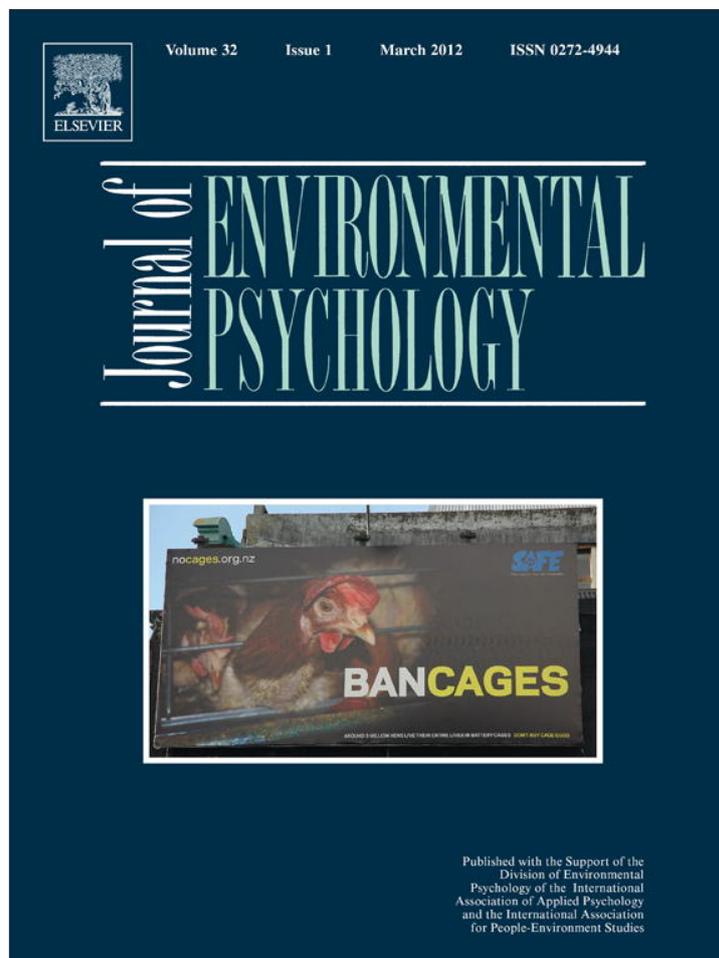


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## Dispositional empathy with nature



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## ABSTRACT

Empathy has been regarded by environmental thinkers as a key in conservation efforts. Nevertheless, systematic research on empathy toward nature, particularly from the personality perspective, has been lacking in psychology. The present research thus provides this needed investigation by testing four propositions regarding a new construct—*dispositional empathy with nature* (DEN), which refers to the dispositional tendency to understand and share the emotional experience of the natural world. In five studies with 817 participants in total (including university students and working adults from two societies), DEN robustly and uniquely predicted conservation behavior (Proposition 1). Females, respondents who felt close to nature, and participants who considered nature to be sentient exhibited stronger DEN (Propositions 2–4). DEN was distinct from empathy with humans and a number of known determinants of conservation behavior (including personality traits, values, emotional involvement with nature, environmental concern, and social desirability bias). Taken together, these findings highlight the possibility of developing a theory of empathy with nature by referring to the existing understanding about empathy with humans. The construct of DEN has much theoretical utility, as it sheds new light on several under-explored issues in conservation psychology (including the gender gap in environmentalism, the role of connection to nature, and the role of anthropomorphism), and bears practical implications for the promotion of environmentalism. In addition, the newly developed scale for DEN is potentially useful for assessing the efficacy of environmental education programs.

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## 1. Introduction

“...we must begin in empathy, by becoming the animals before we can save them.” (Sobel, 1996)

Empathy, broadly defined as the understanding and sharing of another person's emotional experience (Davis, 1983; Hoffman, 2008), has often been regarded by social scientists as the key to altruism and intergroup harmony (e.g., Eisenberg & Miller, 1987; Stephen & Finlay, 1999). In recent years, some environmental thinkers have called for attention to the role of empathy in conservation efforts (e.g., Sobel, 1996). Despite this call, systematic research on the notion of empathy toward nature, particularly from the personality perspective, has been rare in psychology. The present research thus provides this needed investigation.

## 2. Empathy with humans

Empathy has two components: cognitive and affective. The cognitive component refers to the understanding of another person's emotions through perspective taking (e.g., Hogan, 1969). Affective empathy refers to joining and sharing the emotional responses of another person (e.g., Batson, 1991). These two components are considered to be inter-related and not separate (Davis, 1983). For instance, Coke, Batson, and McDavis (1978) showed that perspective taking can trigger empathic emotions. Baron-Cohen and Wheelwright (2004) even suggested that the two components cannot be empirically disentangled.

By definition, empathy could involve either negative or positive emotions. Through empathy, one may feel distress for another person's suffering, or experience joy for other people's triumph. However, psychological research has predominantly analyzed empathy in a negative context (e.g., Batson, 1991; Coke et al., 1978), in part because the academic interest in empathy originates from research on altruistic behavior (Eisenberg & Miller, 1987; Hoffman, 2008). More important, as Royzman and Kumar (2001) pointed out,

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experience of empathic joy is relatively unusual; people's empathic reactions are more readily aroused by the perceived negative affect in others than its positive counterpart, and this asymmetry appears to be hardwired biologically in human lineage. Accordingly, extant studies have typically examined empathic distress only, and considered compassionate feelings and helping behavior as its outcomes (Batson, 1991). These studies could be roughly categorized into two streams: induced empathy and dispositional empathy. The research on induced empathy follows the tradition of social psychology; it typically manipulates empathy through asking participants to take the perspective of a target person in distress. The research on dispositional empathy follows the personality psychology tradition; it assumes that the tendency to empathize is a stable trait, and thereby assesses empathy through self-report measures. Generally, both induced empathy and dispositional empathy have a robust effect on compassion and helping (Batson, 2011; Coke et al., 1978; Eisenberg & Miller, 1987; Hodges, Myers, & Clark, 2011; Konrath, O'Brien, & Hsing, 2011).

