



Reports

Saving Mr. Nature: Anthropomorphism enhances connectedness to and protectiveness toward nature

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HIGHLIGHTS

- ▶ Anthropomorphism of nature refers to assignment of human qualities to nature.
- ▶ 3 experiments examine how anthropomorphism affects people's relation and behavior toward nature.
- ▶ Anthropomorphism fosters conservation behavior, and enhances connectedness to nature.
- ▶ Connectedness to nature mediates the link between anthropomorphism and conservation behavior.
- ▶ These findings contribute to anthropomorphism research and environmental psychology.

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ABSTRACT

Nature is often anthropomorphized in the environmental discourse. However, whether anthropomorphism of nature has any impact on the way people relate to and behave toward nature has rarely been examined. With three experiments, the present research addresses this issue. It shows that in general anthropomorphism of nature fosters conservation behavior. Moreover, when nature is anthropomorphized, people feel more connected to it; this sense of connectedness mediates the association between anthropomorphism of nature and conservation behavior. These findings contribute to the understanding of anthropomorphism and that of human–nature relationship. They also bear practical implications for environmental promotion. Future research directions are identified.

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Introduction

“As a result, the earth has a fever.” Al Gore in his Nobel Lecture thus likened the current condition of nature to a human ailment. Similarly, in 1990s, the Hong Kong government launched a public service announcement that narrated a story about “Mr. Earth”. These cases illustrate anthropomorphism—the assignment of human characteristics to nonhuman entities (Epley, Waytz, & Cacioppo, 2007; Guthrie, 1993; Kwan & Fiske, 2008). Anthropomorphism is often found in the environmental discourse. For instance, environmental legislation in various countries had granted rights to natural entities on the reasoning that these entities are humanlike and can feel emotions (Waytz, Epley, & Cacioppo, 2010). Perhaps the most commonplace effort to anthropomorphize nature is the use of the term “Mother Earth”. For example, in 2009, the United Nations General Assembly proclaimed 22 April “International Mother Earth Day”.

Despite its prevalence, whether *anthropomorphism of nature*—the assignment of human qualities to the natural world—has any effect on people's behavior toward nature has rarely been studied. The present research thus addresses this issue by asking two questions: Is anthropomorphism of nature associated with conservation behavior? What is the psychological mechanism underlying this association? We conducted three experiments to answer these questions.

Association between anthropomorphism of nature and conservation behavior

The prevalent use of anthropomorphism in the environmental discourse suggests a shared belief that this tactic is useful. Some researchers also speculated on the utility of anthropomorphism. For instance, Batson (2011) conjectured that although it is difficult for people to empathize with nature, humanizing it may be able to make that happen. Similarly, Clayton, Fraser, and Burgess (2011) suggested that for people to show concern toward nature, a belief that the natural world's emotions and cognitions parallel humans' is needed. Nevertheless, systematic verification of the possible effect of anthropomorphism in conservation efforts has been lacking. We

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thus in the present research directly test the hypothesis that anthropomorphism of nature motivates conservation behavior.

This hypothesis, though untested to date, is compatible with past research findings. For instance, Gray, Gray, and Wegner (2007) found that the more participants considered a nonhuman character (e.g., fetus, robot) to be able to sense and feel, the more they were reluctant to harm it. Also, when people attribute more mental capacities to animals, they empathize with them more (e.g., Hills, 1995), and show more support for animal rights (e.g., Plous, 1993). Similarly, when people take the perspective of animals being harmed and consider their emotional experiences, they become more concerned about them (e.g., Berenguer, 2007; Schultz, 2000). Some studies about human–nature relationship also hinted at the validity of this hypothesis. For instance, Atran et al. (2002) reported that Itza' Maya, a culture in the Maya Reserve who believe in the existence of “spirits” in the environment, exhibit more ecological practices than do other cultures in the neighboring area. Also, when studying children's moral reasoning, Gebhard, Nevers and Billmann-Mahecha (2003) found that young children spontaneously use anthropomorphism to justify the protection of nonhuman natural entities against human interest.

Connectedness as the mediating mechanism

In the present research, we use three experiments with different designs and operationalizations to test the hypothesized anthropomorphism–behavior association. Nevertheless, as many alerted (e.g., Shrouf & Bolger, 2002), an apparent bivariate association may obscure the true complexity of the underlying relationship. Apart from documenting the anthropomorphism–behavior association, it is important to identify its underlying psychological mechanism. We thus focus on a theoretically informed mediator: connectedness.

