



The prosocial origin of sustainable behavior: A case study in the ecological domain

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ABSTRACT

Prior research has focused on individual difference variables that predict various prosocial behaviors. This work, however, has neglected to consider the underlying commonalities between the different domains behavior can be performed. In line with other authors we propose that individual difference factors can indicate one's propensity toward acting prosocially across domains, and that prosocial behaviors also include behaviors that support behavior for the common good. We argue that in order for one's prosocial propensity to be actualized in a particular domain, a motivator in the form of connectedness to the domain is necessary. This paper examines such a model exemplified in the ecological domain by explaining pro-environmental actions. Through two studies (total $N = 760$) we provide evidence for a mediation model whereby connectedness to nature mediates the positive relation between prosocial propensity and pro-environmental behavior. Prosocial propensity was operationalized as altruism (studies 1 and 2) and honesty-humility (study 2). Further, study 1 also showed a comparison between participants indicating membership in environmental and humanitarian organizations and non-members. This indicated that prosocial propensity was higher in environmentalists and humanitarians compared to non-members, while connectedness to nature and pro-environmental behaviors were higher only in environmental organization members. These studies provide evidence for the premise of a prosocial propensity being actualized in the ecological domain via connectedness to that domain.

1. Introduction

While humanitarian and pro-environmental behavior can be seen as behaviors with a prosocial foundation, it is less clear what motivates some people act more so within humanitarian domains and some more so in ecological domains. Prior research has considered human-oriented behavior as the most eminent domain for prosocial action, and commonly it is also used synonymously for prosocial behavior (e.g., Batson and Powell, 2003). In line with others, we conceptualize pro-environmental behaviors as a form of prosocial behavior. We further suggest that in order for a person to enact their general prosocial motivation, some domain-specific motive or reason is necessary. For the

domain of humanitarian behavior, these reasons may be manifold (e.g., to gain social status or hope for some reciprocity). Reasons are much less obvious for pro-environmental behavior, but connectedness to nature gives a strong reason to protect the environment as previous studies show (e.g., Mayer and Frantz, 2004). Thus, with our focus on prosocial behavior in the ecological domain, namely pro-environmental behavior, we newly examine the motivational role of connectedness to nature as a mediator of the relationship between prosocial propensity and pro-environmental behavior. Based on this example of the ecological domain and on the notion that sustainable behavior in any domain is directed towards the common good, we propose that specific motivators direct an individual's general prosocial propensity to specific domains of

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sustainable development respectively. For example, a strong motive against prejudice might motivate behavior that reduces inequalities (i. e., sustainable development goal no. 10; UN, 2019).

1.1. Prosocial behavior and other sustainable behaviors

Prosocial behaviors are behaviors performed with the intention of benefiting others (e.g., Eisenberg and Shell, 1986; Eisenberg et al., 2016). A failure to differentiate between different kinds of prosocial behaviors has been highlighted as a shortcoming of prosocial behavior research, resulting in difficulty developing coherent theories around the motivations of prosocial behaviors (Dunfield, 2014). In prior research, prosocial behavior has largely been considered as behaviors in the human domain, i.e., behaviors that benefit human others (e.g., comforting, volunteering, helping, sharing, and donating to humans or humanitarian causes; Batson and Powell, 2003; Dunfield, 2014). This approach is, however, limited, as ‘others’ who may benefit from other-orientated action can also include non-human others.

Indeed, prosocial behaviors may be oriented toward non-human others including animals, plants, specific parts of the natural world, or nature as a whole. While humans can benefit from nature-orientated prosocial behaviors (e.g., having clean water, access to stable food supply), nature-orientated prosocial behaviors do not need to benefit humans. Frameworks for environmental concern (e.g., Schultz, 2000; Stern et al., 1993) demonstrate this in that environmental concerns are driven by concerns for self (egoistic concerns), other humans (altruistic, or social-altruistic concerns), and nature (biospheric concerns). Further, environmental problems, such as exploitation of the natural environment, have been linked with egoistic concerns and selfish behavior, namely behavior where individuals act in their own self-interest (e.g., Diekmann and Preisendörfer, 1998; Hardin, 1968).

Especially in commons dilemmas (i.e., tragedy of the commons; Hardin, 1968), selfish behavior opposes commons-oriented, that is nature-oriented, prosocial behavior by definition. Selfish behavior benefits the individual in the short term but depletes the common resource in the long term, and only mutual cooperation by forgoing some immediate benefits can sustain the commons good. Thus, the fate of the individual is linked to the survival and productiveness of the commons or the environment which in turn is linked to altruistic decisions of most individuals. The dilemma in such a situation occurs because all individuals in a group fare better if they cooperate, but they still have an incentive to defect (i.e., be selfish and not altruistic). The overall logic behind the tragedy of the commons can be transferred to sustainable development issues, such as climate change (Milinski et al., 2006). Unfortunately, for the global challenges of sustainable development most situational factors that foster cooperation in a such a global commons dilemma are not met. For instance, people are less likely to support the common cause when longer time periods are involved, the group size is bigger, and contributions are anonymous (Aitken et al., 2011). All these factors obviously do not favor cooperation in addressing today’s global environmental sustainability issues, because they are long-term issues, there are many others (i.e., all humanity) involved, and contributions are mostly anonymous. This therefore highlights the critical role of individual differences, such as one’s intrinsic prosocial propensity (Masson and Otto, 2021), in order to foster cooperation in issues such as climate change. In this respect it might be plausible that such a prosocial propensity relates more to nature (pro-environmentalist) than to humans, because the effect of most pro-environmental behaviors are more directly on nature than on other humans.

Others have similarly pointed to pro-environmental behaviors as being driven by concerns for non-human others (e.g., Bamberg and Möser, 2007). More recently, Neaman et al. (2018) provided evidence that, in their evaluation of measurement tools assessing humanitarian behavior and pro-environmental behavior, human-orientated prosocial behaviors and pro-environmental behaviors are in fact a similar class of behavior. Taken together, prior theory and research suggests that pro-

environmental behaviors can be conceptualized as a form of prosocial behavior.

