

# Mind Attribution to Nature and Proenvironmental Behavior

Kim-Pong Tam

Division of Social Science, The Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong.

## Abstract

*Nature is often portrayed in the environmental discourse as a mindful agent that has intentions, emotions, and other mental capacities. Built upon recent research on mind perception and mind attribution, the present research examines if this representation of nature bears any implications for environmental conservation. Studies 1 and 2 showed that participants who attributed a mind to nature exhibited more self-report and actual proenvironmental behavior than those who attributed fewer mental capacities to nature. This association held even when controlling for a range of well-documented predictors for proenvironmental behavior. Study 3 further revealed the psychological mechanism underlying this association. When thinking about environmental degradation, attribution of a mind to nature allowed participants to empathize with nature and act in a more proenvironmental manner. Theoretically, these findings offer a new angle to explicate recent research on the proenvironmental effects of anthropomorphic images of nature. More important, the present findings suggest a novel approach to understanding the human-nature relationship. How humans relate to nature could be similar to how they relate to other humans, the prototypical mindful agent. Therefore, researchers can theorize about the human-nature relationship with reference to existing social psychological theories on interpersonal relationships. Given the prevalence of mind attribution in the environmental discourse, the present research also provides valuable evidence for environmentalists to consider. Key Words: Mind attribution—Proenvironmental behavior—Empathy—Perspective taking—Environmental conservation—Anthropomorphism.*

## Introduction

Nature is often portrayed in the environmental discourse as a mindful agent that has intentions, emotions, and other mental capacities. For example, environmentalists often depict environmental degradation as nature feeling sick. Some countries have granted legal rights to natural entities (e.g., forests, rivers) based on the reasoning that these entities possess consciousness and experience emotions (Waytz, Epley, & Cacioppo, 2010). Nature is sometimes even considered to be a human, the prototypical mindful agent (see Eddy, Gallup, & Povinelli, 1993; Gray, Gray, & Wegner, 2007), as exemplified in the use of the term “Mr. Earth” or “Mother Nature.”

Despite its prevalence, whether this representation of nature bears any implications for environmental conservation has rarely been studied. Specifically, does attributing a mind to nature encourage proenvironmental efforts? If so, what is the underlying psychological mechanism? Investigation into these issues is significant, as it can not only offer practical recommendations for environmental promotion but also contribute to the theoretical understanding of the human-nature relationship. Built upon recent research on mind perception and mind attribution (see Epley & Waytz, 2010), the present research provides the needed inquiry.

## Mind attribution

Humans cannot step into other people’s minds and understand their mental experience directly. Accordingly, humans can only infer other people’s minds. This ability to perceive minds in others is imperative for successful survival in the social environment, as it allows humans to comprehend others’ actions and coordinate their own behavior with others’ behavior (Epley & Waytz, 2010).

People perceive other minds in terms of two broad sets of mental capacities: agency and experience (Gray et al., 2007; Hume, 1757/1957). Agency refers to the ability to think, formulate intentions, and choose. Experience involves the ability to sense, feel, and be conscious of one’s environment and experience. People generally expect

other humans to have a mind that is capable of both agency and experience (Eddy et al., 1993; Gray et al., 2007). However, recent research has revealed that people sometimes deny other humans a complete mind. For instance, people tend to perceive a reduced mind in out-group members as opposed to in-group members (e.g., Haslam, 2006; Waytz & Young, 2014).

Recent research has also revealed that people may attribute a mind to entities that are mindless or even lifeless. For example, Nass, Lombard, Henriksen, and Steuer (1995) found that some individuals consider computers to be able to experience emotions; this tendency in turn manifests in their social responses (e.g., politeness, self-disclosure) toward computers (Nass and Moon, 2000). Waytz, Cacioppo, and Epley (2010) documented individual differences in the overall tendency to attribute a mind to a wide range of entities. Though contradicting objective reality, the tendency to see nonliving entities as mindful is a psychological phenomenon that deserves research attention, as it is commonplace (Guthrie, 1993) and carries substantial psychological consequences (Epley & Waytz, 2010).

#### *Mind attribution to nature and proenvironmental behavior*

One of the psychological consequences of mind attribution is that mindful agents are seen as worthy of care and concern, while mindless entities are considered as mere objects (Waytz, Epley, & Cacioppo, 2010). Accordingly, people tend to show a more protective attitude toward an entity when they consider it to have a mind. Animal attitude studies have shown that people who more strongly believe that animals are mindful are more concerned about animal welfare (Watanabe, 2007). For example, Knight, Vrij, Cherryman, and Nunkeosing (2004) reported that participants who attributed more mental capacities to animals reported more negative attitude toward animal use (e.g., experimentation, entertainment). Gray et al. (2007) reported that their participants were more reluctant to harm an entity when they considered it to be able to sense and feel. Similarly, Waytz, Cacioppo, and Epley (2010) reported that participants who were high in the tendency of mind attribution considered harming a bed of flowers or a motorcycle to be more morally wrong.

