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Childhood roots of being green:

Environmental morality and behavior in children and adults

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## ABSTRACT

How do environmental morality and sustainable behavior emerge in childhood? We examined individuals' moral judgments of environmental actions and their observed sustainable behavior in an environmental trade-off task in a sample of  $N = 555$  young adults (Study 1) and  $N = 45$  children ages 3–10 (Study 2). We show that both children and adults viewed pro-environmental behavior positively and environmental harm negatively—even if the action was sanctioned by an authority figure; however, both children's and adults' judgments of actions impacting other people were stronger than judgments of actions impacting the environment. Among children, negative judgments of environmental harm strengthened with age, as did their preference to befriend a pro-environmental character. Sustainable behavior was associated with judgments of environmental harm among adults, but with judgments of pro-environmental actions among children. These findings point to both developmental continuity and change in environmental morality and behavior.

*Keywords:* child development, moral development, morality, sustainability

### Childhood roots of being green:

#### Environmental morality and behavior in children and adults

“Since our leaders are behaving like children, we will have to take the responsibility they should have taken long ago.”

– Greta Thunberg, youth climate activist, addressing the United Nations in 2018 in *No One Is Too Small to Make A Difference*

A new, youth-led environmental movement has shifted public discourse on climate at a global scale (Marris, 2019). The voices of this movement include young children (e.g., Havana Chapman-Edwards, who began her activism at age 7; Mari Copeny, who first spoke about the Flint, MI water crisis at age 8), as well as adolescents (e.g., Isra Hirsi, co-executive director of US Youth Climate Strike at age 16; Greta Thunberg, who initiated the School Strike for Climate at age 15). Many adults now view children as a moral authority on issues related to the environment (Marris, 2019)—but how do children themselves come to reason about and act upon ecological issues, and how do their perspectives compare to those of adults? We explore these questions in two empirical studies, using theory and research from the field of moral development to inform the science of sustainable behavior.

Theories of moral development (Smetana et al., 2014; Turiel, 2008) suggest that young children distinguish actions that cause harm (moral violations) from those that disrupt social order (social-conventional violations). Specifically, preschoolers judge moral violations to be more severe than social-conventional violations, often invoking the harm resulting from moral violations to justify their views. Further, they judge moral but not social-conventional violations as wrong even when sanctioned by an authority figure (Smetana et al., 2014).

Importantly, research on children’s moral development has focused almost exclusively on social interactions between people, rarely considering the moral status of other living beings.

Recently, however, a small but growing literature has shown that like harm to other people, children also judge actions that harm the environment (plants, animals, and ecosystems) in moral terms (Kahn et al., 1995, 2002). By preschool, children judge environmental harm as wrong—more severely wrong than social-conventional transgressions but less severely wrong than social-moral violations (Collado & Sorrell, 2019; Hahn & Garrett, 2017). By early adolescence, children across multiple cultures and contexts—urban and rural, industrialized and non-industrialized—overwhelmingly view harm to their local ecology (e.g., polluting a nearby river) as a moral violation, and they justify their judgments using *biocentric reasoning* (focused on the welfare of the broader natural world) and *anthropocentric reasoning* (focused on the welfare of humans; Kahn & Friedman, 1995; Severson & Kahn, 2010). Children and teens thus view environmental harm as a moral violation because of both the direct harm to the environment and potential “downstream” indirect harm to humans (e.g., becoming sick from drinking polluted water).

Critical questions remain open, however. Little research has examined how young children view others’ *pro*-environmental actions, how children’s environmental moral judgments develop and compare to adults, and to what extent early environmental morality is related to morality regarding other people. Crucially, it is unclear whether children’s environmental moral judgments are related to their own emerging sustainable behavior. Children’s self-reported pro-environmental behaviors increase from ages 7–10, plateau around age 14, and then decline through age 18 (Otto et al., 2019). Further, 6- to 11-year-olds’ sustainable behavior in resource dilemma games increases with age and with exposure to pro-environmental role models, but appears unrelated to their social-emotional competencies such as delaying gratification (Ebersbach & Brandenburger, 2020; Ebersbach et al., 2019). Beyond these studies, there is

limited research regarding what factors predict individual differences in children's (particularly young children's) environmental judgments and behavior, and how these factors compare with adults.

The present studies seek to address these questions, first through validating study stimuli and establishing normative data in a large sample of adults (Study 1), then by examining responses to these stimuli among 3- to 10-year-olds (Study 2). Our aims were fivefold. First, we sought to replicate previous findings that children view environmental harm as a moral violation, and extend them by examining both children's and adults' judgments of *pro-environmental* behavior. We hypothesized that children and adults would judge environmental harm as bad and pro-environmental behavior as good, but that judgments would be weaker for environmental than socio-moral actions (Hahn & Garrett, 2017). We also examined whether children preferred pro-environmental over environmentally harmful agents. We hypothesized that if environmental harm is viewed as a moral transgression (Kahn & Friedman, 1995), children and adults would show a preference for pro-environmental agents as they do for prosocial agents (Hamlin, 2013).

Second, we examined whether children's and adults' judgments of environmental actions were related to their socio-moral judgments. If individuals understand that the health of the environment has downstream consequences for the welfare of humans (Kahn & Lourenço, 2002), their judgments of environmental and social actions may be significantly related.

Third, we asked whether individuals' judgments of third-party environmental actions were meaningfully related to their own observed sustainable behavior in an environmental trade-off task that involved choosing between two transportation options: a faster but polluting/unsustainable option vs. a slower but cleaner/ sustainable option. We expected children and

adults who endorsed stronger moral judgments of environmental actions to demonstrate more sustainable behavior themselves.

Fourth, we examined age-related changes in these dimensions of environmental morality to provide, for the first time, a direct comparison to adults. We focused on potential developmental shifts from preschool (3-5) to school-age (6-10), given the changes in children's moral cognition known to occur during this period (Tomasello & Vaish, 2013). We expected that even the younger children would provide moral judgments of environmental actions. However, given prior work showing a spike during the school-age period in judgments of environmental harm (Collado & Sorrel, 2018), and pro-environmental attitudes and behavior (Otto et al., 2019), we expected school-age children to show stronger environmental moral judgments and preferences for pro-environmental agents, and to themselves engage in greater pro-environmental behavior, than preschool-age children.

