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Does personality mediate the relationship between sex and environmentalism?

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ABSTRACT

The finding that females hold more pro-environmental attitudes and engage in more conservation behavior, relative to males, is one of the most robust effects in the field of environmental psychology. Yet sparse research has attempted to understand why males are less pro-environmental than females. In three studies, the present research tested the hypothesis that sex differences in personality account for sex (Studies 1–3) and gender (Study 3) differences in both pro-environmental attitudes and behavior. Results from Study 1 demonstrated that conscientiousness mediated links between sex and attitudes towards environmental utilization, protectionism, and conservation behavior in an undergraduate sample. Results from Study 2 with a community sample demonstrated that conscientiousness, agreeableness, and neuroticism mediated the link between sex and environmental protectionism. Study 3 replicated the mediating effect of conscientiousness on sex differences in environmental behavior using the HEXACO model and extended this finding beyond biological sex to gender differences. Taken together, results suggest that core differences in personality traits explain sex and gender differences in environmentalism, offering new insight into how to potentially promote increased pro-environmental action among men.

1. Introduction

Previous research has demonstrated clear sex and gender differences in environmentalism, such that women report stronger pro-environmental attitudes and more pro-environmental behavior relative to men (for reviews, see Gifford & Nilsson, 2014; Milfont & Schultz, 2018; Zelezny, Chua, & Aldrich, 2000). Moreover, observational and experimental studies indicate that women litter less than men (Kallgren, Reno, & Cialdini, 2000), and leave a smaller carbon footprint (i.e., lower energy consumption; Räty & Carlsson-Kanyama, 2010). This trend has been confirmed cross-culturally (Hunter, Hatch, & Johnson, 2004; Marquart-Pyatt, 2008; Zelezny et al., 2000, Study 2) and through systematic meta-analytic review (Zelezny et al., 2000, Study 1). Sex differences in environmental attitudes hold even when controlling for other important demographic characteristics including age, income, political conservatism, education, and geographic proximity to the potential effects of climate change (Milfont, Evans, Sibley, Ries, & Cunningham, 2014). Moreover, recent research has extended this finding beyond the general public and into the realm of political office such that female political leaders express more environmental concern than their male counterparts (Sundström & McCright, 2013), highlighting the potential societal ramifications of this sex difference in environmentalism. Indeed, nations with more women members of parliament are more likely to protect land areas and ratify international environmental treaties, and regions with more equitable treatment of women tend to exhibit less forest depletion and air pollution (United Nations Development Programme Human Development Report, 2011).

Researchers have therefore attempted to identify individual difference variables that might help to explain women's higher levels of environmental concern and behavior relative to men. For example, Dietz, Kalof, and Stern (2002) examined sex differences in value structures that have previously been associated with environmental concern and behavior (altruism, traditionalism, self-interest, and openness to change). However, results found little evidence of sex differences in the proposed value priorities except for altruism. Similarly, Zelezny et al. (2000) found that women reported higher levels of being socially-oriented and other oriented, however neither of these variables were directly related to environmentalism in their study. Arnocky and Stroink (2011) found that emotional empathy mediated links between sex and both environmental concern and cooperation in a commons dilemma

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scenario, such that women were higher than men in emotional empathy, and empathy in turn predicted each pro-environmental variable. Extending their findings, Milfont and Sibley (2016) found that empathy and social dominance orientation mediated longitudinal associations between sex and environmentalism, and Graça, Calheiros, Oliveira, and Milfont (2018) found that both empathy and social dominance orientation also mediated associations between sex and support for animal exploitation.

Interestingly, variables that have been targeted as potential explanatory factors for this sex difference such as empathy, altruism, self-interest, and openness to change, fall well within the more comprehensive definitions of personality. However, to date, no research has directly examined the potential role of individual differences in personality traits as a potential factor that might help to better understand important sex differences in environmentalism.

Personality involves individual differences in manners of thought, emotion, and behavior that is simultaneously rooted in biological predisposition and influences by social forces, such as gender roles (Eagly, 1987). Most personality research focuses on the Big Five traits, which includes extraversion, openness, conscientiousness, neuroticism/emotion stability and agreeableness. An extraverted person is outgoing, talkative, and friendly; openness encompasses qualities such as originality, imagination, and having broad interests; an agreeable person is someone who trusts others, is cooperative, and sympathetic; low emotional stability is defined as an individual being worrisome, self-conscious, and insecure; and a conscientious person is energetic, hard-working, and ambitious (John & Srivastava, 1999). More recently, a six-dimension model of personality traits has been proposed. In the HEXACO model the sixth factor included is termed honesty-humility, described as an individual who does not feel entitled, is modest, and tries to be fair (Lee & Ashton, 2004).

Notably, personality has been identified as one of the most consistent predictors of environmental concern and behavior in the environmental psychology literature. For example, associations at the individual-level using both retrospective measurement of conservation behavior and a concurrent measure of interest in environmental protection found that environmentalism was positively associated with agreeableness, conscientiousness, and openness to experience; a finding that was also supported by data at a national level (Milfont & Sibley, 2012). The relationship between these three personality variables and environmental variables has also been positively demonstrated in a German community sample (Hirsh, 2010), and also positively demonstrated in Canadian students (Nisbet, Zelenski, & Murphy, 2009), and agreeableness and openness were also the personality traits more strongly correlated with climate change beliefs (Milfont, Milojev, Greaves, & Sibley, 2015). When Brick and Lewis (2016) examined the Big Five personality dimensions and specific environmental behaviour, such as reducing emission production, they found that openness and conscientiousness predicted behaviour aimed at reducing emissions. Markowitz, Goldberg, Ashton, and Lee (2012) suggested personality dimensions are an indirect indicator of environmental behaviour, and found that the relationship between openness to experience and environmental behaviour was mediated by environmental attitudes and connectedness to nature.

Interestingly, sex and gender differences in Big Five personality traits are also well established in the personality psychology literature (see Feingold, 1994). For example, women often score lower on emotional stability and higher in agreeableness, openness, and conscientiousness (Renau, Oberst, Gosling, Rusiñol, & Chamarro, 2013). This finding has also been demonstrated longitudinally from adolescence to young adulthood (Vecchione, Alessandri, Barbaranelli, & Caprara, 2012). Lehmann, Denissen, Allemand, and Penke (2013) found that men consistently report being higher in openness than women at all age categories, whereas women report being higher in conscientiousness than men. When Schmitt, Realo, Voracek, and Allik (2009) examined sex differences in Big Five personality traits through the Big Five Inventory (BFI) cross-nationally, they found that women reported significantly higher conscientiousness in over half of the countries studied; however, they found mixed results of gender differences in openness to experience between countries, highlighting the fact that personality dimensions can be sensitive to environmental context (see Eagly, 1987; Fedvadjiev & van de Vijver, 2015).

1.1. The current studies

Although Big Five personality and conscientiousness in particular, have been robustly linked to both sex and environmentalism, we are unaware of any research to date that has explored personality as a mediator of the relationship between sex and environmentalism. Therefore, the goals of the current studies are to examine if personality traits may mediate the sex-environmentalism relationship and to identify which personality trait in particular would emerge as the main mediator. Across three data sets that differed from one another in terms of sample composition and/or measurements, the present contribution tested the following general predictions: (1) female and male participants will differ in environmental attitudes and behavior, and (2) personality traits (particularly conscientiousness, agreeableness, and/or openness) will mediate sex and gender differences in environmental attitudes and behavior. Specifically, women will be higher in measures of environmentalism as well as in personality factors previously linked to environmentalism, and that these personality traits will mediate (i.e., account for) links between sex/gender and environmentalism. To test these hypotheses, we conducted three studies which built on each other in terms of breadth of both sampling and measurement, as guided by extant literature.

