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Environmental sustainability and national personality

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ABSTRACT

Previous research has linked higher levels of the personality traits Agreeableness and Openness with greater concern about environmental issues. While these traits are important predictors of environmental attitudes among individuals, a growing literature has begun examining the broader consequences of population differences in personality characteristics. The present study examines whether nationally-aggregated personality traits can be significant predictors of a country's environmental sustainability. National personality scores were derived from an existing database of 12,156 respondents across 51 countries and examined in relation to each country's scores on the Environmental Performance Index, a benchmark of the sustainability of a country's environmental policies. Just as Agreeableness and Openness predict environmental concern at the individual level, countries with higher population levels of Agreeableness and Openness had significantly better performance on the sustainability index. These results remained when controlling for national differences in wealth, education, and population size and were unique to these two traits.

1. Introduction

Human behavior plays a critical role in ecological health, with individual and collective actions placing a large amount of strain on the natural environment (Gardner & Stern, 2002; Oskamp, 2000; Saunders, 2003). The long-term survival of human society requires that we adapt our individual behaviors and organizational policies to be more environmentally sustainable (Stern, 2000). Despite the importance of human action in ensuring a sustainable future, there are still large individual differences in the extent to which people are concerned about environmental issues and personally engage in environmentally sustainable behaviors (Bamberg & Möser, 2007; Dietz, Stern, & Guagnano, 1998; Dunlap, Van Liere, Mertig, & Jones, 2000; Fransson & Gärling, 1999; Milfont & Duckitt, 2004; Van Liere & Dunlap, 1980).

A variety of psychological factors play a role in shaping these individual differences: people with greater knowledge and awareness of environmental issues are more likely to act in a sustainable manner (Arcury, 1990; Hines, Hungerford, & Tomera, 1987); social and personal norms also play a role, with more salient guidelines for environmental action influencing attitudes and behavior (Bamberg & Möser, 2007; Biel & Thøgersen, 2007; Blamey, 1998; Schwartz, 1973; Wiidegren, 1998); within the rational-economic framework, the incentives associated with environmental actions are also important, with greater commitment to sustainability emerging as the degree of personal impact and perception of control increases (Ajzen, 1991; Cordano & Frieze, 2000); personal values likewise have an impact, with pro-environmental attitudes associated with higher levels of altruism and openness to change, along with lower levels of traditionalism and self-interest (Dietz, Fitzgerald, & Shwom, 2005; Schultz & Zelezny, 1999; Schultz et al., 2005; Stern & Dietz, 1994; Stern, Dietz, & Kalof, 1993).

A growing body of research has also implicated basic personality traits as a source of individual differences in environmental concern and sustainable actions (Hirsh, 2010; Hirsh & Dolderman, 2007; Markowitz, Goldberg, Ashton, & Lee, 2012; Milfont & Sibley, 2012). Much of this research has focused on the five factor model of personality, which describes variation in personal characteristics along five trait dimensions (Digman, 1990; McCrae & John, 1992): Extraversion, which reflects social potency and sensitivity to rewards (Lucas, Diener, Grob, Suh, & Shao, 2000), Agreeableness, which reflects compassion and empathic social concern (Graziano & Eisenberg, 1997), Conscientiousness, which reflects self-discipline, industriousness, and preferences for order (Roberts, Chernyshenko, Stark, & Goldberg, 2005), Neuroticism, which reflects a strong aversive response to stress and uncertainty (Hirsh & Inzlicht, 2008; Judge, Erez, Bono, & Thoresen, 2002), and Openness,

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which reflects cognitive flexibility and aesthetic interests (DeYoung, Peterson, & Higgins, 2005).

The five factor model has become the most commonly used trait framework within personality psychology, encompassing the variance associated with most other personality taxonomies (McCrae & Costa, 1987). The five major personality dimensions emerge across distinct cultures and languages (McCrae, Terracciano, Khoury, et al., 2005), have a substantial biological component (DeYoung, 2010), and are relatively stable throughout the lifespan (McCrae & Costa, 1994). An individual's standing on each of these personality trait dimensions affects a wide variety of important life outcomes, playing important roles in shaping cognition, motivation, and behavior (Ozer & Benet-Martínez, 2006; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007).

