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**Openness is related to pro-environmental behaviour both within and across
families**

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Abstract

Environment-friendly behaviors may be desirable in helping to solve world-wide ecological issues. This has sparked interest in the associations of such behaviors with established psychological constructs such as the Five-Factor Model personality traits. Of these, Openness has been most consistently linked with pro-environmental behavior, yet the extent of causality in this association is unclear. Using a sample of 168 individuals, including 84 sibling pairs, the present study replicated the association while controlling for factors in which families differ (environmental factors that siblings share and a proportion of genetic variance). Pro-environmental behavior was correlated with Openness ($r = .51$) and the association could be observed both between ($r = .57$) and within families ($r = .29$), with adjustments for various demographic variables. These findings indicate that more open individuals tend to engage in pro-environmental behaviors, even when controlling for possibly confounding factors shared and not shared between siblings.

Keywords; Openness; personality; pro-environmental; sibling differences; confound

Openness is related to pro-environmental behavior both within and across families.

The impact of detrimental human behaviors on the environment is an issue of global importance; behaviors related to energy use, transportation, waste and diet can all contribute to climate change (Intergovernmental Panel on Climate Change, 2013). Clarifying the underlying mechanisms of environment-related behaviors could therefore have implications for moving towards a more sustainable world. For this reason, psychologists attempt to find factors associated with engaging in pro-environmental behavior (PEB). For example, moral responsibility, social norms, self-efficacy, attitudes, and behavioral intention have been investigated in relation to PEB (e.g., Bamberg & Möser, 2007).

Several studies have also linked pro-environmental attitudes and beliefs with the Five-Factor Model (FFM) personality dimensions: a set of traits tailored to summarize individual differences in a wide range of psychological characteristics. Hirsh and Dolderman (2007) reported that environmental connectedness and attitudes were positively correlated with Agreeableness and Openness domains of the FFM. In two studies, Nisbet, Zelensky and Murphy (2009) investigated links between the FFM domains and the degrees to which individuals felt affectively, cognitively and experientially related to the nature: among the sporadic patterns of associations, relatedness to nature was more consistently linked with high Openness and Agreeableness. In a longitudinal study, Hirsh (2010) found that environmental concern was associated with higher levels of Neuroticism, Conscientiousness, Agreeableness and Openness. Milfont and Sibley (2012) measured the value of protecting the environment in a large sample of New Zealanders and found it to be correlated with higher levels of

Agreeableness, Openness and Conscientiousness and lower levels of Neuroticism; they also found country-level environmental attitudes to be linked with country-level FFM scores, most notably Openness. Soliño & Farizo (2014) linked FFM personality domains with preferences for forest management programs and found Openness and Extraversion to have positive and Neuroticism and Agreeableness negative associations with pro-environmental preferences.

While these studies are informative regarding the personality correlates of environmental engagement, they measure attitudes rather than behavior *per se*. According to a meta-analysis (Bamber & Möser, 2007), attitudes only account for 18% of variance in behavior, so the two are far from being identical phenomena. In one of the few attempts to directly link the FFM personality domains with PEB, Milfont and Sibley (2012) found that retrospective self-reports of electricity conservation behavior were linked with higher Agreeableness, Conscientiousness and Neuroticism, but not with Openness and Extraversion. However, Markowitz, Goldberg, Ashton and Lee (2012) found that Openness was the most consistent predictor of PEB across four different personality inventories. Brick and Lewis (2016) investigated HEXACO personality traits (FFM domains plus a trait called Honesty-Humility; Ashton, & Lee, 2007) in relation to emissions-reducing behaviors and found links with Extraversion, Openness and Conscientiousness. Also employing the HEXACO model, Hilbig, Zettler, Moshagen and Heydasch (2013) found in two studies that PEB was associated with several of the traits, with the associations being consistently the strongest for Honesty-Humility and Openness.

Based on these findings, Openness emerges as the FFM personality domain that has most consistently been associated with PEB. Openness encompasses a collection of traits that represent seeking and enjoying diverse cultural, intellectual and emotional experiences, vivid imagination and liberal values. As Brick and Lewis (2016) note, unconventional, intellectual and abstract thinking associated with this trait may potentially help individuals to envisage the long-term damage of detrimental behavior, and these traits may also entail willingness to change one's ways to address the negative environment-related outcomes. Therefore, the present study specifically focused on Openness in relation to PEB, aiming to replicate and extend the past results.