1.2. Prosocial propensity

While there may be situational factors that lead to prosocial behavior, prior work has highlighted the necessity to consider individual factors and the interaction of these factors with the situation (Mischel and Shoda, 1995). This paper will focus on identifying individual factors that predict prosocial behaviors, particularly in the ecological domain. By considering the underlying motivational framework in prosocial behavior, our approach offers a theoretical basis in which future research can build upon, considering the role of both individual and situational factors. We argue that individual prosocial propensity is the foundation of any selfless behavior towards the other, be it nature or persons. To our knowledge there is no measure that can assess a person’s general prosocial propensity that does not consider a particular (e.g., human) domain. We argue that measures of altruism and honesty-humility, which can be considered measures of moral behavior, can indicate the general foundation of prosocial propensity.

Altruism commonly refers to an unselfish concern for others – usually conceptualized as human others (Batson and Powell, 2003). However, as with prosocial behaviors noted above, we argue that this can also include non-human others. This is exemplified via the identification of biospheric environmental concerns (e.g., Schultz, 2000; Stern et al., 1993), which are focused on the impacts of (un)ecological actions on the natural world or parts thereof (Schultz, 2000). While theoretical approaches to altruism have considered it to be both a behaviour and a motivational tendency, no distinction is made between these approaches at the measurement level with similar or identical measures used regardless of its conceptualisation.

Even though it has been argued that altruistic behaviors actually result from selfish motives, Monroe (2002) showed that self-interest explanations have failed to provide sufficient explanation of many other-orientated behaviors. That said, however, in order for concern and behaviors to be truly altruistic, there must remain a conceptual separation between the self and other (Batson and Powell, 2003; Cialdini et al., 1997). When examining the empathy-altruism hypothesis, Cialdini et al. (1997) show that, while empathy did predict altruistic behavior, this relationship was accounted for by the overlap of the self with the other. This thereby challenges the ‘true’ altruistic motive, and suggests a sense of connectedness to the other is a likely prerequisite for directing behavior toward another person. In examining altruism as an individual difference variable, Rushton et al. (1981) provided evidence for this construct given its substantial consistency across situations. As such, we believe individual differences in altruism serve as an indication of an individual’s prosocial propensity. To substantiate this, there is evidence indicating that altruism predicts prosocial behaviors, including behaviors directed towards other humans (e.g., Gebauer et al., 2015; Tapia-Fonllem et al., 2013), and pro-environmental behaviors (e.g., Clark et al., 2003; Tapia-Fonllem et al., 2013).

Honesty-humility, a construct related to altruism, is one of the personality traits of the HEXACO model, and refers to fairness-related tendencies in how individuals cooperate with others (Ashton and Lee, 2007). By definition, honesty-humility refers to ‘the tendency to be fair and genuine in dealing with others, in the sense of cooperation with others even when one might exploit others without suffering retaliation’ (Ashton and Lee, 2007; p. 156), thereby indicating a tendency to display prosociality (Pfattheicher and Böhm, 2018). Of the personality traits, honesty-humility most strongly relates to Schwartz and Bilsky (1987) value of self-transcendence (Lee et al., 2009), demonstrating the role of honesty-humility in other-orientation. This relation is further supported by findings that show how self-transcendence and biospheric values relate to proenvironmental behavior (De Groot and Steg, 2009; Nordlund and Garvill, 2002).

Further, from the definition of honesty-humility, this trait represents

an active reciprocal altruism (Ashton and Lee, 2007). Indeed, altruism has been found to positively relate to honesty-humility (e.g., Aghababaei et al., 2014; Zettler et al., 2011). Indeed, like altruism, we believe that honesty-humility serves as an indication of an individual's prosocial propensity. There is a host of evidence that honesty-humility predicts prosocial behaviors, including in the ecological domain. For example, honesty-humility predicted active cooperation in diverse assessments of prosociality towards humans, such as in the dictator game, and public goods games (Hilbig et al., 2013) and in various other human-orientated prosocial behaviors (e.g., Fang et al., 2019; Wertag and Bratko, 2019; Zettler and Hilbig, 2015). In the ecological domain, honesty-humility has been shown in a recent meta-analysis (Soutter et al., 2020) to be a positive predictor of pro-environmental attitudes ($r = 0.20$) and behaviors ($r = 0.25$). Thus, individual factors such as altruism and honesty-humility indicate an individual's propensity toward prosociality and, based on prior research findings, we suggest that this is driven largely by the tendency to connect to appropriate others.

1.3. Motivations for prosocial behavior

In order for one's prosocial propensity to be actualized in a certain domain, that is, which 'others' one's behaviors are orientated towards, we propose that a certain motivator plays an important part. When considering prosocial behavior directed towards human others, numerous motivations have been identified, including changes or gains in social status (e.g., Guinote et al., 2015), reciprocity (e.g., Kuhlmeier et al., 2014), or to express or modulate mood (e.g., Rosenhan et al., 1981); however, when considering motivations relevant for prosocial propensity, in particular the merging of self with other (Cialdini et al., 1997), connectedness to the other is a strong candidate.

Considering prosocial behavior in the ecological domain, namely pro-environmental behavior, we propose that connectedness to nature provides a motivational basis for enacting one's prosocial propensity in this domain. Connectedness to nature refers to the perceived closeness between one's self and nature, and represents an expansion of the self to include nature (Brügger et al., 2011; Mayer and Frantz, 2004; Nisbet et al., 2009; Schultz, 2001). Prior research has outlined connectedness to nature as providing a motivation for pro-environmental action (e.g., Otto and Pensini, 2017) and considerable prior research has demonstrated that connectedness to nature positively predicts pro-environmental behaviors (e.g., Whitburn et al., 2020). In fact, connectedness to nature outperforms all other variables, and even multi-variable models, in predicting pro-environmental behavior (Steg and Vlek, 2009). Connectedness to nature is also positively related to altruism (e.g., Barrera-Hernández et al., 2020) and to honesty-humility (e.g., Lee et al., 2015). Prior research taken together, we hypothesize that connectedness to nature acts as a motivator for enacting one's prosocial propensity in the ecological domain. The importance of such motivators has also been shown in other fields such as science education, where the motivator "fascination for science" is also related to higher engagement in science activities (Otto et al., 2020).