As noted, nature is often portrayed as mindful. The primary question in the present research is whether this portrayal of nature, or *mind attribution to nature* (MAN), encourages more proenvironmental behavior (PEB). Based on the findings just reviewed, it seems conceivable that MAN is positively associated with PEB. Taking the individual difference approach (e.g., Waytz, Cacioppo, & Epley, 2010), the present research tests the hypothesis that individuals with stronger MAN exhibit more PEB than do those with weaker MAN. This hypothesis has also been speculated by others. For instance, Clayton, Fraser, and Burgess (2011)

suggested that for people to show concern toward nature, a belief that nature's emotions and cognitions parallel humans' is needed.

Up-to-date, direct support for this hypothesis is lacking. Waytz, Cacioppo, and Epley (2010) did find that participants who attributed a mind to a wide range of entities reported stronger agreement with statements about concern for the environment (e.g., "The government should do more to prevent pollution of the environment"). Unfortunately, this finding is limited in two respects. First, the study did not consider the unique predictive power of MAN beyond other well-documented predictors of environmentalism. Second, and most important, expressed environmental concern does not necessarily translate into behavior (see Gifford & Nilsson, 2014). For example, De Groot and Steg (2007) found that their participants' environmental concern was not significantly related to their actual use of a green facility. In all, while Waytz, Cacioppo, and Epley (2010) signifies an important beginning in the study of the environmental implications of MAN, it does not lend any strong support to the hypothesized MAN-PEB relationship. The present research thus more stringently tests this hypothesis by addressing the limitations in Waytz, Cacioppo, and Epley (2010).

#### *Empathy as the underlying mechanism*

Another objective of the present research is to identify the psychological mechanism behind the hypothesized MAN-PEB association. It is noteworthy that past studies on the protective consequences of mind attribution (e.g., Knight et al., 2004) did not identify the underlying mechanism explicitly.

In the present research, the mediating role of empathy is proposed. Empathy is typically defined as the understanding and sharing of another person's emotional experience (Davis, 1983). It has two components: cognitive and affective. The cognitive component refers to the understanding of another person's emotional experience through perspective taking (Hogan, 1969), while the affective component, or empathic concern, refers to the joining and sharing of such experience (Batson, 1991). Past studies have documented that empathy is a key to compassion and helping (Eisenberg & Miller, 1987).

Based on the link between empathy and prosocial behavior, some researchers have called for attention to the role of empathy in environmental conservation (e.g., Sobel, 1996). Some findings validate this view. For example, Schultz (2000) found that when his participants had taken the perspective of animals threatened by pollution, they became more concerned about the natural world as a whole (see also Sevillano, Aragones, & Schultz, 2007). Additionally, Berenguer (2007) found that perspective taking can trigger PEB. Participants who had taken the perspective of a suffering bird or tree favored an environmental cause in a subsequent money allocation task.

**Table 1. Items Used in the Present Research**

Mind attribution to nature (in Studies 1 to 3; 1 = <i>not at all</i> to 7 = <i>very much</i> )
To what extent does nature have a mind of its own?
To what extent does nature have intentions?
To what extent does nature have free will?
To what extent does nature have consciousness?
To what extent does nature experience emotions?
Proenvironmental behavior (in Study 1; 1 = <i>never</i> to 5 = <i>very often</i> )
recycling newspapers
recycling cans or bottles
encouraging friends or family to recycle
conserving gasoline by walking or bicycling
buying environmentally friendly products even if they may not work as well as competing products
purchasing something made of recycled materials even though it is more expensive
buying products only from companies that have a strong record of protecting the environment
using energy-efficient household devices such as light bulbs
Proenvironmental behavior intention (in Study 3; 0 = <i>0% chance, I certainly will not do it</i> to 5 = <i>50% chance I will do it</i> to 10 = <i>100% chance, I certainly will do it</i> )
looking for ways to reuse things
recycling things (e.g., papers, cans, and bottles)
using reusable shopping bags
buying environmentally friendly products even if they may not work as well
purchasing something made of recycled materials even though it is more expensive
taking shorter showers
using energy-efficient products
turning off lights not being used
turning off standby household appliances not being used
increasing temperature setting on air-conditioners

(continued)

**Table 1. Continued**

Empathy (in Study 3; 1 = <i>strongly disagree</i> to 7 = <i>strongly agree</i> )
Perspective taking
I tried to understand how things in nature feel by imagining their perspective.
I put myself in the place of things in nature.
I imagined how I would feel if I were things in nature.
Empathic concern
I felt sympathetic toward things in nature.
I felt what things in nature feel.
I felt the pain that things in nature experience.

