badness-of-fit index: the smaller the SRMR, the better the model fit. A cut-off value for SRMR is recommended to be "close to" or < .09 (Hu & Bentler, 1999, p.27). The comparative fit index (CFI) measures the proportionate improvement in fit by comparing a target model with a more restricted, nested baseline model. The CFI reflects a goodness-of-fit index and is recommended to "close to" or > .95 for adequate fit (Hu & Bentler, 1999, p.27). Even so, these recommended cut-off values should be considered subjective guidelines (Heene, Hilbert, Draxler, Zeigler, & Bühner, 2011; Marsh et al., 2011).

The hypothesised model did not fit these data well in women, $\chi^2 = 413.136$, $p < .001$; $df = 26$; $\chi^2_{normed} = 15.890$; CFI = .379; SRMR = .227; RMSEA = .274 with 90% *CI* = .251-.298, or in men, $\chi^2 = 547.392$, $p < .001$; $df = 26$; $\chi^2_{normed} = 21.054$; CFI = .334; SRMR = .224; RMSEA = .317 with 90% *CI* = .295-.341. Accordingly, non-significant paths were removed and modification indices were assessed to suggest covarying terms that would improve the overall fit of the hypothesised model. The modified model for women is displayed in Figure 2 and provided good fit to the data, $\chi^2 = 16.129$, $p = .013$; $df = 6$; $\chi^2_{normed} = 2.688$; CFI = .958; SRMR = .065; RMSEA = .092 with 90% *CI* = .039-.148. The modified model for men is displayed in Figure 3 and provided adequate fit to the data, $\chi^2 = 21.758$, $p = .005$; $df = 8$;

χ^2_{normed} = 2.720; CFI = .963; SRMR = .075; RMSEA = .093 with 90% *CI* = .047-.141. The RMSEA for the proposed models were near the upper recommended cut-off level, but this index may be inflated due to the low *df* in the model (Kenny, Kaniskan, & McCoach, 2014).

Bootstrapping procedures were used to obtain bias-corrected confidence intervals for the indirect effect, drawing on 5,000 bootstrap samples from the dataset. Significant indirect effects were demonstrated by a confidence interval that did not include zero. For women, there was a significant indirect effect from nature exposure to body appreciation via self-esteem (standardised indirect effect = -.11; 95% *CI* = -.223-.006). There was also a significant indirect effect from nature exposure to body appreciation via connectedness to nature (standardised indirect effect = .16; 95% *CI* = .076-.276). Further, there was a significant indirect effect from connectedness to nature to body appreciation via self-esteem (standardised indirect effect = .19; 95% *CI* = .056-.339).

For men, there was a significant indirect effect from nature exposure to body appreciation via self-esteem (standardised indirect effect = -.15; 95% *CI* = -.264-.052). There was a significant indirect effect from nature exposure to body appreciation via connectedness to nature (standardised indirect effect = .08; 95% *CI* = .022-.160). Further, there was a significant indirect effect from connectedness to nature to body appreciation via self-esteem (standardised indirect effect = .31; 95% *CI* = .190-.465). There was also a significant indirect effect from connectedness to nature to body appreciation via motivational salience (standardised indirect effect = .04; 95% *CI* = .007-.112). Finally, there was a significant indirect effect from connectedness to nature to body appreciation via internalisation of muscularity (standardised indirect effect = .03; 95% *CI* = .001-.081).

Discussion

In the present study, we examined associations between exposure to nature and connectedness to nature, respectively, and body image in U.S. adult women and men. In

broad outline, our results replicated previous work (Swami et al., 2016) in showing that connectedness to nature is positively associated with body appreciation, but furthers current knowledge by showing a similar relationship between exposure to nature and body appreciation. Moreover, our analysis revealed important mediation pathways between the included variables, but these appeared to be slightly different for women compared to men. Specifically, in both women and men self-esteem mediated the relationships between nature exposure and connectedness to nature, respectively, and body appreciation. In addition, connectedness to nature mediated the relationship between nature exposure and body appreciation. In men only, the relationship between connectedness to nature and body appreciation was also mediated by motivational salience of appearance and internalisation of a muscular ideal. Below, we discuss each of these findings in turn.