Study 1 examined these hypotheses in a student sample using a brief measure of Big Five personality. Study 2 extended this design within a community sample. Because personality differs across different socio-demographic groups, including within different educational and vocational streams (e.g., Vedel, 2016), it is possible that these personality traits matter more for environmentalism among more diverse groups of individuals. Indeed, previous studies linking agreeableness and neuroticism to environmentalism have largely relied upon community samples (Brick & Lewis, 2016; Hirsh, 2010; Milfont & Sibley, 2012), suggesting there may be fundamental differences in the personality factors linked to environmentalism between students and non-students. Study 3 then tested these hypotheses using the HEXACO model of personality in a student sample, with the addition of gender as a predictor of both personality and environmentalism. Most environmental psychology research to date has conceptualized and measured differences in environmental attitudes and behavior as occurring across dichotomous conceptualizations of gender or biological sex (see Zelezny et al., 2000). Study 1 (student sample) and Study 2 (community sample) therefore utilize this measurement of sex as it extends to our mediation model. Yet given that biological sex can sometimes differ from one's gender identity, and some research suggests that these constructs can vary in their prediction of environmentalism (Zelezny et al., 2000), Study 3 extends the testing of our model by also including gender, or the degree to which one identifies along a continuum of femininity and masculinity, in order to examine the degree of concordance as it pertains to the models tested. Finally, following Markowitz et al. (2012) who demonstrated that environmental attitudes mediated links between personality and environmental action, we tested subsequent multiple mediation models whenever possible (i.e., when links between personality, attitudes, and behavior were present) to determine if multiple-mediation effects were present, whereby sex differences in behavior were explained by personality effects on pro-environmental attitudes.

2. Study 1

In Study 1, we investigated whether Big Five personality mediates the relationship between sex and environmental attitudes and behavior

using well-established self-report measures. We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in all three studies.

2.1. Method

2.1.1. Participants

A G*Power analysis indicated that a sample size of 391 was needed to detect an effect size of 0.17, which was chosen due to previous research on gender and environmentalism (Arnocky & Stroink, 2011) indicating a similarly small effect between sex and environmentalism, with 95% power and an alpha of 0.05. The final sample comprised 437 students (244 females) recruited from a small university in Canada (M_{age} = 20.6, SD = 4.32; 81% Caucasian, 6% First Nations, 5% Asian, 3% Black, 5% Mixed heritage). All procedures were approved by the university research ethics board.

2.1.2. Procedure and measures

As part of a larger protocol examining environmentalism, personality, and learned helplessness, participants received $5 CAD remuneration and completed a counter-balanced survey package that included basic demographic information (e.g., sex) and self-report measures, including the measures detailed below (see Supplementary Material for all measures included in our survey).

2.1.2.1. Personality. Big Five personality dimensions were assessed using the Ten-Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003). The TIPI consists of ten items (two for each personality dimension) assessing Openness, Agreeableness, Conscientiousness, Emotionality, and Extraversion scored using a 7-point Likert-type scale ranging from 1 = *Disagree strongly* to 7 = *Agree strongly*. The measure has been previously shown to have good content validity and stability over time (Gosling et al., 2003). In the current study, the correlations between the two items comprising each TIPI subscales were as follows: conscientiousness (r = 0.39, p < .001), extraversion (r = 0.55, p < .001), agreeableness (r = 0.13, p = .008), openness (r = 0.25, p < .001), and emotionality (r = 0.48, p < .001).

2.1.2.2. Environmental attitude. Pro-environmental attitudes were measured using the brief version of the Environmental Attitude Inventory (EAI-24; Milfont & Duckitt, 2010). The EAI-24 consists of 24 items scored using a 7-point Likert-type scale anchored at 1 = *strongly disagree* and 7 = *strongly agree*. Items assess enjoyment of nature, support for interventionist conservation policies, environmental movement activism, conservation motivated by anthropocentric concern, confidence in science and technology, environmental fragility, altering nature, personal conservation behaviour, human dominance over nature, human utilization of nature, ecocentric concern, and support for population growth policies. Items were combined and averaged to form two subscales assessing general attitudes towards environmental protectionism (α = 0.82) and utilization (α = 0.75), whereby preservation reflects the belief that priority should be given to preserving and protecting nature, and utilization reflects the belief that it is appropriate for nature to be used and altered for human objectives.

2.1.2.3. Pro-environmental behavior. Self-reported pro-environmental behavior was assessed using a measure developed by Schultz et al. (2005). The measure asks participants to indicate how often they have engaged in 12 acts of pro-environmental behavior during the past year. It covers a variety of domains and ranges from easy to difficult, including having: looked for ways to reuse things, recycled newspapers, recycled cans or bottles, encouraged friends or family to recycle, purchased products in reusable containers, picked up litter that was not your own, composted food scraps, conserved gasoline by walking or bicycling, written a letter supporting an environmental issue, voted for a candidate who supported environmental issues, donated money to an environmental group, and volunteered time to help an environmental group. Responses were scored along a 5-point Likert-type scale anchored at 1 = *never* and 5 = *very often*. A "not applicable" response was also provided "if there was no opportunity for the action." In the present study the measure of environmental behavior demonstrated good internal consistency, α = 0.83.

2.1.2.4. In-vivo environmental behaviour. Due to the overuse of self-report environmental behavior in environmental psychology research, this study utilizes a novel behavioral measure. Milfont (2009) found a weak relationship between image management, which is a part of social desirability responding, and self-report environmental behavior. Therefore, a behavioral measure could remove the effects of social desirability on responding environmental questionnaires. To improve self-report environmental behavior, two in-vivo behavioral measures were utilized. First, participants were given the opportunity to either keep their $5 remuneration, or to donate it to a well-known environmental organization (the World Wildlife Fund); 33.9% of participants donated their winnings. Consistent with previous research on donating (Arnocky, Piché, Albert, Ouellette, & Barclay, 2017), of those who donated females donated more often (males = 30.4%, females = 69.6%, χ^2 (1, N = 437) = 16.63, p < .001, Cramer's V = 0.2, p < .001). Second, participants were also given the opportunity to sign up for emails from a bogus university/college environmental group; 77.1% of participants did not opt-in to the bogus environmental group. Males were more likely to opt-in to the bogus environmental group than females (males = 57%, females = 43%, χ^2 (1, N = 437) = 8.99, p = .003, Cramer's V = 0.14, p = .003).

2.1.3. Identifying testable models

Preliminary analysis examined correlations between personality and environmental variables. Extraversion, agreeableness, and emotional stability did not correlate with any of the environmental variables. Consistent with previous research, conscientiousness correlated with environmental protectionism (r = 0.15, p = .003), utilization attitude (r = −0.15, p = .002), self-report behavior (r = 0.12, p = .01), and willingness to donate (r = 0.16, p = .001). Openness also correlated with environmental protectionism (r = 0.24, p < .001), utilization (r = −0.23, p < .001), and behavior (r = 0.19, p < .001). Yet of these, point-biserial correlations showed that only conscientiousness (r = 0.17, p < .001), but not openness (r = 0.02, p = .71), correlated with sex (0 = male, 1 = female), such that females were more conscientious than males. Thus, only conscientiousness satisfied inclusion criteria for consideration as a mediator. The Supplementary Material presents all correlations among variables for each study.

Multiple mediation models (Model 4) (PROCESS, Hayes, 2013) examined the extent to which conscientiousness mediated sex differences in environmental attitudes (protectionism and utilization) and behavior (self-report and in-vivo).

2.2. Results

First, we examined the total effects model for sex as a predictor of environmental protectionism. Females reported stronger protection attitudes relative to males (b = 0.28, SE = 0.08, t = 3.73, p = .0002). Sex predicted conscientiousness (b = 0.33, SE = 0.12, t = 2.61, p = .009), whereby females were more conscientious than males. With both variables in the model, conscientiousness predicted protectionism (b = 0.07, SE = 0.03, t = 2.45, p = .014), indicating a partial mediation effect (b = 0.26, SE = 0.08, t = 3.40, p = .0007, bootstrapping: 95% LL = 0.003, 95% UL = 0.061).

Second, we examined the total effects model for sex as a predictor of environmental utilization attitudes. Males reported stronger utilization attitudes relative to females (b = −0.35, SE = 0.08, t = −4.34,

$p < .0001$). Sex predicted conscientiousness ($b = 0.39$, SE = 0.12, $t = 3.28$, $p = .001$), whereby females were more conscientious than males. With both variables in the model, conscientiousness predicted utilization attitude, ($b = -0.08$, SE = 0.03, $t = -2.41$, $p = .016$), indicating a partial mediation effect ($b = -0.31$, SE = 0.08, $t = 3.93$, $p = .0001$, bootstrapping: 95% LL = −0.08, 95% UL = −0.007).

Third, we examined the total effects model for sex as a predictor of pro-environmental behavior. Females reported engaging in more pro-environmental behavior relative to males ($b = 0.14$, SE = 0.07, $t = 2.06$, $p = .04$). Sex significantly predicted conscientiousness ($b = 0.43$, SE = 0.12, $t = 3.63$, $p = .0003$), whereby females were more conscientious than males. With both variables in the model, conscientiousness predicted pro-environmental behavior ($b = 0.06$, SE = 0.03, $t = 2.20$, $p = .03$), indicating a full mediation effect ($b = 0.11$, SE = 0.07, $t = 1.66$, $p = .10$, bootstrapping: 95% LL = 0.004, 95% UL = 0.06).