Fifth, we examined potential sources of individual differences in children's and adults' environmental morality. We cast a wide net by including predictors such as gender, urbanicity, and socioeconomic status; these analyses were exploratory with no a priori hypotheses.

## Study 1

### Results

***Descriptive analysis.*** We first examined adults' ( $N = 555$ ; 65% female) judgments of actions impacting people and actions impacting the environment. Distributional properties of the data and bivariate correlations are shown in Table 1. Adults' judgments of environmental actions were unrelated to age but showed significant differences by gender. Women judged environmental harm as significantly more negative ( $M = 3.73$ , 95% CI [3.60, 3.85]) compared to men ( $M = 4.13$ , 95% CI [3.98, 4.29]),  $t = -3.84$ ,  $p < .001$ , and viewed pro-environmental

behavior as more positive ( $M = 8.25$ , 95% CI [8.20, 8.30]),) than men ( $M = 8.11$ , 95% CI [8.03, 8.20]),),  $t = 2.82$ ,  $p = .005$ . Women also were less likely to say that environmental harm would be permissible if sanctioned by authority ( $M = 0.72$ , 95% CI [0.65, 0.80]),) than men ( $M = 0.89$ , 95% CI [0.78, 1.00]),),  $t = -2.46$ ,  $p = .014$ . Women produced significantly lower total emissions on the environmental trade-off task ( $M = 83.30$ , 95% CI [76.71, 89.88]),) than did men ( $M = 111.49$ , 95% CI [100.94, 122.05]),),  $t = -4.47$ ,  $p < .001$ , and self-reported greater eco-friendly behavior ( $M = 86.09$ , 95% CI [84.51, 87.66]),) than men ( $M = 81.05$ , 95% CI [78.87, 83.22]),),  $t = 3.72$ ,  $p < .001$ .

Adults' environmental moral judgments varied depending on the type of behavior: Judgments of environmental harm as "bad" were strongest for unsustainable resource use ( $M = 2.92$ , 95% CI [2.75, 3.08]) and weakest for harm to plants (i.e., breaking branches off a tree to make a fort,  $M = 5.39$ , 95% CI [5.27, 5.50]). Most of adults' judgments of environmental harm were resistant to authority sanction, with approximately 90% saying that harm to animals, littering, and unsustainable resource use would still be "not okay" even if sanctioned by authority; in contrast, a slight majority (55%) of participants who initially judged harm to plants as bad said it would be "okay" if their professor sanctioned it. Positive judgments of pro-environmental behavior were strongest for planting trees ( $M = 8.49$ , 95% CI [8.43, 8.55]) and helping animals ( $M = 8.45$ , 95% CI [8.36, 8.53]) and weakest for sustainable resource use ( $M = 7.51$ , 95% CI [7.42, 7.59]). To simplify subsequent analyses, we averaged ratings of the four environmental harm behaviors and the four pro-environmental behaviors to create a composite score for each.

Overall, 94% of adults preferred to befriend the character who had engaged in sustainable behavior over the character who had engaged in environmentally harmful behavior. On an

environmental trade-off task in which participants chose to use a car or a bike for transportation over multiple trials, participants' total CO<sub>2</sub> emissions showed substantial variability (range: 0 – 256kg of CO<sub>2</sub>,  $M = 93.30$ , 95% CI [87.55, 99.06]) and a bimodal distribution, with 17% of participants choosing the bicycle across all trials (zero emissions); the remaining 83% of participants were normally distributed.

***Are moral judgments of environmental harm related to judgments of social behavior?***

Adults' judgments of environmental harm were positively related to their judgments of antisocial behavior,  $r = .40$ ,  $p < .001$ ; similarly, judgments of pro-environmental behavior were positively correlated with judgments of prosocial behavior,  $r = .48$ ,  $p < .001$ . On average, adults judged harm to other people as significantly worse than harm to the environment, paired-samples  $t = 3.82$ ,  $p < .001$ , Cohen's  $d = 0.16$ ; just 9% of adults said that antisocial behavior would be "okay" if sanctioned by authority. Similarly, adults judged prosocial behavior as significantly more positive than pro-environmental behavior, paired-samples  $t = 2.22$ ,  $p = .027$ , Cohen's  $d = 0.09$  (Figure 2, left panel). Adults who preferred the pro-environmental character were significantly more likely to also prefer the prosocial character,  $\chi^2(1, N = 555) = 24.36$ ,  $p < .001$ , Cramér's  $V = .21$  (Figure 3, left panel).

***Are moral judgments related to sustainable behavior?*** In a set of linear regressions, we examined whether adults' friend preferences and behavior in the environmental trade-off task were predicted by their judgments of environmentally harmful and helpful actions. Given the significant gender differences in participants' responses, we controlled for gender in the first step of each analysis. In separate binary logistic regressions predicting adults' friend preference, neither judgments of environmental harm nor judgments of pro-environmental behavior were significant predictors, all  $ps > .05$ , likely due to lack of variability on this outcome variable. In

separate regressions predicting total CO<sub>2</sub> emissions, more negative judgments of environmental harm predicted lower emissions,  $\beta = .14$ ,  $t = 3.26$ ,  $p < .001$ , model  $R^2 = .05$ , and more positive judgments of pro-environmental behavior predicted marginally lower emissions, though this trend did not reach significance,  $\beta = -.08$ ,  $t = -1.87$ ,  $p = .062$ , model  $R^2 = .04$ . When the two predictors were entered together in the same step, only judgments of harm were significant.

***What contributes to differences in adults' environmental judgments and behavior?***

Exploratory follow-up analyses (controlling for gender) were conducted to test whether demographic variables were associated with adults' environmental judgments or behavior on the environmental trade-off task. Three potential predictors—urbanicity, socioeconomic status (SES), and political orientation—were entered together in a linear regression predicting each outcome of interest. In the regression predicting judgments of environmental harm, only more conservative political ideology predicted more lenient judgments of harm,  $\beta = .14$ ,  $t = 3.26$ ,  $p = .001$ ; model  $R^2 = .04$ . In the regression predicting judgments of pro-environmental behavior, no significant predictors emerged, all  $ps > .05$ . In the regression predicting total emissions in the environmental trade-off task, only more conservative political ideology predicted greater CO<sub>2</sub> emissions,  $\beta = .17$ ,  $t = 3.97$ ,  $p < .001$ ; model  $R^2 = .06$ . Socioeconomic status and urbanicity were not significant predictors in any model,  $ps > .05$ .