Within the environmental domain, two personality traits have emerged most consistently as predictors of environmental concern and behavior: Agreeableness and Openness (Hirsh, 2010; Hirsh & Dolderman, 2007; Milfont & Sibley, 2012; Nisbet, Zelenski, & Murphy, 2009). More agreeable individuals tend to display greater empathy and compassion, whereas less agreeable people tend to be more selfish and antisocial (Graziano & Eisenberg, 1997). The positive relationship between Agreeableness and environmental concern is consistent with research demonstrating that altruistic concerns are one of the major components of pro-environmental attitudes (Schultz, 2001). Empathic engagement with the natural world tends to promote the desire for environmental conservation as individuals become more aware of the harmful consequences of their actions (Schultz, 2000). A longitudinal analysis similarly found that higher levels of environmental engagement predicted more prosocial behavior and attitudes in a laboratory experiment two years later (Kaiser & Byrka, 2011).

More open individuals, meanwhile, tend to have greater levels of cognitive flexibility and stronger aesthetic interests (DeYoung et al., 2005; McCrae, 1994). The relationship between higher levels of Openness and more environmentally conscious behavior may be due to a number of factors. First, Openness is associated with greater cognitive ability, which may boost environmental concern through greater awareness of the long-term consequences of one's actions. Second, highly open individuals are also more open to change and self-transformation, suggesting a greater willingness to alter the status quo by adopting a sustainable lifestyle (e.g., becoming a vegetarian or vegan; Goldberg & Strycker, 2002). Third, one of the primary motivators for pro-environmental attitudes is the aesthetic value that nature provides (Kellert, 1997). Open individuals' higher levels of aesthetic appreciation may thus result in a more direct experience of nature's value and importance.

Finally, both Agreeableness and Openness influence the extent to which the natural world is regarded as part of the self-concept (Hirsh & Dolderman, 2007; Nisbet et al., 2009). The extent to which the self is regarded as part of nature or separate from it is a central issue within the deep ecology movement (Bragg, 1996; Naess, 1973), and is an important predictor of environmental attitudes (Mayer & Frantz, 2004; Nisbet et al., 2009; Schultz, Shriver, Tabanico, & Khazian, 2004). Agreeable individuals tend to be more inclusive in their self-concepts, broadening their empathic circles to include a larger community than less agreeable individuals (Graziano & Eisenberg, 1997). Openness is likewise associated with the permeability of self-boundaries, and the ease with which a rigid sense of self is transcended (McCrae, 1994). While other personality traits have also been associated with environmental concern, such as Neuroticism and Conscientiousness, these relationships have been inconsistently observed, suggesting that their impact may be moderated by some unspecified contextual variable (Hirsh, 2010; Milfont & Sibley, 2012).

While personality psychologists have traditionally examined dispositional variation in psychological characteristics among individuals, researchers have recently begun examining personality differences between entire populations of individuals (Rentfrow, Gosling, & Potter, 2008). Aggregating individual scores on personality questionnaires to a broader group of people produces reliable estimates of population-level personality traits (McCrae, Terracciano, Leibovich, et al., 2005). Although there still remains a great deal of within-population variation in these traits, such aggregation procedures have resulted in reliable personality differences being observed across different geographical regions within a single country (Rentfrow, 2010), and across nations (McCrae, Terracciano, Leibovich, et al., 2005). Population differences in personality traits could emerge from a variety of factors, including shared cultural and socioeconomic influences, selective migration, and genetic drift due to distinct selective pressures in different geographic environments (Rentfrow et al., 2008). Aggregate personality traits are in fact closely related to variation in cultural dimensions and social values (Hofstede & McCrae, 2004; McCrae, 2001). Most importantly, aggregate personality scores are effective predictors of large scale social outcomes. National personality differences, for example, are significant predictors of Gross Domestic Product, global competitiveness, and indices of human development (McCrae, Terracciano, Leibovich, et al., 2005). Regional personality differences within the United States have likewise been used to predict geographical differences in voting patterns (Rentfrow, Jost, Gosling, & Potter, 2009), well-being (Rentfrow, Mellander, & Florida, 2009), and social equality (De Vries, Gosling, & Potter, 2011).