Fourth, we examined the total effects model for sex as a predictor of overt donating behavior. Females were more likely to donate their remuneration relative to males ($b = 0.78$, SE = 0.22, $t = 3.57$, $p = .0004$). Females were more conscientious than males ($b = 0.43$, SE = 0.12, $t = 3.6$, $p = .0004$). With both in the model, conscientiousness predicted donating behavior ($b = 0.24$, SE = 0.09, $t = 2.74$, $p = .006$), indicating a partial mediation effect ($b = 0.1$, SE = 0.05, $t = 2.13$, $p = .03$, bootstrapping: 95% LL = 0.03, 95% UL = 0.23).

Last, we tested a sequential mediation model (PROCESS Model 6, Hayes, 2013) based on Markowitz et al., (2012) who found the pro-environmental attitude mediated links between personality and behavior. Both conscientiousness and environmental attitudes (protectionism and utilization) were thus tested as successive mediators of the sex difference in pro-environmental behavior (self-report and in-vivo) such that environmental attitudes provided an additional mediation pathway between conscientiousness and behavior (Fig. 1; also see supplement for bivariate links between environmental attitudes and behavioral measures). We began by examining self-report conservation behavior. When entering protectionism attitudes into the model, results showed that conscientiousness and environmental protectionism attitudes together had a mediating effect on the sex difference in self-report pro-environmental behavior ($b = 0.012$ SE = 0.007, bootstrapping: 95% LL = 0.0009, bootstrapping: 95% UL = 0.03). Regarding donating behavior, conscientiousness and protectionism again had a significant mediating effect ($b = 0.01$, SE = 0.009, bootstrapping: 95% LL = 0.0007, 95% UL = 0.04). Next, we considered utilization attitudes within the same context. Conscientiousness and environmental utilization attitude mediated the sex difference in self-report pro-environmental behavior ($b = 0.1$ SE = 0.03, bootstrapping: 95% LL = 0.05, 95% UL = 0.16) and donating behavior ($b = 0.02$, SE = 0.01, bootstrapping: 95% LL = 0.002, 95% UL = 0.04). In each case, the inclusion of environmental attitude (a) predicted self-report and in-vivo environmental action, (b) was predicted by conscientiousness, and (c) buffered the role of conscientiousness in predicting environmental action. This suggests that sex differences in conscientiousness influence pro-environmental attitudes, such that women are more conscientious, which predicts their more pro-environmental attitudes, which in turn promote environmental behavior.

3. Study 2

Abbreviated measures of reliable and valid scales are acceptable to use in group statistics; however, using abbreviated measures are often more efficient than they are internally consistent (Ziegler, Kemper, & Kruyen, 2014). Shorter measures of personality are more susceptible to increased Type I and Type II errors due to the small variance among items and have also been argued to exhibit potentially lower criterion and content validity (Credé, Harms, Niehorster, & Gaye-Valentine, 2012). Accordingly, we conducted Study 2 with the specific aim of addressing this limitation by examining Big Five personality using a longer well-established measure. Another potential limitation of Study 1 was the reliance on an undergraduate sample, which potentially restricts the generalizability of the findings. Accordingly, Study 2 utilized a community sample from distinct nations.

3.1. Method

3.1.1. Participants

Using the average effect size from Study 1, a power analysis indicated a total sample of 331 would be required to detect an effect of 0.19 with a 95% power and an alpha set to 0.05. Participants were 321 (47.3% male) community members over the age of 18 recruited via Amazon's Mechanical Turk online sampling technologies ($M_{age} = 35.2$, $SD = 10.64$; 71% Caucasian, 37% South Asian, 23% Asian, 21% Black, 11% Latin-American). The respondents were recruited from the following countries: The United States of America (77.5%), India (14.5%), Canada (1.1%), Venezuela, The Philippines, Mexico, Romania, Bangladesh, The Dominican Republic, Bulgaria, Latvia, Portugal, Italy, Jamaica, Nicaragua, Greece, Egypt, Pakistan, Ecuador, Sweden, Poland and Hong Kong (all < 1%). Participants received $2 USD remuneration. All procedures were approved by the university research ethics board.

3.1.2. Procedure and measures

Participants completed an online counter-balanced survey that included basic demographic information (e.g., sex) and self-report measures, including the following measures.

3.1.2.1. Personality. Personality traits were examined through the Big Five Inventory (BFI; John & Srivastava, 1999). This 44-item measure examines all Big Five personality traits with 8 to 10 items per trait, with items rated on a 5-point Likert scale from 1 = *Disagree Strongly* to 5 = *Agree Strongly*. The scale shows good reliability, content validity and stability over time (John & Srivastava, 1999). The internal consistencies for each personality trait were as followed: extraversion (α = 0.86), agreeableness (α = 0.84), conscientiousness (α = 0.87), neuroticism (α = 0.89), and openness (α = 0.82).

3.1.2.2. Self-report environmental attitudes and behaviors. Following Study 1, self-report questionnaires on environmental attitudes and behaviors were assessed using EAI-24 (Milfont & Duckitt, 2010) and Schultz et al. (2005) environmental behaviour scale, respectively.

3.1.3. Identifying testable models

Primary analyses were run to examine the bivariate correlation of Big Five personality traits and environmental variables. Consistent with most of the previous literature, the participants' sex was positively correlated to environmental protectionism ($r = 0.11$, $p = .048$) and environmental utilization ($r = 0.13$, $p = .02$). Sex was also positively correlated with agreeableness ($r = 0.16$, $p = .003$), conscientiousness ($r = 0.14$, $p = .009$), and neuroticism ($r = 0.16$, $p = .004$). Next, bivariate correlations were analyzed between personality and environmental variables. Environmental behavior was positively related to extraversion ($r = 0.19$, $p = .001$), and openness ($r = 0.24$, $p < .001$). Environmental protection attitudes were positively related to agreeableness ($r = 0.23$, $p < .003$), conscientiousness ($r = 0.22$, $p < .001$), and openness ($r = 0.43$, $p < .001$). Environmental utilization was negatively correlated to neuroticism ($r = -0.11$, $p = .047$), and openness ($r = -0.32$, $p < .001$). Due to the sex differences in these personality dimensions at the bivariate level, agreeableness ($r = 0.11$, $p = .003$), conscientiousness ($r = 0.14$, $p = .009$), and neuroticism ($r = 0.16$, $p = .004$) were examined as mediators of the sex differences in environmental protection and environmental utilization (see correlations in Supplement Table 2).

Multiple mediation models (model 4) (PROCESS, Hayes, 2013) were tested to examine the extent that personality traits, agreeableness,