**Discussion**

Study 1 provided several insights into adults' environmental moral judgments and behavior. First, we found that adults view harm to the environment as negative, but less egregious than harm to people. Views of environmental harm as “bad” were moderately resistant to change even when sanctioned by an authority figure, suggesting that environmental harm may be viewed as more of a moral than a social-conventional violation (with the exception of harm to

plants). Second, we found that adults also view pro-environmental behavior as positive, but less positive than prosocial behavior benefitting people. Together, these data suggest that participants view ecological action in moral terms but privilege the welfare of humans over that of other living beings (plants, animals, broader ecosystems). Notably, adults' views of environmental and social actions were strongly related. Further, moral judgments of others' environmentally harmful behavior, but not pro-environmental behavior, predicted participants' own behavior in the environmental trade-off task, suggesting that considerations of environmental harm may be a more salient driver of sustainable actions (in this case, choice of transportation) than considerations of environmental benefit. Additionally, consistent with previous research (Xiao & McCright, 2013), gender and political orientation emerged as significant sources of individual differences, with women and more liberal participants demonstrating stronger pro-environmental values and behavior.

To what extent are these patterns observable in early childhood, before extensive socialization—and politicization—have occurred? How might we begin to characterize the development of environmental morality, including children's own ecological behavior? Study 2 addressed these questions by using near-identical stimuli as Study 1, but in an in-person interview format with children in which we could ask *why* children viewed environmental behaviors as good or bad.

## Study 2

### Results

***Descriptive analysis.*** We examined these questions in a sample of 3- to 10-year-old children ( $N = 45$ , 58% female). Distributional properties of the data and bivariate correlations are shown in Table 1. Children meaningfully distinguished between environmentally harmful and

pro-environmental actions and showed variation in the strength of their moral judgments depending on the type of behavior: Children's judgments of environmental harm as "bad" were strongest for littering ( $M = 1.89$ , 95% CI [1.43, 2.35]) and weakest for harm to plants ( $M = 3.16$ , 95% CI [2.39, 3.93]). Children's judgments of pro-environmental behavior as "nice" were strongest for helping animals ( $M = 8.53$ , 95% CI [8.26, 8.81]) and picking up trash ( $M = 8.58$ , 95% CI [8.22, 8.94]) and weakest for sustainable resource use ( $M = 6.64$ , 95% CI [5.81, 7.48]). To simplify subsequent analyses, we averaged ratings of the four environmental harm behaviors and the four pro-environmental behaviors to create a composite score for each.

Children's judgments of environmental harm were resistant to authority sanction, with the vast majority (>80%) of children saying that each harmful behavior would still be "not okay" even if sanctioned by their teacher. Only 22% of children said that *any* of the four environmentally harmful actions would be "okay" if their teacher said it was okay. When justifying their responses, children relied more often on biocentric reasoning ( $M = 3.66$ , 95% CI [2.91, 4.41]; 46% of stories) than anthropocentric reasoning ( $M = 1.39$ , 95% CI [0.92, 1.86]; 17% of stories; see Table 2); just 25% of children displayed systems thinking (considering the downstream consequences of an action; see Lezak & Thibodeau, 2016). Overall, a significant majority of children preferred to befriend the character who had engaged in sustainable behavior (68%) over the character who had engaged in environmentally harmful actions (exact binomial test: Clopper-Pearson 95% CI [52%, 81%],  $p = .024$ ). In an environmental trade-off task adapted for children, a nonsignificant majority of children chose to drive a slower but more eco-friendly toy car (62%) over a faster but more polluting one (Clopper-Pearson 95% CI [47%, 76%],  $p = .136$ ). There were no gender differences for any variables of interest, all  $ps > .05$ .

***Do children's environmental moral judgments and behavior change with age?*** Pearson correlations showed that children's exact age was significantly associated with ratings of environmental harm, with older children judging environmental harm more harshly; older age was also associated with children's greater use of biocentric reasoning and systems thinking when justifying their moral judgments (Table 1). Children's judgments of pro-environmental actions and use of anthropocentric reasoning were not significantly related to age.

To probe results further, we examined children's responses by age category, comparing younger (ages 3-5) to older (ages 6-10) children. Results are illustrated in Figures 2 and 3. The older age group judged environmental harm as significantly worse compared to the younger age group,  $F(1, 43) = 4.55$ ,  $\eta_p^2 = .10$ ,  $p = .039$ , and judged pro-environmental behavior as marginally better, though this trend was not significant,  $F(1, 43) = 3.30$ ,  $\eta_p^2 = .07$ ,  $p = .076$  (Figure 2). Older children also were more likely to prefer the pro-environmental character (91%) compared to younger children (43%),  $\chi^2(1, N = 45) = 11.88$ ,  $p = .001$ , Cramér's  $V = .52$  (Figure 3, right panel). Similarly, older children were somewhat more likely to choose the eco-friendly car (74%) compared to younger children (50%); however, this trend did not reach significance,  $\chi^2(1, N = 45) = 2.74$ ,  $p = .089$ , Cramér's  $V = .25$ .

***Do children's moral judgments of environmental behavior develop alongside judgments of social behavior?*** As with adults in Study 1, children's judgments of environmental harm were strongly positively correlated with their judgments of antisocial behavior,  $r = .56$ ,  $p < .001$ ; similarly, judgments of pro-environmental behavior were positively correlated with judgments of prosocial behavior,  $r = .44$ ,  $p = .003$ . Similar to adults in Study 1, children judged harm to other people as significantly worse than harm to the environment, paired-samples  $t = 4.06$ ,  $p < .001$ , Cohen's  $d = 0.61$ ; just 7% of children said that antisocial behavior would be

“okay” if sanctioned by authority. Similarly, children judged prosocial behavior as significantly more positive than pro-environmental behavior, paired-samples  $t = 4.42, p < .001$ , Cohen’s  $d = 0.66$  (Figure 2, right panel). Children who preferred the pro-environmental character were significantly more likely to also prefer the prosocial character,  $\chi^2(1, N = 45) = 4.47, p = .035$ , Cramér’s  $V = .32$ , as seen with adults in Study 1.