Although population-level personality traits appear to be important predictors of various social and economic outcomes, their relation to indices of environmental sustainability remains underexplored. In recent years, a variety of metrics have been developed for benchmarking a country's effective management of its natural resources (Böhringer & Jochem, 2007; Parris & Kates, 2003). These benchmarks are important because they help to translate the goal of environmental sustainability into measurable quantitative targets, allowing for the scientific assessment of different environmental policies and initiatives (Liverman, Hanson, Brown, & Merideth, 1988). Ranking countries on their environmental performance also helps to make salient the specific challenge areas where greater attention is needed to ensure sustainability. Although the measurement of environmental sustainability is continually developing and being refined, there is nonetheless some degree of convergence among alternative indices (Siche, Agostinho, Ortega, & Romeiro, 2008; Wilson, Tyedmers, & Pelot, 2007).

Given the importance of population-level personality differences in predicting a variety of social outcomes, combined with personality's relationship with environmental attitudes and behavior among individuals, national differences in aggregated personality traits might be related to a nation's environmental sustainability. If more of a country's citizens have personality characteristics that predispose them toward an environmentally sustainable mindset, this may have implications for the environmental performance of the nation as a whole. The current study explored this possibility by examining cross-national differences in aggregated personality traits in relation to nationally-measured environmental sustainability.

Only one study has previously investigated this possibility. In addition to examining the relationship between individual personality traits and environmental outcomes in two nationally-representative samples, Milfont and Sibley (2012) also examined how nationally aggregated traits relate to country-level scores on the New Environmental Paradigm scale (Hawcroft & Milfont, 2010),

measures of environmental concern, the perceived value of environmental harmony, and ratings of environmental sustainability. This research provided an important contribution, including the largest sample to date in which the relationship between individual personality characteristics and environmental outcomes has been examined. Nonetheless, the country-level analysis had three key limitations. First, the analysis did not control for any potentially confounding variables. For example, national sustainability has been linked to differences in national wealth, education level, and population size (Esty, Levy, Srebotnjak, & De Sherbinin, 2005; Ostman & Parker, 1987; Shi, 2003), but none of these variables were entered as covariates in the previous analysis. This is particularly important given the relationships between these variables and national personality (McCrae, Terracciano, Leibovich, et al., 2005), making them potential confounds. Second, although the individual-level studies conducted by Milfont and Sibley (2012) featured multivariate analyses, their country-level study was examined only with zero-order correlations. Personality traits are known to correlate with one another (Digman, 1997), so it is important to examine their effects while controlling for their relationships with one another. While the previous analysis identified significant effects for four of the five major personality dimensions, this did not take into account the covariance amongst personality traits. Finally, the previous analysis was based on national sustainability measures from 2010. Sustainability metrics are constantly improving, and more updated indices might produce distinct results. More importantly, however, the previous analysis had a 6–8 year gap between the assessments of sustainability and national personality, which may have influenced the observed relationships.

The current analysis extends the previous work on this topic by examining the relationship between nationally-aggregated personality traits and environmental sustainability while addressing the above limitations. Because Agreeableness and Openness are the most consistent personality trait predictors of environmental concern among individuals (Hirsh, 2010; Hirsh & Dolderman, 2007; Milfont & Sibley, 2012; Nisbet et al., 2009), it was hypothesized that populations with higher levels of Agreeableness and Openness would similarly be characterized by more sustainable environmental policies.

2. Methods

2.1. National personality data

Nationally-aggregated personality scores were obtained from the Personality Profiles of Cultures Project (McCrae, Terracciano, Leibovich, et al., 2005). This database reports population-level scores on each of the five major personality trait dimensions for 51 national cultures and has been used in previous work examining environmental outcomes (Milfont & Sibley, 2012). A total of 12,156 participants provided personality ratings of a native-born citizen of their country whom they knew well, thus reducing pressures for socially desirable responding. Ratings were assessed using the 240-item NEO-PI-R, which is among the most reliable and well-validated measures of the five factor model of personality (Costa & McCrae, 1992). Each country had personality ratings from an average of 238 respondents (SD = 137, $Range$ = 106–919), which were then aggregated to create national-level personality scores for each of the five trait dimensions. These aggregate scores showed good convergent and divergent validation with related culture-level constructs (McCrae, Terracciano, Leibovich, et al., 2005). Demographic characteristics of respondents were broadly representative of their host cultures and are available in McCrae, Terracciano, Khoury, et al. (2005). The majority of the personality data was assessed between 2002 and 2004.