First, we replicated the results of Swami et al. (2016), who found that connectedness to nature was positively associated with body appreciation in British women. These findings are supportive of the contention that a higher degree of connectedness to nature is associated with improved life satisfaction, happiness, and positive affect (Mayer & Frantz, 2004; Tam, 2013). However, unlike Swami et al. (2016), we found positive associations between connectedness to nature and body appreciation in both women and men. It is possible that the difference between these two studies was caused by conceptual differences in the measurement of body appreciation. More specifically, we used a more up-to-date measurement tool (i.e., the BAS-2 vs. the original BAS) that may have more accurately captured the meaning of body appreciation in men. Alternatively, it is possible that the difference between the studies reflects real differences in the association between connectedness to nature in British versus U.S. men. Further replications of the present work in diverse samples would help to determine the veracity of these alternative explanations.

Building on the work of Swami et al. (2016), we also found that greater exposure to nature was positively associated with higher body appreciation in U.S. women and men. Broadly speaking, this finding is consistent with previous work indicating that direct exposure to natural environments has positive effects on psychological well-being (e.g., Berman et al., 2008; Bowler et al., 2010; White et al., 2013). Nevertheless, we believe our findings are important in their own right because it extends available knowledge to show a direct relationship between exposure to nature and a facet of positive body image. As argued by Swami et al. (2016), greater immersion in nature may focus an individual's attention on eudaimonic aspects of well-being, rather than hedonic aspects that are appearance-focused. Greater immersion in nature may also promote embodying experiences, through which individuals develop a sense of ownership over their physical selves, develop greater respect for their bodies (particularly in terms of functionality, that is, a focus on what the body can do; see Alleva, Martijn, van Breukelen, Jansen, & Karos, 2015), and promote a sense of empowerment that is characteristic of body appreciation.

Our findings also showed that both sets of associations were mediated by self-esteem. Based on the Psychophysiological Stress Recovery Theory (Ulrich, 1983), it might be argued that greater immersion in nature provides opportunities for emotional restoration that includes healthier self-esteem. In turn, improvements to self-esteem may promote more positive body appreciation. In addition, higher self-esteem may also provide women and men with better tools to filter body image-related information in a manner that is protective of their bodies or that protects against threats to body image (Wood-Barcalow, Tylka, & Augustus-Horvath, 2010). As suggested by Swami et al. (2016), improved self-esteem as a result of nature exposure or connectedness to nature may also help individuals develop more equalitarian worldviews that are based on compassion and harmony, rather than competition or

aggression. This, in turn, may generate feelings of social acceptance that are important aspects of higher body appreciation (e.g., see Avalos & Tylka, 2006).

Our results also showed that connectedness to nature mediated the relationship between nature exposure and body appreciation, which is broadly consistent with previous work (e.g., Mayer et al., 2009). In other words, aside from their direct effects on body appreciation, exposure to nature also seems to be associated with improved connectedness to nature, which in turn is associated with more positive body image. Taken as a whole, these findings are important because they paint a complex picture of inter-relationships between nature-related variables and body image outcomes, at least in terms of body appreciation. An important next step for future research would be to more carefully test causational links. For example, it would be useful to examine the extent to which exposure to natural environments improve state body image. Positive findings in this regard would lend weight to our conclusion that nature exposure and connectedness to nature are associated with more positive body appreciation.