As Batson (1991) explained, perception of another person's need is prerequisite for the experience of empathy, and this perception requires the recognition that the suffering person is a sentient and intentional agent. Indeed, individuals who consider others as non-sentient tend to empathize with them less (see Haslam, 2006). Mind attribution, by definition, allows people to consider an entity as sentient and intentional. Thus, MAN should enable people to experience empathy toward nature. It is therefore hypothesized that when people notice the degradation of nature, MAN allows them to take its perspective and feel empathetic toward it, which motivates PEB.

*Overview of the present research*

In three studies, the present research tests the two hypotheses with the individual difference approach. Across these studies, individual differences in MAN were measured with the Mind Attribution to Nature Scale (MANS). The five items on the scale (see Table 1) were written with reference to past mind attribution studies (e.g., Gray et al., 2007; Waytz, Cacioppo, & Epley, 2010). These items referred to nature broadly without specifying any entities, allowing participants to conceptualize nature in their own ways (see Vining, Merrick, & Price, 2008). Participants responded on a 7-point scale (1 = *not at all* to 7 = *very much*).

As a point of departure, Study 1 tested the first hypothesis with a self-report measure of PEB. Personality dispositions including traits and values were also assessed. Hirsh and Dolderman (2007) reported that environmentalism is associated with agreeableness and openness to experience. Additionally, self-transcendence positively and self-enhancement negatively predict environmental concern and

behavior (e.g., Schultz & Zelezny, 1998). Study 1 examined whether MAN predicts PEB beyond the influences of traits and values.

Study 2 replicated Study 1. Most important, it measured actual PEB rather than self-report PEB. While self-report measures can cover a wide range of behavior, they do not always reflect actual behavior (Steg & Vlek, 2009). In addition, due to common method biases (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003), using self-report measures for all variables in the same study might artificially inflate any observed correlations. Thus, actual PEB was assessed instead. To further examine the incremental validity of MAN, the study controlled for influences of social desirability (see Milfont, 2009) and demographic variables (gender, age, and education; see Gifford & Nilsson, 2014). To achieve this, a more diverse sample of working adults was used.

With the hypothesized MAN-PEB association established in the first two studies, Study 3 extended the investigation by testing the mediating role of empathy. Participants viewed some photos about environmental degradation; their empathy toward nature and PEB intention were then assessed. To minimize the influences of common method biases, MAN and the outcome measures were assessed in two separate sessions (see Podsakoff et al., 2003).

### Study 1

#### Method

One hundred twenty-six undergraduates in Hong Kong (71 males and 55 females;  $M_{age} = 19.87$  and  $SD_{age} = .84$  years) participated for partial course fulfillment. They completed the MANS ( $\alpha = .95$ ) and the

**Table 2. Descriptive Statistics and Intercorrelations of the Key Variables in Studies 1 and 2**

	MEAN (SD)	1	2	3	4	5	6	7	8	9	10	11
<i>Study 1</i>												
1. Extraversion	3.67 (.74)	—										
2. Agreeableness	3.98 (.64)	.30***	—									
3. Conscientiousness	3.81 (.69)	.19*	.20*	—								
4. Neuroticism	3.78 (.84)	-.32***	-.17	.05	—							
5. Openness to experience	4.16 (.72)	.29***	.20*	.38***	.06	—						
6. Self-enhancement	5.57 (.99)	.27**	.21*	.41***	.14	.33***	—					
7. Openness	5.82 (.87)	.28**	.34***	.35***	.04	.47***	.62***	—				
8. Self-transcendence	5.98 (.80)	.15	.36***	.29***	-.01	.33***	.60***	.74***	—			
9. Conservation	5.43 (.78)	.16	.35***	.26**	.03	.16	.53***	.56***	.66***	—		
10. Mind attribution to nature	4.02 (1.57)	-.03	.06	.03	.08	.22*	.18*	.09	.14	.10	—	
11. Proenvironmental behavior	3.11 (.60)	-.02	.07	.08	-.14	.10	-.04	.15	.11	.10	.24**	—
<i>Study 2</i>												
1. Age	32.82 (8.39)	—										
2. Gender (0 = female, 1 = male)	.41 (.49)	-.03	—									
3. Education	2.57 (.77)	-.24**	.18*	—								
4. Social desirability	9.55 (2.97)	.13	-.00	-.13	—							
5. Mind attribution to nature	4.15 (1.68)	.05	-.05	-.12	.18*	—						
6. Donation	8.18 (14.75)	.21**	-.18*	.02	-.06	.17*	—					