2.2. Environmental sustainability data

In order to assess the environmental sustainability of each country, scores were obtained from the Environmental Performance Index (EPI; Emerson et al., 2012). The EPI is a measure of national environmental sustainability developed by Yale University's Centre for Environmental Law and Policy and Columbia University's Centre for International Earth Science Information Network. Serving as the successor to the earlier Environmental Sustainability Index (Esty et al., 2005), the EPI was designed to quantify a nation's environmental performance, as reflected in their environmental policy choices. Because each nation faces a unique set of environmental challenges, the EPI scores are calculated from 22 environmental indicators across 10 distinct policy categories: environmental health, water (effects on human health), water resources (ecosystem effects), air pollution (effects on human health), air pollution (ecosystem effects), biodiversity and habitat, forests, fisheries, agriculture, and climate change. The EPI serves as a useful benchmark for a nation's overall effectiveness at handling environmental issues in a sustainable manner because it assesses environmental indicators across a variety of domains, including CO_2 emission levels, use of renewable energy, and pesticide regulation, among others (for further details, see Emerson et al., 2012). EPI Scores are based on the relative performance of each nation across the environmental indicators. Retroactively computed EPI scores for 2002, 2003, and 2004, based on the 2012 EPI formula, were averaged together in order to match the time period during which the personality assessments were made.

3. Results

3.1. Environmental sustainability and national personality

Of the 51 cultures for whom aggregate personality scores were reported in McCrae, Terracciano, Leibovich, et al. (2005), 46 nations also had EPI scores available. All analyses were conducted on this subsample of countries. Country-level personality scores for each of the five trait dimensions were correlated with the average of the EPI values from 2002, 2003, and 2004. Environmental sustainability was significantly positively correlated with national levels of Agreeableness ($r = .42$, $p < .01$) and Openness ($r = .49$, $p < .01$), but showed no relationship with Conscientiousness ($r = .07$, $p > .05$), Extraversion ($r = .29$, $p > .05$), or Neuroticism ($r = .14$, $p > .05$). A bootstrapped correlation analysis with 5000 resamples confirmed the robustness of these results, as significant effects were again observed for Agreeableness (95% BCa CI from .11 to .67) and Openness (95% BCa CI from .25 to .67), but not for any of the other three traits. Figs. 1 and 2 show the scatterplots of EPI scores and national levels of Agreeableness and Openness, respectively.

In order to examine whether national levels of Agreeableness and Openness are both unique predictors of environmental sustainability, a simultaneous regression was conducted predicting EPI scores from these two traits. The overall regression equation predicted a significant amount of variance in EPI scores, $R^2 = .31$, $F(2,43) = 9.53$, $p < .01$. Significant unique effects were also observed for both Agreeableness ($\beta = .28$, $t(43) = 2.08$, $p < .05$) and Openness ($\beta = .39$, $t(43) = 2.89$, $p < .01$). A bootstrapped regression analysis with 5000 resamples again revealed the robustness of the relationships for Agreeableness (95% BCa CI from 0.01 to 2.74) and Openness (95% BCa CI from 0.59 to 2.92).

Adding the remaining three personality traits into the regression model in a second block failed to account for any incremental variance in EPI scores, R^2 Change = .06, $F(3,40) = 1.29$, $p = .29$. When all five traits were entered simultaneously, however, only Openness remained a significant predictor ($\beta = .47$, $t(40) = 3.30$,