However, it is important to note the mixed nature of our findings in relation to investment in physical appearance and sociocultural attitudes toward appearance, respectively. In general, these variables were not significantly associated with either nature exposure or connectedness to nature in women. This runs counter to our hypothesis and is difficult to explain without additional data. As a tentative conclusion, it might be suggested that, in women, the strongest effects of nature exposure and connectedness to nature occur via self-esteem, rather than through investment in appearance or sociocultural attitudes toward appearance. However, a different story emerged in men: in our sample, we found that the relationship between connectedness to nature and body appreciation was mediated by motivational salience of appearance and internalisation of a muscular ideal. In other words, it would appear that higher connectedness to nature in men is associated with lower importance

placed on appearance and lower internalisation of societal beauty ideals, which in turn has a protective effect on their body images. These associations were in the hypothesised direction, but we would caution that they require replication. Another way for future research to extend these findings would be to examine direct relationships between nature-related variables and indices of negative body image (e.g., actual-ideal weight discrepancy, drive for thinness, or drive for muscularity). This would help to clarify the extent to which nature-related variables are associated with multidimensional aspects of body image.

There are a number of additional ways in which the present findings could be extended. First, we relied on self-reported data: this is particularly important when considering our nature exposure measure, as it is possible that participants engaged in hypothesis guessing and massaged their responses accordingly. Comparing differences in body appreciation between individuals living in areas with more or less green space (e.g., White et al., 2013) would be one way of extending the present work. Alternatively, examining the effects of viewing images of nature (e.g., Berman et al., 2008) on state body image would also help to further current knowledge. In addition, our reliance on cross-sectional data means that our conclusions should be treated with caution, particularly as cross-sectional data may generate biased estimates of parametres in mediation analyses (Maxwell & Cole, 2007). The direction of causation should also be interpreted carefully: it is possible that individuals with higher body appreciation are more likely to seek out natural environments, which increases their exposure to nature and/or connectedness to nature.

Additionally, we also note that our findings may be contextually limited. To date, associations between nature-related variables and body appreciation have been reported in British and American adults. In future work, it will be important to examine the extent to which these findings are generalizable to other national contexts, racial, and socioeconomic groups. The online recruitment method in the present work may have also introduced

unforeseen sampling biases that may have affected our results. Future research would also do well to examine associations between nature-related variables and a broader range of body image constructs, such as body functionality (Alleva et al., 2015), body image flexibility (Sandoz, Wilson, Merwin, & Kellum, 2012), broad conceptualisations of beauty (Tylka & Iannantuono, 2016), and other measures of positive body image, such as body pride and body acceptance (for a review, see Tylka & Wood-Barcalow, 2015a). In a similar vein, it may be useful to examine the utility of self-compassion (Neff, 2003) as a mediator of the relationships between nature-related variables and body appreciation, particularly as self-compassion may be more likely to evoke feelings of commonality with nature compared to ego-syntonic self-esteem.

Nevertheless, a growing body of evidence now demonstrates that both connectedness to nature and self-reported exposure to natural environments are associated with higher body appreciation. If these findings can be replicated and extended, they may point to novel methods for promoting positive body image. For example, it will be useful to examine the efficacy of intervention technique that involve exposure to nature on body appreciation (e.g., nature walks, hiking excursions; Atchley, Strayer, & Atchley, 2012; Mitchell, 2013; White, Pahl, Ashbulby, Herbert, & Depledge, 2013). Likewise, examining the efficacy of programmes designed to promote connectedness to nature (e.g., Ernst & Theimer, 2011) on body appreciation would also be welcome. Taken together, it is possible that scholars and practitioners may uncover new methods of promoting body appreciation and positive body image more generally through engagement with nature. In the meantime, further studies examining relationship between nature-related variables and body image seem worthwhile.

Footnotes

[1] We performed a principal-axis exploratory factor analysis with the four items of the NES using our total sample. Barlett's test of sphericity, $\chi^2(6) = 392.89$, $p < .001$, indicated that the

correlation matrix was factorable, whereas the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, KMO = .89, indicated that the four NES items had adequate common variance for exploratory factor analysis. The results of the analysis revealed only one factor with an eigenvalue above 1.0 (i.e., $\lambda = 2.16$, 54.1% of the variance explained). All four items loaded onto this factor (item-factor loadings ranged from .56-.86). These findings suggest that a one-dimensional factor structure for the NES is appropriate with our data.