### 3. Empathy with nature

The robust finding regarding the association between empathy and helping has inspired some environmental thinkers to consider the possibility of *empathy with nature*—the understanding and sharing of the emotional experience, particularly distress, of the natural world. This form of empathy can be exemplified with the following. When reading news that a deep-water oil spill is polluting the ocean, an individual may put himself or herself in the place of the affected animals and feel what they are feeling. Similarly, when watching a video about shark finning, some individuals may visualize vividly the sharks' experience and feel the pain the sharks are experiencing. One of the proponents for the primacy of empathy in conservation efforts is Sobel (1996). As he expressed in the opening quote, conservation efforts must begin in empathy. In his view, empathy should be taught in early childhood, and the empathy thus developed will serve as the foundation for more abstract environmental stewardship later in one's life. This view has been echoed by others (e.g., Chawla, 2009; Myers, Saunders, & Bexell, 2009). In particular, Guergachi, Ngenyama, Magness, and Hakim (2010) proposed that, rather than studying a long list of such characteristics as environmental friendliness or frugality, one should focus on the smallest set of qualities which, once met by the majority, will lead to sustainability directly; in their view, this resides in empathy.

#### 3.1. Induced empathy with nature

Some studies have already found empirical support to the presumed importance of empathy. They commonly used perspective taking manipulations to arouse participants' empathic concern toward certain natural elements in distress (*induced empathy with nature*; IEN hereafter). Shelton and Rogers (1981) found that participants who had taken the perspective of a suffering whale, as compared to those who had not, exhibited stronger compassion toward whales in general and intention to protect them. This effect was replicated by Schultz (2000), who showed that when participants had taken the perspective of some animals harmed by pollution, they became more concerned about the biosphere as a whole (see also Sevillano, Aragonés, & Schultz, 2007). Berenguer (2007) extended these studies by showing that IEN can trigger actual behavior. He found that participants who had taken the perspective of a suffering bird or tree felt not only more compassionate but also more obligated to help it and nature as a whole. When asked to allocate some money to several student programs, these participants favored an environmental cause (see also

Berenguer, 2010). Taken together, induced empathy toward certain natural elements in distress is able to activate concern for not only these elements but also the whole natural world.

#### 3.2. Dispositional empathy with nature: the missing construct

As Cronbach (1957) warned, to build a theory about a phenomenon, it is necessary to study its variance both among experimental treatments and among individuals. In this spirit, a complete theory of empathy with nature needs to consider *dispositional empathy with nature* (DEN hereafter)—the dispositional tendency to understand and share the emotional experience of the natural world. Some individuals may spontaneously empathize with nature more strongly than do others. The overall objective of the present research is thus to develop a systematic understanding regarding this previously neglected construct. To achieve this objective, close reference to existing, well-established understanding about dispositional empathy with humans is made. This gives rise to four theoretical propositions (see Section 3.3). As noted, by definition, empathy is not confined to negative emotions. For instance, one may feel joy when he or she takes the role of a forest that is well-protected from human interference. Nevertheless, the present investigation centers on the distress of nature for three reasons. First, as identified earlier, empathy is more likely to be aroused by distress than by good fortune (Royzman & Kumar, 2001). To develop a theory about empathy with nature with reference to existing research about empathy (e.g., Batson, 1991; Hoffman, 2008), it is conceivable to start with a focus on distress. Second, past studies on IEN (e.g., Berenguer, 2007; Sevillano et al., 2007) focused on distress only. To connect to these studies and thereby to build a general theory, the present research centers on distress too. Third, empathy with nature has often been discussed in the context of environmental degradation (e.g., Guergachi et al., 2010; Sobel, 1996), as the practical concern of this discussion is how to mitigate such degradation.

#### 3.3. Four propositions regarding DEN

The present research aims to test four propositions. The first proposition considers the effect of DEN, while the next three propositions consider factors that account for individual differences in DEN. These propositions are certainly not exhaustive; some other possible propositions for future studies will be discussed in the *General Discussion*.

##### 3.3.1. DEN motivates conservation behavior

As reviewed, empathy with humans motivates helping behavior. Based on this finding, it is expected that empathy with nature motivates protective behavior toward the natural environment (e.g., Sobel, 1996). Some studies on IEN have already supported this view (e.g., Berenguer, 2007; Schultz, 2000). It is thus intuitive to propose that people with stronger DEN exhibit more conservation behavior (*Proposition 1*). It should be noted that among the existing studies on IEN, only Berenguer (2007) provided behavioral evidence. As Cronbach (1957) noted, "simultaneous consideration of many criteria is needed for a satisfactory evaluation of performance" (p. 676) of a construct. Accordingly, in the present research, two forms of conservation behavior will be assessed. Public behavior ranges from active participation (e.g., joining an environmental group) to less active support (e.g., donation) in environmental movement, whereas private behavior refers to personal and household decisions (e.g., recycling; see Stern, 2000). Dispositional empathy with nature is expected to motivate both forms. Also, its predictive power is expected to be independent from that of other known determinants of conservation behavior.

### 3.3.2. Females have stronger DEN

Batson (1991) suggested that valuing other people's welfare is a key antecedent for empathy. This valuing is partly subject to one's socialization experience (Hoffman, 2008). Generally, females are socialized to take care of other people's needs more strongly, and to have a stronger "ethic of care" (e.g., Gilligan, 1982). Accordingly, women are expected to exhibit stronger empathy than men (Hoffman, 2008). Indeed, this gender difference has been found (e.g., Baron-Cohen & Wheelwright, 2004; Davis, 1983; Jolliffe & Farrington, 2006). Based on this reasoning, it is proposed that women have stronger DEN than do men (*Proposition 2*).