As with judgments of environmental behavior, moral judgments of social behavior changed with age: Older children judged antisocial behavior as significantly worse compared to younger children  $F(1, 42) = 6.59, \eta_p^2 = .14, p = .014$ , mirroring findings for environmental harm; although older children judged prosocial behavior as slightly better than younger children, this difference was not significant,  $F(1, 43) = 2.49, \eta_p^2 = .06, p = .122$ , paralleling findings for pro-environmental behavior. Older children were more likely to prefer the prosocial character (91%) compared to younger children (62%),  $\chi^2(1, N = 45) = 5.06, p = .024$ , Cramér’s  $V = .34$  (Figure 3).

***Are children’s moral judgments related to sustainable behavior?*** In a set of binary logistic regressions, we examined whether children’s friend preferences and choice of car in the environmental trade-off task were predicted by their judgments of environmentally harmful and helpful actions. Children’s likelihood of choosing the pro-environmental friend was not significantly predicted by moral judgments of environmental actions, all  $ps > .05$ . However, children’s likelihood of choosing the eco-friendly car was significantly predicted by higher ratings of pro-environmental behavior ( $b = .71, SE = .35, Wald = 4.05, p = .044; Exp(b) = 2.03, 95\% CI [1.02, 4.06]$ ), but not by ratings of environmental harm ( $b = -.27, SE = .18, Wald = 2.36, p = .124; Exp(b) = .76, 95\% CI [.54, 1.08]$ ). The model remained significant when child gender was included as a covariate.

*What contributes to differences in children's environmental judgments and behavior?*

Exploratory follow-up analyses were conducted to test whether parent and demographic variables were associated with children's environmental judgments or behavior on the environmental trade-off task. Four potential predictors—urbanicity, parent education level, parent political orientation, and time spent outdoors in a typical week—were entered together in a linear regression predicting each outcome of interest. In the regression predicting children's judgments of environmental harm, higher parental education predicted more negative judgments of environmental harm,  $\beta = -.45$ ,  $t = -2.43$ ,  $p = .021$ , as did the amount of time children spent outdoors in a typical week,  $\beta = -.38$ ,  $t = -2.20$ ,  $p = .035$ ; model  $R^2 = .19$ . In the regression predicting judgments of pro-environmental behavior, only urbanicity emerged as a significant predictor, with children from more rural communities judging pro-environmental behaviors more positively,  $\beta = -.51$ ,  $t = -3.31$ ,  $p = .002$ ; model  $R^2 = .27$ . In the logistic regression predicting children's behavior in the environmental trade-off task, no predictors were significant, all  $ps > .05$ . Parents' political orientation was not significant in any of the three models.

**Discussion**

Children in Study 2 viewed harm to the environment as negative, but less so than harm to people, mirroring findings with adults in Study 1. Views of environmental harm as “bad” strengthened with age and were highly resistant to change even when sanctioned by an authority figure, providing preliminary evidence that children, too, view environmental harm more as a moral violation than a social-conventional violation. Like adults, children also viewed pro-environmental behavior as positive, but less so than prosocial behavior benefitting people. Together, these data suggest that children also view ecological action in moral terms but may prioritize the welfare of humans. Nevertheless, the ways children justified their judgments of

environmental actions focused principally on the welfare of the natural world (i.e., biocentric reasoning). Children's views of environmental and socio-moral actions were robustly related and showed similar age-related changes, suggesting that children's morality in these domains may track together in development. In contrast to adults, children's moral judgments of others' *pro-environmental* behavior, but not environmentally harmful behavior, predicted children's own behavior in the environmental trade-off task, suggesting that children's considerations of potential benefits may be more salient in their ecological decision-making. Finally, in contrast to adults, neither gender nor parents' political orientation predicted children's environmental judgments and behavior; instead, factors that may support children's access to and connection with nature (living in a more rural environment, spending more time outdoors, having more educated parents) emerged as significant sources of variation.

### **General Discussion**

Mounting scientific evidence suggests that present-day environmental crises will have the greatest impact on younger generations (Salas et al., 2019); in response, youth themselves have become active participants in environmental movements and are widely regarded as voices of moral authority (Marris, 2019). The present research illuminates the developmental origins of environmental morality in childhood, providing some of the first evidence that moral judgments about both environmentally harmful and sustainable actions emerge early in life, change with age, correlate with moral judgments of social interactions, and meaningfully predict one's own observed sustainable behavior. Importantly, the factors associated with sustainable behavior for children (e.g., positive views of pro-environmental actions in Study 2) appear to differ from those associated with sustainable behavior among adults (e.g., gender, political orientation, and

negative views of environmental harm in Study 1). Here we synthesize results from both studies, offer potential explanations for the findings, and outline avenues for future research.

### **Developmental “Roots” of Environmental Morality**

Previous work has shown that children as young as preschool age view environmental harm negatively (Collado & Sorrel, 2019), and that school-age children prioritize humans over animals less than adults do when making moral judgments (Wilks et al., 2020). Here we demonstrated that both children’s and adults’ views of environmental harm as wrong were upheld even when sanctioned by authority, supporting the notion that environmental harm is viewed as a moral (and not a social-conventional) violation (Smetana et al., 2014). While adults viewed unsustainable resource use (i.e., overfishing) as the worst offense, children were most strongly opposed to littering, perhaps because littering is a more familiar behavior to children, or because understanding unsustainable resource use requires more complex thinking about downstream effects. Indeed, systems thinking was only observed in one quarter of children’s responses; however, because adults did not provide verbal justifications for their responses, we cannot directly compare systems thinking between children and adults. Among both children and adults, negative judgments of environmental harm were weakest for harm to plants, possibly because the particular action—breaking branches off a tree—was not sufficient to do lasting damage (i.e., a tree can survive such treatment), or because plants are less likely to be seen as part of humans’ “moral circle” compared to animals and other humans (see Rottman et al., 2015). Future work should examine whether increasing the severity or scale of the harm described (e.g., cutting down a larger number of trees), priming individuals to consider the downstream consequences of the harmful action, or localizing where the harm transpires (e.g., destroying plant life in one’s own neighborhood) may shift these judgments.