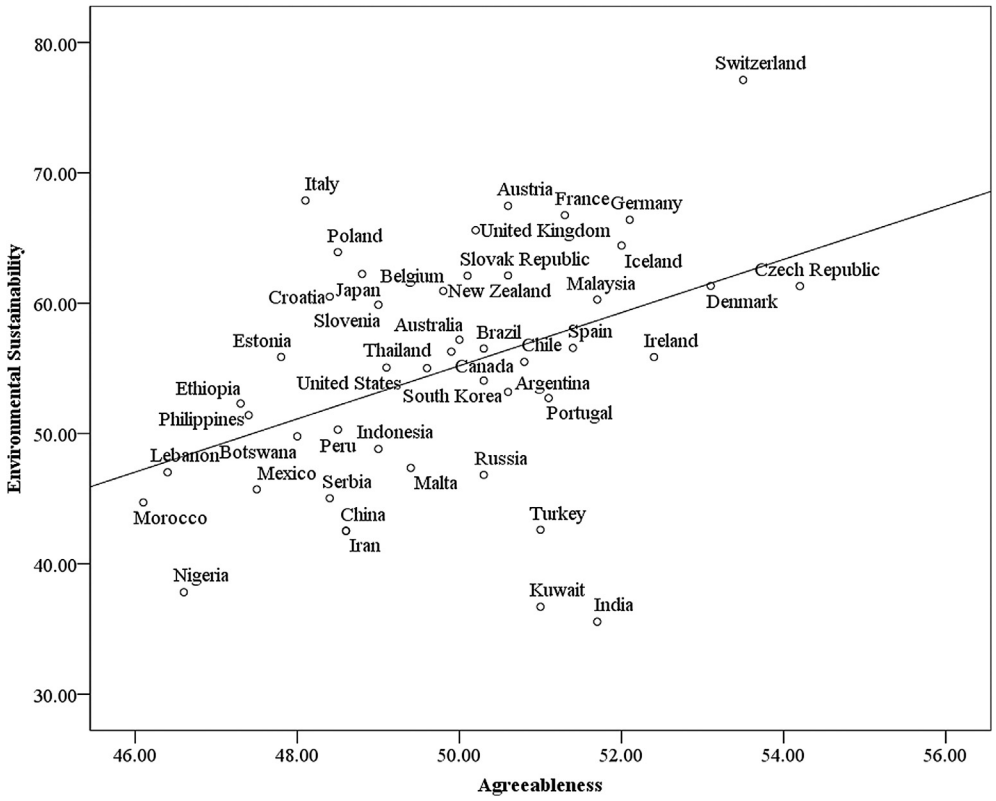

Fig. 1. Environmental Performance Index scores as a function of nationally-aggregated Agreeableness.

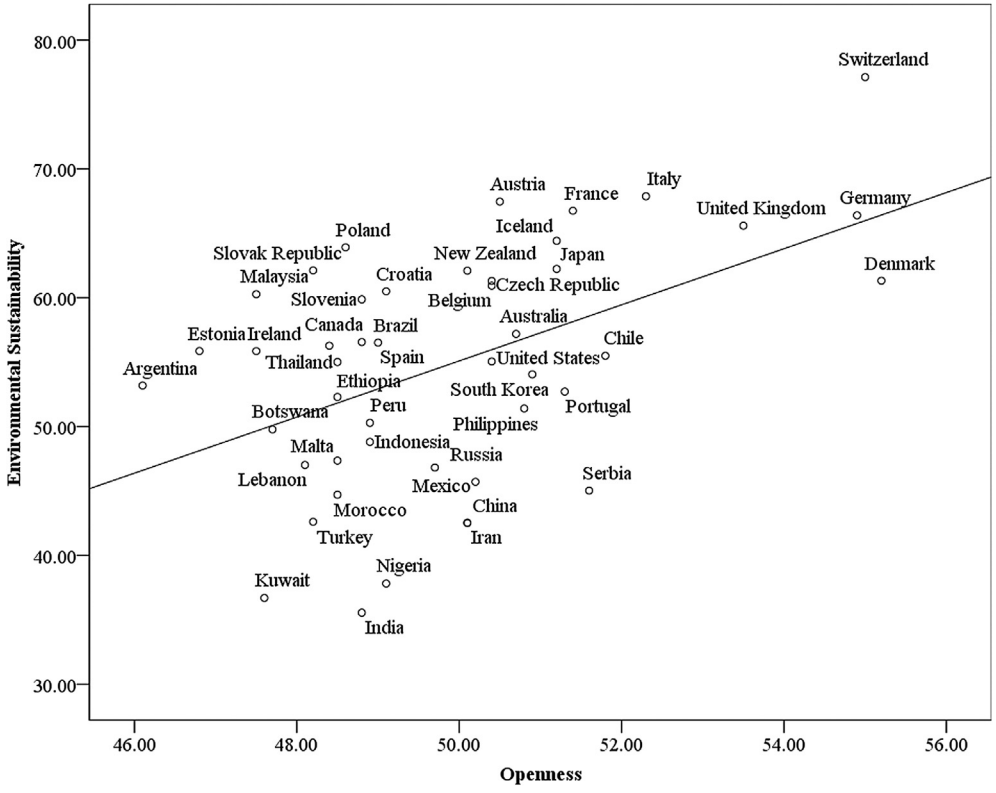

Fig. 2. Environmental Performance Index scores as a function of nationally-aggregated Openness.