One factor that motivates anthropomorphism is the quest for social connection (Epley et al., 2007). The need to affiliate with other people and maintain a sense of connectedness is a fundamental motive (Baumeister & Leary, 1995). Social connection enhances survival chance and mental health (see Baumeister & Leary, 1995). By anthropomorphizing nonhuman agents, individuals can establish the social connectedness they need (Epley et al., 2007; Serpell, 2003). For example, Epley, Akalis, Waytz, and Cacioppo (2008) found that individuals who feel lonely find such nonhuman agents as dogs, gadgets, and God to be more humanlike (see also Epley, Waytz, Akalis, & Cacioppo, 2008). Also, people who experience social exclusion report stronger belief in commonly humanized religious agents (Kirkpatrick & Shaver, 1990).

This reasoning points to the possibility that when an entity is anthropomorphized, it becomes a source of social connection. Accordingly, we hypothesize that people experience stronger connectedness to nature when they anthropomorphize it. Because anthropomorphism of nature highlights the similarity between nature and humans, this hypothesis is also consistent with the notion that similarity breeds affiliation (e.g., Byrne, 1971; Heider, 1958).

Connectedness to nature refers to the extent to which an individual feels that he/she and nature are interconnected (Mayer & Frantz, 2004; Schultz, 2001). To a large extent, connectedness to nature mirrors relatedness to other human beings (Davis, Green, & Reed, 2009; Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). Aron, Aron, Tudor, and Nelson (1991) argued that close interpersonal relationships are characterized by an inclusion of the relationship partner in one's self-schema. In a similar way, people who feel connected to nature also tend to include nature in their self-concepts (Schultz, 2001). Also, one important aspect of interpersonal relationship is commitment to the relationship partner (Davis et al., 2009). Indeed, people who have stronger connectedness to nature are more committed to their relationship with nature (Davis et al., 2009). More important,

Mayer et al. (2009) stated that connectedness to nature can meet people's need for social connection, thus contribute to well-being; they indeed found a significant association between connectedness to nature and well-being (see also Nisbet, Zelenski, & Murphy, 2011).

Recent environmental psychology research has shown that connectedness to nature is a strong determinant of conservation behavior. People who report stronger connectedness to nature also report more pro-environmental attitude and behavior (e.g., Davis et al., 2009; Hinds & Sparks, 2008; Kals, Schumacher, & Montada, 1999; Mayer & Frantz, 2004). Also, Schultz (2001) found that participants who included nature in their self-concept held more environment-friendly beliefs and engaged in more pro-environmental behavior.

Taken together, if anthropomorphism of nature can foster connectedness to nature (as hypothesized), and if connectedness to nature motivates conservation behavior (as environmental psychology research has shown), then it is reasonable to further hypothesize that connectedness to nature mediates the expected anthropomorphism–behavior association.

The present research

We examined the association between anthropomorphism of nature and conservation behavior in Experiment 1. Next, we tested the role of connectedness to nature in mediating this association in Experiments 2 and 3. Table 1 summarizes the research design.

Methodological strengths

As Cronbach (1957) noted, “simultaneous consideration of many criteria is needed for a satisfactory evaluation of performance” (p. 676) of a construct. Accordingly, across the three experiments, two forms of conservation behavior (public and private) were examined. Public behavior ranges from active participation to less active support in environmental movement (e.g., donation), whereas private behavior refers to such personal and household decisions as purchasing and using green products (see Stern, 2000). We used multiple operationalizations of these two forms of behavior in the present research.

To build a united theory about a psychological phenomenon, it is necessary to study its variance both among experimental treatments and among individuals (Cronbach, 1957). In this spirit, in two of the experiments, anthropomorphism of nature was manipulated, while in the other it was assessed as individual differences. The former allows us to simulate the use of anthropomorphism in the environmental discourse as well as to establish the causal effect of anthropomorphism, whereas

Table 1
Research design.