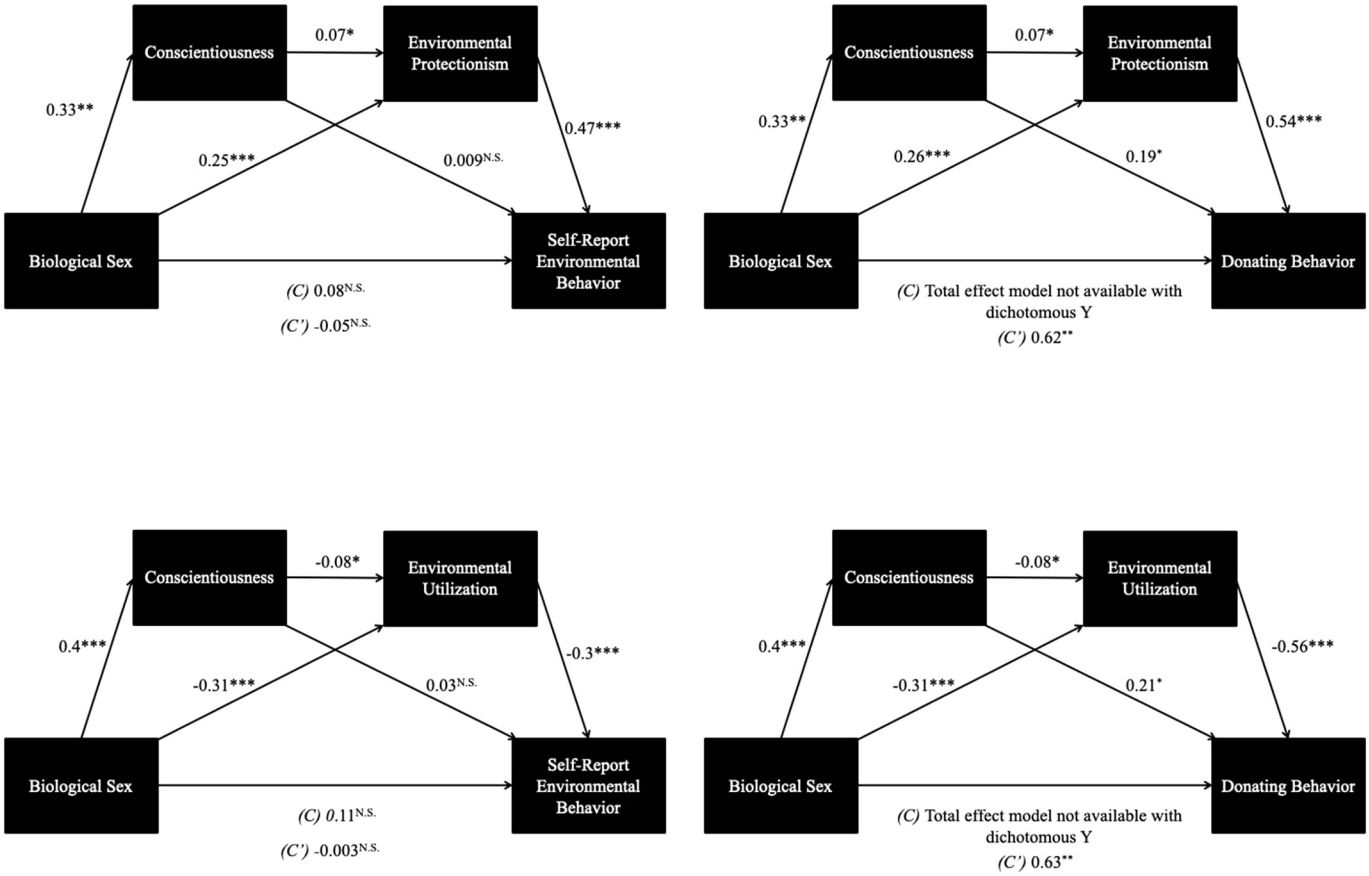

Fig. 1. Sequential mediation model (PROCESS, Model 6) (Hayes, 2013) for Study 1. Top left: Conscientiousness and environmental protectionism mediated link between sex and self-report environmental behavior. Top right: Conscientiousness and environmental protectionism mediated the link between sex and in-vivo environmental behavior. Bottom left: Conscientiousness and environmental utilization mediated the link between sex and self-report environmental behavior. Bottom right: Conscientiousness and environmental utilization mediated the link between sex and in-vivo environmental behavior. Values represent unstandardized regression coefficients. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

conscientiousness, and neuroticism, mediated the sex differences in environmental attitudes (protectionism and utilization). Sex, as a dichotomous variable, was dummy-coded as 0 = male and 1 = female.

3.2. Results

First, the total effects model for sex predicting environmental protectionism was analyzed. The relationship between sex and protectionism was significant ($b = 0.21$, SE = 0.11, $t = 1.98$, $p = .048$), where females had more favorable attitudes towards protecting the environment than males. Sex statistically predicted agreeableness ($b = 0.24$, SE = 0.08, $t = 3.0$, $p = .003$), conscientiousness ($b = 0.22$, SE = 0.08, $t = 2.64$, $p = .009$), and neuroticism ($b = 0.24$, SE = 0.08, $t = 2.94$, $p = .004$), whereby females had higher levels of all three personality dimensions than males. With all variables entered in the model, environmental protectionism was significantly predicted by agreeableness ($b = 0.27$, SE = 0.08, $t = 3.21$, $p = .002$), conscientiousness ($b = 0.26$, SE = 0.08, $t = 3.17$, $p = .002$), and neuroticism ($b = 0.26$, SE = 0.09, $t = 2.99$, $p = .003$). With these personality traits entered into the model, the relationship between sex and protectionism was reduced to statistical non-significance ($b = 0.03$, SE = 0.11, $t = 0.24$, $p = .81$). Examining the confidence intervals, each mediator had a significant effect (agreeableness: 95% LL = 0.02, 95% UL = 0.13; conscientiousness: 95% LL = 0.01, 95% UL = 0.12; neuroticism: 95% LL = 0.01, 95% UL = 0.13). The pairwise contrasts indicated no statistical difference between each indirect relationship.

Second, the total effects model for sex predicting environmental utilization was analyzed. The relationship between sex and utilization was significant ($b = -0.25$, SE = 0.1, $t = -2.35$, $p = .02$), where females had less favorable attitudes towards utilizing the environment than males. Sex statistically predicted agreeableness ($b = 0.24$, SE = 0.08, $t = 2.99$, $p = .003$), conscientiousness ($b = 0.22$, SE = 0.08, $t = 2.64$, $p = .009$), and neuroticism ($b = 0.24$, SE = 0.08, $t = 2.94$, $p = .004$), whereby females were more agreeable, conscientious, and neurotic than males. With all variables entered in the model, environmental utilization was significantly predicted only by neuroticism ($b = -0.26$, SE = 0.087, $t = -2.59$, $p = .01$). With the personality variables entered into the model, the relationship between sex and protectionism was reduced to statistical non-significance ($b = -0.14$, SE = 0.11, $t = -1.28$, $p = .21$), indicating a full mediation. Examining confidence intervals for each indirect relationship, only neuroticism had a significant mediating effect (95% UL = −0.13, 95% LL = −0.007). Given that there were no sex differences or personality differences (in relation with sex) that predicted actual environmental *behavior*, we could not test the more complex multiple mediation model examined in Study 1.

4. Study 3

Recently in personality research, there has been an emergence of a six-factor model of personality: the HEXACO model introduced by Lee and Ashton (2004). Regarding environmentalism, previous environmental psychology research has shown that all HEXACO personality dimensions except for emotionality correlated with emission-reduction behaviour; however, only openness to experience and conscientiousness uniquely predicted these behaviors—moreover, all facets of

conscientiousness (organization, diligence, perfectionism and prudence) positively predicted emission-reduction (Brick & Lewis, 2016). Likewise, Markowitz et al. (2012) found that facets of HEXACO's conscientiousness, diligence and organization, related to self-report environmental practices. Milfont et al. (2015) found the highest levels of honesty-humility traits among climate skeptics (i.e., individuals who are skeptical about both reality and human cause of climate change) but observed that other personality traits had stronger correlations with climate change belief. These findings suggest that other personality traits besides the new honesty-humility dimension are consistently correlated with environmentalism.

To test this empirically, Study 3 examined the mediating role of personality of sex differences in environmental attitudes and behavior using the HEXACO model. Study 3 also expanded upon our conceptualization of sex differences by also considering gender differences, as a distinct construct that differs from biological sex, in both personality and environmental variables. Therefore, gender was considered using a continuous spectrum, ranging from totally feminine to totally masculine along a well-established measure. Previous research has identified that gender role identity also maps onto environmentalism: femininity was positively associated with scores of the New Environmental Paradigm (NEP) scale, and it was found that the effect femininity had over NEP scores were stronger than the effect of biological sex differences (Zelezny et al., 2000). More recent experimental research has identified that consumers who engage in green purchasing behavior rate themselves as being more feminine, and that men's willingness to engage in pro-environmental behavior can be manipulated by threatening or bolstering their masculinity (Brough, Wilkie, Ma, Isaac, & Gal, 2016). It was therefore expected that the mediating role of HEXACO traits would be largely consistent across both sex and gender measures.

4.1. Method

4.1.1. Participants

The same power analysis as Study 2 was used to indicate a total sample of 331 would be required to detect a direct effect of 0.19 with a 95% power and an alpha set to 0.05. Participants were 391 (44% males) students from Ontario recruited in classrooms and common spaces, and completed the survey in these locations (M_{age} = 21.59, SD = 4.91, 90.5% Caucasian, 4.3% Aboriginal, 3.6% African-Americans, 2.8% Asian, 2% South Asian, 1.3% Latin-American). Participants were included in a $100 draw as compensation for participating in the study. All procedures were approved by the university research ethics board.

4.1.2. Procedure and measures

Participants completed a counter-balanced paper questionnaire that included basic demographic information (e.g., sex) and self-report measures, including the following measures.

4.1.2.1. Gender. Traditional Masculinity-Femininity Scale (TMF; Kachel, Steffens, & Niedlich, 2016) is a 5-item scale to assess the individual's femininity and masculinity on a spectrum. Participants were asked to rate themselves from 1 = *very masculine* to 7 = *very feminine* for bipolar items, such as "I consider myself…", "Ideally, I would like to be…", "Traditionally, my interests would be considered as…", "Traditionally, my behaviour would be considered as…", "Traditionally, my outer appearance would be considered as…". In the present study the measure of gender demonstrated good internal consistency, α = 0.97. As theorized, the total sample mean was 4.04, while the male sample mean was 2.30, and the female sample mean was 5.38.