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Table 1

Descriptive Statistics and the Results of Between-Group Comparisons between Women and Men

Variable	Women (*n* = 199)		Men (*n* = 200)		*t*	*p*	*d*	95% *CI*	
	M	*SD*	*M*	*SD*				Lower	Upper
Body appreciation	3.54	0.91	3.53	0.90	0.12	.906	0.01	-0.19	0.17
Connectedness to nature	3.43	0.71	3.28	0.72	2.11	.035	0.21	-0.29	-0.01
Nature exposure	3.56	0.78	3.37	0.82	2.31	.021	0.23	-0.34	-0.03
Self-esteem	3.12	0.66	3.07	0.75	0.71	.479	0.07	-0.19	0.09
Internalisation: Thin	3.00	0.96	3.00	0.86	0.01	.999	0.01	-0.18	0.18
Internalisation: Muscular	2.30	1.03	3.06	1.07	7.19	< .001	0.72	0.55	0.96
Pressure: Family	2.26	1.23	1.98	1.03	2.52	.012	0.25	-0.51	-0.06
Pressure: Peers	1.93	1.08	1.95	1.00	0.20	.845	0.02	-0.18	0.23
Pressure: Media	2.99	1.46	2.48	1.29	3.70	< .001	0.37	-0.78	-0.24
Self-evaluative salience	3.26	0.84	2.97	0.86	3.45	.001	0.35	-0.46	-0.13
Motivational salience	3.48	0.78	3.24	0.85	2.87	.004	0.29	-0.39	-0.07
Body mass index	26.66	6.47	25.58	4.90	0.15	.884	0.02	-1.21	1.04
Age	34.99	11.17	34.12	10.60	0.80	.423	0.08	-3.02	1.27

Table 2

Bivariate Correlations between All Variables Included in the Present Study

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Body appreciation		-.17*	-.19**	-.28**	-.16*	-.23**	-.40**	-.24**	.30**	.35**	.67**	-.28**	.02
(2) Internalisation: Thin	.10		.25**	.19*	.31**	.42**	.44**	.26**	-.06	-.11	-.18*	-.17*	-.27**
(3) Internalisation: Muscularity	-.34**	.46**		.07	.16*	.13	.08	.04	-.05	-.09	-.08	-.27**	-.17*
(4) Pressure: Family	-.08	.18*	.12		.57**	.46**	.32**	-.05	-.03	-.07	-.31**	.22*	-.10
(5) Pressure: Peers	-.10	.29**	.16*	.72**		.53**	.40**	-.01	-.07	-.05	-.22*	.06	-.17*
(6) Pressure: Media	-.22*	.28**	.13	.41**	.53**		.52**	.17*	.01	-.08	-.19	.09	-.18*
(7) Self-evaluative salience	-.15*	.41**	.41**	.28**	.42**	.51**		.43**	-.03	-.14*	-.41**	-.05	-.37**
(8) Motivational salience	-.39**	.35**	.62**	.07	.19*	.10	.55**		-.09	-.08	.06	-.27**	-.24*
(9) Connectedness to nature	.35**	-.13	-.17*	.03	.01	-.08	-.05	-.21*		.62**	.18*	-.18*	.16*
(10) Nature exposure	.26**	-.01	-.09	.03	-.02	.01	-.13	-.04	.52**		.28**	-.07	.16*
(11) Self-esteem	.70**	.03	.14*	-.16*	-.18*	-.20*	-.30**	.21*	.34**	.31**		-.12	.07
(12) Body mass index	-.30**	-.09	-.16*	.18*	.11	.16*	.09	-.22*	-.13	-.01	-.12		.16*
(13) Age	-.04	-.15*	-.21*	-.21*	-.23*	-.11	-.33	-.19*	.06	.13	.21**	-.02	

Note. Women $n = 199$, Men $n = 200$. * $p < .05$, ** $p < .001$. Correlations for women are represented above the diagonal and for men below the diagonal.