	Anthropomorphism of nature	Operationalizations of key variables	
		Connectedness to nature	Conservation behavior
Experiment 1	Drawing a poster, with spontaneous anthropomorphic content coded	(NA)	Product use intention; environmental indicator support (NA)
Experiment 2	Reading an article with anthropomorphic content	Connectedness to Nature Scale (Mayer & Frantz, 2004)	
Experiment 3	Reading some posters with anthropomorphic content	Connectedness to Nature Scale (Mayer & Frantz, 2004)	Product use intention; environmental indicator support; environmental movement support

the latter enables assessment of the role of naturalistic variations in people's dispositional tendency to anthropomorphize nature.

Contributions

The present research contributes to the anthropomorphism research in multiple ways. First, although there has been some evidence to the link between anthropomorphism and protectiveness, this evidence is often focused on animals as the target (e.g., Hills, 1995; Plous, 1993), and concerned about protective attitude only. The present investigation can extend this body of evidence to a novel target (i.e., nature) and to protective behavior. More important, apart from merely demonstrating the anthropomorphism–protectiveness association, the present investigation goes beyond this bivariate link and attempts to identify the underlying psychological mechanism. Second, although it has been argued that the need for social connection underlies anthropomorphism (Epley et al., 2007; Serpell, 2003), past studies have mainly evidenced that lack of social connection enhances anthropomorphism (e.g., Epley, Akalis, et al., 2008; Epley, Waytz, et al., 2008; Kirkpatrick & Shaver, 1990); whether anthropomorphism fulfills the need for connection and thereby enhances people's connectedness to an object is less certain. Recently, McConnell, Brown, Shoda, Stayton, and Martin (2011) reported that pet owners who anthropomorphized their pet reported greater inclusion of the pet in the self. As this finding is correlational, it remains to be demonstrated that anthropomorphism causally enhances connectedness. The present investigation can address this issue with its experimental design.

The present research also contributes to environmental psychology. Arguably, it is the first systematic investigation about the role of anthropomorphism in conservation ethics. It can extend previous studies (Atran et al., 2002; Gebhard, Nevers, & Billmann-Mahecha, 2003) by showing that anthropomorphism of nature varies across individuals, identifying the causal effect of anthropomorphism on conservation behavior, and demonstrating that the anthropomorphism–behavior link applies to adults and urban cultures as well. Also, although connectedness to nature is known to be a robust determinant of conservation behavior (e.g., Davis et al., 2009; Mayer & Frantz, 2004), past studies have rarely identified its antecedents. The present investigation addresses this gap. We believe that findings from this investigation can generate useful recommendations for environmental promotion.

Experiment 1

Experiment 1 examined the hypothesized association between anthropomorphism of nature and conservation behavior. We asked participants to construct a poster to promote environmental awareness. Participants' anthropomorphism of nature was assessed in terms of the anthropomorphic content in their posters.

Method

Fifty undergraduates (20 males, 30 females; $M_{age} = 21.00$, $SD_{age} = 3.10$ years) in Singapore participated for partial fulfillment of course requirement. We told participants that there were two tasks. In Task 1, they were asked to design a poster to promote environmental awareness. They were told that the most important point of their drawing was the overall design; their drawing did not have to be very detailed. To facilitate their drawing, participants were provided with a video and a website that described the current state of the natural environment. This information did not contain any anthropomorphic content. Participants had 20 min to finish their drawing.

In Task 2, participants' conservation behavior was measured. First, they reported their intention to try and tell other people about each of four new green products (e.g., biodegradable trash bags, phosphate-free detergents) by answering two questions (“How much do you

want to try this product?”, and “How much do you want to tell your friends and family about this product?”) on a 5-point scale (1 = *not at all* to 5 = *very much*). The eight items were averaged to form a composite index ($\alpha = .89$). Second, participants indicated their support for adopting an indicator about the nation's environmental impact. They were told that a nation's development was typically evaluated by its economic output, but in recent years alternative indicators had been called for. They then indicated their support for each of four alternative indicators (economic output, life expectancy, life satisfaction, and environmental impact) on a 7-point scale (1 = *not important at all* to 7 = *supremely important*).

At the end of the experiment, participants were probed for suspicion and fully debriefed. No participant expressed suspicion, or guessed the hypothesis correctly. The same applied to the subsequent experiments.