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

following measures. For PEB, the participants were asked to indicate how often they did each of eight behaviors (see Table 1) on a 5-point scale (1 = *never* to 5 = *very often*;  $\alpha = .70$ ). The participants also completed the 44-item Big Five Inventory (John, Donahue, & Kentle, 1991) on a 7-point scale (1 = *strongly disagree* to 7 = *strongly agree*;  $\alpha = .78$  for extraversion,  $\alpha = .70$  for agreeableness,  $\alpha = .79$  for conscientiousness,  $\alpha = .81$  for neuroticism, and  $\alpha = .79$  for openness to experience) and the 56-item Schwartz Value Questionnaire (Schwartz, 1992) on a 9-point scale (0 = *not important at all* to 8 = *extremely important*;  $\alpha = .85$  for self-enhancement,  $\alpha = .79$  for openness,  $\alpha = .88$  for self-transcendence, and  $\alpha = .82$  for conservation).

**Results and discussion**

Mind attribution to nature was significantly correlated with PEB (see Table 2). A hierarchical regression then examined the unique predictive power of MAN (see Table 3). In Model 1, all traits and values were entered. This model explained 10% of the variance in PEB and was nonsignificant overall. In Model 2, MAN was added. This model showed significant improvement over Model 1 by explaining an additional 6% of the variance in PEB and was significant overall. In this model, three predictors were significant: self-enhancement, openness, and MAN.

Participants who attributed more of a mind to nature reported more PEB than did those who attributed fewer mental capacities to nature. This association held when controlling for traits and values. In sum, these findings are consistent with the first hypothesis. However, one may question the validity of these findings based on the fact that self-report PEB does not necessarily reflect actual PEB (Steg & Vlek, 2009). Study 2 thus replicated Study 1 with a measure of actual PEB. To further examine the unique predictive power of MAN, the study controlled for another set of known predictors of environmentalism (social desirability and demographic variables).

**Study 2**

**Method**

One hundred eighty-one staff members of a university in Hong Kong (73 males, 103 females, and 5 unreported;  $M_{age} = 32.82$  and  $SD_{age} = 8.39$  years) completed a questionnaire battery that contained measures for multiple studies. Each participant was compensated by HKD 40. The measures for the present study included the MANS ( $\alpha = .97$ ) and the Social Desirability Scale (Stöber, 2001). For the latter, there were 16 statements (e.g., "In traffic I am always polite and considerate of others"); the participants indicated whether these statements were true of them or not ( $\alpha = .65$ ). The participants also reported their education level (1 = *high school or below*, 2 = *bachelor's degree*, 3 = *master's degree*, and 4 = *doctoral degree*); 12 participants

**Table 3. Testing the Unique Predictive Power of Mind Attribution to Nature in Studies 1 and 2**

PREDICTORS	MODEL 1		MODEL 2	
	B	SE	B	SE
<i>Study 1</i>				
Extraversion	-.09	.09	-.07	.08
Agreeableness	.00	.10	-.01	.09
Conscientiousness	.08	.09	.10	.09
Neuroticism	-.12 <sup>+</sup>	.07	-.12 <sup>+</sup>	.07
Openness to experience	.05	.09	-.01	.09
Self-enhancement	-.15 <sup>+</sup>	.08	-.18*	.08
Openness	.17	.11	.20*	.10
Self-transcendence	-.02	.12	-.03	.11
Conservation	.07	.10	.07	.09
Mind attribution to nature			.10**	.04
	$R^2 = .10, p = .22$		$R^2 = .16, p = .03$	
			$R^2 \text{ change} = .06, p = .004$	
<i>Study 2</i>				
Age	.40**	.14	.40**	.14
Gender (0 = female, 1 = male)	-6.33**	2.26	-6.13**	2.24
Education	1.72	1.52	2.11	1.52
Social desirability	-.37	.38	-.49	.38
Mind attribution to nature			1.34*	.67
	$R^2 = .10, p = .003$		$R^2 = .12, p = .001$	
			$R^2 \text{ change} = .02, p = .05$	

Note. B = unstandardized regression coefficients; SE = standard errors.  
<sup>+</sup>  $p < .10$ . \*  $p < .05$ . \*\*  $p < .01$ .

picked the first option, 70 the second, 78 the third, and 18 the last. At the end of the questionnaire, the participants were shown a message that introduced the World Wide Fund for Nature Hong Kong, a local environmental organization. The participants were asked if they wanted to donate part or all of their compensation to support this organization. They were allowed to indicate any amount from HKD 0

to HKD 40. The participants were contacted the next day and paid the compensation (after deducting the donation amount).

### Results and discussion

Mind attribution to nature was significantly correlated with donation (see Table 2). A hierarchical regression was then performed (see Table 3). Model 1, which included age, gender, education, and social desirability as predictors, explained 10% of the variance in donation and was significant overall. In Model 2, MAN was added. This model showed improvement over Model 1 by explaining an additional 2% of the variance in donation and was significant overall. In this model, three predictors were significant: age, gender, and MAN.