$p < .01$; 95% BCa CI from 0.79 to 3.44). By contrast, no significant effects were observed for Agreeableness ($\beta = .13$, $t(40) = 0.79$, $p > .05$; 95% BCa CI from −1.06 to 2.09), suggesting that the predictive variance had been spread across the other variables. Non-significant relationships remained for Extraversion ($\beta = .25$, $t(40) = 1.78$, $p > .05$; 95% BCa CI from −0.09 to 1.56), Neuroticism ($\beta = .12$, $t(40) = 0.89$, $p > .05$; 95% BCa CI from −1.02 to 2.08), and Conscientiousness ($\beta = -.06$, $t(40) = -0.46$, $p > .05$; 95% BCa CI from −1.57 to 0.89).

3.2. Effects on specific domains of sustainability

Given that environmental sustainability is a multifaceted construct, an additional analysis was conducted to examine the relationships between personality and more specific dimensions of environmental performance. Table 1 presents the zero-order correlations with bootstrapped confidence intervals between national personality scores and each country's rating on the ten indicator categories that comprise the EPI. Across diverse indicators of environmental sustainability, Openness was the most consistent predictor, significantly relating to 6 out of 10 of the sustainability sub-domains, with significant one-tailed effects in 2 additional domains. Agreeableness was the next most common predictor, with 5 significant two-tailed associations and 1 significant one-tailed association. Extraversion, meanwhile, demonstrated 3 significant associations, while Neuroticism displayed 1 significant relationship. No significant effects were observed for Conscientiousness. Both Agreeableness and Openness predicted sustainability outcomes across a broad spectrum of domains. Extraversion, by contrast, was only related to the three EPI categories that assess the effects of the environment on human health.

3.3. Controlling for alternative explanations

While higher levels of national Agreeableness and Openness were correlated with better overall environmental sustainability, it is possible that some third factor might account for these relationships. To assess this possibility, a partial correlation analysis was conducted while statistically controlling for some potentially confounding variables. These variables included national wealth, as reflected in the United Nation's Human Development Index for Income; education level, as reflected in the United Nation's Human Development Index for Education; and a country's overall population size. All three of these variables have previously been related to indices of environmental impact (Esty et al., 2005; Ostman & Parker, 1987; Shi, 2003). Averaged data from 2002 to 2004 was used to reflect the state of these variables at the time that the personality and environmental sustainability assessments were made. In the case of the Human Development Index, the 2002 to 2004 data was extracted from the 2004 to 2006 reports. Population size was log-transformed to normalize the variable distribution. In addition to these demographic and economic factors, Acquiescence scores from the national personality database were included as a covariate to control for cross-national differences in scale usage that might have affected the results. These scores reflect the extent to which respondents in different nations simply indicated agreement with the personality items, regardless of their content (Smith, 2004).

Controlling for these variables had no effect on the initial pattern of results. As expected, better environmental sustainability scores were again associated with higher levels of national Agreeableness ($r = .31$, $p < .05$) and Openness ($r = .40$, $p < .05$). No other traits demonstrated any significant relationship with environmental sustainability (all $ps > 0.2$). A bootstrapped partial correlation analysis with 5000 resamples again confirmed the robustness of the relationships for Agreeableness (95% BCa CI from .02 to .52) and Openness (95% BCa CI from .13 to .59), but not for Extraversion ($r = -.17$; 95% BCa CI from −.47 to .11), Conscientiousness ($r = .08$; 95% BCa CI from −.26 to .45), or Neuroticism ($r = .15$; 95% BCa CI from −.23 to .50). The relationships between a country's environmental sustainability and national levels of Agreeableness and Openness thus cannot be explained by national differences in wealth, education, population size, or biases in personality scale usage.