Results and discussion

There was no existing method for coding anthropomorphism in open-ended responses. We therefore devised two new methods; this procedure allows us to check their convergent validity. In Method 1, the first and second authors classified a poster as anthropomorphic (if any human characteristic was attributed to nature or any natural entity) or non-anthropomorphic (if otherwise). Typical anthropomorphic posters show the earth having a human face or four limbs (see Fig. 1). In Method 2, five undergraduates independently rated each poster on the extent to which the natural entities on the poster was humanlike on a 7-point scale (1 = *not at all* to 7 = *very much*). These raters shared a certain level of agreement; the average r within any pair of raters was .63. Ratings from the raters were therefore averaged for each poster.

Output from the two coding methods converged. Method 1 revealed that 18 (out of 50) posters contained anthropomorphic content. An independent-samples t -test revealed that these posters were indeed rated in Method 2 as containing more humanlike content ($M = 4.27$, $SD = 1.30$) than did the non-anthropomorphic posters, ($M = 1.64$, $SD = .40$), $t(48) = 10.69$, $p < .001$, $d = 2.73$. This suggests the validity of the coding methods.

We performed two sets of analyses to test the hypothesized link between anthropomorphism of nature and conservation behavior. First, independent-samples t -tests revealed that the participants whose posters were anthropomorphic exhibited stronger product use intention ($M = 3.74$, $SD = .67$) than did the participants whose posters were non-anthropomorphic ($M = 3.29$, $SD = .86$), $t(48) = 2.07$, $p < .05$, $d = .58$. Also, they exhibited stronger environmental indicator support ($M = 6.11$, $SD = .47$) than did the latter ($M = 5.44$, $SD = 1.22$), $t(48) = 2.78$, $p < .01$, $d = .72$. The two groups of participants did not differ in their support for the other development indicators ($ps > .33$). Second, correlational analyses revealed that the participants whose posters received higher humanlike-ness rating exhibited stronger product use intention, $r = .29$, $p < .05$, and environmental indicator support, $r = .30$, $p < .05$. Humanlike-ness rating did not significantly correlate with support for the other development indicators (rs ranging from .04 to .21, $ps > .14$).

In sum, as hypothesized, across the two coding methods, anthropomorphism of nature was positively associated with conservation behavior.

Experiment 2

Experiment 2 proceeded to test the hypothesized effect of anthropomorphism of nature on connectedness to nature. We presented participants with a newsletter that described the environmental crisis. Anthropomorphism was manipulated by the newsletter content.

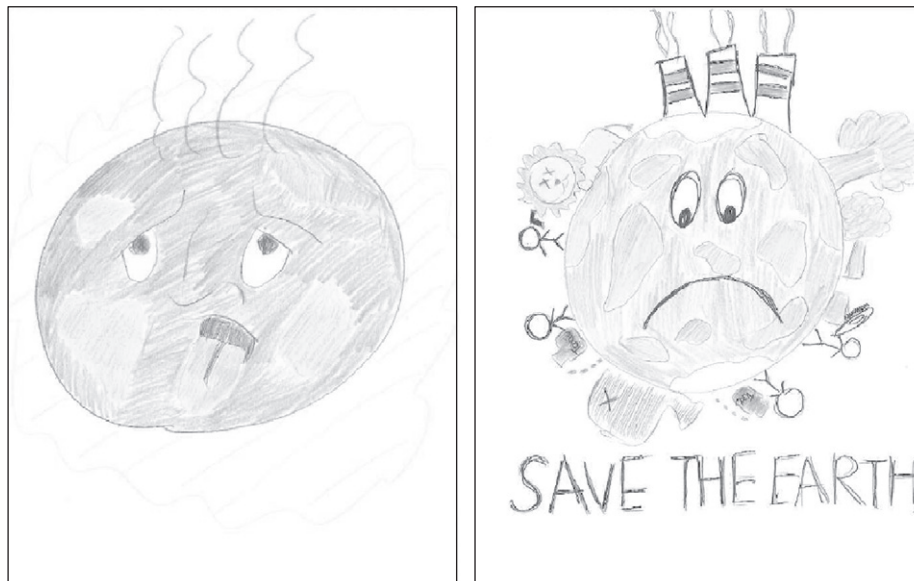
Non-anthropomorphic postersAnthropomorphic posters

Fig. 1. Examples of the posters collected in Experiment 1.