Past studies have revealed a gender gap in environmentalism. In a review of studies spanning from 1988 to 1999, Zelezny, Chua, and Aldrich (2000) concluded that women exhibit significantly more environmental concern and participation in environmental behavior than do men. This gap has also been attributed to the gender difference in socialization: Because proenvironmental behavior can be considered as a kind of helping, females, who are more socialized than males to value other beings' needs, show stronger environmentalism (McCright, 2010; Zelezny et al., 2000). Given the expected gender difference in DEN and its role in conservation behavior, it is likely that socialization gives rise to the gender difference in DEN, which in turn generates the gender difference in conservation behavior. Although the gender gap in environmentalism has already been explained in terms of socialization, direct evidence to its more proximal mechanisms has been called for (see Zelezny et al. 2000). Testing the mediational role of DEN could be useful in answering this call.

### 3.3.3. Individuals who feel close to nature have stronger DEN

One force that works against empathy is seeing another person as different and remote from oneself (Batson, 1991; Gutsell & Inzlicht, in press; Royzman & Kumar, 2001). People show more empathy toward others to whom they feel close. For instance, Gutsell and Inzlicht (2010) showed that the neural networks involved in empathy were more responsive to actions by ingroup members than those by outgroup members. Yzerbyt, Dumont, Wigboldus, and Gordijn (2003) showed that participants who categorized victims into their own group reported more emotional responses than did those who categorized them into an outgroup. It is thus proposed that DEN is stronger among people who feel connected to nature (*Proposition 3*).

Environmental psychologists have considered the possibility that reconnecting humans to nature helps mitigate the environmental crisis. Connection to nature could be defined as the extent to which people feel affectively attached to the natural community (Mayer & Frantz, 2004), the extent to which people cognitively include the knowledge structure about nature in the self-schema (Schultz, 2001), or a combination of these tendencies (Nisbet, Zelenski, & Murphy, 2009). Connection to nature motivates conservation behavior. For instance, Schultz (2001) reported that inclusion of nature in the self is positively correlated with concern about the biosphere and environmental behavior (see also Mayer & Frantz, 2004). Nisbet et al. (2009) reported that connection to nature predicts love for animals, membership in environmental organizations, self-identification as an environmentalist, and preference for green products. It is noteworthy that DEN should be distinct from connection to nature. Though the latter may entail certain emotions (e.g., love) toward nature, it does not concern how people react to the emotional experience of nature. Nevertheless, if feeling connected to nature enhances DEN, as proposed, then it is reasonable to hypothesize that DEN mediates the association between connection to nature and conservation behavior. Thus far, only one study (Gosling & Williams, 2010) has studied the mediating mechanism underlying such association. Support to this mediational hypothesis can attest the theoretical utility of DEN.

Some have suggested that empathy can induce self-other merging. Davis, Conklin, Smith, and Luce (1996) reported that perspective taking produces greater overlap between the cognitive representations of the self and the target person. Although Batson et al. (1997) failed to replicate this finding, it is still of importance to consider the possibility that DEN enhances connection to nature. Schultz (2000) also noted this possibility: "taking perspective may have expanded the participants' inclusiveness of self and reduced the degree of separation that participants perceived between themselves and nature" (p. 403). Thus, this reverse mediational hypothesis (i.e., connection to nature mediates the effect of DEN) will be explored.

### 3.3.4. Individuals who consider nature to be sentient have stronger DEN

As Batson (1991) explained, perception of another person's need is a prerequisite for empathy, and this perception requires the recognition that the person is a sentient, intentional agent (see also Hoffman, 2000). Thus, another force working against empathy is people's reluctance to recognize a target as sentient (Batson, 1991). Indeed, individuals who dehumanize other ethnic groups tend to empathize with them less (see Haslam, 2006). One means to recognizing nonhumans as sentient is anthropomorphism—attribution of human qualities to nonhumans (Guthrie, 1993). One study (Riek, Rabinowitch, Chakrabarti, & Robinson, 2009) found that people empathize with robots more when they are humanlike. Thus, it is proposed that anthropomorphism is associated with DEN (*Proposition 4*). This proposition has been speculated by others too (e.g., Chawla, 2009; Clayton, Fraser, & Burgess, 2011). For instance, Batson (2011) acknowledged that people may find it difficult to empathize with the environment unless it is personalized.

Anthropomorphism of nature has been widely observed in different cultures (Epley, Waytz, & Cacioppo, 2007; Guthrie, 1993), but there have been just a few studies on its role in conservation behavior. Gebhard, Nevers, and Billmann-Mahecha (2003) found that young children who spontaneously ascribed mental and emotional qualities to natural entities showed heightened concern toward them. Waytz, Cacioppo, and Epley (2010) found that the tendency to anthropomorphize nonhumans in general predicted how concerned they were about the environment. Atran et al. (2002) found that Itza' Maya, who believed in the existence of "spirits" in the natural world, exhibited more ecological practices than did other cultures in the neighboring area. Testing the present proposition enables one to examine directly the link between anthropomorphism of nature and conservation behavior, and the mediating role of DEN. Support to these hypotheses can once again illustrate the theoretical value of DEN.

## 3.4. The present research

The present research tests the four propositions in five studies. Studies 1–3 validate a scale for DEN. Propositions 1 and 2 will be tested in all five studies. Proposition 3 will be tested in Study 4, while Proposition 4 will be tested in Study 5. Because it is important to demonstrate that a new construct is conceptually and empirically distinct from other related constructs (Block, 1995), the distinctiveness of DEN will be assessed in Studies 1 and 2.