In particular, the present study probes the extent to which the Openness-PEB link could, at least in principle, be considered causal. Existing studies have examined correlations between traits and behaviors, without necessarily controlling for environmental and genetic effects that could influence both environment-related behavior and personality traits, and thereby confound their association. To mitigate this, the present study used a sibling-comparison design, wherein *differences between siblings of the same family* are investigated. This approach allowed us to control for variance arising from environmental differences between parental families (Lahey & D'Onofrio, 2010). These include parental socioeconomic status, attitudes and practices related to environment, alongside any downstream consequences of these variables, and other common-to-siblings childhood influences such as local community and neighborhood (and their environment-related traditions, policy and regulations), often-shared friends, role models, and school environment. It is entirely possible that the associations between personality traits and pro-environmental behaviors are at least partly confounded by

experiences that families differ in. For example, there are systematic geographic variations within nations and even within cities in personality traits (e.g., due to people with particular traits being more likely to settle in areas that help to fulfil their personality-related ambitions; Jokela, Bleidorn, Lamb, Gosling, & Rentfrow, 2015) and areas also vary in PEB-related values, traditions, policies and regulations.

Because siblings are also more genetically similar than unrelated individuals, the design reduces the possibility that the Openness-PEB association is confounded by overlapping genetic influences and genetically mediated environmental experiences (due to gene-environment correlations, whereby people tend to experience environments that match their genetic predispositions). It has been argued that many associations among psychological-behavioral phenomena could be partly genetically confounded because most behavioral characteristics are to some extent heritable, and (indirect) genetic influences tend to be general across wide ranges of psychological phenomena (Turkheimer & Harden, 2014; Turkheimer, Pettersson, & Horn, 2014; Lo et al., 2017; Mõttus et al., 2017). Of course, any non-twin siblings are not genetically identical, as they only share about 50% of their segregating genetic material. Therefore, such sibling comparisons cannot fully control for genetic confoundedness of associations. But to the extent that genetic influences on the traits at hand are not entirely non-additive (whereby there is limited similarity at the phenotypic level among siblings who are not genetically identical), sibling comparisons can substantially reduce the genetic confounds.

We hypothesized that Openness would be correlated with PEB even when controlling for environmental factors shared by siblings and part of genetic influences on the phenomena. That is, we expected differences within families (between sibling pair

members) in Openness to be correlated with PEB; by investigating differences between siblings, we could control for many factors that families which people come from differ in, because much of between-family variation has been removed from these analyses. Additionally, like some previous studies (e.g., Brick & Lewis, 2016), we aimed to control for a range of factors related to individuals' *current* situations, which siblings may not have in common (e.g., education, socioeconomic status and country of residency) but which are likely to correlate with pro-environmental behavior (Scott & Willits, 1994; Chen et al., 2011).

In subsequent robustness analyses, we explored whether the effect generalized across different facets of Openness, which is a necessary precondition for the effect to be interpretable as pertaining to Openness (Möttus, 2016). For example, Markowitz et al. (2012) showed that the strongest associations for Openness facets involved appreciation of aesthetics and the natural world, and intellectual curiosity. Should the association between Openness and PEB be driven by only one or a few facets of the personality trait, its interpretation is not be generalized to Openness but focused at the level of relevant facet(s) (Möttus, 2016).

Methods

Participants

Participants were 205 individuals (age range from 18 to 54, $M = 22.7$, $SD = 6.80$; 129 females) currently living in 14 different countries, mainly the UK ($n = 169$); the other countries were the US ($n = 9$), Australia ($n = 7$), Canada ($n = 7$), France ($n = 2$), Italy ($n = 2$), New Zealand ($n = 2$), Germany ($n = 1$), Ireland ($n = 1$), Lithuania ($n = 1$), the

Netherlands ($n = 1$), Norway ($n = 1$), Pakistan ($n = 1$) and Switzerland ($n = 1$). The 205 individuals included 84 sibling pairs, of which 53 were same-sex pairs; in our analyses, we focused on the 168 individuals comprising 84 sibling pairs, leaving out those participants without information about their sibling.