4.1.2.2. Personality. Personality traits were assessed with the Brief HEXACO Inventory (BHI; de Vries, 2013). This inventory consists of 24 items, where each of the six dimensions is represented by four items. The six dimensions of HEXACO being honesty-humility, agreeableness, emotional stability, openness and conscientiousness (Lee & Ashton, 2004). The BHI was shown adequate test-rest stability, self-agreement levels and highly correlated with HEXACO-PI-R (de Vries, 2013). This widely used inventory initially showed poor internal consistencies during initial validation of the measure, however the creators of the scale argued that it nevertheless shows "adequate levels of test-retest stability, adequate levels of self-other agreement, and high levels of convergent correlations with the HEXACO-PI-R" (de Vries, 2013, p. 877). The present study showed similar Chronbach's alphas to those reported in the initial validation research for this measure: openness (α = 0.46, omega = 0.38), conscientiousness (α = 0.58, omega = 0.62), agreeableness (α = 0.36, omega = 0.38), extraversion (α = 0.38, omega = 0.46), emotionality (α = 0.55, omega = 0.57), and honesty-humility (α = 0.42, omega = 0.43).

4.1.2.3. Self-report environmental attitudes and behaviors. Following Studies 1 and 2, self-report questionnaires on environmental attitudes and behaviors will utilize the EAI-24 (Milfont & Duckitt, 2010) and Schultz et al. (2005) environmental behavior scale, respectively.

4.1.2.4. In-vivo environmental behavior. Study 3 utilized similar behavioral measures as Study 1, where participants could donate their remuneration to an environmental cause and sign up for a bogus university/college environmental group. The difference between the studies was that participants in Study 3 were given the opportunity to either keep their $100 winnings (versus real remuneration), or to donate it to a well-known environmental organization (the World Wildlife Fund); 32.7% of participants wanted to donate their winnings. Consistent with our Study 1, of those who donated females donated more often (males = 38.1%, females = 61.9%), but this difference was only marginally statistically significant, χ^2 (1, N = 361) = 2.72, p = .10, Cramer's V = 0.09, p = .10). For the bogus environmental group, 72.1% of participants did not opt-in. There was no statistical sex difference in those who opted-in (males = 48%, females = 52%, χ^2 (1, N = 365) = 0.66, p = .42, Cramer's V = −0.04, p = .42).

4.1.3. Identifying testable models

Primary analyses were run to examine correlations between sex/gender and each of the environmental variables. Sex correlated with environmental protectionism attitudes (r = 0.12, p = .02), environmental utilization attitudes (r = −0.11, p = .03), and self-report environmental behavior (r = 0.17, p = .001). Sex did not correlate with either of the two in-vivo behavior (donating r = 0.09, p = .1; opt-in r = −0.04, p = .42). TMF was only significantly correlated with environmental behavior (r = 0.16, p = .002). In relation to personality and each of the environmental variables, extraversion, agreeableness, and neuroticism are not correlated with any of the environmental variables. Consistent with previous research, conscientiousness correlated with environmental protectionism (r = 0.13, p = .02) and behavior (r = 0.15, p = .004). Openness also correlated with environmental protectionism (r = 0.35, p < .001), utilization (r = −0.2, p < .001), and behavior (r = 0.29, p < .001). Moreover, honesty-humility correlated with protectionism (r = 0.16, p = .003) and utilization (r = −0.22, p < .001). In relation to biological sex and personality traits, point-biserial correlation analysis showed conscientiousness (r = 0.12, p = .02), openness (r = −0.15, p = .003), and honesty-humility (r = 0.19, p = .001) were significantly correlated to sex. As well in relation to TMF, conscientiousness (r = 0.11, p = .04), openness (r = −0.13, p = .01), and honesty-humility (r = 0.13, p = .01) were significantly correlated. Therefore, both conscientiousness and honesty-humility correlated with sex and femininity in the same direction as the mediation model. Open people were more likely to engage in environmental behavior; however, because women were less open than men, openness did not satisfy criteria as a potential explanatory

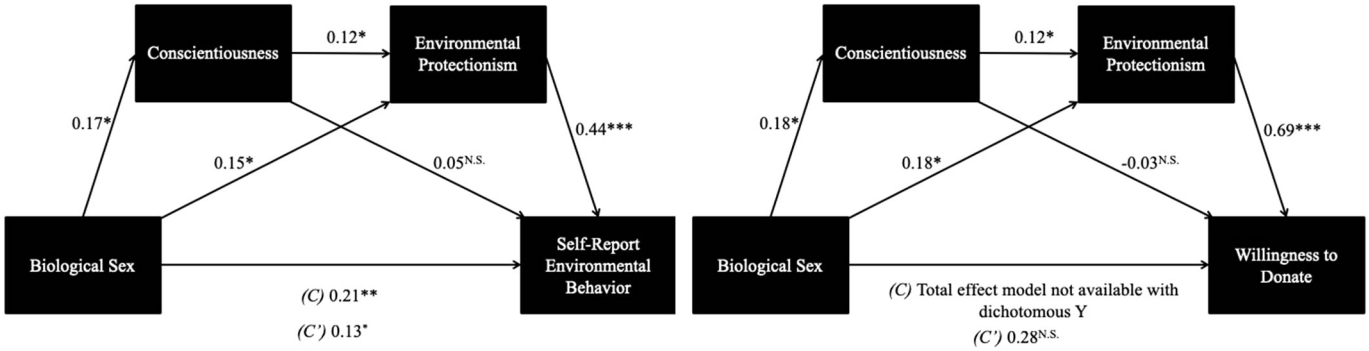

Fig. 2. Sequential mediation models (PROCESS, Model 6) (Hayes, 2013). Left: Conscientiousness and environmental protectionism did not significantly mediate links between sex and self-report environmental behaviors. Right: Conscientiousness and environmental protectionism did not significantly mediate the links between sex and in-vivo environmental behavior. Values represent unstandardized regression coefficients. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

variable for why women are, overall, more pro-environmental than men. Thus, only conscientiousness and honesty-humility satisfied inclusion criteria for consideration as a mediator variable for both biological sex and TMF (i.e., correlations between X and M, and between M and Y; see Kenny, 2016). See all correlations in Supplement Table 3.

Multiple mediation models (PROCESS, Model 4; Hayes, 2013) were tested to examine the extent that personality traits mediated the sex/gender differences, through biological sex and gender as a continuous variable, in environmental attitudes and behaviors. Sex, as a dichotomous variable, was dummy-coded as 0 = male and 1 = female. In this final study, there are four mediation analyses examined: 1. Conscientiousness and honesty-humility mediating the relationship between biological sex and environmental protectionist attitudes; 2. Honesty-humility mediating the relationship between biological sex and environmental utilization; 3. Conscientiousness mediating the relationship between biological sex and self-report environmental behavior; and 4. Conscientiousness mediating the relationship between gender and self-report environmental behavior.

4.2. Results

First, the total effects model for sex predicting environmental protectionism attitudes was analyzed. The relationship between sex and environmental protectionism was significant ($b = 0.17$, $SE = 0.07$, $t = 2.27$, $p = .02$), where females had more favorable attitudes towards protecting the environment than males. Sex statistically predicted conscientiousness ($b = 0.16$, $SE = 0.07$, $t = 2.34$, $p = .02$) and honesty-humility ($b = 0.26$, $SE = 0.07$, $t = 3.87$, $p < .001$), whereby females were more conscientious and honest/humble than males. With all variables entered in the model, protectionism was not significantly predicted by conscientiousness ($b = 0.09$, $SE = 0.06$, $t = 1.54$, $p = .12$), but was significantly predicted by honesty-humility ($b = 0.15$, $SE = 0.06$, $t = 2.66$, $p = .008$). Due to conscientiousness and honesty-humility as mediators, the relationship between sex and protectionism was reduced to non-significant ($b = 0.12$, $SE = 0.07$, $t = 1.68$, $p = .09$), indicating a full mediation. Examining confidence intervals, only honesty-humility had a significant effect (95% UL = 0.009 LL = 0.08).