Sears (1986) reported evidence regarding differences between adolescents and adults, and between college students and non-students. It is of concern whether using a sample of undergraduates produces similar or different findings as using a more heterogeneous sample. One way to cope with this concern is to cross-validate the findings in diverse samples. Accordingly, both undergraduates and working adults will be used. Some studies have identified cultural difference in environmentalism (see

Milfont, 2012). In addition, empathy, as a form of other-focused emotions, is considered to be more frequently experienced in cultures that emphasize interdependence between the self and others than cultures that emphasize independence (Markus & Kitayama, 1991). Though the present research does not aim to be a cross-cultural comparison, given the concern about the generalizability of findings across cultures, the five studies will involve samples from two different cultures.

#### 4. Study 1

Study 1 aimed to validate the Dispositional Empathy with Nature Scale (DENS hereafter). Propositions 1 and 2 were tested. The distinctiveness of DEN was also examined.

##### 4.1. Scale construction

Davis's (1983) Interpersonal Reactivity Index (IRI hereafter) has been considered the best measure for empathy as it taps both cognitive and emotional components (Baron-Cohen & Wheelwright, 2004). Its scores predict not only prosocial behavior (Konrath et al., 2011), but also empathy-related biological activities (Singer et al., 2004). The IRI specifies four aspects of empathy: fantasy, perspective taking, empathic concern, and personal distress. However, only perspective taking and empathic concern are considered relevant to empathy (Baron-Cohen & Wheelwright, 2004; Jolliffe & Farrington, 2006; Konrath et al., 2011). Personal distress (e.g., "I tend to lose control during emergencies") is self-focused, not other-oriented, and therefore does not fit the definition of empathy. When an individual views another person who is sad and, as a consequence, feels anxious and concerned about his or her own welfare, this is personal distress, not empathy (Eisenberg & Miller, 1987). Fantasy refers to the tendency to imaginatively transpose oneself into hypothetical scenarios (e.g., "I daydream and fantasize, with some regularity, about things that might happen to me"). Although imagination is related to empathy, it should not be taken as empathy itself. With reference to the items on perspective taking and empathic concern in the IRI, 12 items were written. Five items captured perspective taking. They used different wordings to refer to the tendency to spontaneously take the perspective of certain natural entities in distress. The remaining seven items captured empathic concern. They referred to the tendency to share the distress of certain natural entities and experience compassionate feelings toward them. As cognitive and affective components of empathy are inter-related (Davis, 1983) and even empirically inseparable (Baron-Cohen & Wheelwright, 2004), a single factor was expected for these items. To ascertain their content validity, an expert review was conducted (see DeVellis, 2003). Three social psychologists (PhD holders with at least four years of research experience after doctoral graduation) were shown the definitions of DEN, perspective taking and empathic concern. They then rated how relevant each of these items was to DEN, perspective taking, and empathic concern, respectively, on a 7-point scale (1 = *strongly irrelevant*–7 = *strongly relevant*). For each item, the mean rating on each question across the three reviewers was computed. As expected, all 12 items were regarded as highly relevant to DEN ( $M_s$  ranging from 6.00 to 7.00). Also, in terms of relevance to perspective taking, the five items regarding perspective taking ( $M_s = 7.00$ ) were indeed higher than the seven items regarding empathic concern ( $M_s$  ranging from 2.67 to 5.67); in terms of relevance to empathic concern, the empathic concern items ( $M_s$  ranging from 6.33 to 6.67) were indeed higher than the perspective taking items ( $M_s$  ranging from 4.67 to 6.00). These findings demonstrate the content validity of the scale items.

As discussed, the present research centers on distress. Thus, a short instruction guided participants to consider instances in which nature was in distress (e.g., pollution, deforestation). The items specified the experience of animals and plants but not inanimate entities because animals and plants are core in people's mental representations of nature (van den Born, Lenders, de Groot, & Huijsman, 2001), and psychological reactions toward animate elements are often generalizable to nature as a whole (Berenguer, 2007) and serves as the basis of general concern for the ecosystem (Myers, Saunders, & Garrett, 2004).

##### 4.2. Distinctiveness of DEN

Many other dispositional variables also motivate conservation behavior. It is important to consider how DEN is related to or distinct from these variables (see Block, 1995).

Personality traits predict conservation behavior. For instance, Hirsh and Dolderman (2007) reported that both openness to experience and agreeableness predict environmentalism (see also Markowitz, Goldberg, Ashton, & Lee, 2012). Dispositional empathy is associated with personality traits too. It is considered to be part of the altruism facet of agreeableness (Jolliffe & Farrington, 2006). Also, as empathy to some extent involves imagination ability, it is related to openness to experience (Mooradian, Davis, & Matzler, 2011). It is thus expected that DEN is related, but not reducible to agreeableness and openness (as empathy is not related to the other facets of agreeableness and openness).

Values also predict conservation behavior. Schultz and Zelezny (1998) observed a positive relationship between self-transcendence values and proenvironmental behavior in various cultures. Dispositional empathy is related to self-transcendence values too (Myrsky & Helkama, 2001), as the latter also entail concerns about the environment and other people's needs. It is thus expected that DEN is related, but not reducible to self-transcendence values (as self-transcendence values also involve other unrelated aspects).

Kals, Schumacher, and Montada (1999) introduced the concept of emotional affinity toward nature, which refers to emotional inclinations, particularly positive ones, toward nature (e.g., feeling good, free, and safe in nature). Although both DEN and emotional affinity concern emotions, the former is other-focused, while the latter refer to self-oriented emotions. It is thus expected that DEN is related, but not reducible to emotional affinity toward nature.