1.4. Research goal

The current paper sought to demonstrate that connectedness to nature serves as a motivator for enacting one's prosocial propensity in the ecological domain. Through two studies, we aim to demonstrate the predictive relation between prosocial propensity (operationalized as altruism— studies 1 and 2, honesty-humility—study 2) and pro-environmental behavior, as well as the mediation of this relation by connectedness to nature. Further, we sought to compare those indicating membership in humanitarian or environmentalist groups to the general population. Doing so will provide further evidence for differing levels of prosocial propensity, and connectedness to nature, and that these may be important to enact prosocial behaviors in the ecological domain. Data was collected in two studies with different samples in Chile in 2018 and

2019.

2. Study 1

The aim of study 1 was to demonstrate that pro-social propensity predicts pro-environmental behaviors via connectedness to nature. This study conceptualized pro-social propensity as altruism, given that it provides an indication of orientation towards others. A community sample was utilized in this study.

2.1. Method

2.1.1. Sample

A total of 443 persons completed the survey. 45% of the participants were male and the mean age was 36.7 years ($SD = 14.2$ years). 29% of the sample were members in social welfare organizations, and 29% indicated membership in environmental organizations. We explicitly asked for membership in order to follow the known groups approach, because in doing so, we can be sure by definition (Hattie and Cooksey, 1984), that members of a humanitarian or an environmental organization respectively show a higher than average prosocial or pro-environmental motivation.

2.1.2. Measures

Prosocial propensity was assessed by 16 of the 20 items of the Self-Report Altruism scale (Rushton et al., 1981) and four newly created items to adjust the scale to present Chilean society.

Connectedness to nature was measured with 20 items describing different behaviors indicating the extent of one's connectedness to nature. From the Disposition to Connect to Nature scale (DCN; Brügger et al., 2011), we omitted items regarding views and feelings, keeping only behavior-related items, and modified some items to better suit Chilean culture and geography. Thus, eight original items from the DCN were used, six were modified, and an additional six items were constructed.

Pro-environmental behavior was assessed with the General Ecological Behavior scale (Kaiser and Wilson, 2004). Of the 40 items, 11 were modified for a Chilean sample (e.g., "I buy soft drinks or beers in returnable bottles" was modified to "I buy milk in returnable bottles") and 17 items were exchanged for newly created questions relating to common Chilean pro-environmental behaviors. 20 items were presented in a dichotomous format with 0 (if the specific behavior is not displayed) and 1 (if the specific behavior is displayed). The remaining 20 items were assessed with a five-point scale from 1 (*not at all*) to 5 (*absolutely*). Prosocial propensity and connectedness to nature were assessed with the same 5-point scale. For scoring, all polytomous items were transformed into a dichotomous format according to Kaiser et al. (2007). Therefore, the first three options indicating no or low pro-environmental behavior were recoded as no pro-environmental behavior, while the other two options were recoded as pro-environmental behavior. By using a broad measure of pro-environmental behavior, we were able to substantially reduce the likelihood of situational influences and artefacts based on the specificity of only a few items (e.g., Otto et al., 2018).

2.1.3. Data analysis

A Rasch model was used to calculate person scores for pro-environmental behavior, connectedness to nature, and prosocial propensity. The person separation reliability for pro-environmental behavior was 0.75. *MS* infit values were below 1.3, except for one item ($MS = 1.38$), so 39 of the 40 items showed good to acceptable fit values. For connectedness to nature, the person separation reliability was 0.88, fit values were good ($MS \leq 1.2$) for all items except for one which still showed acceptable fit ($MS = 1.26$). Person separation reliability for altruism was 0.78 and again, all items except for one ($MS = 1.37$) showed good *MS* infit (≤ 1.2). For a detailed overview of the fit statistics, see Appendices A, B & C.

2.2. Results

Table 1 displays the means of the person parameters, standard deviations, and Pearson correlations of connectedness to nature, pro-environmental behavior, and altruism. All three correlations are positive, indicating medium to large interrelations between the three variables.

2.2.1. Mediation

The mediation hypothesis was tested with R, using the package “psych” (Revelle, 2018). The significance of the mediation effect was tested through bootstrapping (5,000 iterations) and with an additional Sobel test (Sobel, 1982). The relationship between a prosocial propensity (operationalized as altruism) and pro-environmental behavior was mediated by connectedness to nature, there was a significant indirect effect, $p < .001$, 95% CI [0.134, 0.239], the overall model was also significant, $F(2, 440) = 100.95, p < .001$. The total effect of prosocial propensity on pro-environmental behavior was $c = 0.32, p < .001$. Fig. 1 illustrates the standardized regression coefficients of the proposed model. Thus, the indirect effect ($ab = 0.18$) accounting for more than half the total effect ($c = 0.32$) seems to be as important as the direct effect ($c' = 0.14$).

We further computed a mediation analysis with membership in an environmental organization as the dependent variable. Because membership in an environmental organization was a binary variable, we estimated a probit regression for the outcome (not standardized) and calculated quasi-Bayesian confidence intervals with 5,000 simulations using the algorithm from Imai et al. (2010). To obtain a conservative estimation, we excluded those individuals who were members of both environmental and social welfare organizations. There was a significant mediation effect (0.04), $p < .001$, 95% CI [0.03, 0.06] of prosocial propensity (altruism) on membership in an environmental organization through connectedness to nature. The total effect (0.05) was also significant, $p = .004$, 95% CI [0.02, 0.09]. The direct effect (0.01) was not significant ($p = .700$), that is, the mediation accounts for 85% of the total effect of prosocial propensity on membership in an environmental organization.

Analogous to the previous analysis, we computed a mediation analysis with membership in a social welfare organization as the dependent variable. There was a negative mediation effect (-0.02), $p = .002$, 95% CI [-0.03, -0.01] of prosocial propensity on membership in a social welfare organization through connectedness to nature. The total effect (0.06) was significant, $p < .001$, 95% CI [0.02, 0.10]. The direct effect of prosocial propensity on membership in a social welfare organization (0.08) was significant, $p < .001$, 95% CI [0.04, 0.12]. That is, connectedness to nature reduced the effect of prosocial propensity on membership in a social welfare organization.