Extending previous work, we also found that young children viewed *pro*-environmental behavior favorably. Children and adults viewed helping animals as particularly positive; perhaps relatedly, children's and adults' positive views were weakest for sustainable resource use, possibly because the action (catching only the two fish that one needs) still involved harm to animals. Findings align with research suggesting that animals are typically viewed as sentient and deserving of certain rights and moral status (Rottman et al., 2015), as well as theory suggesting that care for animals is an important link in children's developing capacity to care for the natural world more broadly (Meyers & Saunders, 2002).

By school-age, children, like adults, reliably preferred *pro*-environmental over environmentally harmful agents, mirroring previous observations of early-emerging preferences for prosocial agents (Hamlin, 2013). Results suggest that children take others' environmental behavior into account when forming impressions of others and choosing with whom to affiliate. Future work should examine how children weigh potential trade-offs between individuals' *pro*-environmental behavior and associated costs (e.g., sacrificing convenience, forgoing a desired resource that may confer social status, or paying more for an "eco-friendly" item) when selecting social partners.

Critically, environmental morality appears to undergo important developmental changes from preschool to school-age. Specifically, moral judgments of environmental harm (but not *pro*-environmental behavior) strengthened with age, and older children were more likely to draw upon biocentric reasoning and systems thinking to support their moral judgments. One possibility is that older children's cognitive advances—including increasing attention to *indirect* harmful effects (Smetana et al., 2014) and conceptual flexibility in intuitive biological reasoning (Betz & Coley, 2020)—allow for greater consideration of the consequences of ecological actions

in terms of harm to living beings and larger ecological systems. A second possibility is that children's capacity for moral emotions such as sympathy or empathic concern increase during this period (Eisenberg, 2017), such that acts of environmental harm elicit stronger affective responses that heighten children's perceptions of their severity.

### **Connecting Environmental Morality to Human Welfare**

Central to the current youth environmental movement is an emphasis on social justice and the ways in which environmental harm is interconnected with social harm (e.g., Zero Hour). From this perspective, it is no surprise that children's and adults' moral judgments of environmental actions were strongly related to their judgments of social interactions. That is, children's and adults' ratings of environmental harm and pro-environmental behavior were significantly related to their ratings of antisocial and prosocial behavior, respectively. Similarly, individuals' preferences for pro-environmental and prosocial agents often co-occurred. Given that children's judgments of environmental and social actions were closely intertwined, it is possible that young children may be capable of understanding more complex issues related to environmental justice (e.g., environmental racism), highlighting an important direction for future work. A related question is whether age-related increases in children's systems thinking may support children's development of morality that includes humans as *part of* nature, with the welfare of people and their ecology as interrelated. To that end, future work could test whether interventions or experimental manipulations to increase systems thinking could boost both social and environmental morality simultaneously. Further, contextual factors such as having direct experience of how ecological harm adversely impacts humans may be more common in places where people rely directly and daily on their natural resources and witness the harmful effects of their own and others' actions (e.g., frontline communities). Such contexts and experiences may

impact the development of environmental judgments and behavior.

### **What predicts “being green”?**

A central goal of the present research was to examine not only children’s judgments of third-party environmental actions, but to test whether these judgments bear meaningfully on their observed “green” behavior. Hypotheses were partially supported, with a different pattern of results emerging for adults vs. children. Specifically, the choice of a more sustainable mode of transportation in an environmental trade-off task was associated with adults’ judgments of environmental harm, but with children’s judgments of *pro*-environmental behavior. These findings likely reflect meaningful differences in how children and adults make ecological decisions; for example, adults may attend more to the costs of unsustainable behavior (e.g., emissions contributing to climate change) that contribute to harm, whereas children may be driven by a desire to do what is perceived as “good” or to maintain a positive identity that they associate with pro-environmental actions.

Finally, exploratory analyses highlighted several factors associated with variation in sustainable behavior—factors which differed for children and adults. Most strikingly, we found robust evidence for gender differences in almost all outcomes related to environmental morality among adults in Study 1, consistent with numerous previous studies demonstrating heightened environmental concern among women compared to men (Xiao & McCright, 2015). In contrast, no differences emerged between girls and boys in Study 2, suggesting that gender differences in environmental morality emerge over the course of development—potentially via gender socialization. Future work in larger samples should examine what socialization messages children receive about the environment, how such messages may differ by gender at different ages, and whether there are ways to support boys’ sustained care for the natural world into

adulthood. Beyond gender, the most consistent predictor of adults' pro-environmental judgments and sustainable behavior was more liberal political orientation, similar to prior work (Feinberg & Willer, 2013). In contrast, young children's responses were unrelated to their parents' political leanings, suggesting that children's environmental morality is not simply determined by their parents' politics. Instead, children's stronger moral judgments of environmental actions were associated with spending more time outdoors in a typical week and living in a more rural environment—two markers of greater exposure (and perhaps connection) to nature. This was not the case for adults, raising the possibility that childhood may be a sensitive period for developing environmental morality as a function of experience with local ecosystems. Although these findings are preliminary, they highlight the importance of considering developmentally specific predictors of environmental morality.

### **Charting the Future**

Although evidence suggests that youth from many cultures view environmental harm as a moral violation and voice biocentric and anthropocentric justifications (Howe et al., 1996; Kahn & Friedman, 1995; Kahn & Lourenço, 2002; Villarroel et al., 2017), the field is ripe for further research across diverse cultures, contexts, and socioeconomic strata. In addition, experimental work is needed to examine whether factors such as context (e.g., whether an action occurred in one's local environment vs. further away), the degree of impact (e.g., the severity of harm caused), or individuals' knowledge of potential downstream consequences (e.g., priming "systems thinking") could be manipulated to shift environmental moral judgments and sustainable behavior at different ages. The present research provides a useful starting point for fruitful future work on these important topics. Finally, children's responses often included affective expression (e.g., pouting and shaking their head in response to a story about

environmental harm), and future research should assess the role of emotion in children's environmental morality and behavior. Research suggests that children as young as 18 months engage in affective perspective taking toward the victim of harm, which predicts their own prosocial behavior (Vaish et al., 2009), and that children show increased physiological arousal in response to moral compared to conventional norm violations (Yucel et al., 2020). It may be interesting in future work to examine whether children and adults experience similar or distinct moral emotions across environmental and socio-moral contexts.