Participants with stronger MAN donated more money to an environmental organization than did those with weaker MAN. This association was true when controlling for social desirability and various demographic variables. In sum, these findings support the first hypothesis. Across Studies 1 and 2, the hypothesized MAN-PEB association was established. Next, Study 3 extended the investigation by testing the mediating role of empathy.

## Study 3

### Method

Sixty-two undergraduates in Hong Kong (32 males and 30 females;  $M_{\text{age}} = 20.69$  and  $SD_{\text{age}} = 1.58$  years) participated for partial course fulfillment. In this study there were two parts, which were 14 days apart. In Part 1, the participants completed the MANS ( $\alpha = .96$ ) and some filler measures. In Part 2, they first completed a measure of empathy toward nature. They were presented a slideshow of 10 photos illustrating environmental degradation (e.g., ocean being polluted by deep-water oil spill). The slideshow proceeded automatically, with each photo being shown for 8 s. After seeing the photos, the participants were asked to respond to six statements on a 7-point scale (1 = *strongly*

*disagree* to 7 = *strongly agree*). Three of the statements related to perspective taking and three related to empathic concern (see Table 1). A factor analysis on these items revealed a two-factor structure (Eigenvalues = 3.74 and 1.09; variances explained = 62.34% and 18.11%;  $\alpha = .92$  and  $\alpha = .92$ ). The participants' PEB intention was then measured. They indicated the likelihood that they would perform each of 10 behaviors (see Table 1) in the near future on an 11-point scale (from 0 = 0% chance, *I certainly will not do it* to 5 = 50% chance *I will do it* to 10 = 100% chance, *I certainly will do it*;  $\alpha = .80$ ). They also completed the social desirability measure used in Study 2 ( $\alpha = .65$ ).

### Results and discussion

Mind attribution to nature was significantly correlated with PEB intention,  $r = .29$ ,  $p = .02$ . It was also significantly correlated with both perspective taking,  $r = .41$ ,  $p = .001$ , and empathic concern,  $r = .29$ ,  $p = .02$ . Perspective taking was correlated with PEB intention,  $r = .52$ ,  $p < .001$ ; the same was true for empathic concern,  $r = .45$ ,  $p < .001$ . In all, the expected association between MAN and PEB intention was observed. Additionally, the two components of empathy, the proposed mediator, were both significantly associated with MAN and PEB intention.

The next analysis examined if the two components of empathy mediated the association between MAN and PEB intention. A multiple-mediator model that included both components simultaneously was tested with the bootstrapping method. Many researchers have recommended the bootstrapping method (as opposed to the Sobel test) for testing mediation, particularly when the model involves multiple mediators and the sample is small (e.g., Preacher & Hayes, 2008; Shrout & Bolger, 2002). Essentially, the bootstrapping method involves repeatedly sampling from the data set and thereby generating a confidence interval estimate for each indirect effect (MacKinnon, Lockwood, & Williams, 2004). In the present analysis,

the bias-corrected 95% confidence interval (with 5,000 re-samples) for the indirect effect of each empathy component was examined. As shown in Fig. 1, the association between MAN and PEB intention became nonsignificant when the two empathy components were considered. Most important, both indirect effects were significant. The confidence intervals for both the indirect effect through perspective taking (.03, .26) and the indirect effect through empathic concern (.00, .24) excluded 0.

These findings support the second hypothesis. Empathy appears to be the mechanism that

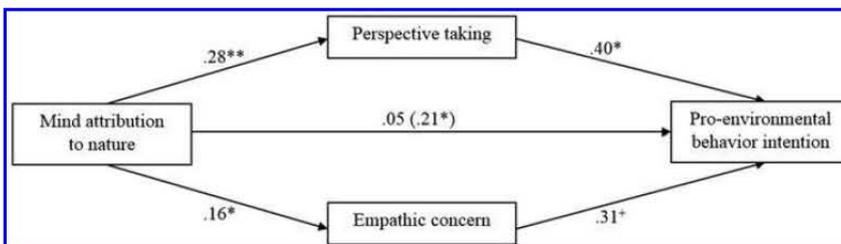


Fig. 1. The multiple-mediator model in Study 3.  $^+p = .07$ .  $*p < .05$ .  $**p < .01$ . Gender and social desirability were controlled for as covariates. Coefficients are unstandardized. The number in the parentheses indicates the total effect of mind attribution to nature on proenvironmental behavior intention.

underlies the MAN-PEB association. Individuals with stronger MAN exhibit more PEB than do those with weaker MAN because mind attribution allows them to take the perspective of nature and feel empathetic toward its degradation.