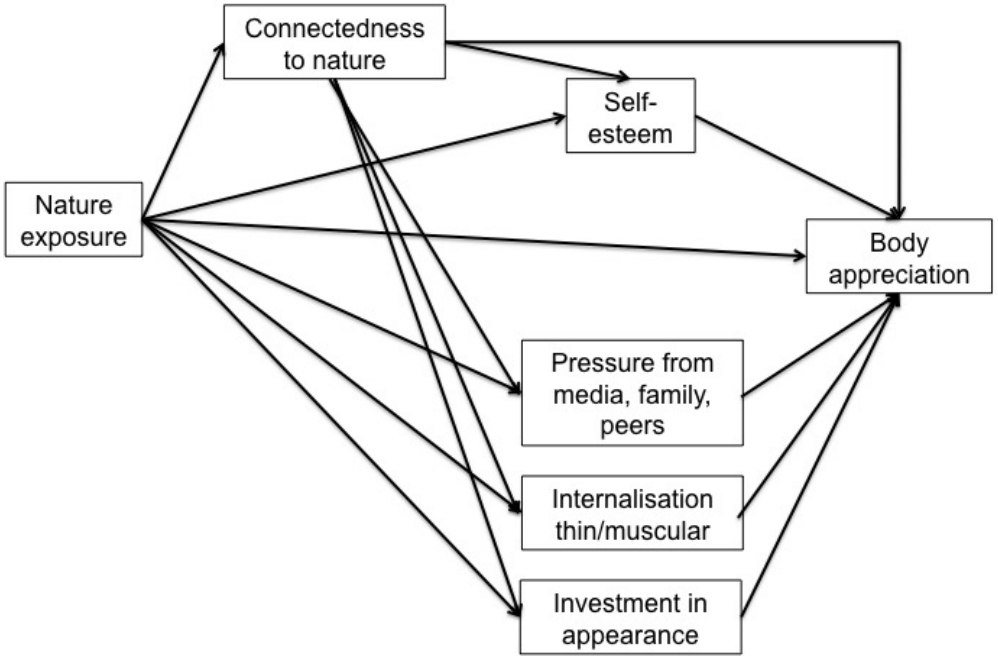

*Figure 1.*The hypothesized model. Internalisation of the thin ideal was included as a mediator for women and internalisation of the muscular ideal as a mediator for men. Investment in appearance is presented as a single variable here for parsimony, but included self-evaluative and motivational salience, respectively.