2.2.2. Group comparisons

A one-way MANOVA revealed a significant difference between the groups (social/environmental organizations or non-members) on the combined dependent variables (altruism, connectedness to nature, and pro-environmental behavior), $F(3, 419) = 22.17, p < .001$. Univariate ANOVAs displayed significant group differences in altruism ($F(2, 424) = 16.03, p < .001, \eta_p^2 = 0.07$), connectedness to nature ($F(2,421) =$

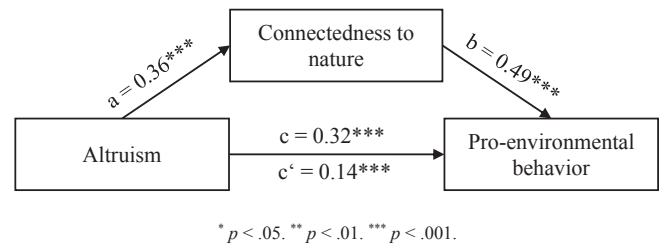


Fig. 1. Study 1: Standardized regression coefficients for the relationship between prosocial propensity (altruism) and pro-environmental behavior, mediated by connectedness to nature. * $p < .05$. ** $p < .01$. *** $p < .001$.

30.21, $p < .001, \eta_p^2 = 0.13$), and pro-environmental behavior ($F(2, 425) = 43.99, p < .001, \eta_p^2 = 0.17$).

Members of both environmental ($M = 0.08, SD = 1.27$), and humanitarian organizations ($M = 0.14, SD = 1.18$) showed more altruism compared to the general population ($M = -0.57, SD = 1.25$), $p < .001$. Members of environmental organizations ($M = 1.35, SD = 1.65$) scored significantly higher on connectedness to nature than the other groups ($p < .001$), while there were no significant differences in means of humanitarians ($M = 0.05, SD = 1.70$) and non-members ($M = -0.18, SD = 1.79$). Similarly, environmentalists ($M = 0.41, SD = 0.63$) scored highest in pro-environmental behavior. However, humanitarians ($M = -0.46, SD = 0.72$) displayed even less pro-environmental behavior than non-members ($M = -0.21, SD = 0.80$), $p = .012$.

Fig. 2 illustrates group means and group confidence intervals of altruism, connectedness to nature, and pro-environmental behavior for members of humanitarian organizations ($N = 116$), environmental organizations ($N = 120$), and persons with no membership ($N = 192$). We excluded 10 persons who were members of both humanitarian and environmental organizations and 5 persons with missing values in organizational membership.

2.3. Discussion – Study 1

This study demonstrated that connectedness to nature partially mediates the relationship between pro-social propensity and pro-environmental behaviors. This study operationalized pro-social propensity as altruism. These findings provide evidence for the theoretical proposition that individuals’ propensity towards prosociality predicts pro-environmental behavior. This is in line with prior research which has shown altruism is a positive predictor of pro-environmental behavior (e.g., Clark et al., 2003; Tapia-Fonllem et al., 2013). Furthermore, in line with prior research (Whitburn et al., 2020), we found that connectedness to nature positively predicted pro-environmental behavior.

We argued that in order for one’s prosocial propensity to be activated within a particular domain, in this case the ecological domain, a motive such as connectedness to nature can be an additional driver. That connectedness to nature was found to partially mediate the relationship between altruism and pro-environmental behaviors supports this rationale. However, there was still a direct effect from altruism to pro-environmental behaviors, which might be due to the fact that most pro-environmental behaviors also benefit other humans. For instance, by not using a plane or commuting by bus or bicycle instead of car, CO2-emissions are reduced and climate change is mitigated which benefits all other humans. This direct link between altruism or pro-social propensity and pro-environmental behavior very well explains the direct common variance of these two constructs. This finding provides further evidence that altruism operates on prosocial behavior via the increased connectedness with the other (Batson and Powell, 2003; Cialdini et al., 1997). Furthermore, using the membership in an environmentalist organization as the dependent variable in our mediation, we found that the effect from altruism was fully mediated through connectedness to

Table 1
Descriptive statistics and Pearson correlations of the study variables (Study 1).

Variable	N	M	SD	1.	2.	3.
1. ALT	442	-0.18	1.28	1.00		
2. CN	438	0.36	1.87	0.36***	1.00	
3. GEB	443	-0.08	0.81	0.32***	0.55**	1.00

Note. ALT = Altruism, CN = Connectedness to nature, GEB = Pro-environmental behavior. M indicates the mean values of the Rasch person parameters.
* $p < .05$. ** $p < .01$. *** $p < .001$.