### General Discussion

While mind attribution is prevalent in the environmental discourse, direct evidence of its implications for environmental conservation is lacking. The present findings fill this void and extend the finding of Waytz, Cacioppo, and Epley (2010). These findings robustly show that MAN predicts PEB and empathy seems to be the underlying mechanism.

The present findings also provide a new angle to explicate some recent findings on the proenvironmental effects of anthropomorphism. These recent findings show that after viewing images that depict nature in a human form (e.g., a human face, an upright body), individuals express more support for environmental policies and the environmental movement (Tam, Lee, & Chao, 2013) and stronger PEB intention (Tam, 2014a). Based on the present findings, a plausible account for these effects is that when individuals perceive nature in a humanlike form they automatically infer the presence of a humanlike mind. Therefore, it is actually mind attribution that drives the proenvironmental effects. This account is consistent with findings showing that adults and even infants tend to perceive mental capacities in an entity when it is morphologically similar to humans (Johnson, 2003; Morewedge, Preston, & Wegner, 2007). It is also in line with the suggestion that mind attribution is the essence of anthropomorphism (Epley, Waytz, & Cacioppo, 2007; Waytz, Cacioppo, & Epley, 2010). Future studies may verify this account by testing whether MAN mediates the proenvironmental effects of viewing anthropomorphic images of nature.

#### *Implications for understanding the human-nature relationship*

That people might consider nature as mindful implies that how they relate to nature can be similar to how they relate to other mindful agents. Given that humans are the prototypical mindful agent (see Eddy et al., 1993; Gray et al., 2007), it can be further argued that how people relate to nature can be similar to how they relate to other humans. If this is true, then researchers actually can refer to existing theories on interpersonal relationships and develop parallel theories about the human-nature relationship.

A recent study has demonstrated the validity of this novel theoretical approach. Because mindful agents are considered to be able to formulate intentions, they should be held accountable for their actions (Epley et al., 2007). It is known that when people have received a

benefit from another person's intentional actions, they experience gratitude, which motivates them to act prosocially toward the benefactor (e.g., Bartlett & DeSteno, 2006). Based on these findings, Tam (2014b) recently gathered supportive evidence for a new construct: gratitude toward nature. He found that when individuals with stronger MAN are conscious of the benefits they receive from nature, they feel more grateful toward it and become more motivated to perform PEB.

Viewed from this new approach, it is expected that MAN does not always bear proenvironmental effects. For instance, MAN should allow people to perceive intentions behind natural disasters. Accordingly, MAN may intensify individuals' anger toward nature when they think about destruction by natural disasters; such anger could in turn suppress PEB. This prediction is in line with past findings on interpersonal anger (e.g., Averill, 1983).

Given the bulk of research findings on interpersonal relationships, the theoretical approach just proposed can help researchers develop new theories and concepts for understanding the human-nature relationship in a systematic, efficient manner. This approach also represents an innovative way to integrate social psychological knowledge with environmental psychology and ecopsychology.

#### *Implications for environmental promotion*

Some attribute the environmental crisis to the problem in how humans think about nature. In the past, nature was a source of wonder, awe, and spiritual enhancement, but in the modern world it is just a pool of resources or an object for scientific observation (see Barlett, 2008). Some suggest that there is a need to complement this modern view about nature with other representations that are more favorable to the environment (e.g., Berman, 1981). The present findings suggest that the portrayal of nature as mindful can be one of these needed representations; in fact, such representation is already prevalent in the environmental discourse.

Three issues are noteworthy when one considers the use of MAN for environmental promotion. First, because the present findings are purely correlational, the effectiveness of MAN as a promotion strategy needs to be validated by experimental findings showing that MAN can be induced through interventions. Second, how MAN can be instilled in individuals on a relatively long-term basis is unknown. Although individual differences in mind attribution are now well documented, it is still unclear how these individual differences arise. Is it possible that as people age and receive more education, particularly scientific education, objectivity dominates and crowds out mind attribution (see Epley et al., 2007)? Unfortunately, this question is beyond the scope of the present research and can only be addressed in future

investigations. Third, the scientific community may oppose the use of MAN as it deviates from objectivity (see Horowitz & Bekoff, 2007). How to strike a balance between objectivity and proenvironmental effects is an important point to note in future discussions about MAN.

### Limitations

The zero-order MAN-PEB correlations observed in the present research were around .20 to .30, indicating a small to medium effect (see Cohen, 1988). It is noteworthy that this effect size is actually quite typical among the correlates of PEB. For example, the correlations of PEB with traits (e.g., Markowitz, Goldberg, Ashton, & Lee, 2012), values (e.g., Schultz & Zelezny, 1998), and demographic variables (e.g., Hines, Hungerford, & Tomera, 1986–1987) are typically within this range. These observations imply the complexity of PEB (see Gifford & Nilsson, 2014). There is not a single predominant determinant. Researchers need to consider a wide array of factors when trying to explain PEB.