Second, the total effects model for sex predicting self-report environmental behavior was analyzed. The relationship between sex and environmental behavior was significant ($b = 0.21$, $SE = 0.06$, $t = 3.29$, $p = .001$), where females were more likely to report acts of environmentalism than males. Sex predicted conscientiousness ($b = 0.65$, $SE = 0.27$, $t = 2.38$, $p = .02$), whereby females were more conscientious than males. With all variables entered in the model, environmental behavior was predicted by conscientiousness ($b = 0.03$, $SE = 0.01$, $t = 2.55$, $p = .01$). With conscientiousness included in the model, the relationship between sex and environmental behavior was statistically-significantly reduced ($b = 0.19$, $SE = 0.06$, $t = 2.98$, $p = .003$, bootstrapping: 95% LL = 0.004, 95% UL = 0.05), indicating a partial mediation.

Third, the total effects model for TMF predicting self-report environmental behaviors was analyzed. The relationship between TMF and environmental behavior was significant ($b = 0.05$, $SE = 0.02$, $t = 3.10$, $p = .002$), where those who were more feminine were more likely to report acts of environmentalism than were masculine participants. TMF predicted conscientiousness ($b = 0.16$, $SE = 0.08$, $t = 2.10$, $p = .04$), where those who were more feminine were also more conscientious than masculine participants. With all variables entered in the model, environmental behavior was significantly predicted by conscientiousness ($b = 0.03$, $SE = 0.01$, $t = 2.52$, $p = .01$). With conscientiousness included as a mediator, the relationship between TMF and environmental behavior was statistically-significantly reduced ($b = 0.05$, $SE = 0.02$, $t = 2.83$, $p = .005$, bootstrapping: 95% LL = 0.001, 95% UL = 0.01), indicating partial mediation.

Last, we tested a sequential mediation model (PROCESS Model 6; Hayes, 2013) similar to that in Study 1. Specifically, environmental attitude may mediate links between personality (conscientiousness) and behavior. Accordingly, environmental attitude was included in a multiple mediation model (as in Study 1) such that conscientiousness mediated sex differences in environmental behavior, and where protectionism attitude simultaneously mediated the link between conscientiousness and behavior. Because TMF scores did not relate to protectionism attitude, testing of this model was limited to sex. View Fig. 2 for a visual of the multiple mediation model (see supplement for bivariate links between environmental attitudes and behavioral measures). Given that, unlike Study 1, only protectionism (but not utilization) attitude correlated with conscientiousness (a necessary pathway), we limited testing of the multiple mediation model to protectionism attitude only. When entering protectionism into our model, results showed that conscientiousness and environmental protectionism mediated the sex difference effect in self-report environmental behavior ($b = 0.01$, SE = 0.01, bootstrapping: 95% LL = 0.00, 95% UL = 0.04). When examining the addition of protectionism with donating behavior, conscientiousness and environmental protectionism mediated the sex difference in in-vivo pro-environmental behavior ($b = 0.02$, SE = 0.01, bootstrapping: 95% LL = 0.00, 95% UL = 0.04). Similar to study 1, the addition of environmental protectionist attitudes (a) predicted both self-report and in-vivo environmental behavior, (b) was predicted by conscientiousness, and (c) influenced the strength of the link between conscientiousness and environmental behavior. Again, this suggests that females are more conscientiousness, which influences their environmental protectionist attitudes, which in turn affects their frequency of environmental behavior.

5. Discussion

Women, relative to men, consistently score higher on measures of pro-environmental attitudes and conservation behavior. This finding has been replicated cross-nationally and has been cited as one of the most robust in the field of environmental psychology (Sundström & McCright, 2013). This sex difference holds considerable importance to societal efforts aimed at curbing environmental degradation. For instance, the theme of a recent International Women's Day focussed specifically on “Planet 50-50 by 2030: Step It Up for Gender Equality” with the recognition that women play an important role in environmental sustainability (Elwell & Williams, 2016). Yet hitherto, there has been a surprising lack of research aimed at understanding this sex difference. Previous studies have considered a relatively narrow set of potential explanatory variables, and little research has appropriately modeled the relationship by testing the target variable as a mediator (Arnocky & Stroink, 2011; Graça et al., 2018). Concurrently, a separate yet potentially informative line of research has identified broad differences in personality, measured using both Big Five and HEXACO models, as important predictors of pro-environmental attitudes and behavior. In particular, conscientiousness appears to be consistently linked to greater engagement in environmentalism. The present research sought to align these important lines of inquiry by testing whether personality traits, as broad and relatively stable set of interrelated individual differences in attitudes and behavior, might account for sex and gender differences in environmentalism. Over the course of three studies, the sex difference in environmentalism was significantly mediated by personality traits, in particular conscientiousness.

To this end, Study 1 examined a brief measure of Big Five personality (TIPI) in a large undergraduate sample. Participants reported on pro-environmental attitudes and behavior, as well as engaged in novel in-vivo measures of pro-environmental behavior: Donating their remuneration to an environmental organization and indicating intention of joining an on-campus environmental group. Results showed that whereas trait agreeableness, neuroticism, openness, and extraversion were inconsequential to the environmental variables, conscientiousness mediated observed sex differences in environmental protectionism, utilization, self-report conservation behavior, and donating to an environmental organization.

Study 2 examined Big Five personality using a longer measure, the Big Five Inventory, in a community sample recruited from Mechanical Turk. Similar to Study 1, participants reported pro-environmental attitudes and behaviors. Results showed that conscientiousness, agreeableness, and neuroticism mediated sex differences in environmental protectionism attitudes. However, the sex differences in environmental utilization attitudes were only mediated by neuroticism. Findings from this study extended the role of conscientiousness in explaining sex differences in environmentalism in a less homogenous sample. However, some important differences were also observed in the similar mediating roles of neuroticism and agreeableness, which were not observed in either of the student samples (Studies 1 and 3). Accordingly, it is possible that in less heterogeneous samples (i.e., more diverse ethnic, educational, geographic, and socioeconomic backgrounds), these personality dimensions also play an important role in explaining men's and women's environmentalism. Future research should address this possibility by employing a mixed sample and testing the personality as a mediator in each concurrently.

More interestingly, conscientiousness did not mediate the sex-environmental utilization relationship in both Studies 2 and 3. However, conscientiousness mediated the sex difference in environmental *protectionist* attitudes in all three studies. The EAI subscales of protectionism and utilization differentiate between the two value systems when examining environmentalism, where protectionist attitudes encompass ecocentric concern (i.e., concern due to valuing the environment itself) and utilization attitudes engulf anthropocentric concern (i.e., concern due to valuing the environment for its benefits to oneself or humans) towards the environment. In relation to these two value systems, conscientiousness has previously been positively correlated with environmental ecocentrism (Boeve-de Pauw, Donche, & Van Petegem, 2011), as well with concepts relating to ecocentrism, such as emotional affinity towards nature and commitment to nature (Tam, 2013). This demonstrates that conscientiousness may not be as important to sex differences in resource utilization as it is to individuals' willingness to conserve the environment for its own inherent value.

In Study 3, personality was assessed through the Brief HEXACO Inventory in a student sample. Results showed that honesty-humility mediated the link between sex and environmental protectionism attitude, whereas Conscientiousness mediated the sex differences in self-reported environmental behavior. Study 3 also extended beyond biological sex to examining gender differences using a continuous gender measure, the Traditional Masculinity-Femininity Scale. Results showed that conscientiousness again mediated the gender difference in self-report environmental behavior, but not environmental protectionism which was unrelated to gender. Past research using continuous measures of gender has identified potential differences from sex, such that gender may better capture individual differences in environmental outcomes (Zelezny et al., 2000). Our findings similarly demonstrated that when gender is considered instead of sex, the difference in protectionist attitudes dissipated; perhaps female masculinity and male femininity may bear upon mitigating established sex differences in this attitude. However, the difference in actual conservation behavior remained across both measures and was mediated consistently by conscientiousness.

It is also noteworthy that in Study 3, the sex difference observed in the in-vivo measure of donating to an environmental organization did not replicate findings from our first study. In Study 1, participants were remunerated with $5 CAD, whereas in Study 3 participants were remunerated with a chance to win $100. It is possible that the act of donating tangible money is conceptually different than agreeing to donate potential winnings. Indeed, although the overall rates of donation were nearly identical between the two studies, the sex differences were not: with actual money females donated more and men less than when the remuneration involved potential draw winnings. In other words, the sex difference in donating was much more restricted in the monetary draw sample which could explain the null findings for Study 3. Future research should utilize actual monetary resources instead of potential winnings.