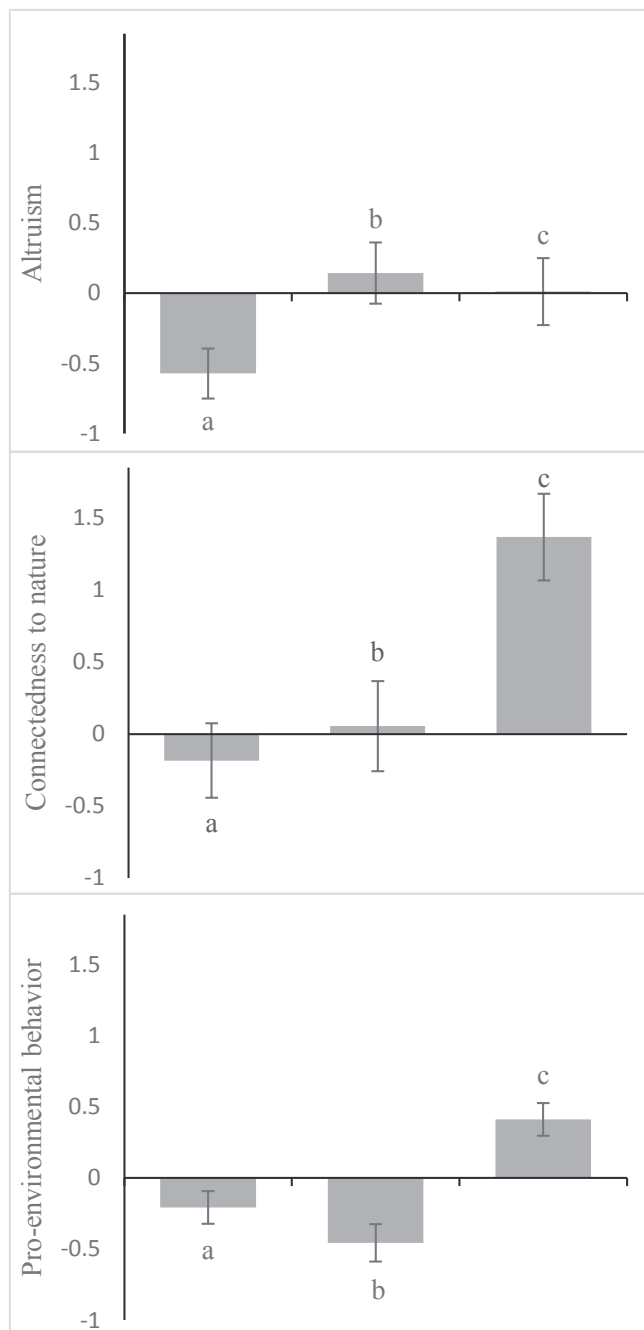


Fig. 2. Comparison of group means in altruism, connectedness to nature and pro-environmental behavior among the general population (a), members of social welfare organizations (b) and environmental organizations (c). Group means (grey bars) are presented within 95% confidence intervals.

nature. In combination with the finding that the other models were only partially mediated, this further supports the premise of this paper that prosocial propensity predicts pro-environmentalism via connectedness to nature. Our central criterion (dependent variable), the index of pro-environmental behaviors, expresses support for the environment in general and in this way also the common good (with positive humanitarian outcomes). The aim of environmental organizations however, is much more narrowly directed towards helping the environment – sometimes even opposing humanitarian aims. Thus, with the membership in an environmental organization, a fully mediated effect through connectedness to nature seems more likely. In order to further demonstrate this mediation model, we utilized another conceptualization of

pro-social propensity. Replication using a different sample would also add weight to this conclusion.

The comparisons between those identifying membership in a humanitarian or environmental organization, and those identifying neither revealed that altruism was highest, and equivalent, in humanitarians and environmentalists. This lends weight to the notion of one's prosocial propensity as a predictor of prosocial behavior. That both connectedness to nature and pro-environmental behavior were highest in the environmentalists, compared to humanitarians and general population speaks to the motivating role of connectedness to nature in actioning one's prosocial propensity in the ecological domain. It is interesting to note that pro-environmental behaviors were lowest in the humanitarians. Reasons for this may be manifold, but include that one's behavioral options are inherently limited; thus, acting prosocially towards (exclusively) humans limits opportunities to act prosocially towards nature, potentially having negative effects on pro-environmental behavior.

3. Study 2

The aim of study 2 was to conceptually replicate the findings of study 1 adding another indicator of pro-social propensity, namely honesty-humility. In addition, study 2 utilized a university student sample, to examine the robustness of the model that prosocial propensity is activated in the ecological domain via connectedness to nature.

3.1. Method

3.1.1. Sample

Students at the School of Agriculture of the Pontifical Catholic University of Valparaiso and the Institute of Statistics at the University of Valparaiso, Chile participated in the study. In total, 317 participants (57% male) responded to the survey. The participants' average age was $M = 21.4$ ($SD = 4.2$).

3.1.2. Measures

To replicate the findings of study 1, pro-environmental behavior, connectedness to nature, and prosocial propensity were assessed in the same way as in study 1. Furthermore, the honesty-humility domain of the HEXACO personality inventory was added as a second indicator for a prosocial propensity. We used a Spanish translation of the original short version of the Honesty-Humility scale consisting of 16 items (Lee and Ashton, 2018) provided at hexaco.org. For a review of the validity of the Spanish version, see Romero, Villar, and López-Romero (2015).

3.1.3. Data analysis

Again, a Rasch-type model was used to calculate person scores for pro-environmental behavior, connectedness to nature, and altruism. Reliability (Cronbach's alpha) was $\alpha = 0.76$ for honesty-humility. The person separation reliability for pro-environmental behavior was again 0.75. One item was excluded from the analyses, because there was no variance. There was one item ($MS = 1.22$) with an acceptable fit and, like in study 1, another item ($MS = 1.36$) exceeding the upper limit for an acceptable MS infit of 1.3, while the other 37 items showed good fit values. For connectedness to nature, the separation reliability was 0.87, fit values were good, except for one item with an acceptable infit ($MS = 1.21$). For altruism, person separation reliability was again 0.78 and all items showed good MS infit values (≤ 1.2) except for one item with an acceptable infit ($MS = 1.29$).

3.2. Results

Table 2 indicates means, standard deviations and Pearson correlations of the study variables in study 2. As expected, all correlations are again positive and significant.

Table 2
Descriptive statistics and Pearson correlations of the study variables (Study 2).

	N	M	SD	1.	2.	3.	4.
1. ALT	315	-0.60	1.27	1.00			
2. HH	317	3.70	0.60	0.31***	1.00		
3. CN	317	0.51	1.66	0.33***	0.12*	1.00	
4. GEB	317	0.09	0.89	0.40***	0.32***	0.51***	1.00

Note. ALT = Altruism, CN = Connectedness to nature, GEB = Pro-environmental behavior, and HH = Honesty-humility. For ALT, CN and GEB, means of the Rasch person parameters are displayed. For honesty-humility, the arithmetic mean of the person's mean scores was calculated.
* $p < .05$. ** $p < .01$. *** $p < .001$.

3.2.1. Mediation

Analogous to study 1, a mediation model was tested. Again, the relationship between prosocial propensity (altruism) and pro-environmental behavior was mediated by connectedness to nature, the indirect effect was significant, $p < .001$, 95% CI [0.086, 0.194], while the overall model was also significant, $F(2, 314) = 74.19, p < .001$. The total effect of prosocial propensity on pro-environmental behavior was $c = 0.40, p < .001$. Thus, the indirect effect accounted for a substantial part of the total effect. Fig. 3 illustrates the mediation model including the standardized regression coefficients.