## **Conclusions**

As the climate crisis perpetuates increasing harm—to humans and the broader natural world—social scientists are tasked with understanding and leveraging the psychological processes that drive ecological concern and action (for perspectives on adults, see Pearson et al., 2016; van der Linden et al., 2015). Our findings contribute to a growing literature on this issue by suggesting that even young children are capable of considering environmental action in a moral framework that is coherent, supported by reasoning that considers the wellbeing of both humans and nature, and predictive of children's own pro-environmental behavior. Further, initial evidence suggests that environmental morality undergoes important developmental shifts—namely, moral judgments appear to strengthen as children enter school age, and the factors that predict pro-environmental views and behavior differ in childhood vs. adulthood. These findings open the door for education policy and programs to support young children's environmental awareness in developmentally appropriate ways (for example, by using stories like those in the present study, and discussing issues of harm and downstream consequences with children). Science is clear that environmental harm will most severely impact children (Salas et al., 2019),

and the present findings point to the potential to draw on the moral convictions of children and adults alike to be a part of the solution.

## Method

### Study 1 Method

#### *Participants*

Young adults ( $N = 555$ ; 65% female;  $M_{\text{age}} = 19.22$  years,  $SD = 1.30$ ) were recruited through an undergraduate participant pool at a large university in the mid-Atlantic United States. Seventy-two additional participants were tested but excluded for failing to complete the survey ( $n = 19$ ), answering in response sets (e.g., responding “1” to all items) and failing practice questions ( $n = 53$ ). Approximately 68% identified as White, 27% Asian, 8% African American, 7% Hispanic/Latinx, and 3% multiracial/multi-ethnic (for details see Supplemental Table S1). We recruited a large sample size in order to provide sufficient norming data among adults against which children’s responses could be compared.

#### *Procedures*

All procedures for both studies were approved by the University’s IRB (protocol #2203). Participants provided informed consent and completed all tasks independently online. First, participants read stories about environmental actions and social actions, in counterbalanced order. Next, they completed an environmental trade-off task. Finally, participants reported on their typical ecological behavior and provided demographic information about their political orientation (1 = *very liberal*, 4 = *moderate*, 7 = *very conservative*) and one item assessing the area where they live (1 = *very rural*, 7 = *very urban*).

#### *Materials*

**Moral Judgments.** Participants were familiarized with a 9-point pictorial response scale previously validated for use with children (Yucel et al., under review; Figure 1A); responses range from *really bad* to *really nice*. Following a scale comprehension check, participants read

environmental and social stories involving characters gender-matched to the participant (Supplemental Table S2; adapted from Hahn & Garrett, 2017; Hussar & Hovarth, 2011). In the set of 8 environmental stories, four depicted a character engaging in ecologically harmful actions (e.g., “Marcus catches all the fish for dinner so there are none left in the river”), and four depicted a character engaging in pro-environmental actions (e.g., “Alex catches two fish that he needs for dinner so there are some left in the river”; see Figure 1B and C). In the set of two social stories, one depicted a character engaging in antisocial behavior (i.e., “Lee takes someone else’s toy without asking”), and the other depicted a character engaging in a prosocial action (i.e., “Michelle helps to pick up the papers that someone dropped”).

After each story, participants indicated “how nice or bad” the action was using the 9-point scale. If a participant indicated that an action was “bad,” they were probed regarding whether the action would be permissible if sanctioned by an authority figure (their professor). After each set of stories (environmental and social), participants were asked which of the two characters they would prefer to be friends with. Environmental and social story sets were presented in counterbalanced order, and stories were randomized within each set.

**Environmental Trade-off Task.** We used an adapted version (Austin & Converse, under review) of the Pro-Environmental Behavior Task (PEBT; Lange et al., 2018) to assess real-time environmental behavior. Participants engaged in 20 trials in which they could complete a virtual journey by car or bicycle, with realistic associated costs: By selecting the car, they completed the journey faster (i.e., there was less wait time before the next trial) but emitted a certain number of kilograms of CO<sub>2</sub>, whereas by selecting the bicycle, the journey took more time but emitted no CO<sub>2</sub>. A final score was calculated by summing the total kg of CO<sub>2</sub> emitted across the task. The task shows good reliability and validity (Austin & Converse, under review; Lange et al., 2018).

In the present study adults' lower CO<sub>2</sub> emissions on this task were related to greater self-reported ecological behavior on the General Ecological Behavior scale (GEB; Kaiser, 1998),  $r = -.28$ ,  $p < .001$ , suggesting convergent validity.

## **Study 2 Method**

### ***Participants***

Children ( $N = 45$ ; 58% female) and their parents were recruited through a database of families who had volunteered to participate in child development studies through the University's Child Development Labs, and through a local children's museum. Children ranged in age from 3–10 years ( $n = 23$  preschool-age [3–5y];  $n = 22$  school-age [6–10y]). Parents indicated their child's race and ethnicity: 82% identified as White, 13% Asian, 7% Hispanic/Latinx, 4% Black, 11% multiracial/multi-ethnic (for details see Supplemental Table S1). Data collection was stopped early due to safety precautions related to COVID-19. Notably, however, the sample size is comparable to or exceeds previously published work on this topic (Hahn & Garrett, 2017; Severson & Kahn, 2010), and power analyses indicated that moderate to large effect sizes could be adequately detected with a power of .80 in the present sample.

### ***Procedures***

Parents provided informed consent, and children over the age of 7 provided written assent prior to data collection, which occurred either in a laboratory setting or at a private table at a children's museum. An experimenter guided children first through the moral judgments task and then through an environmental trade-off task (a copy of the full experimenter script is provided in Online Supplemental Materials). While children engaged in these tasks, parents completed questionnaires on a tablet.

## **Materials**

**Moral Judgments.** All story stimuli were identical to those used in Study 1. Children were familiarized with the 9-point pictorial response scale, providing greater nuance in responses than previously used 2- and 3-point scales (Collado & Sorrel, 2019). They then completed a series of comprehension checks. Then the experimenter read each story and asked, “How nice or bad is that?” Immediately following children’s scale ratings, the experimenter also asked, “*Why* is this nice/bad?” Children’s verbal justifications for each story were coded for the presence of (a) *biocentric reasoning* (considering the wellbeing of plants, animals, or larger ecosystems) and (b) *anthropocentric reasoning* (considering the wellbeing of humans), following Kahn and colleagues (1995, 2002, 2010), as well as a new category, (c) *systems thinking* (considering the downstream consequences of an action; see Lezak & Thibodeau, 2016). Details of the coding scheme appear in Supplemental Materials. All verbal responses were coded by two independent coders blind to other information about the child; discrepancies were resolved via conferencing.