When additional analyses were run in Studies 1 and 3 examining the addition of environmental attitudes as further mediating the link between conscientiousness and environmental behavior, we observed that environmental attitudes (protectionism in Studies 1 and 2, and utilization in Study 1 only) served as an additional mediating variable such that females were more conscientious relative to males, which accounted for their greater pro-environmental attitude, whereby attitude in turn directly predicted pro-environmental action. These results extend the results of Markowitz et al. (2012), where environmental attitudes mediated the relationship between personality traits and environmental behavior. Together, findings from this set of studies demonstrate a robust mediating effect of conscientiousness upon sex and gender differences in pro-environmental attitudes and behavior. The research also highlights two additional personality factors, agreeableness and neuroticism, as targets for future research which might also bear upon this link.

Over the course of three studies, conscientiousness was identified as an important mediator for the sex-environmentalism link. This information could be useful in discovering how to increase males' desire to help the environment and their subsequent actions. Previous research has explored the concept of inducing conscientiousness in participants. Participants primed with conscientious adjectives were more likely to have higher conscientiousness scores on a complex personality measure of conscientiousness (Nordlund, 2009). Similarly, participants who went through self-regulating training for six-weeks had higher

scores of conscientiousness (Della Porta, 2013). This research suggests male conscientiousness can be influenced. The present research suggests that in so doing, researchers could potentially promote environmentalism among men. Future research should examine the effect of priming conscientiousness on environmental attitudes and more importantly environmental behavior.

5.1. Limitations and future directions

In all three studies, both environmental attitudes, protectionism and utilization, had a sex difference, however results indicated an inconsistency in sex differences of self-reported environmental behavior. In Studies 1 and 3, with student samples, females reported engaging in more self-report pro-environmental behavior than males. In Study 2, with a community sample, there was no sex difference for environmental behavior. This demonstrates a potential difference between student and non-student samples. The difference in the self-report environmental behavior measures between Study 1 and 3 with Study 2 is that Study 2 did not have the 'Not Applicable' option when responding. This difference in measurement did not allow for the participants to respond in a way if they had no opportunity to engage in such a behavior. Interestingly, previous research on rural vs urban residents found urban residents engaged in more environmentally friendly behavior mostly due to the availability of the communities' environmental services (Huddart-Kennedy, Beckley, McFarlane, & Nadeau, 2009; Saphores, Nixon, Ogunseitan, & Shapiro, 2006). For rural residents who do not have services, such as roadside recycling programs, recycling becomes more of an inconvenience to them (Saphores et al., 2006). This could help explain the difference found across our studies, although it should be noted that we employed different measures of environmentalism in our research. The student samples, from the same city, would have relatively the same availability in terms of environmental services, whereas a community sample, from different locations, predominately throughout the United States, could potentially have different options for their pro-environmental behaviors. Accordingly, if these community members did not have the option to respond with "Not Applicable", there could be a possibility of response skewness. This study lacks the ability to investigate the cause and effect relation of the variables due to the correlational design. However, it does elucidate a better understanding of the role personalities play in the gender differences in environmentalism. Future research should take this information into consideration when examining why men are less environmentally friendly. Another potential measurement limitation involves the utilization of a brief measure of HEXACO personality dimensions in Study 3. The subscales did not exhibit high internal consistency. Future research should employ a longer more detailed measure to address this limitation.

Large cross-cultural studies have demonstrated much consistency with adult sex differences in personality (see De Bolle et al., 2015). Yet some research suggests that personality is not purely biologically-driven, but rather is at least in part amenable to socio-cultural influence (Eagly, 1987). Some research has even investigated the effects of priming personality dimensions which appear to increase self-reports personality, including conscientiousness. From this perspective, future research could employ these priming techniques to identify whether attempts at increasing conscientiousness among men might enhance their pro-environmental attitudes and behavior.

The in-vivo behavior of environmentalism (donating to an environmental organization) should be examined cautiously as we did not rule out the possibility that this is merely an index of generalized altruism (e.g., see Kaiser & Byrka, 2011), rather than environmentalism specifically. However, when examining bivariate correlations between donating behavior and environmental variables, donating did relate to environmental attitudes and behaviors (Study 1 ranged from $r = 0.14$ to $r = 0.27$; Study 3 ranged from $r = 0.12$ to $r = 0.28$). This demonstrates that environmental individuals were more likely to be the individuals who were donating to the environmental cause, suggesting it is a valid index of environmentalism. It is however, unclear whether there are potentially important differences between the actual donation of a relatively smaller amount of money (Study 1) versus the donation of a relatively larger amount money that is uncertain in the form of draw winnings (Study 3). Future research should consider including a control charity that is not associated with environmentalism to examine the true relationship with in-vivo environmental behavior, and allow for partial donation of real or potential earnings to allow for more flexibility in these measures.

6. Conclusion

A large body of research has identified robust sex differences between men and women in their pro-environmental attitudes and behavior. Yet to date, very little research has attempted to understand the underlying psychological characteristics that mediate the link between sex and environmentalism. The current set of studies demonstrated that sex differences in trait personality dimensions, and in particular conscientiousness, plays an important role in accounting for why women appear to care more about, and act to protect, the environment. Such a finding may have important implications for pro-environmental initiatives. These findings suggesting that increasing conscientiousness generally among males may be a viable strategy for mitigating environmental depletion.

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Appendix A. Supplementary data

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References

Arnocky, S., Piché, T., Albert, G., Ouellette, D., & Barclay, P. (2017). Altruism predicts mating success in humans. *British Journal of Psychology, 108*(2), 416–435. https://doi.org/10.1111/bjop.12208.

Arnocky, S., & Stroink, M. L. (2011). Gender differences in environmental concern and cooperation: The mediating role of emotional empathy. *Current Research in Social Psychology, 16*(9), 1–14.

Boeve-de Pauw, J., Donche, V., & Van Petegem, P. (2011). Adolescents' environmental worldview and personality: An explorative study. *Journal of Environmental Psychology, 31*(2), 109–117. https://doi.org/10.1016/j.jenvp.2010.05.003.

Brick, C., & Lewis, G. J. (2016). Unearthing the "Green" personality. *Environment and Behavior, 48*(5), 635–658. https://doi.org/10.1177/0013916514554695.

Brough, A. C., Wilkie, J. E. B., Ma, J., Isaac, M. S., & Gal, D. (2016). Is eco-friendly unmanly? The green-feminine stereotype and its effect on sustainable consumption. *Journal of Consumer Research, 43*, 567–582. https://doi.org/10.1093/jcr/ucw044.

Credé, M., Harms, P., Niehorster, S., & Gaye-Valentine, A. (2012). An evaluation of the consequences of using short measures of the Big Five personality traits. *Journal of Personality and Social Psychology, 102*(4), 874–888. https://doi.org/10.1037/a0027403.

De Bolle, M., De Fruyt, F., McCrae, R. R., Löckenhoff, C. E., Costa, P. T., Jr., Aguilar-Vafaie, M. E., & Terracciano, A. (2015). The emergence of sex differences in personality traits in early adolescence: A cross-sectional, cross-cultural study. *Journal of Personality and Social Psychology, 108*(1), 171–185. https://doi.org/10.1037/a0038497.

Della Porta, S. S. (2013). *Increasing conscientiousness to improve health behaviors: Findings from a self-regulation intervention* (Unpublished Doctoral dissertation) UC Riverside, Riverside, California: United States of America. Retrieved from https://escholarship.org/uc/item/06b6s7vc.

Dietz, T., Kalof, L., & Stern, P. C. (2002). Gender, values, and environmentalism. *Social Science Quarterly, 83*(1), 353–364. https://doi.org/10.1111/1540-6237.00088.

Eagly, A. H. (1987). *Sex differences in social behavior: A social-role interpretation.* New Jersey, USA: Lawrence Erlbaum Associates, Publishers.