Although the present studies included measures of both self-report and actual PEB, the mediation model in Study 3 was tested on a self-report measure only. It is suggested that future studies examine a broader spectrum of behavior. One may replicate Study 3 with the donation measure used in Study 2. Additionally, it will be interesting to examine the MAN-PEB association with records of participants' actual household consumption of resources (e.g., energy, water), for example.

Future studies can reveal a more complete picture about the environmental implications of MAN by identifying mediators other than empathy. Take connectedness to nature, the extent to which an individual feels that he or she and nature are interconnected (Mayer & Frantz, 2004; Tam, 2013), as an example. Past studies have shown that mind attribution can fulfill people's need for relationships (Epley et al., 2007). For example, Epley, Akalis, Waytz, and Cacioppo (2008) found that individuals who feel lonely attribute more mental capacities to dogs, gadgets, and God. Based on these findings, it seems reasonable to hypothesize that MAN fosters a stronger sense of connectedness to nature, which motivates more PEB.

### Conclusion

Mind attribution signifies an alternative way people think about nature. This representation about nature plays an important role in how people relate to and behave toward the environment. The present research marks just the beginning of the inquiry into this important factor. Future studies need to further examine its implications, both positive and negative, for the human-nature relationship and investigate how it develops in some individuals but not others.

### Acknowledgment

The work described in this paper was fully supported by a grant from the Research Grants Council of the Hong Kong Special Administrative Region, China (Project No. HKUST645311).

### REFERENCES

- Averill, J. R. (1983). Studies on anger and aggression: Implications for theories of emotion. *American Psychologist, 38*, 1145–1160.
- Barlett, P. F. (2008). Reason and reenchantment in cultural change: Sustainability in higher education. *Current Anthropology, 49*, 1077–1098.
- Bartlett, M. Y., & DeSteno, D. (2006). Gratitude and prosocial behavior helping when it costs you. *Psychological Science, 17*, 319–325.
- Batson, C. D. (1991). *The altruism question: Toward a social-psychological answer*. Hillsdale, NJ: Erlbaum.
- Berenguer, J. (2007). The effect of empathy in proenvironmental attitudes and behavior. *Environment and Behavior, 39*, 269–283.
- Berman, M. (1981). *The reenchantment of the world*. New York: Cornell University Press.
- Clayton, S., Fraser, J., & Burgess, C. (2011). The role of zoos in fostering environmental identity. *Ecopsychology, 3*, 87–96.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum.
- Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology, 44*, 113–126.
- De Groot, J., & Steg, L. (2007). General beliefs and the theory of planned behavior: The role of environmental concerns in the TPB. *Journal of Applied Social Psychology, 37*, 1817–1836.
- Eddy, T. J., Gallup, G. G., & Povinelli, D. J. (1993). Attribution of cognitive states to animals: Anthropomorphism in comparative perspective. *Journal of Social Issues, 49*, 87–101.
- Eisenberg, N., & Miller, P. A. (1987). The relation of empathy to prosocial and related behaviors. *Psychological Bulletin, 101*, 91–119.
- Epley, N., Akalis, S., Waytz, A., & Cacioppo, J. T. (2008). Creating social connection through inferential reproduction loneliness and perceived agency in gadgets, gods, and greyhounds. *Psychological Science, 19*, 114–120.
- Epley, N., & Waytz, A. (2010). Mind perception. In S. T. Fiske, D. T. Gilbert & G. Lindzey (Eds.), *The handbook of social psychology* (pp. 498–541). New York: Wiley.
- Epley, N., Waytz, A., & Cacioppo, J. T. (2007). On seeing human: A three-factor theory of anthropomorphism. *Psychological Review, 114*, 864–886.
- Gifford, R., & Nilsson, A. (2014). Personal and social factors that influence pro-environmental concern and behaviour: A review. *International Journal of Psychology, 49*, 141–157.
- Gray, H. M., Gray, K., & Wegner, D. M. (2007). Dimensions of mind perception. *Science, 315*, 619.
- Gutherie, S. (1993). *Faces in the clouds*. Oxford, UK: Oxford University Press.
- Haslam, N. (2006). Dehumanization: An integrative review. *Personality and Social Psychology Review, 10*, 252–264.
- Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1986–1987). Analysis and synthesis of research on responsible environmental behaviour: A meta-analysis. *Journal of Environmental Education, 18*, 1–8.