4. Discussion

Using a large international dataset, nationally-aggregated personality traits were found to be significantly related to a nation's environmental sustainability. In particular, countries with higher aggregated population levels of Agreeableness and Openness had significantly higher scores on the Environmental Performance Index. At the national level, Agreeableness and Openness were thus associated with more sustainable environmental policies across a variety of specific indicators. Simultaneous regression analysis revealed that both of these traits were independent predictors of sustainability outcomes, and bootstrapped analyses confirmed that the effects were not driven by outliers. These effects also could not be accounted for by national differences in wealth, education, population size, or biases in scale usage. No other personality traits showed significant relationships with overall environmental performance. Although Extraversion showed a trend toward significance at the zero-order level, this relationship weakened (and even changed direction) after controlling for other cross-national factors. The relationship between Extraversion and the EPI's health-related indicators reported in Table 1 thus appears to be due to the strong

Table 1
Correlations between big five traits and EPI categories (95% bootstrapped CIs in parentheses).

	E	A	C	N	O
Overall EPI scores	.29 (−.04, .54)	**.42*** (.11, .68)	.07 (−.28, .38)	.14 (−.17, .42)	**.49*** (.24, .67)
Air pollution effects on human health	**.53*** (.32, .71)	**.36*** (.05, .64)	.03 (−.31, .35)	**.31*** (.04, .56)	**.34*** (.12, .54)
Water effects on human health	**.50*** (.25, .73)	**.49*** (.22, .69)	.19 (−.15, .46)	.24 (−.04, .48)	**.35*** (.15, .51)
Environmental burden of disease	**.45*** (.21, .68)	**.48*** (.20, .68)	.22 (−.18, .51)	.19 (−.08, .41)	**.35*** (.18, .52)
Air pollution effects on ecosystem	.04 (−.30, .33)	.25 (−.05, .52)	−.06 (−.32, .21)	.13 (−.15, .40)	**.36*** (.01, .62)
Water effects on ecosystem	.08 (−.19, .32)	.23 (−.07, .48)	.05 (−.21, .31)	−.01 (−.28, .24)	.06 (−.20, .31)
Biodiversity and habitat	−.07 (−.42, .25)	.12 (−.23, .42)	−.05 (−.38, .29)	.11 (−.37, .17)	**.29*** (−.03, .58)
Forests	.13 (−.20, .46)	.24 (−.02, .48)	.12 (−.19, .44)	.09 (−.26, .46)	.28 (.03, .50)
Fisheries	−.20 (−.45, .04)	**−.38*** (−.62, −.08)	.02 (−.27, .29)	.27 (−.04, .53)	**−.35*** (−.60, −.01)
Agriculture	−.13 (−.42, .22)	**−.32*** (−.54, −.10)	−.16 (−.43, .16)	−.05 (−.34, .25)	−.27 (−.51, −.02)
Climate change	−.20 (−.47, .08)	−.20 (−.47, .15)	−.07 (−.37, .33)	−.05 (−.34, .27)	−.04 (−.28, .23)

Notes. E = Extraversion; A = Agreeableness; C = Conscientiousness; N = Neuroticism; O = Openness.
*$p < .05$.

association of this trait with national factors such as income and education (McCrae, Terracciano, Leibovich, et al., 2005).

Agreeableness and Openness are the two most consistently observed personality trait predictors of pro-environmental attitudes and behavior (Hirsh, 2010; Hirsh & Dolderman, 2007; Milfont & Sibley, 2012; Nisbet et al., 2009). The fact that these same two traits predict environmental outcomes at the national level provides additional evidence for their importance, while generalizing their potential impact to a much larger scale. Agreeable individuals are known to be caring and empathic, characterized by a more encompassing sense of self and community (Graziano & Eisenberg, 1997). Open individuals, meanwhile, tend to have greater cognitive flexibility, a deeper aesthetic engagement with nature, and more permeable self-concepts (McCrae, 1994). One consequence of these characteristics is a pre-disposition for pro-environmental attitudes and behavior.

At the aggregate level, higher national scores on these traits indicate that the population as a whole is characterized by relatively higher Agreeableness and Openness scores. Individual citizens within these countries are thus more likely to display empathy, aesthetic interest, and cognitive flexibility. More agreeable and open populations should thus be characterized by a greater public desire for environmental sustainability. To the extent that the motives of individual citizens play a role in shaping public policy, variations in personality characteristics within a society should have an impact on government actions. Indeed, personality characteristics have been shown to influence support for various political agendas at both the individual and aggregate levels (Hirsh, DeYoung, Xu, & Peterson, 2010; Jost, Nosek, & Gosling, 2008; Rentfrow, Jost, et al., 2009). An emerging research literature suggests that personality differences at the population level can predict a broad variety of social and economic outcomes (McCrae, Terracciano, Leibovich, et al., 2005; Rentfrow, 2010). It should be noted, however, that population differences in basic personality traits are not set in stone, and can change substantially over time as a result of cultural and economic changes, or selective migration (Rentfrow et al., 2008; Twenge, 2001).