As in Study 1, if a child indicated that an action was “bad,” the experimenter read the authority probe: “If your teacher said it was okay to do this, would it be okay or not okay?” After each story set, children were asked which of the two characters (helpful vs. harmful) they would prefer to be friends with. Story sets (environmental vs. social) were presented in counterbalanced order, and stories were randomized within each set.

**Environmental Trade-off Task.** Children completed an environmental trade-off task designed for this study to be comparable to the PEBT. Children were shown two red toy cars, presented in counterbalanced order as the experimenter described each one: “This car goes *really* fast, but makes the air dirty to breathe in the neighborhood,” and “This car goes *a little* fast, but keeps the air clean to breathe in the neighborhood.” Following a comprehension check, the

experimenter then set both cars down in front of the child and said, “Now tell me: which car do *you* want to drive today?” Children could then play with whatever car they chose until the end of the session.

**Parent Questionnaires.** Parents completed questionnaires with demographic items, including their political orientation and urbanicity, as well as one item assessing the amount of time their child spends outdoors in a typical week.

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**Table 1**

*Bivariate correlations among study variables for adults in Study 1 (N = 555; below diagonal) and children in Study 2 (N = 45; above diagonal).*

	Social Tasks					Environmental Tasks							
	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Age	-	-.14	.21	-.20	.38*	.09	-.37*	.41**	-.08	.30*	-.04	.39**	.25 <sup>†</sup>
2. Urbanicity	-.03	-	-.12	.03	.09	-.40**	-.01	.13	.16	-.08	-.09	.18	.34*
<b>Social Tasks</b>													
3. Prosocial behavior ratings	.01	-.01	-	-.25 <sup>†</sup>	.45**	.44**	-.36*	-.19	-.37*	.29 <sup>†</sup>	-.22	.17	-.07
4. Antisocial behavior ratings	-.01	-.02	-.37**	-	-.14	-.05	.56**	-.07	-.14	-.20	-.10	-.07	.06
5. Preference for prosocial friend	-.11**	.04	-.01	-.12**	-	.33*	-.32*	.32*	-.22	.18	.05	.30 <sup>†</sup>	.18
<b>Environmental Tasks</b>													
6. Pro-environmental behavior ratings	.01	-.01	.48**	-.29**	.01	-	-.12	.10	-.16	.32*	-.27 <sup>†</sup>	.11	.08
7. Environmental harm ratings	.06	.02	-.25**	.40**	-.02	-.24**	-	-.12	.18	-.24	.07	-.48**	-.24
8. Preference for pro-environmental friend	.07	.05	.08 <sup>†</sup>	-.04	.21**	.03	-.06	-	.25 <sup>†</sup>	.19	-.07	.19	.15
9. Authority probe	.04	.01	-.06	.09*	-.07 <sup>†</sup>	-.05	.23**	-.10*	-	.20	-.10	-.32*	-.31*
10. Environmental trade-off task	.05	.06	-.01	.03	-.17**	-.10*	.16**	-.07	-.16**	-	-.23	.06	.03
11. Anthropocentric reasoning	-	-	-	-	-	-	-	-	-	-	-	-.25 <sup>†</sup>	-.04
12. Biocentric reasoning	-	-	-	-	-	-	-	-	-	-	-	-	.55**
13. Systems thinking	-	-	-	-	-	-	-	-	-	-	-	-	-

*Note.* The environmental trade-off task in Study 1 reflects total CO<sub>2</sub> emissions, with higher scores reflected less eco-friendly choices. Dummy-coded variables were: friend preferences (0 = choice of harmful character, 1 = choice of helpful character); environmental trade-off task for children in Study 2 (0 = choice of faster/ polluting car, 1 = choice of slower/ eco-friendly car); and children's systems thinking in Study 2 (0 = absent, 1 = present). The authority probe represents the sum of all environmental harm behaviors for which participants said the harm would be "okay" (1) if sanctioned by authority figure (range: 0-4). Adults in Study 1 did not provide verbal justifications for their ratings and thus do not have values for those variables (11-14).

<sup>†</sup> $p < .10$ , \* $p < .05$ , \*\* $p < .01$ .