Method

Forty undergraduates (10 males, 30 females; $M_{age}=20.50$, $SD_{age}=1.63$ years) in Singapore participated for partial fulfillment of course requirement. First, we asked them to read a newsletter that described the current condition of the natural environment and called for actions to protect nature. In the anthropomorphism condition, the newsletter title read “Current Condition of Mr. Nature”, and the text referred to nature as “Mr. Nature” and used personal pronouns (e.g., “him”). All content was identical in the control condition, except that the title became “Current Condition of Nature”, and “Nature” and non-personal pronouns were used. Participants were randomly assigned to either condition ($N=20$ in each condition).

After reading the newsletter, participants completed the 14-item Connectedness to Nature Scale (Mayer & Frantz, 2004). This measure was widely accepted as reliable and valid by environmental psychologists (Mayer & Frantz, 2004; Mayer et al., 2009). Participants responded to the items (e.g., “I often feel a sense of oneness with

the natural world around me”) on a 7-point scale (1 = strongly disagree to 7 = strongly agree) ($\alpha=.79$).

Results and discussion

An independent-samples *t*-test revealed that the anthropomorphism condition participants reported stronger connectedness to nature ($M=4.86$, $SD=.63$) than did the control condition participants ($M=4.45$, $SD=.69$), $t(38)=1.97$, $p=.05$, $d=.62$. This finding attests to the hypothesized effect of anthropomorphism of nature on connectedness to nature.

Experiment 3

We already found support to the hypothesized association of anthropomorphism of nature with connectedness to nature and conservation behavior respectively. However, the hypothesized mediational role of connectedness remained to be tested. Experiment 3 aimed at

achieving this by manipulating anthropomorphism of nature and measuring both connectedness to nature and conservation behavior subsequently.

There was one important change regarding the anthropomorphism manipulation. The manipulation in Experiment 2 was embedded in a newsletter; anthropomorphism was manipulated linguistically. In Experiment 3, the manipulation was embedded in some posters instead; anthropomorphism was thus manipulated visually. This change allows us to check the robustness of the key findings across formats of anthropomorphic representations.

To construct this manipulation, we used the posters collected in Experiment 1. We randomly selected 10 posters from the pool of anthropomorphic posters, and 10 from the pool of non-anthropomorphic posters. An independent-samples *t*-test based on the raters' ratings collected in Experiment 1 showed that the selected anthropomorphic posters indeed contained more humanlike content ($M = 5.00$, $SD = .42$) than did the selected non-anthropomorphic poster ($M = 1.50$, $SD = .29$), $t(18) = 21.71$, $p < .001$, $d = 9.70$.

Method

Seventy-three undergraduates (42 males, 31 females; $M_{age} = 20.88$, $SD_{age} = 1.30$ years) in Hong Kong participated for partial fulfillment of course requirement. We told them that there were two parts in the experiment. In Part 1, participants read and evaluated 10 posters. We told them that these posters were randomly selected from a pool of posters constructed by participants in a previous study. They were randomly assigned to either the anthropomorphic posters ($N = 38$) or the control posters ($N = 35$). The evaluation dimensions included emotional tone, information richness, creativity, and liking. Participants responded on a 7-point scale. This evaluation also served as a check of the equivalence of the posters across the two conditions.

In Part 2, participants completed a questionnaire that contained the dependent measures. The Connectedness to Nature Scale (Mayer & Frantz, 2004) was used ($\alpha = .76$). Conservation behavior was assessed with the product use intention measure ($\alpha = .81$) and the environmental indicator support measure used in Experiment 1. In addition, participants' support for environmental movement was assessed. The 10-item environmental activism subscale from the Environmental Attitudes Inventory (Milfont & Duckitt, 2010) was used. The items were slightly modified to reflect intention (e.g., "I will join and actively participate in an environmentalist group"). Participants responded on a 7-point scale (1 = strongly disagree to 7 = strongly agree). As a manipulation check, participants completed the five items pertaining to nonanimal natural entities from the Individual Differences in Anthropomorphism Questionnaire (Waytz, Cacioppo, & Epley, 2010) ($\alpha = .85$).