Concern about the environment is determined by how much importance people place on themselves (egoistic), other people (altruistic), or plants and animals (biospheric). It has been found that IEN enhances biospheric concern (see Schultz, 2000). Thus, DEN should be related to biospheric concern. However, DEN is not reducible to biospheric concern, as the latter does not specify empathy as the source of the concern. A person may show biospheric concern because he or she considers the biosphere to be intrinsically valuable, for instance.

In all, it is expected that DEN is related, but not reducible, to the concepts named above. It is also expected that DEN uniquely and independently predicts conservation behavior.

##### 4.3. Method

Two hundred and eighty-eight ethnic Chinese undergraduates (157 males, 130 females, and 1 unreported;  $M_{age} = 20.39$  and  $SD_{age} = 1.28$  years) in Hong Kong participated for partial course fulfillment. Participants understood English (English is the primary medium of instruction in universities in Hong Kong). All materials were in English therefore.

The participants completed the DENS and the following measures on a 7-point scale, if not specified otherwise, and all measures

were presented in a completely randomized order (the same applies to all subsequent studies). Traits were assessed by the Big Five Inventory (John, Donahue, & Kentle, 1991;  $\alpha$ s = .77 for extraversion, .68 for agreeableness, .78 for conscientiousness, .82 for neuroticism, and .86 for openness). Values were measured by the Schwartz (1992) Value Questionnaire: Participants indicated the importance of each value on a 9-point scale (0 = not important at all–8 = extremely important;  $\alpha$ s = .85 for self-enhancement, .83 for openness, .88 for self-transcendence, and .81 for conservation). Participants also completed the Emotional Affinity Toward Nature Scale (Kals et al., 1999;  $\alpha$  = .82), and the Environmental Motives Scale (Schultz, 2001). In the latter, participants indicated to what extent they were concerned about 12 items (e.g., my future, children, birds;  $\alpha$ s = .87 for biospheric concern, .83 for egoistic concern, and .83 for altruistic concern). Public conservation behavior was measured by a scale on environmental movement support (e.g., “I would like to support an environmentalist organization”) from the Environmental Attitudes Inventory (Milfont & Duckitt, 2010;  $\alpha$  = .86). For private behavior, participants reported how frequently (1 = never–5 = very often) they performed 12 behavior (see Appendix) adopted from past studies (e.g., Kaiser, Doka, Hofstetter, & Ranney, 2003;  $\alpha$  = .83). In previous studies (Tam, 2013; Tam, in press), this measure was correlated with environmental movement support, and commitment to volunteering for an environmental cause, indicating its validity.

4.4. Results and discussion

A principal axis factoring analysis on the 12 items of DENS revealed a one-factor structure (Eigenvalue = 6.11, with 50.90% of variance explained). However, two items had low factor loadings (<.40); they were leading candidates for removal (DeVellis, 2003).

One of these items (“I feel protective towards the suffering animals and plants”) had low variance (SD < 1.00), possibly because its tone renders disagreement with it highly undesirable. The other item (“I try to put myself in the shoes of the suffering animals and plants”) had low item-total correlation ( $r$  = .37), possibly because the expression used was not direct enough. Accordingly, these two items were dropped. Another factor analysis performed on the remaining 10 items revealed a one-factor structure (Eigenvalue = 5.70, with 56.96% of variance explained). The factor loadings and the internal reliability were high (see Table 1). These 10 items formed the final DENS.

An overall DEN score was computed by averaging the item scores. Because age, income, and education level did not show any consistent relationship with DEN or conservation behavior in any study, they were not reported. As expected, DEN was significantly correlated with agreeableness,  $r$  = .22,  $p$  < .001, and openness,  $r$  = .12,  $p$  < .05. It was also correlated with extraversion,  $r$  = .21,  $p$  < .001. However, it is noteworthy that all these correlations were just weak. Dispositional empathy with nature was neither significantly correlated with conscientiousness,  $r$  = .08, nor neuroticism,  $r$  = -.03. As expected, DEN was significantly correlated with self-transcendence values,  $r$  = .32,  $p$  < .001, and this correlation was medium in magnitude. Dispositional empathy with nature was also significantly correlated with self-enhancement,  $r$  = .12,  $p$  < .05, openness,  $r$  = .23,  $p$  < .001, and conservation,  $r$  = .25,  $p$  < .001, but these correlations were weak. It was correlated moderately with emotional affinity toward nature,  $r$  = .36,  $p$  < .001, moderately with biospheric concern,  $r$  = .48,  $p$  < .001, and weakly with altruistic concern,  $r$  = .18,  $p$  < .01. It was not correlated with egoistic concern,  $r$  = -.07. In all, DEN showed theoretically informed relationships with the other concepts. These relationships were just weak to moderate, indicating that DEN is distinct from them.