Based on prior to data collection power analyses with a single effect size (i.e., the relationship between Openness and education) estimate of $r = .25$ and intended power of about 70% (or an effect size of $r = .28$ and power of about 80%), the sample was intended to include about 95 sibling pairs. Such effect sizes were expected because the above-discussed studies have reported correlations in .20s and sometimes in .30s. However, siblings of several participants failed to complete the survey, and these data points were excluded from the analysis, leaving us with a sample of 168 individuals from 84 sibling pairs. Based on post-data collection power analyses, data from 84 sibling pairs allowed us to detect a sibling-difference correlation of $r = .30$ with a power of 79% or an association of $r = .25$ with 63% power.

Data were collected via an online questionnaire, the link to which was shared in social media, mainly through Facebook groups or profiles, targeting biological siblings of any social background. Participants were given full information about the study on the first page of the link and then asked to give their consent before proceeding. Participants were also required to provide a pseudonym which both they and their brother or sister would share, so they could be identified as siblings while remaining anonymous.

Measures

The online self-report questionnaire contained sections for demographic information (gender, age, current years of education, country of residence, and current socioeconomic

status [SES]), PEB, and Openness, presented in this order. For statistical analyses, country of residence was coded as UK vs other countries, and gender was coded as 1 for female, and 0 for male. SES was measured by asking respondents to indicate where they would place themselves on a numbered socioeconomic ladder image, an illustration of MacArthur's Scale of Subjective Social Status (Adler & Stewart, 2007). Education was quantified as the number of years participants had experienced formal education.

PEB was assessed with 32 items (Appendix A), some of which were taken from Student Environmental Behavior Scale (Markowitz et al., 2012) and from Brick and Lewis' (2016) emissions-reducing behaviors. The items were intended to be suitable for a young UK population (e.g., we discarded items pertaining to private transport such as "How often do you drive slower than 60mph on the highway?", but included items pertaining to recycling such as "I use the recycling facilities available to me to their fullest extent"). The items were rated on a 6-point Likert-type scale, ranging from *strongly agree* to *strongly disagree*.

Openness was measured with the 60-item Openness scale of the International Personality Item Pool (IPIP; Goldberg, 1999), a public domain version of Costa and McCrae's (1992) NEO Personality Inventory (Costa & McCrae, 1992), which is a golden standard FFM questionnaire. There were 10 items per each Openness facet, yet due to a questionnaire setup error, the Imagination facet was assessed with 8 items instead of 10. Openness items were rated on the same 6-point scale as PEB items. The Cronbach's alphas for the PEB measure and Openness were .90 and .92, respectively, whereas the alphas ranged from .82 to .88 for the Openness facets. Both Openness and PEB scores were near-normally distributed (according to Shapiro-Wilk Normality Test, hypothesis of

the non-normality of distribution could not be rejected in either case, with $p = .212$ and $p = .737$, respectively). However, the distributions deviated from normality for all facet scores ($p < .05$).

In accordance with the standard disclosure endorsed by the Center of Open Science, we confirm that all measures and data exclusions have been reported, and that the sample sizes were determined as stated in the methods.

Results

Data were analyzed using R statistical software (R Core Team, 2017); the main analyses constituted multi-level regressions carried out with the lmer package (Bates et al., 2015).

First, we performed a multi-level regression wherein PEB scores were predicted from Openness (both standardized across the whole sample; $M = 0$, $SD = 1$), age, gender, SES, educational level and current country of residence, allowing for random intercept for sibling pairs to account for dependencies in data due to shared family. The standardization of PEB and Openness variables rendered regression coefficient (b) interpretable in the correlation metric (Table 1). Figure 1 shows a basic scatterplot depicting the relationship between Openness and PEB before standardization. PEB was significantly associated with Openness ($b = .51$, $p < .001$) and additional years of age ($b = .03$, $p = .002$), but not with being a female ($b = .21$, $p = .123$), higher educational level ($b = .02$, $p = .279$), SES ($b = -.01$, $p = .903$) or living in the UK ($b = -.09$, $p = .589$). Likewise, all six Openness facets were significantly linked with PEB (Table 1), with coefficients at least .40 for four of them (Artistic Interests, Adventurousness, Intellect and

Liberalism, $p < .001$) but somewhat smaller for the remaining two facets, Emotionality and Imagination ($b \geq .18, p < .050$).

Next, we correlated the main variables between sibling pair members: PEB, Openness and two of its facets showed significant positive sibling correlations ($r = .21$ to $.33, p < .05$), whereas four facets showed non-significant (albeit often marginally significant with $p < .1$) positive correlations ($r = .07, .17, .19, \text{ and } .20$). Thus, there was a general tendency for siblings to be similar in these variables and this could have, in principle, confounded the PEB-Openness associations.