Elwell, N., & Williams, Y. (2016). If you care about the environment, you should care

about gender. Retrieved from: http://www.wri.org/blog/2016/03/if-you-care-about-environment-you-should-care-about-gender.
Fedvadjiev, V., & van de Vijver, F. J. R. (2015). Universality of the five-factor model of personality. In J. D. Wright (Vol. Ed.), *International Encyclopedia of Social and Behavioral Sciences*(2 ed.). *9. International Encyclopedia of Social and Behavioral Sciences* (pp. 249–253). Oxford: Reed Elsevier.
Feingold, A. (1994). Gender differences in personality: A meta-analysis. *Psychological Bulletin, 116*(3), 429–456. https://doi.org/10.1037/0033-2909.116.3.429.
Gifford, R., & Nilsson, A. (2014). Personal and social factors in environmental concern and behaviour. *International Journal of Psychology, 49*(3), 141–157. https://doi.org/10.1002/ijop.12034.
Gosling, S. D., Rentfrow, P. J., & Swann, W. B. (2003). A very brief measure of the big-five personality domains. *Journal of Research in Personality, 37*(6), 504–528. https://doi.org/10.1016/S0092-6566(03)00046-1.
Graça, J., Calheiros, M. M., Oliveira, A., & Milfont, T. L. (2018). Why are women less likely to support animal exploitation than men? The mediating roles of social dominance orientation and empathy. *Personality and Individual Differences, 129*, 66–69. https://doi.org/10.1016/j.paid.2018.03.007.
Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach.* New York, NY: The Guilford Press.
Hirsh, J. B. (2010). Personality and environmental concern. *Journal of Environmental Psychology, 30*(2), 245–248. https://doi.org/10.1016/j.jenvp.2010.01.004.
Huddart-Kennedy, E., Beckley, T. M., McFarlane, B. L., & Nadeau, S. (2009). Rural-urban differences in environmental concern in Canada. *Rural Sociology, 74*(3), 309–329. https://doi.org/10.1526/003601109789037268.
Hunter, L. M., Hatch, A., & Johnson, A. (2004). Cross-national gender variation in environmental behaviors. *Social Science Quarterly, 85*(3), 677–694. https://doi.org/10.1111/j.0038-4941.2004.00239.x.
John, O. P., & Srivastava, S. (1999). The big-five trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin, & O. P. John (Vol. Eds.), *Handbook of personality: Theory and research. Vol. 2. Handbook of personality: Theory and research* (pp. 102–138). New York: Guilford Press.
Kachel, S., Steffens, M. C., & Niedlich, C. (2016). Traditional masculinity and femininity: Validation of a new scale assessing gender roles. *Frontiers in Psychology, 7*, 956. https://doi.org/10.2289/fpsyg.2016.00956.
Kaiser, F. G., & Byrka, K. (2011). Environmentalism as a trait: Gauging people's prosocial personality in terms of environmental engagement. *International Journal of Psychology, 46*(1), 71–79.
Kallgren, C. A., Reno, R. R., & Cialdini, R. B. (2000). A focus theory of normative conduct: When norms do and do not affect behavior. *Personality and Social Psychology Bulletin, 26*(8), 1002–1012. https://doi.org/10.1177/01461672002610009.
Lee, K., & Ashton, M. C. (2004). Psychometric properties of the HEXACO personality inventory. *Multivariate Behavioral Research, 39*(2), 329–358. https://doi.org/10.1207/s15327906mbr3902_8.
Lehmann, R., Denissen, J. J. A., Allemand, M., & Penke, L. (2013). Age and gender differences in motivational manifestations of the Big Five from age 16 to 60. *Developmental Psychology, 49*(2), 365–383. https://doi.org/10.1037/a0028277.
Markowitz, E. M., Goldberg, L. R., Ashton, M. C., & Lee, K. (2012). Profiling the 'pro-environmental individual': A personality perspective. *Journal of Personality, 80*(1), 81–111. https://doi.org/10.1111/j.1467-6494.2011.00721.x.
Marquart-Pyatt, S. T. (2008). Are there similar sources of environmental concern? Comparing industrialized countries. *Social Science Quarterly, 89*(5), 1312–1335. https://doi.org/10.1111/j.1540-6237.2008.00567.x.
Milfont, T. L. (2009). The effects of social desirability on self-reported environmental attitudes and ecological behaviour. *The Environmentalist, 29*(3), 263–269. https://doi.org/10.1007/s10669-008-9192-2.
Milfont, T. L., & Duckitt, J. (2010). The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes. *Journal of Environmental Psychology, 30*(1), 80–94. https://doi.org/10.1016/j.jenvp.2009.09.001.
Milfont, T. L., Evans, L., Sibley, C. G., Ries, J., & Cunningham, A. (2014). Proximity to coast is linked to climate change belief. *PLoS One, 9*(7), e103180. https://doi.org/10.1371/journal.pone.0103180.
Milfont, T. L., Milojev, P., Greaves, L., & Sibley, C. G. (2015). Socio-structural and psychological foundations of climate change beliefs. *New Zealand Journal of Psychology, 44*(1), 17–30.
Milfont, T. L., & Schultz, P. W. (2018). The role of attitudes in environmental issues. In D. Albarrac, & B. T. Johnson (Eds.). *The Handbook of Attitudes: Applications*. New York: Routledge.
Milfont, T. L., & Sibley, C. G. (2012). The Big Five personality traits and environmental engagement: Associations at the individual and societal level. *Journal of Environmental Psychology, 32*(2), 187–195. https://doi.org/10.1016/j.jenvp.2011.12.006.
Milfont, T. L., & Sibley, C. G. (2016). Empathic and social dominance orientations help explain gender differences in environmentalism: A one-year Bayesian mediation analysis. *Personality and Individual Differences, 90*, 85–88. https://doi.org/10.1016/j.paid.2015.10.044.
Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The nature relatedness scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior, 41*(5), 715–740. https://doi.org/10.1177/0013916508318748.
Nordlund, M. L. (2009). *The effects of priming on personality self-reports: Challenges and opportunities* (Unpublished Doctoral dissertation) Akron, Ohio, United States of America: University of Akron. Retrieved from https://etd.ohiolink.edu/!etd.send_file?accession=akron1240857337&disposition=inline.
Räty, R., & Carlsson-Kanyama, A. (2010). Energy consumption by gender in some European countries. *Energy Policy, 38*(1), 646–649. https://doi.org/10.1016/j.enpol.2009.08.010.
Renau, V., Oberst, U., Gosling, S., Rusiñol, J., & Chamarro, A. (2013). Translation and validation of the Ten-Item-Personality Inventory into Spanish and Catalan. *Aloma: Revista de Psicologia, Ciències de l'Educació i de l'Esport, 31*(2).
Saphores, J. M., Nixon, H., Ogunseitan, O. A., & Shapiro, A. A. (2006). Household willingness to recycle electronic waste: An application to California. *Environment and Behavior, 38*(2), 183–208. https://doi.org/10.1177/0013916505279045.
Schmitt, D. P., Realo, A., Voracek, M., & Allik, J. (2009). "Why can't a man be more like a woman? Sex differences in Big Five personality traits across 55 cultures": Correction to Schmitt et al. (2008). *Journal of Personality and Social Psychology, 96*(1), 118. https://doi.org/10.1037/a0014651.
Schultz, P. W., Gouveia, V. V., Cameron, L. D., Tankha, G., Schmuck, P., & Franěk, M. (2005). Values and their relationship to environmental concern and conservation behavior. *Journal of Cross-Cultural Psychology, 36*(4), 457–475. https://doi.org/10.1177/0022022105275962.
Sundström, A., & McCright, A. M. (2013). Examining gender differences in environmental concern across four levels of the Swedish polity. *International Journal of Sociology, 43*(4), 63–86. https://doi.org/10.2753/IJS0020-7659430402.
Tam, K. (2013). Concepts and measures related to connection to nature: Similarities and differences. *Journal of Environmental Psychology, 34*, 64–78. https://doi.org/10.1016/j.jenvp.2013.01.004.
United Nations Development Programme (2011). *Human Development Report 2011 (UNDP document ISBN: 9780230363311).* New York: NY, USA.
Vecchione, M., Alessandri, G., Barbaranelli, C., & Caprara, G. (2012). Gender differences in the Big Five personality development: A longitudinal investigation from late adolescence to emerging adulthood. *Journal of Personality and Individual Differences, 53*(6), 740–746. https://doi.org/10.1016/j.paid.2012.05.033.
Vedel, A. (2016). Big five personality group differences across academic majors: A systematic review. *Journal of Personality and Individual Differences, 92*, 1–10. https://doi.org/10.1016/j.paid.2005.12.011.
de Vries, R. E. (2013). The 24-item brief HEXACO inventory (BHI). *Journal of Research in Personality, 47*(6), 871–880. https://doi.org/10.1016/j.jrp.2013.09003.
Zelezny, L. C., Chua, P. P., & Aldrich, C. (2000). Elaborating on gender differences in environmentalism. *Journal of Social Issues, 56*(3), 443–457. https://doi.org/10.1111/0022-4537.00177.
Ziegler, M., Kemper, C. J., & Kruyen, P. (2014). Short scales–Five misunderstandings and ways to overcome them. *Journal of Individual Differences, 35*(4), 185–189. https://doi.org/10.1027/1614-0001/a000148.