In addition to altruism, honesty-humility was also utilized to measure prosocial propensity in study 2, therefore, another mediation model was estimated. A mediation analysis revealed a significant, although slightly smaller, indirect effect, $p = .015$, 95% CI of the mean bootstrapped indirect effect [-0.001, 0.12], while the overall model was also significant, $F(2,314) = 74.67, p < .001$. The total effect of prosocial propensity (measured by honesty-humility) on pro-environmental behavior was $c = 0.32, p < .001$. Fig. 4 displays the path model of the mediation analysis.

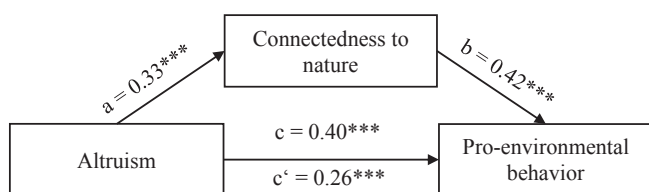
A comparison of the mediation effects in studies 1 and 2 is displayed in Table 3.

3.3. Discussion – Study 2

This study demonstrated that connectedness to nature partially mediates the relationship between prosocial propensity and pro-environmental behavior. As with study 1, this provides evidence that connectedness to nature serves as a motive for enacting one's prosocial propensity within the ecological domain. That this was demonstrated with a different operationalization of prosocial propensity, namely honesty-humility, and with a different sample, serves as further support to the robustness of this rationale.

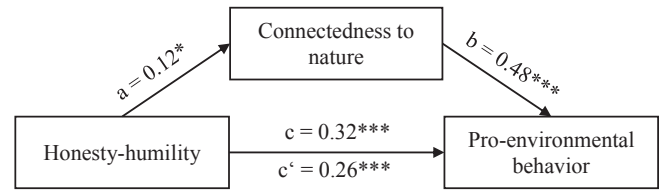
4. General discussion

We have provided evidence for the predictive role of prosocial propensity in pro-environmental behavior, and the explanatory role of connectedness to nature in this relation. This was the case utilizing two indicators of prosocial propensity, namely altruism and honesty-



* $p < .05$. ** $p < .01$. *** $p < .001$.

Fig. 3. Relation between prosocial propensity (altruism) and pro-environmental behavior, mediated by connectedness to nature with standardized regression coefficients.



* $p < .05$. ** $p < .01$. *** $p < .001$.

Fig. 4. Relation between prosocial propensity (honesty-humility) and pro-environmental behavior, mediated by connectedness to nature with standardized regression coefficients.

Table 3
Comparison of the mediation analyses with altruism or honesty-humility as predictor and connectedness to nature as mediator.

Outcome variable	Standardized regression coefficients				Bootstrap 95% CI	
	X -> M	M -> Y	Total effect	Indirect effect		
<i>Study 1</i>						
GEB	ALT	0.36***	0.49***	0.32***	0.18***	0.13, 0.24
<i>Study 2</i>						
GEB	ALT	0.33***	0.42***	0.40***	0.14***	0.09, 0.19
GEB	HH	0.12*	0.48***	0.32***	0.06***	-0.00, 0.12

Note. ALT = Altruism, CN = Connectedness to nature, GEB = Pro-environmental behavior, HH = Honesty-humility.
* $p < .05$. ** $p < .01$. *** $p < .001$.

humility, and within two samples (i.e., a community and a university student sample). While the constructs of altruism and honesty-humility differ, they also have the underlying conceptual similarity in that they are underpinned by a consideration for others. This consideration for others, we found, predicted pro-environmental behavior. This provides evidence that behaviors in the ecological domain constitute prosocial behaviors, and that they are underpinned by a prosocial propensity (Neaman et al., 2018). The replication of the model within the community and university student samples speaks further towards the premise of the model that prosocial propensity produces pro-environmental behaviors when there is a sufficient motive for doing so, namely with connectedness to nature.

That pro-environmental behaviors are driven by one's generalized prosocial propensity and (partially) accounted for by connectedness to the domain suggests that prosocial propensity reflects, at least to some extent, a tendency to connect to the others' domain. In that prosocial behaviors are driven by a connectedness of the self to the other (e.g., Cialdini et al., 1997), a connectedness to the others in the particular domain allows one's prosocial propensity to be actualized in that domain. Similarly, Hoot and Friedman (2010) outline that connectedness can be a generalized, or more specific phenomenon; however, connectedness at all levels are interrelated. They showed that the tendency to be connected to nature, to one's future self, and to all of reality 'unlimited by time and space' (p.89) were positively interrelated (Hoot and Friedman, 2010). Taken together, this suggests that prosocial propensity is embodied by a tendency to connect to others, and it is connectedness to the domain that drives a particular prosocial behavior - in our case behaviors in the ecological domain.

The partial mediation of the prosocial propensity - pro-environmental behaviors relation by connectedness to nature speaks to additional motivations arising from prosocial propensity in predicting pro-environmental behavior. In this case, this may constitute a connectedness to other humans as humans also benefit from pro-environmental action. Indeed, prior research has found positive

relationships between honesty-humility and connectedness to humanity (e.g., McFarland et al., 2012; Lee et al., 2015), where connectedness to humanity refers to a feeling of community with all humans across the world (McFarland et al., 2012). At least one recent study has shown that the teachings of the classic Catholic Church (mainly on humanitarianism) only related to respective humanitarian behavior and not to pro-environmental behavior (Neaman et al., 2021). In addition to connectedness to humanity predicting prosocial behaviors in the human domain (e.g., McFarland et al., 2012), prior research has also demonstrated positive relationships between connectedness to humanity and pro-environmental behaviors (e.g., Devine-Wright et al., 2015; Renger and Reese, 2017). Thus, as Schultz (2000) notes, in addition to threats and benefits to one's personal self, environmental concerns are 'rooted in a person's interconnectedness with other people and with the natural environment' (p. 402). In addition to sharing personality correlates, including honesty-humility, connectedness to humanity, and to nature, have also been shown to positively correlate with each other (e.g., Lee et al., 2015). In this line, both altruism and pro-environmental attitudes have been found to uniquely predict pro-environmental behavior (Clark et al., 2003). Overall, this suggests that connectedness to humanity and to nature are underpinned by a prosocial propensity. Future research would benefit from investigating both connectedness to humanity and connectedness to nature as parallel mediators of the prosocial propensity - pro-environmental behaviors relation. Further, future research would benefit from investigating connectedness to humanity as a mediator of the relationship between prosocial propensity and prosocial behavior in uniquely human domains. Evidence supporting this mediation model would add further support to the premise of this paper in that prosocial propensity is activated in certain domains via a motive, such as a connectedness to the 'others' of that domain.