**Table 2**

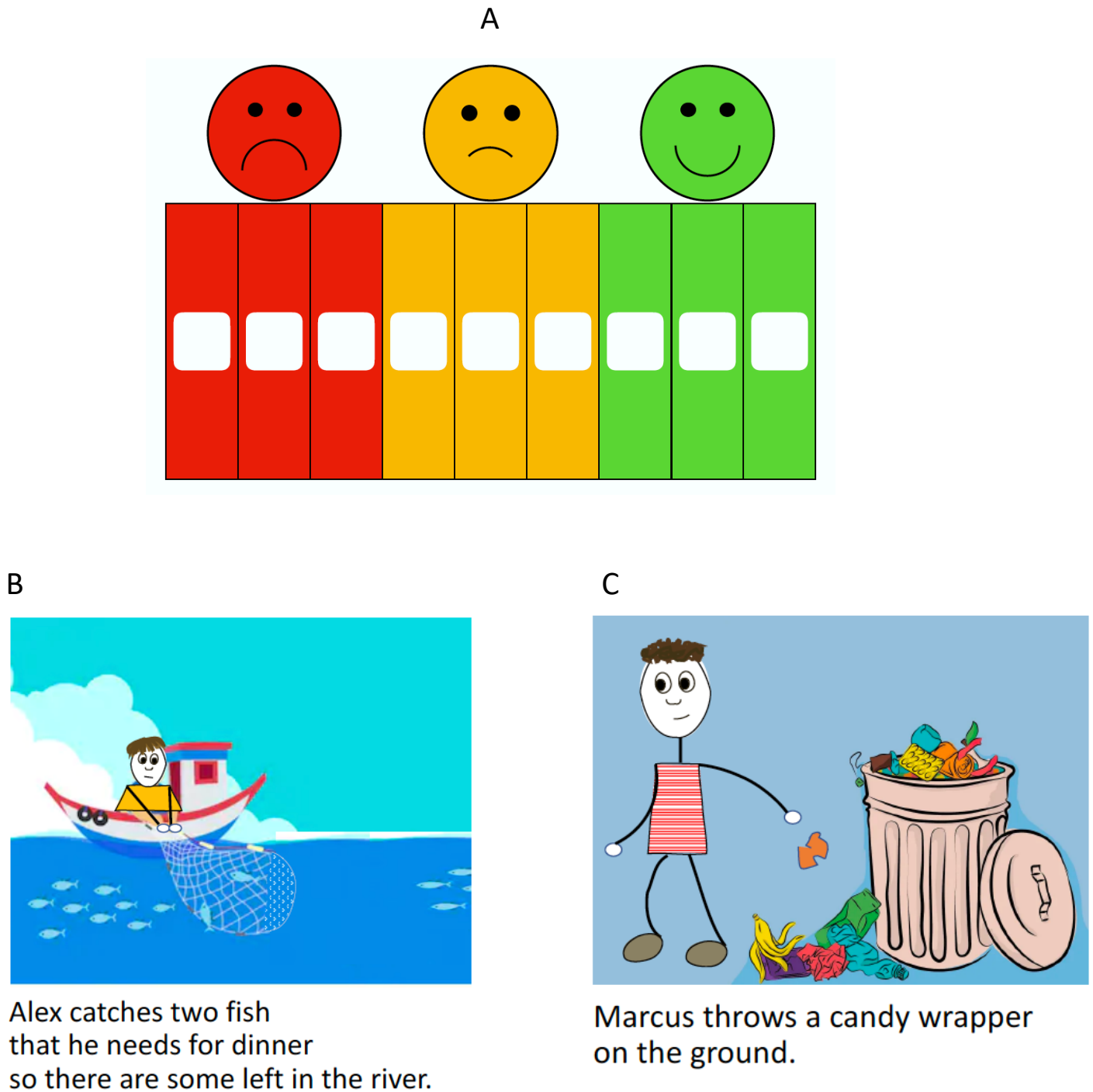
*Examples of children's biocentric (nature-focused) and anthropocentric (human-focused) reasoning about environmental actions.*

<b>Story &amp; Prompt</b>	<b>Biocentric Reasoning</b>	<b>Anthropocentric Reasoning</b>
Unsustainable resource use (catching all fish from a river) <i>Why is this bad?</i>	"Because other kind of fishes that are way bigger like sharks, whales, narwhals, and dolphins can't eat any food, so they would die."	"Because, I mean, other people have to catch fish, and it's like, 'oh man, I couldn't catch any fish, and I can't even see any fish.'"
Planting trees <i>Why is this nice?</i>	"Because then there is going to be a tree that birds can fly on and also make nests."	"Because the trees give us oxygen and if you kill the trees, we would have less oxygen."

*Note.* Children's responses could include both biocentric and anthropocentric reasons.

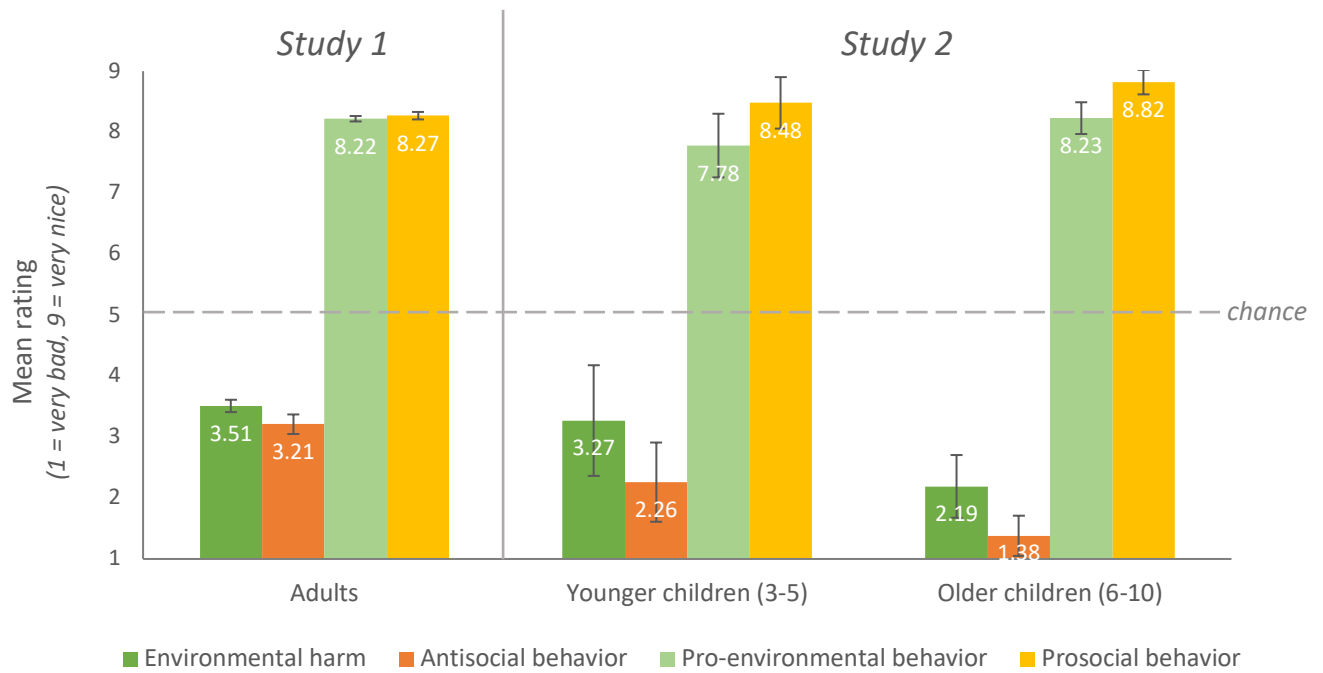
**Figure 1**

*Stimuli used in the moral judgment tasks in Studies 1 and 2. (A) The pictorial response scale, (B) an example of a pro-environmental action, and (C) an example of an ecologically harmful action.*



**Figure 2.**

*Mean ratings of harmful and helpful behaviors in Study 1 (left panel) and Study 2 (right panels).*



*Note.* Bars indicate 95% confidence intervals for each value.

**Figure 3.**

*Proportion of participants who preferred to befriend the helpful vs. harmful characters in Study 1 (left panel) and Study 2 (right panels).*