- Hirsh, J. B., & Dolderman, D. (2007). Personality predictors of consumerism and environmentalism: A preliminary study. *Personality and Individual Differences, 43*, 1583–1593.
- Hogan, R. (1969). Development of an empathy scale. *Journal of Consulting and Clinical Psychology, 33*, 307–316.
- Horowitz, A. C., & Bekoff, M. (2007). Naturalizing anthropomorphism: Behavioral prompts to our humanizing of animals. *Anthrozoös, 20*, 23–35.
- Hume, D. (1957). *The natural history of religion*. Stanford, CA: Stanford University Press. (Original work published 1757)
- John, O. P., Donahue, E. M., & Kentle, R. L. (1991). *The Big Five Inventory—Versions 4a and 54*. Berkeley, CA: University of California, Berkeley, Institute of Personality and Social Research.
- Johnson, S. C. (2003). Detecting agents. *Philosophical Transactions of the Royal Society of London B, 358*, 549–559.
- Knight, S., Vrij, A., Cherryman, J., & Nunkoosing, K. (2004). Attitudes towards animal use and belief in animal mind. *Anthrozoös, 17*, 43–62.
- Mackinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research, 39*, 99–128.
- Markowitz, E. M., Goldberg, L. R., Ashton, M. C., & Lee, K. (2012). Profiling the "pro-environmental individual": A personality perspective. *Journal of Personality, 80*, 81–111.
- Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology, 24*, 503–515.
- Millfont, T. L. (2009). The effects of social desirability on self-reported environmental attitudes and ecological behaviour. *The Environmentalist, 29*, 263–269.
- Morewedge, C. K., Preston, J., & Wegner, D. M. (2007). Timescale bias in the attribution of mind. *Journal of Personality and Social Psychology, 93*, 1–11.
- Nass, C., Lombard, M., Henriksen, L., & Steuer, J. (1995). Anthropocentrism and computers. *Behaviour and Information Technology, 14*, 229–238.
- Nass, C., & Moon, Y. (2000). Machines and mindlessness: Social responses to computers. *Journal of Social Issues, 56*, 81–103.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*, 879–903.
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*, 879–891.
- Schultz, P. W. (2000). Empathizing with nature: The effects of perspective taking on concern for environmental issues. *Journal of Social Issues, 56*, 391–406.
- Schultz, P. W., & Zelezny, L. C. (1998). Values and pro-environmental behavior: A five-country survey. *Journal of Cross-Cultural Psychology, 29*, 540–558.
- Schwartz, S. H. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 25, pp. 1–65). New York: Academic Press.
- Sevillano, V., Aragonés, J. I., & Schultz, P. W. (2007). Perspective taking, environmental concern, and the moderating role of dispositional empathy. *Environment and Behavior, 39*, 685–705.
- Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods, 7*, 422–445.
- Sobel, D. (1996). *Beyond ecophobia: Reclaiming the heart in nature education*. Great Barrington, MA: The Orion Society and the Myrin Institute.
- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology, 29*, 309–317.
- Stöber, J. (2001). The Social Desirability Scale-17 (SDS-17): Convergent validity, discriminant validity, and relationship with age. *European Journal of Psychological Assessment, 17*, 222–232.
- Tam, K.-P. (2013). Concepts and measures related to connection to nature: Similarities and differences. *Journal of Environmental Psychology, 34*, 64–78.
- Tam, K.-P. (2014a). Are anthropomorphic persuasive appeals effective? The role of the recipient's motivations. *British Journal of Social Psychology*. Advance online publication. doi:10.1111/bjso.12076
- Tam, K.-P. (2014b). *Gratitude toward nature*. Manuscript in preparation.
- Tam, K.-P., Lee, S.-L., & Chao, M. M. (2013). Saving Mr. Nature: Anthropomorphism enhances connectedness to and protectiveness toward nature. *Journal of Experimental Social Psychology, 49*, 514–521.
- Vining, J., Merrick, M. S., & Price, E. A. (2008). The distinction between humans and nature: Human perceptions of connectedness to nature and elements of the natural and unnatural. *Human Ecology Review, 15*, 1–11.
- Watanabe, S. (2007). How animal psychology contributes to animal welfare. *Applied Animal Behaviour Science, 106*, 193–202.
- Waytz, A., Cacioppo, J. T., & Epley, E. (2010). Who sees human? The stability and importance of individual differences in anthropomorphism. *Perspectives on Psychological Science, 5*, 219–232.
- Waytz, A., Epley, N., & Cacioppo, J. T. (2010). Social cognition unbound: Insights into anthropomorphism and dehumanization. *Current Directions in Psychological Science, 19*, 58–62.
- Waytz, A., & Young, L. (2014). Two motivations for two dimensions of mind. *Journal of Experimental Social Psychology, 55*, 278–283.

Address correspondence to:

Kim-Pong Tam

Division of Social Science

The Hong Kong University of Science and Technology

Clear Water Bay

Hong Kong

E-mail: kevinam@ust.hk

Received: October 29, 2014

Accepted: January 9, 2015