While the position of the variables in our model hold theoretically, as we have only cross-sectional correlational data in these studies, we were unable to empirically demonstrate the causal directions of the pathways in our model. Future studies would benefit to examine these constructs within experimental, longitudinal, and developmental frameworks. There may be a recursive effect of the variables in our model, whereby thoughts and feelings associated with connectedness to nature, or from engaging in pro-environmental behavior, impact one's prosocial propensity and connectedness to nature, which then drive further pro-environmental behavior. Future research could, for example, examine interventions targeting connectedness to nature (such as nature exposure, or activities where one's inclusion with nature is made salient) and examine the recursive effect on one's prosocial propensity. Future research can also investigate the influence of external variables, such as environmental education, and its role in prosocial behavior. Given that environmental education interventions can also impact connectedness to nature, as well as pro-environmental behavior (e.g., Monroe, 2002; Otto and Pensini, 2017), investigating any recursive effect on prosocial propensity will provide further understanding of the interrelatedness of these constructs, and inform the delivery of the most effective environmental education programs. Indeed, it may also demonstrate that prosocial propensity can be enhanced via such interventions, and lead to prosocial behaviors in other domains (Neaman et al., 2018; Tapia-Fonllem et al., 2013; Zhang et al., 2014). Furthermore, the interrelatedness between pro-environmental behavior and connectedness to nature might come into play for a sustainable economy in the form of a circular bioeconomy, where nature-based products are introduced to support ecological behavior (Otto et al., 2021).

In the comparison of environmentalists, humanitarians, and the general population, we provided some evidence that prosocial

propensity (altruism) is higher in environmentalist and humanitarian organizations, further demonstrating the presence of prosocial propensity with prosocial behavior. That connectedness to nature and pro-environmental behavior were highest in environmentalists compared to both humanitarians and the general population lends weight to our mediation findings that connectedness to nature offers a motivation for actioning prosociality in the ecological domain. This pattern of findings is consistent with what would be expected from these known groups. That pro-environmental behaviors were lowest in humanitarians, compared to environmentalists and the general population, could be for manifold reasons. Firstly, it may be due to a perception of humanitarians that human-nature relations are zero-sum, leading to a prioritizing of human outcomes at the expense of the ecological domain. Secondly, it may be due to behavioral opportunities being inherently limited. Thus, prosocial individuals may enact their prosociality in whichever domain/s they are most connected to, and neglecting others. This is especially interesting, given that pro-environmental action also benefits humans. Indeed, prior known groups research has shown that connectedness to nature is higher in students enrolled in environmental studies, compared to students enrolled in other courses (e.g., maths, chemistry, psychology; Mayer & Frantz, 2004, Study 4), and in park and recreation management students compared to sports management students (Scarborough, 2013). To our knowledge, no prior work has compared members of humanitarian groups alongside that of environmentalist groups on these variables. Future research would benefit from examining these groups differences more scrupulously, in particular with targeted recruitment from humanitarian and environmental organizations to allow for sufficient sample size comparisons. Doing so will also enable an investigation of the human prosocial behavior of environmentalists.

5. Conclusion

Overall, we have provided evidence for an individual difference of prosocial propensity being actioned in the ecological domain via connectedness to nature. We have also provided evidence that prosocial propensity is equivalent in humanitarians and environmentalists, and that connectedness to nature and pro-environmental behaviors were higher in environmentalists. Finally, we demonstrated that connectedness to nature mediated the relationship between prosocial propensity and pro-environmental behavior, suggesting that prosocial behavior inherently stems from a connection to the relevant domain - in this case, the ecological domain. Especially for the ecological domain it has been shown that the connectedness to this domain spreads or "spills-over" to all behaviors in this domain (Henn et al., 2020). Future work would benefit to investigate other prosocial behaviors, the recursive effects of these variables, as well as compare known groups to provide further support for this model. Overall, it seems likely that all sustainable behavior is based on a general prosocial propensity, with the prosocial behavior directed toward that domain partially depending on the individual's attachment or connection to that specific domain.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

Person scores and MS fit values for pro-environmental behavior in study 1 and 2.