**Table 1**  
The DENS and its factor loadings, internal consistency, and descriptive statistics.

|                         | Items                                                                                                                               | Study 1 | Study 2 | Study 3 (time 1) | Study 3 (time 2) | Study 4 | Study 5 |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------|---------|---------|------------------|------------------|---------|---------|
| Factor loadings         | 1. I imagine how I would feel if I were the suffering animals and plants. <sup>pt</sup>                                             | .77     | .81     | .84              | .83              | .79     | .83     |
|                         | 2. I get involved with the feelings of the suffering animals and plants. <sup>ec</sup>                                              | .81     | .85     | .78              | .84              | .83     | .77     |
|                         | 3. I feel as though I were one of the suffering animals and plants. <sup>ec</sup>                                                   | .79     | .80     | .78              | .86              | .78     | .69     |
|                         | 4. I can very easily put myself in the place of the suffering animals and plants. <sup>pt</sup>                                     | .78     | .87     | .87              | .88              | .86     | .69     |
|                         | 5. I try to understand how the suffering animals and plants feel by imagining how things look from their perspective. <sup>pt</sup> | .74     | .82     | .80              | .83              | .80     | .69     |
|                         | 6. I visualize in my mind clearly and vividly how the suffering animals and plants feel in their situation. <sup>pt</sup>           | .67     | .80     | .83              | .88              | .72     | .71     |
|                         | 7. I have tender, concerned feelings for the suffering animals and plants. <sup>ec</sup>                                            | .50     | .72     | .72              | .67              | .78     | .64     |
|                         | 8. I feel what the suffering animals and plants are feeling. <sup>ec</sup>                                                          | .83     | .82     | .85              | .82              | .83     | .73     |
|                         | 9. I feel the pain the suffering animals and plants are experiencing. <sup>ec</sup>                                                 | .78     | .83     | .81              | .87              | .77     | .61     |
|                         | 10. I feel sympathetic toward the suffering animals and plants. <sup>ec</sup>                                                       | .51     | .66     | .74              | .67              | .54     | .54     |
| Eigenvalue              |                                                                                                                                     | 6.11    | 6.74    | 6.80             | 6.99             | 6.38    | 5.28    |
| % of variance explained |                                                                                                                                     | 50.90%  | 67.35%  | 68.01%           | 69.88%           | 63.81%  | 52.78%  |
| $\alpha$                |                                                                                                                                     | .92     | .95     | .95              | .95              | .94     | .90     |
| Mean                    |                                                                                                                                     | 4.31    | 4.06    | 4.54             | 4.48             | 4.35    | 4.27    |
| SD                      |                                                                                                                                     | 1.05    | 1.36    | 1.20             | 1.23             | 1.06    | 1.06    |

Notes. The instruction of the DENS reads: “Nowadays, we often hear news reporting how nature is being destroyed by humans. For instance, rivers are being polluted by chemicals or toxic waste from factories, oceans being polluted by deep-water oil spill, forests being cleared and degraded into wasteland. Many animals and plants living in nature are suffering. We want to know how you think and feel when you hear this type of news. According to this scale (1 = strongly disagree; 2 = disagree; 3 = mildly disagree; 4 = neither disagree or agree; 5 = mildly agree; 6 = agree; 7 = strongly agree), please write a number before each item to indicate your agreement or disagreement with it”.  
<sup>pt</sup>Items reflecting to perspective taking; <sup>ec</sup>items reflecting empathic concern.

Dispositional empathy with nature predicted conservation behavior: It was correlated with environmental movement support,  $r = .36, p < .001$ , and green behavior frequency,  $r = .26, p < .001$ . A hierarchical regression analysis was then performed. In Model 1, conservation behavior was regressed on traits, values, emotional involvement with nature, and environmental concern. In Model 2, DEN was added. Model 1 explained a significant proportion of variance of environmental movement support,  $R^2 = .37, p < .001$ . Adding DEN in Model 2 significantly improved the prediction,  $R^2 \text{ change} = .02, \beta = .14, p < .05$ . Similarly, Model 1 explained a significant proportion of variance of green behavior frequency,  $R^2 = .13, p < .01$ . Adding DEN significantly improved the prediction,  $R^2 \text{ change} = .02, \beta = .14, p < .05$ . These findings support Proposition 1, and demonstrate the incremental validity of DEN.

Female participants had stronger DEN than did male participants ( $M = 4.43$  vs.  $4.21$ ), and this difference was marginally significant,  $t(284) = 1.82, p = .07$ . Also, compared to males, females reported more environmental movement support ( $M = 4.82$  vs.  $4.47$ ),  $t(283) = 3.29, p < .001$ , but not green behavior frequency ( $M = 2.70$  vs.  $2.66$ ). Mediation analyses were then performed to test if DEN mediated this gender difference. The approach recommended by Baron and Kenny (1986) was followed. As shown in Table 2, paths a–c, and c' were all significant. According to a Sobel test, there was a marginally significant drop from path c to path c'. To further the confidence in this finding, another analytic strategy, bootstrapping, was used. It is a resampling procedure which has been advocated by many for testing mediation (e.g., MacKinnon, Lockwood, & Williams, 2004). Bootstrapping with 5000 resamples was used, and bias-corrected 95% confidence interval (BC 95% CI) of the indirect effect of DEN was examined. As Table 2 shows, the hypothesized indirect effect was significant (i.e., the BC 95% C.I. not including 0). These findings support Proposition 2, and show that DEN partially mediates the gender difference in conservation behavior.

## 5. Study 2

To cross-validate the key findings, Study 2 used a sample of diverse background from a non-Chinese society. Propositions 1 and 2 were tested again.

### 5.1. Distinctiveness of DEN

Past studies have shown that empathy with humans also predict concern for nature (e.g., Schultz, 2001). One may question if DEN is distinct from dispositional empathy with humans. There are three reasons to expect so. First, empathy with humans does not always

predict concern about nature. For instance, Berenguer (2010) found that induced empathy with another person activated anthropocentric, but not ecological, concern. Second, empathy is target-specific: Empathy with humans does not even necessarily entail empathy toward a specific subset of humans. For instance, Hojat et al. (2001) found that medical professionals' empathy toward patients was just moderately correlated with their general empathy with humans. Third, it is more difficult for people to empathize with nonhumans than humans (Batson, 1991). As noted, empathy is usually limited to close others, and people do not always consider natural entities and the abstract notion of nature to be as close as other humans (Gutsell & Inzlicht, in press). Also, not everyone would recognize the natural world or certain natural elements to be as sentient as humans (Waytz et al., 2010). Taken together, a person who empathizes with other human beings does not necessarily empathize with nature to an equal extent. It is thus expected that there is certain overlap between DEN and dispositional empathy with humans (perspective taking and empathic concern, but not fantasy and personal distress, in the IRI), but such overlap should be far from perfect.