One implication of this research is that personality differences may play a larger role in predicting environmentally sustainable behavior than previously realized. Although individual actions have a substantial impact on the environment, collective policies and organizational actions have much larger consequences (Stern, 2000). The present research suggests that the personality profiles of individuals within a larger social structure can nonetheless influence the policies that are adopted by that society (cf. Schneider, 1987). Personality differences may thus affect environmental actions not only through individual choices, but also by shaping collective policy. At the societal level, some plausible mechanisms by which a population's personality characteristics might influence national environmental performance include a heightened support and demand for political candidates with more progressive environmental policies; the mobilization of political will to encourage regulatory bodies to take action on environmental challenges; or the prioritization of environmental issues as relatively more important among more open and agreeable nations.

While these explanations focus on collective political action, it is also possible that the reported relationships may be influenced by the aggregate effects of individual behaviors. In particular, more open and agreeable populations will feature a larger number of individuals who are motivated to engage in environmentally-responsible behaviors (e.g., reducing one's carbon footprint or supporting organizations that follow sustainable practices). The aggregate effect of these individual actions may contribute to national differences in environmental sustainability as reflected in the EPI scores. An important goal for future research will be to identify the specific behaviors and pathways through which a population's personality characteristics can influence environmental sustainability at a national level.

Because the observed relationships are correlational, it is worth discussing the likely causal direction of the effects. The mechanisms described above are focused on explaining the causal influence of personality traits on a nation's environmental performance. An alternative interpretation of the results could reverse this relationship, such that a nation's environmental performance has a causal influence on the personality characteristics of its citizens. This causal direction is unlikely, however, given the lack of plausible mechanisms by which national environmental performance could influence individual personality traits. Another interpretation is that a third variable might influence both the personality characteristics and environmental performance of a nation. While this remains a possibility, the current study has ruled out the most likely confounds, including differences in national wealth, education, and population size. Given that the aggregate-level relationships mirrored those observed at the individual level and could not be accounted for by key national differences, the most likely interpretation of the observed effects is that personality traits do indeed have a causal impact on environmental performance.

Although the current research provides an important extension of the existing literature on personality and environmental concern, there are still some limitations to the current study and many questions that remain open for future research. First, the use of archival data limited the analysis to a subset of 46 nations for whom both EPI and personality data was available. Data from additional countries may become available with time, allowing for a broader test of the observed relationships. Second, focusing on nationally-aggregated personality traits ignores the considerable amount of within-nation variability in these characteristics. Future research could examine whether population levels of Agreeableness and Openness are related to environmental sustainability at smaller geographic scales, such as among states or cities. Third, the cross-sectional nature of the present study makes it difficult to assess how national personality and environmental performance may change over time. Given the apparent role of Agreeableness and Openness in shaping environmentally sustainable attitudes and behavior, an important question for future research is how to promote the development of these personality characteristics on a large scale. Fourth, the measurement of environmental sustainability is a complex and multifaceted endeavor, with many challenges and limitations (Esty et al., 2005; McCool & Stankey, 2004). Nonetheless, the EPI has been under development for a decade, and appears to provide a useful index of cross-national differences in sustainable policies. Finally, the current study looked only at the main effects of national personality on environmental sustainability, but there may still be unidentified factors that moderate these relationships. Identifying these potential factors could be facilitated by investigations into contextual variables that might influence the reported relationships.

Overall, the current study provides evidence that population differences in basic personality traits are related to national differences in environmental sustainability. Although previous research on this topic identified effects for 4 of the 5 major personality dimensions (Milfont & Sibley, 2012), an updated analysis with EPI data from the same time period as the personality assessments resulted in significant effects being observed only for Agreeableness and Openness – the same two traits that best predict environmental concern at the individual level. Just as individuals who are more agreeable and open tend to report more pro-environmental attitudes and behaviors, countries with more agreeable and open citizens tend to adopt more sustainable environmental policies. Personality characteristics thus appear relevant

not only for understanding environmental sustainability at the individual level, but also at the broader societal level.

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