Item	Study 1		Study 2	
	Delta	MS Infit	Delta	MS Infit
I turn off the TV, computer and other electrical devices when I don't use them.	-2.173	0.962	-1.999	0.951
I buy natural products and / or with ecological label (for example, detergents, shampoos, etc.).	0.830	0.928	1.426	0.892
I buy beverages or beers in disposable bottles (plastic or can).	1.202	1.036	4.562	1.081
I wait until I have a full load before doing my laundry.	-2.257	0.932	-2.059	0.893
When I take a shower. I close the water to use the soap, then I open it again to rinse myself.	0.708	1.079	1.011	1.064
I read about environmental issues.	0.018	0.754	0.596	0.847
I buy products in refillable packages.	-0.006	0.830	0.397	0.875
I make purchases using my own reusable bags (for example, gender bags).	-0.956	0.803	-2.221	0.923
In nearby areas, I use public transportation or ride a bike or walk.	-0.978	1.073	-1.711	1.044
I recycle or reuse used paper.	0.604	0.858	1.614	0.887
I recycle or reuse glass bottles and/or jars.	-0.264	0.790	-0.006	0.914
I put cans in the garbage.	0.350	0.948	1.907	0.925
I put garbage packs or cardboard packaging in the garbage.	0.451	0.979	1.568	0.994
I buy soft drinks or beers in returnable bottles.	0.007	1.026	0.153	1.083
I have tried to make my family and/or friends more environmentally friendly.	-0.450	0.814	-0.578	0.850
I recycle or reuse plastic bottles and/or jars.	-0.136	0.816	0.184	0.857
I turn down the heat when I leave my apartment for more than 1h.	-2.578	0.923	-1.865	0.919
I buy seasonal produce.	-1.743	0.883	-0.580	0.930
I take tub baths.	-2.623	1.037	-2.760	1.012
I buy organic food.	1.108	0.953	1.738	0.880
I use wood heating.	0.735	1.195	-0.675	1.221
I reuse my shopping bags.	-2.736	0.903	-3.445	0.857
In the winter, I keep the heat on so that I do not have to wear a sweater.	1.108	1.218	-2.043	0.987
I use a clothes dryer all year.	0.847	1.247	-2.064	0.985
When I brush my teeth, I keep the tap running.	0.702	1.284	-2.289	0.912
I make compost with my organic waste (food scraps, fruit and vegetable waste), then I use it to fertilize the plants.	0.972	0.843	0.923	0.974
I am a member of an environmental organization.	0.895	0.890	4.045	0.817
I change the towels used daily	0.878	1.255	-2.055	0.959
I prioritize plane over the car and / or bus for long trips (more than 100 kilometers) within Chile.	-0.136	1.151	-0.551	1.357
After a picnic, I leave the place as clean as it was originally.	-4.248	0.918	-	-
I bought solar panels to produce energy.	2.701	0.963	2.627	1.115
I produce my own organic food (fruits, vegetables or honey, etc.).	1.690	0.939	1.340	1.038
I put dead batteries in the garbage.	0.522	1.383	-0.424	0.947
I boycott companies with an unecological background.	1.137	0.937	1.018	0.872
When I go to work or to study, I usually carpool with one or more persons.	-0.153	1.039	-1.001	0.969
I own a fuel-efficient automobile more than 13 km per liters).	-1.033	1.051	-0.470	1.001
In the kitchen, I collect the used oil in a bottle or container, and then I leave it at a collection point.	0.930	0.948	0.756	0.995
I contribute financially to environmental organizations.	1.726	0.910	2.680	0.908
I buy bulk products (for example, rice, noodles, nuts, beans, etc.) using my own containers.	1.213	0.919	1.328	1.069
I have taken environmental classes to be more informed.	1.135	0.905	1.814	0.960

Note. Items in boldface were reversed.

Appendix B

Person scores and MS infit values for altruism in study 1 and 2.

Item	Study 1		Study 2	
	Delta	MS Infit	Delta	MS Infit
I have helped push a stranger's broken car.	0.691	1.040	-0.004	0.974
I have given directions to a stranger.	-1.917	0.816	-1.959	0.808
I have made change for a stranger.	1.565	0.892	1.304	0.989
I have given money to a charity or fundraising campaign to help somebody.	0.194	0.984	0.813	0.968
I have given money to a stranger who needed it (or asked me for it).	0.639	0.867	0.627	0.887
I have donated goods or clothes to a charity.	0.234	0.919	0.136	0.884
I have done volunteer work for a charity.	1.175	1.050	1.784	0.905
I have donated blood.	1.871	0.912	2.109	0.962
I have helped carry a stranger's belongings (bags, parcels, etc.).	0.425	0.820	0.147	0.847
I have delayed an elevator and held the door open for a stranger.	-1.196	0.882	-1.133	0.900
I have allowed someone to go ahead of me in a lineup (driving a car, in the supermarket).	-0.247	0.897	-0.422	0.929
I have given a stranger a lift in my car.	2.625	0.868	2.243	0.938
When I receive extra change, I give it back to the cashier.	-2.009	1.181	-1.654	0.996
I have bought a "Teletón" product.	-0.315	1.372	-0.456	1.289
I refuse help from an unknown person.	-0.734	1.198	-1.251	1.163
I have offered to help a handicapped or elderly stranger across a street.	-0.942	0.867	-0.679	0.917
I have offered my seat on a bus or train to a stranger who was standing.	-1.558	0.858	-1.496	1.075
I comfort a stranger who was crying.	1.272	0.969	-1.404	0.899
I help an unknown person who fell on the street.	-1.393	0.819	-0.916	0.892
I continue my way when an unknown person asks me something and I don't listen to him.	-0.382	1.143	-0.599	1.143

Note. Items in boldface were reversed.

Appendix C

Person Scores and MS Infit values for connectedness to nature in study 1 and 2.

Item	Study 1		Study 2	
	Delta	MS Infit	Delta	MS Infit
I mimic animal behavior: for example, the way a vulture walks.	-2.259	1.101	1.739	1.155
I get up early to watch the sunrise.	1.066	1.073	1.378	1.073
I mimic the sounds of animals.	0.898	1.153	0.505	1.110
I walk on the grass without shoes.	-0.385	1.102	-0.899	1.111
I camp in nature.	-0.354	1.264	-0.297	0.975
I watch TV programs or internet videos about nature.	-1.504	1.062	-1.573	1.033
I take time to watch the clouds pass by.	-1.032	0.811	-0.831	0.894
I practice outdoor sports (trekking, surfing, kayaking, mountain biking, etc.).	0.248	1.039	0.013	1.213
I take time to listen to the birds in the morning.	-0.399	0.815	0.097	0.776
I talk to plants.	0.303	1.014	0.245	1.039
I deliberately take time to watch stars at night.	-1.780	0.839	-1.687	0.860
I picnic in nature.	-0.601	0.969	-0.314	0.844
I take time to watch the sunset.	-1.416	0.761	-1.822	0.797
I listen to the sounds of nature (for example, recorded on a CD / mp3 or on the Internet).	0.774	1.147	1.135	0.916
If there is an insect, such as a fly, in my home, I try to catch and release it rather than kill it.	-0.634	1.002	-0.681	1.185
I take time to consciously smell flowers.	-0.221	0.851	-0.170	0.893
I get up early to watch the birds.	1.752	0.798	2.187	0.777
I go to secluded beaches.	0.163	0.957	0.144	1.006
I go hiking in nature reserves and/or forests.	-0.459	0.854	-0.296	0.918
I hug the trees.	1.321	0.944	1.127	0.905

Appendix D. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.gloenvcha.2021.102312>.

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