Results and discussion

A series of independent-samples *t*-tests (see Table 2) revealed that the two sets of posters did not differ in any of the four evaluation dimensions (*ts* ranging from $-.59$ to $.54$, $ps > .56$). Another independent-samples *t*-test (see Table 2) showed that the anthropomorphism condition participants exhibited stronger anthropomorphism of natural entities ($M = 4.37$, $SD = 1.10$) than did the control condition participants ($M = 3.73$, $SD = 1.30$), $t(71) = 2.31$, $p < .05$, $d = .83$. These findings suggest that the anthropomorphism manipulation was effective.

Replicating Experiments 1 and 2, another series of independent-samples *t*-tests (see Table 2) revealed that the anthropomorphism condition participants reported stronger connectedness to nature ($M = 4.99$, $SD = .52$) than did the control condition participants ($M = 4.63$, $SD = .76$), $t(71) = 2.29$, $p < .05$, $d = .55$. They exhibited stronger product use intention ($M = 5.10$, $SD = 1.04$) than did the control condition participants ($M = 4.61$, $SD = 1.00$), $t(71) = 2.03$, $p < .05$, $d = .48$. Also, they exhibited stronger environmental indicator support ($M = 5.76$, $SD = 1.20$) than did the latter ($M = 5.08$, $SD =$

Table 2
Comparing the two conditions (Experiment 3).

Variables	Control condition	Anthropomorphism condition	Independent-samples <i>t</i> -test <i>t</i> statistics
Emotional tone	3.27 (.65)	3.18 (.76)	-.59
Information richness	3.44 (.77)	3.39 (.59)	-.30
Creativity	3.60 (.80)	3.69 (.69)	.54
Liking	3.63 (.72)	3.71 (.61)	.52
Anthropomorphism of natural entities	3.73 (1.30)	4.37 (1.10)	2.31*
Connectedness to nature	4.63 (.76)	4.99 (.52)	2.29*
Product use intention	4.61 (1.00)	5.10 (1.04)	2.03*
Environmental indicator support	5.08 (1.46)	5.76 (1.20)	2.17*
Environmental movement support	4.39 (1.01)	4.75 (.80)	1.66+

Notes. All $df = 71$.

* $p < .05$.

+ $p = .10$.

1.46), $t(71) = 2.17$, $p < .05$, $d = .51$. Similarly, they reported stronger environmental movement support ($M = 4.75$, $SD = .80$) than did the latter ($M = 4.39$, $SD = 1.01$), though this difference was marginally significant, $t(71) = 1.66$, $p = .10$, $d = .40$.

We then tested the mediational role of connectedness to nature with the bootstrapping method. Bootstrapping is a resampling procedure recommended by many researchers for testing mediational models (e.g., MacKinnon, Lockwood, & Williams, 2004; Shrout & Bolger, 2002). We examined the bias-corrected 95% confidence interval (BC 95% CI) of the indirect effect of connectedness to nature (with 5000 re-samples). This indirect effect was significant (i.e., not containing zero) for environmental indicator support (a BC 95% CI of $.00$ to $.53$) and environmental movement support (a BC 95% CI of $.02$ to $.54$); for product use intention, it was marginally significant (a BC 95% CI of $-.00$ to $.45$) (see Table 3).

In sum, Experiment 3 showed support to all hypotheses.

General discussion

Findings from the three experiments show robust support to our hypotheses. Anthropomorphism of nature was associated with connectedness to nature, which in turn led to conservation behavior. These findings held across different operationalizations of anthropomorphism of nature and multiple measures of conservation behavior.

Table 3
Mediational analyses (Experiment 3).

Outcomes	Unstandardized regression coefficients				Bootstrapping BC 95% CI
	Path a	Path b	Path c	Path c'	
Product use intention	.35*	.48**	.48*	.32	(-.00, .45)
Environmental indicator support	.35*	.63**	.68*	.46	(.00, .53)
Environmental movement support	.35*	.68***	.35+	.12	(.02, .54)

Notes. Path a = Condition to Connectedness to nature. Path b = Connectedness to nature to Outcome (when Condition was controlled). Path c = Condition to Outcome. Path c' = Condition to Outcome (when Connectedness to nature was controlled).

*** $p < .001$.

** $p < .01$.

* $p < .05$.

+ $p = .10$.

The primary motivation underlying this research is to examine whether anthropomorphism of nature has the presumed utility for conservation efforts. The findings suggest “yes”. We believe that this investigation not only contributes to anthropomorphism research and environmental psychology, but also bears implications for the promotion of environmentalism. We discuss these issues next. Afterward, we suggest how the present findings stimulate future research.