Therefore, in the next multi-level regression model, individual participants' PEB scores were predicted from their sibling pair mean Openness scores and individuals' deviations from their sibling pair means, alongside age, gender, SES, educational level and current country of residence. Siblings' Openness scores had been standardized before calculating pair means, and the pair means and within-pair deviations were standardized again across the sample such that their regression coefficients would be in the correlation metric. Again, random intercepts were allowed for sibling pairs to account for the family structures. The regression coefficient for sibling pair mean Openness quantified the PEB-Openness association due to factors in which families differed: that is, factors in which siblings of the same family were alike (shared genetic and environmental influences) as opposed to their distinctive characteristics and experiences. In contrast, the coefficient pertaining individuals' deviations from their sibling pair means in Openness quantified the PEB-Openness association due to factors in which siblings of the same family were different; this within-family regression coefficient thus controlled for family-level confounding factors (Turkheimer & Harden, 2014). We expected the latter associations to

remain positive and significant, indicating that PEB-Openness association was not due to confounding factors shared by siblings.

This hypothesis was confirmed (Table 2). Sibling pair mean Openness scores were significantly associated with PEB ($b = .57, p < .001$), as were differences between the siblings' Openness scores ($b = .29, p < .001$); note however that the within-family association was weaker. In this model, too, higher age was linked with higher PEB ($b = .03, p = .002$), but no other co-variate. Positive between-family associations with PEB did not generalize equally to all facets of Openness, with the link being non-significant albeit positive for Emotionality ($b = .08, p = .228$) and Imagination ($b = .12, p = .061$) facets and the strongest for Artistic Interest ($b = .26, p < .001$) and Intellect facets ($b = .31, p < .001$). However, the general trend was evidently not driven by only one or two facets and it therefore seems appropriate to interpret the Openness-PEB link at the level of the Openness domain *per se*.

Discussion

We replicated the previously documented association between the personality trait of Openness and engagement in pro-environmental behaviors (e.g., Brick & Lewis, 2016; Hilbig et al., 2013; Markowitz et al., 2012). We extended previous research by comparing these variables within families: did more open siblings also display more pro-environmental behavior than their less open co-siblings? Siblings are likely to share a range of influences such as parental or other common childhood experiences (e.g., schools, friends, role models, communities) and a part of their segregating genetic variants, and these shared influences can confound the associations between personality traits and other variables (e.g., Turkheimer et al., 2014; Mõttus et al., 2017). Results from

our within-family comparison analyses suggest that the PEB and Openness association is unlikely to be entirely confounded by the influences that siblings share. This is because significant correlations between Openness and PEB could be observed both between and within families. Furthermore, the association was not confounded by concurrent demographic factors such as age and gender (which correlated with PEB), and education, SES, or country of residence (which did not even correlate significantly with PEB).

Strengths and Limitations

By using the sibling-comparison design, we could *partially* control for genetic and non-genetic confounds shared between siblings; this had never been done before in exploring the link between personality and PEB. Such confounds could include anything in childhood environment that siblings experienced alike and genetic influences and environmental influences (in childhood or later life) that were aligned with genetic factors (e.g., due to people selecting environments that match their characteristics). The importance of such a design was highlighted by sibling-similarities in Openness and PEB, which could have indicated shared underlying influences on these factors.

However, we should emphasize that the design could not control for all possible confounding factors. For example, non-identical siblings still differed genetically, and these non-shared genetic influences may have confounded Openness-PEB associations. Likewise, the within-family design could not control for experiences not shared by siblings, either in childhood or later life. We could control for part of these by including age, gender, educational level, self-rated socioeconomic status and current residency as co-variants in our models, but there may have been confounding factors not captured by

these co-variates; ideally a larger range of concurrent environmental factors could have been used.