Batson (2011) argued that existing measures of dispositional empathy with humans are potentially confounded by social desirability. These doubts can be addressed by the fact that scores on these measures can predict actual prosocial behavior (e.g., Konrath et al., 2011) and even physiological processes related to empathy (Singer et al., 2004). It is thus expected that DEN is related, just weakly, to social desirability bias.

### 5.2. Method

One hundred and seventy-two individuals (65 males and 107 females;  $M_{\text{age}} = 32.77$  and  $SD_{\text{age}} = 13.90$  years) who had been residing in the U.S. for at least 10 years participated. Each participant was compensated USD0.30. Most participants were Caucasian (78.49%). The remaining were of various ethnicities (5.81% African Americans, 5.23% Hispanics, 5.23% mixed ethnicity, 4.65% Asian Americans, and the remaining unreported). They were recruited through Amazon's Mechanical Turk (<http://www.mturk.com>), a website that contains a large register of workers. Workers can browse available tasks and choose to work on a particular task and get paid upon successful completion. This platform allows researchers to recruit participants and collect data from them all through the internet. Buhrmester, Kwang, and Gosling (2011) showed that data collected via this method are at least as reliable as those collected using traditional methods. Participants were told that the study explored their attitudes toward some environmental issues. Apart from the DEN and the two conservation behavior

**Table 2**  
Mediation analyses with gender as the predictor.

| Outcome variables              | Unstandardized regression coefficients |        |        |                  | Sobel test Z statistics | Bootstrapping BC 95% CI |
|--------------------------------|----------------------------------------|--------|--------|------------------|-------------------------|-------------------------|
|                                | Path a                                 | Path b | Path c | Path c'          |                         |                         |
| <i>Study 1</i>                 |                                        |        |        |                  |                         |                         |
| Environmental movement support | .23*                                   | .30*** | .36**  | .28**            | 1.80 <sup>+</sup>       | .00, .16                |
| <i>Study 2</i>                 |                                        |        |        |                  |                         |                         |
| Environmental movement support | .58**                                  | .45*** | .45*   | .18              | 2.56*                   | .08, .48                |
| <i>Study 3</i>                 |                                        |        |        |                  |                         |                         |
| Environmental movement support | .62*                                   | .30*** | .39*   | .20              | 2.26*                   | .04, .44                |
| Green behavior frequency       | .62*                                   | .13**  | .21*   | .13              | 1.94*                   | .02, .21                |
| <i>Study 4</i>                 |                                        |        |        |                  |                         |                         |
| Environmental movement support | .44***                                 | .47*** | .32**  | .12              | 3.15**                  | .10, .35                |
| <i>Study 5</i>                 |                                        |        |        |                  |                         |                         |
| Environmental movement support | .48 <sup>+</sup>                       | .39*** | .59*   | .40 <sup>+</sup> | 1.69 <sup>+</sup>       | .02, .50                |

Notes. \*\*\* $p < .001$ . \*\* $p < .01$ . \* $p < .05$ . <sup>+</sup> $p < .10$ . Path a refers to the path from gender to DEN. Path b refers to the path from DEN to the outcome variable (when gender was controlled). Path c refers to the path from gender to the outcome variable. Path c' refers to the path from gender to the outcome variable (when DEN was controlled).

measures ( $\alpha$ s = .93 and .87 respectively), they completed the IRI ( $\alpha$ s = .79, .81, .83, and .85 for fantasy, perspective taking, empathic concern, and personal distress, respectively) and the Social Desirability Scale (Crowne & Marlowe, 1960;  $\alpha$  = .81).

### 5.3. Results and discussion

The one-factor structure of the DENS was replicated. As shown in Table 1, both factor loadings and internal reliability were high. As expected, DEN was significantly correlated with perspective taking,  $r = .18$ ,  $p < .05$ , and empathic concern,  $r = .29$ ,  $p < .001$ , but these correlations were just weak. Also, DEN was neither correlated with fantasy,  $r = .12$ , nor personal distress,  $r = .02$ . Dispositional empathy with nature was just weakly correlated with social desirability bias,  $r = .18$ ,  $p < .05$ . In sum, the distinctiveness of DEN was found.

Supporting Proposition 1, DEN was significantly correlated with environmental movement support,  $r = .48$ ,  $p < .001$ , and green behavior frequency,  $r = .46$ ,  $p < .001$ . A hierarchical regression analysis revealed that DEN continued to predict conservation behavior even when dispositional empathy with humans and social desirability bias were controlled, demonstrating the incremental validity of DEN. When predicting environmental movement support, DEN led to a significant improvement in prediction (Model 1  $R^2 = .15$ ,  $p < .001$ ; Model 2  $R^2$  change = .16,  $\beta = .42$ ,  $p < .001$ ). The same was true for green behavior frequency (Model 1  $R^2 = .12$ ,  $p < .05$ ; Model 2  $R^2$  change = .17,  $\beta = .43$ ,  $p < .001$ ).

Supporting Proposition 2, female participants had significantly stronger DEN than did male participants ( $M = 4.27$  vs. 3.70),  $t(170) = 2.75$ ,  $p < .01$ . Also, compared to males, females reported more environmental movement support ( $M = 4.51$  vs. 4.06),  $t(170) = 2.21$ ,  $p < .05$ , but not green behavior frequency ( $M = 2.87$  vs. 2.75). Replicating Study 1, mediational analyses revealed a significant, complete mediation by DEN (see Table 2).

## 6. Study 3

DEN is assumed to be a stable trait. If the DENS truly measures DEN, then its scores should be temporally consistent (DeVellis, 2003). Study 3 thus assessed the test–retest reliability of the DENS. Propositions 1 and 2 were tested again. To continue to cross-validate the key findings, a sample of working adults was used.