Anthropomorphism research

There have been some studies on the anthropomorphism–protectiveness link. However, these studies were concerned mostly about protective attitudes, with animals (e.g., Hills, 1995; Plous, 1993) or robots (e.g., Gray et al., 2007) as the attitudinal object. The present findings thus extend these studies by showing that anthropomorphism can motivate not only protective attitudes but also protective behavior toward a broader, more abstract target. More important, going beyond the mere bivariate relationship, the mediational finding marks the first piece of evidence about the underlying psychological mechanism. This finding suggests that anthropomorphism can generate a sense of connectedness to the anthropomorphized entity, which in turn motivates protective behavior. Existing accounts usually refer to moral inclusion as the explanation for the anthropomorphism–protectiveness link (e.g., Watanabe, 2007; Waytz, Epley, & Cacioppo, 2010). That is, when an entity is anthropomorphized, it becomes deserving for moral consideration. However, direct evidence on this account has been lacking. Future studies may explore how this account is related to or differentiable from the connectedness mechanism identified in the present research.

Connectedness to close others promotes communal behavior (e.g., Aron et al., 1991), while connectedness to a social group promotes positive relation with the group and support for collective action (e.g., Tropp & Wright, 2001). Some studies have shown that even connectedness to strangers can be induced, and this sense of connectedness promotes emotional sharing and empathy (e.g., Cwir, Carr, Walton, & Spencer, 2011). The present findings extend these past findings regarding human–human or human–group relationships to human–nature relationship: Connectedness to the natural world can be induced (through anthropomorphism), and promotes protective behavior. Also, although there has been ample evidence showing that lack of connection motivates anthropomorphism (e.g., Epley, Akalis, et al., 2008), evidence showing that anthropomorphism enhances connectedness to an entity (e.g., McConnell et al., 2011) is still needed. In this regard, the causal effect of anthropomorphism of nature on connectedness to nature observed in the present research is noteworthy.

Environmental psychology

Anthropomorphism of nature is prevalent in the environmental discourse. This prevalence suggests a general belief that this tactic is useful (see Batson, 2011). Nevertheless, researchers have seldom examined the validity of this belief. The present research provides this needed inquiry. The findings extend the previous studies on children’s moral reasoning (Gebhard et al., 2003) and cultural mental models (e.g., Atran et al., 2002) about nature in three ways. First, the findings in Experiment 1 show that there could be variations across individuals in terms of dispositional anthropomorphism of nature. Second, the findings in Experiments 2 and 3 demonstrate the causal role of anthropomorphism in motivating environmental practice. Third, these findings show that the anthropomorphism–behavior association applies to adults and urban cultures as well.

Although past research has consistently documented the importance of connectedness to nature in fostering environmental concern and behavior, the antecedents of connectedness to nature have rarely been identified. Most past studies were focused on the role of real

contact with nature. For instance, Barlett (2008) showed that immersion in the natural environment made respondents feel more connected to nature (see also Mayer et al., 2009). Also, Hinds and Sparks (2008) and Kals et al. (1999) reported that past positive experiences in the natural environment, particularly when shared with significant others, predicted affiliation with nature. Nevertheless, contact with nature is difficult to achieve for modern people. Evans and McCoy (1998) estimated that people spend 90% of their lives in buildings. This implies that modern people, compared to their ancestors, are both physically and emotionally more disconnected from nature (Barlett, 2008; Vining, Merrick, & Price, 2008). This further implies that environmentalists cannot rely solely on direct experience in nature as their promotion strategies. There is a strong need for other tactics. The present research hints at a potentially efficacious tactic: anthropomorphism.

Environmental promotion

Considering the present findings, it appears that anthropomorphizing nature could be a relatively low-cost but useful strategy in environmental promotion. Educators may consider incorporating anthropomorphic narratives of nature into school curricula and public service announcements.

Nevertheless, it is noteworthy that using anthropomorphism in education has been subject to some controversies. One oppositional view is that anthropomorphism is primitive and therefore will not sustain among adults. However, as Melson (2001) noted, primitive and industrialized cultures alike are rife with anthropomorphic narratives (see also Guthrie, 1993). Also, as Experiment 1 shows, a substantial proportion of the adult participants did exhibit dispositional anthropomorphism (see also Waytz, Cacioppo, & Epley, 2010). Overall, we believe that anthropomorphic representations of nature should not be dismissed as infantile. The interplay between age, anthropomorphism, and human–nature relationship is definitely an interesting direction for future research.