The creation of our own questionnaire to measure PEB allowed us to adapt items to the context of our participants. Moreover, the 32 items covered various aspects of PEB, whereas some other studies (e.g., Markowitz et al., 2012) had used far fewer comprehensive measures of the phenomena. This could explain why in their second study, Milfont and Sibley (2012) found an insignificant association between Openness and electricity conservation behavior, as this measure of PEB only reflects one aspect of pro-environmentalism. Additionally, the items of our PEB measure referred to specific behaviors rather than beliefs or attitudes, which could reduce the risk of content overlap with Openness items. This contradicts results found in Milfont and Sibley's (2012) second study. The study also measured Openness in a comprehensive manner, with 58 items contributing to overall Openness scores as well as scores of six facets. Combined with a comprehensive PEB-measure, this could explain why we observed a stronger Openness-PEB association than some of these previous studies (e.g., Brick & Lewis, 2016; Markowitz et al., 2012). We note that one of the possible contributors to the strong associations may have been the use of a similar 6-point rating scale for both personality and PEB ratings. However, many items were reverse-coded, which mitigated the possibly confounding role of participants' tendency to use one end of the rating scale.

Importantly, the Openness-PEB association tended to generalize across more than a few facets, facilitating the interpretation of the association as pertaining to the Openness domain per se (Möttus, 2016). We note, however, that some of facet-PEB associations were weakened to the level of no longer being statistically significant in some of the

analyses, suggesting that facets such as Artistic Interests, Intellect and Liberalism were among the main drivers of the Openness-PEB association.

One of the main limitations of the study was non-ideal sampling. First, the sample was somewhat smaller than we had intended based on the prior-to-data-collection power analysis; however, the number of participants still allowed for at least satisfactory statistical power according to our post-data-collection power analysis. Second, the sample was not representative of the whole population. This may have distorted our estimates, most plausibly in the direction of being underestimates due to range restrictions. We note that the non-representativeness was less of a problem for the within-family analyses, as a substantial proportion of influences that could have made participants less representative of general population was likely to be at least partly shared between siblings. Thus, they could not bias estimates of within-family analyses.

Also, the exclusive reliance on self-report questionnaires could be criticized. For instance, socially desirable responding may have tempted participants into portraying a better image of themselves by exaggerating the extent to which they are pro-environmental. However, Milfont (2009), who directly analyzed the relationship between socially desirable responding and self-reported PEB, only found a weak effect, meaning social desirability may not be a serious issue in our measure of PEB. Perhaps the bigger issue is that the present measures lack objectivity. More recent research that connects objective measures of PEB, such as investment in green energy installations (Busic-Sontic & Brick, 2018) and personality, found much weaker associations between Openness and PEB. It is possible, however, that this difference in strength of association is related to differences in the unique aspects of the PEB being measured. Using such

objective measures could be an interesting avenue for future research in understanding more precisely how Openness relates to PEB.

Implications

Openness reflects flexibility of thought, which may promote an understanding of the value of nature and entail fewer conservative perspectives on environmental movement and protection (Hirsh, 2010; Milfont & Sibley, 2012). This finding may have implications for how we design policies and advertise ecological behavior, as it could be equally effective, if not more effective, to target individuals based on their personality rather than demographic background (e.g., educational or socioeconomic factors). Markowitz and colleagues (2012) suggest that popularizing ecological thinking and behavior could benefit from campaigns appealing specifically to groups who are less open and thereby in line with the *status quo*; this is because more open individuals may already be the ones thinking and behaving in pro-environmental ways. Taking personality traits into account when creating policies may be even more beneficial than considering factors such as political orientation, which may have modest associations with PEB (Brick & Lewis, 2016).

Furthermore, past research (e.g., Allik et al., 2017; Rentfrow et al., 2013) has documented geographical variations in the FFM traits, including Openness, across countries and US states. Combining these findings with those of the likes of the present study may, in principle, be informative with respect to how different regions can be targeted by educational programs – or even why regions differ in their rates of environment-friendly behaviors. However, more representative samples, in certain studies looking at non-Western countries, are needed for world-wide effective policies.

We cannot generalize current findings to all populations and cultures, who may have very different views on environmental issues.

Conclusion

People differ in the extents to which they make environment-friendly behavioral choices. We showed that the personality trait of Openness appears to be a robust correlate of these differences, over and above a range of environmental and genetic factors that could confound such associations.

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Table 1. *Associations of PEB with Openness and its facets across the whole sample.*

	<i>b</i>	2.5% <i>CI</i>	97.5% <i>CI</i>	<i>p</i>
Openness	0.52	0.39	0.64	0.000
Artistic Interests	0.40	0.26	0.54	0.000
Emotionality	0.18	0.03	0.33	0.020
Adventurousness	0.41	0.31	0.55	0.000
Intellect	0.45	0.33	0.58	0.000
Liberalism	0.40	0.27	0.54	0.000
Imagination	0.22	0.08	0.36	0.003

NOTE: *b* = standardized regression coefficient; *CI* = confidence intervals, *p* = p-value. *N* = 168.