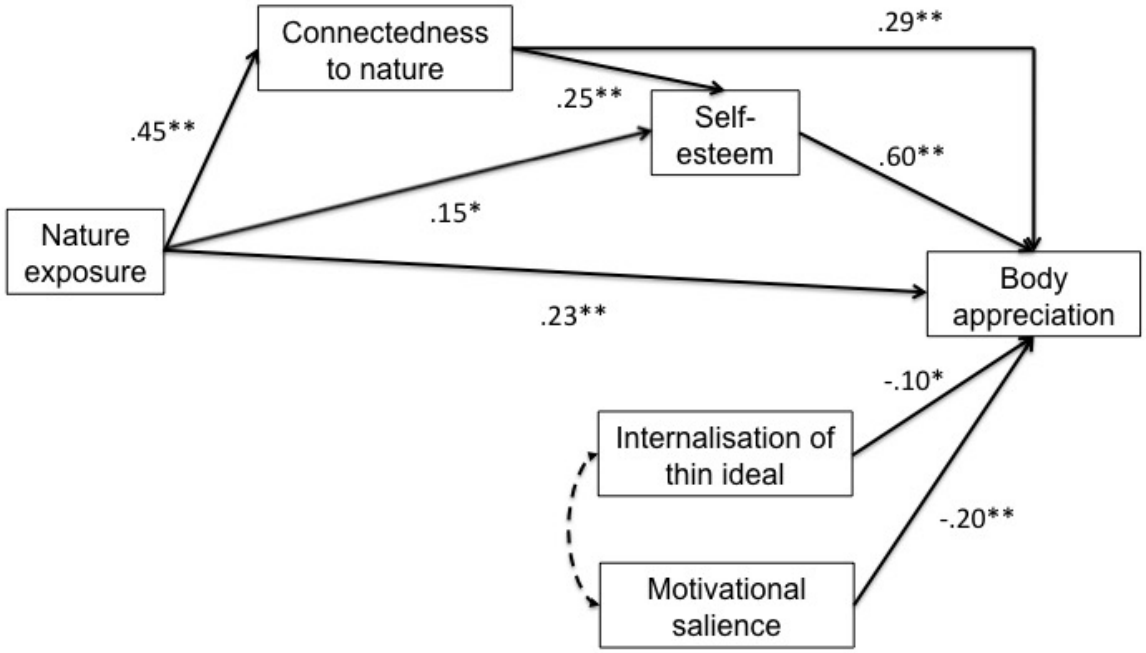

Figure 2. The final fitted model for women's data. Figure depicts standardised regression weights. Dashed lines represent covarying of error terms. *$p \leq .05$, ** $p \leq .001$.

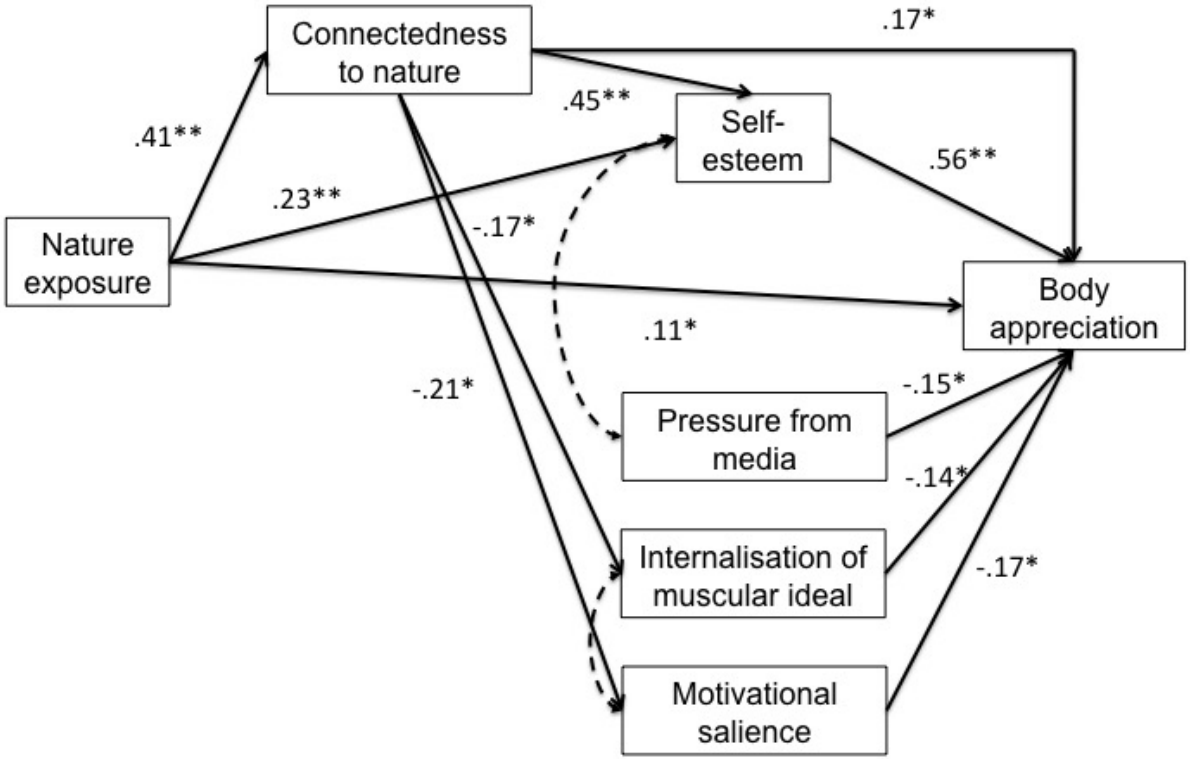

Figure 3. The final fitted model for men's data. Figure depicts standardised regression weights. Dashed lines represent covarying of error terms.

*$p \leq .05$, ** $p \leq .001$.