There is another concern. Some worry that cultivating anthropomorphism may obfuscate people’s objective, scientific understanding of the world (see Kennedy, 1992; Mitchell, Thompson, & Miles, 1997). Whether this worry is warranted or not is subject to future investigation. For example, researchers may study whether people with strong dispositional anthropomorphic belief have difficulty in acquiring objective knowledge. Also, it is debatable whether science is really the only acceptable doctrine. As expressed by Gebhard et al. (2003), “if anthropomorphism is indeed indicative of a kind of categorical identity that permits nature to be moralized, then it might be something we should nurture rather than eliminate” (p.108). Rather than rejecting anthropomorphism completely or embracing it unquestioningly, perhaps environmentalists should try to cultivate “enlightened anthropomorphism” (see Chawla, 2009): the eclectic use of anthropomorphic representations and scientific ones in different contexts for different purposes (see also Hills, 1995).

Future research directions

Full mediation through connectedness to nature was found in Experiment 3. However, the effect of anthropomorphism may still operate through other unidentified mechanisms. One possible mechanism concerns efficacy. Past research has demonstrated that the need for effectance motivates anthropomorphism. By mapping the familiar concept of “humans” onto abstract and inexplicable entities, anthropomorphism provides people with a sense of mastery and control (Epley et al., 2007). Indeed, people report greater understanding and predictability about an object when they have anthropomorphized it (Waytz et al., 2010). Accordingly, we expect that when people anthropomorphize nature, they tend to consider it and the environmental issues to be more understandable and controllable;

this sense of efficacy in turn motivates conservation behavior. This hypothesis has received support recently (Tam, 2013).

The ability of anthropomorphism in fostering connectedness with nonhuman entities may have an interesting but untested effect: enhancing subjective well-being. Waytz, Morewedge, et al. (2010) speculated on this relationship by suggesting that anthropomorphism increases people's efficacy, which in turn counteracts the negative emotions associated with the lack of control over one's environment. The present research implies an alternative route: If anthropomorphism enhances connectedness, then it may be able to help people cope with their lack of social attachment and thereby contribute to their well-being. Some studies have already shown that connectedness to nature is linked to positive emotions (Mayer et al., 2009; Nisbet et al., 2011). If anthropomorphism of nature can enhance connectedness to nature, then it seems reasonable to expect that it can also enhance subjective well-being. This implication is worth attention in future studies.

The present research defines anthropomorphism of nature as anthropomorphism of the broad notion of nature. One may wonder if it can be alternatively defined as anthropomorphism of some specific natural entities. Our manipulation check in Experiment 3 shows that manipulating anthropomorphism of nature in its general form could lead to a higher level of anthropomorphism of specific natural entities. This finding indicates that the two forms of anthropomorphism of nature are likely to be inter-correlated. In addition, we suspect that these two forms of anthropomorphism of nature may share the same pattern of relationships with connectedness to nature and conservation behavior. This speculation is in line with two broad conclusions from past studies: (i) specific entities such as animals and seas are core in people's mental images of nature (e.g., van den Born, Lenders, de Groot, & Huijsman, 2001); and (ii) psychological orientation toward specific natural entities is often generalizable to nature as a whole (e.g., Berenguer, 2007; Schultz, 2000), and serves as the basis of general concern toward nature (Myers, Saunders, & Garrett, 2004). This speculation is worth further investigation.

One caveat in the present research is that the conservation behavior measures were self-reported. There are two concerns. First, whether the effect of anthropomorphism translates into actual behavior remains to be demonstrated. Second, the construct validity of these measures could have been contaminated by such biases as social desirability responding; this validity problem could have attenuated the relationship of these measures with the other variables, damaging the power of the present research. Future studies may address these concerns by using observations of actual behavior in laboratory or real-life settings.

Concluding remark

Anthropomorphism is prevalent in the environmental discourse. Surprisingly, little research has examined its effect. As the present research reveals, perhaps efforts that liken nature to humans, as exemplified in the opening quote, have an important role to play in changing how people relate to and behave toward nature.

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