Table 2. *Between- and within-family associations of PEB with Openness and its facets.*

	<i>Between-family associations</i>				<i>Within-family associations</i>			
	<i>(sibling pair means)</i>				<i>(sibling pair differences)</i>			
	<i>b</i>	<i>2.5%</i>	<i>97.5%</i>	<i>p</i>	<i>b</i>	<i>2.5%</i>	<i>97.5%</i>	<i>p</i>
	<i>CI</i>	<i>CI</i>			<i>CI</i>	<i>CI</i>		
Openness	0.57	0.42	0.71	< .001	0.29	0.18	0.41	< .001
Artistic Interests	0.42	0.26	0.58	< .001	0.26	0.14	0.38	< .001
Emotionality	0.23	0.06	0.40	0.012	0.08	-0.05	0.21	0.228
Adventurousness	0.50	0.42	0.62	< .001	0.14	0.03	0.27	0.030
Intellect	0.46	0.31	0.61	< .001	0.31	0.20	0.42	< .001
Liberalism	0.43	0.28	0.58	< .001	0.20	0.08	0.32	0.002
Imagination	0.29	0.12	0.47	0.001	0.12	0.00	0.25	0.061

NOTE: *b* = standardized regression coefficient; *CI* = confidence intervals, *p* = p-value. *N* = 168.

Appendix A

PEB questionnaire items with their means and standard deviations ($N = 168$).

	ITEMS <i>(Scale: 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Somewhat agree, 5 = Agree, 6 = Strongly agree)</i>	MEAN	SD
1	I don't worry about turning the lights off when I leave a room.	2.20	1.29
2	I occasionally litter	3.53	1.72
3	I use reusable coffee or tea cups.	3.06	1.45
4	I buy products from companies with pro-environmental policies over those that don't.	4.27	1.36
5	I use the recycling facilities available to me to their fullest extent.	3.28	1.51
6	I pick up litter that isn't mine	3.41	1.26
7	I abstain from activities that are known to have a negative environmental impact.	4.60	1.84
8	I turn the tap off when brushing my teeth.	3.99	1.55
9	I use the "Eco" setting on appliances where available.	3.19	1.50
10	I seek information that can help me act more environmentally friendly.	4.45	1.62
11	I tend not to use reusable water bottles.	5.10	1.46
12	I have taken part in pro-environmental rallies and/or community gathering.	2.14	1.39
13	I try to reduce the amount I travel by aeroplane.	5.37	1.28
14	I would rather use cardboard plates over reusable ones to save washing up.	2.87	1.54
15	Even where a bath is available, I choose to shower to conserve water.	5.06	1.33
16	I wait until I have a full load to use the washing machine or dishwasher.	3.10	1.98
17	I don't use compost bins.	3.68	1.78
18	I never really discuss pro-environmental behaviors with my	4.57	1.67

	friends.		
19	I follow pro-environmental organizations on social media.	3.13	2.01
20	I have no interest in reducing my meat intake for environmental reasons.	4.38	1.79
21	I leave chargers plugged in when they are not in use.	3.71	1.86
22	The party I voted for in the last election partially convinced me due to their pro-environmental policies (please leave blank if you did not vote).	4.00	1.67
23	I turn appliances off instead of leaving them on "stand-by"	3.00	1.62
24	I seek out information about environmental issues.	3.14	1.69
25	The amount of packaging a product uses does not influence my decision to buy or not.	3.90	1.51
26	I rarely attempt to improve my friends' environmental behavior.	3.58	1.50
27	I prefer to buy recycled paper products such as toilet paper or tissues.	4.58	1.65
28	I don't take my own shopping bag when shopping.	2.46	1.50
29	I throw recyclable materials in the rubbish.	2.73	1.52
30	I don't buy energy efficient light bulbs.	3.51	1.54
31	I don't go out of my way to be green.	3.47	1.70
32	I do not wash my clothes on a cold setting on the washing machine.	3.36	0.76

NOTE: Shapiro-Wilks tests of normality were carried out on all items, indicating non-normality in all cases ($p < .001$). However, the distribution of aggregate PEB scores did not differ from non-normality ($p = .74$).