### 6.1. Method

One hundred and four ethnic Chinese employees (35 males and 69 females;  $M_{\text{age}} = 31.83$  and  $SD_{\text{age}} = 9.36$  years) from a university in Hong Kong participated. Each participant was compensated HKD70 (approximately USD9). Participants understood English (English is the official language in universities in Hong Kong). This study was thus administered in English. Participants completed the DENS and the two measures for conservation behavior ( $\alpha$ s = .84 and .84 respectively). One month later, these participants were invited to complete the DENS again. Ninety-two participants (32 males and 60 females) took part in this second phase.

### 6.2. Results and discussion

The one-factor structure of the DENS was replicated. As shown in Table 1, both factor loadings and internal reliability were high. Participants' DEN scores were very strongly inter-correlated between Time 1 and Time 2,  $r = .81$ ,  $p < .001$ , indicating test–retest reliability.

Supporting Proposition 1, DEN was significantly correlated with environmental movement support,  $r = .45$ ,  $p < .001$ , and green behavior frequency,  $r = .31$ ,  $p < .001$ .

Supporting Proposition 2, female participants had stronger DEN than did male participants ( $M = 4.75$  vs. 4.13),  $t(101) = 2.57$ ,  $p < .05$ . Also, compared to males, females reported more environmental movement support ( $M = 4.87$  vs. 4.48),  $t(101) = 2.23$ ,  $p < .05$ , and green behavior frequency ( $M = 3.02$  vs. 2.80),  $t(101) = 1.92$ ,  $p = .05$ . Replicating Studies 1 and 2, mediational analyses revealed a significant, complete mediation by DEN in these gender differences (see Table 2).

## 7. Study 4

The objective of Study 4 was to test Proposition 3. Propositions 1 and 2 were also tested.

### 7.1. Method

One hundred and seventy-five ethnic Chinese undergraduates (92 males and 83 females;  $M_{\text{age}} = 20.93$  and  $SD_{\text{age}} = 1.30$  years) in Hong Kong participated for partial course fulfillment. They had not participated in Study 1. All materials were in English. Apart from the DENS and the two conservation behavior measures ( $\alpha$ s = .80 and .87, respectively; a 7-point scale was also used for green behavior frequency), the participants completed two measures for connection to nature. The Connectedness to Nature Scale (Mayer & Frantz, 2004) measures the affective aspect of connection to nature. It has been widely accepted as reliable and valid (e.g., Gosling & Williams, 2010; Mayer & Frantz, 2004). Sample items include “I often feel a sense of oneness with the natural world around me” and “I often feel disconnected from nature”. The second measure, the Inclusion of Nature in Self Scale (Schultz, 2001), assesses the cognitive aspect of connection to nature. This scale contains one item: Participants were shown seven pairs of circles (one labeled “self” and the other labeled “nature”) with varying degrees of overlap and asked to select the pair that best described their relationship with nature. These two measures are strongly inter-correlated, and correlated with other measures of connection to nature (Davis, Le, & Coy, 2011; Perkins, 2010).

### 7.2. Results and discussion

The one-factor structure of the DENS was replicated. As shown in Table 1, both factor loadings and internal reliability were high.

Supporting Proposition 1, DEN was significantly correlated with both environmental movement support,  $r = .51$ ,  $p < .001$ , and green behavior frequency,  $r = .39$ ,  $p < .001$ .

Supporting Proposition 2, female participants had stronger DEN than did male participants ( $M = 5.11$  vs. 4.67),  $t(173) = 3.47$ ,  $p < .001$ . Also, females reported more environmental movement support than did males ( $M = 4.81$  vs. 4.49),  $t(173) = 2.66$ ,  $p < .01$ , but not green behavior frequency ( $M = 4.30$  vs. 4.18). Replicating Studies 1–3, mediational analyses revealed a significant, complete mediation by DEN (see Table 2).

Supporting Proposition 3, DEN was significantly correlated with both connectedness to nature,  $r = .59$ ,  $p < .001$ , and inclusion of nature in self,  $r = .27$ ,  $p < .001$ . Replicating past studies (e.g., Mayer & Frantz, 2004), connection to nature predicted conservation behavior. Connectedness to nature was correlated with both environmental movement support,  $r = .52$ ,  $p < .001$ , and green behavior frequency,  $r = .41$ ,  $p < .001$ . The same was true for inclusion of nature in self ( $r = .35$ ,  $p < .001$ , and  $r = .30$ ,  $p < .001$ , respectively). The two mediational analytic approaches were used to test if DEN mediated the effect of connection to nature on conservation behavior (see Table 3). Regardless of which predictor and which outcome were considered, paths a–c, and c' were all significant, and there was a significant drop from path c to path c', indicating a

**Table 3**  
Mediational analyses with connection to nature or anthropomorphism as the predictor and DEN as the mediator (Studies 4 and 5).

| Outcome variables              | Unstandardized regression coefficients         |        |        |                  | Sobel test Z statistics | Bootstrapping BC 95% CI |
|--------------------------------|------------------------------------------------|--------|--------|------------------|-------------------------|-------------------------|
|                                | Path a                                         | Path b | Path c | Path c'          |                         |                         |
| <i>Study 4</i>                 |                                                |        |        |                  |                         |                         |
|                                | Connectedness to nature                        |        |        |                  |                         |                         |
| Environmental movement support | .77***                                         | .30*** | .64*** | .41***           | 3.84***                 | .12, .35                |
| Green behavior frequency       | .77***                                         | .21**  | .50*** | .33**            | 2.58**                  | .02, .30                |
|                                | Inclusion of nature in self                    |        |        |                  |                         |                         |
| Environmental movement support | .15***                                         | .43*** | .18*** | .11***           | 3.19**                  | .03, .12                |
| Green behavior frequency       | .15***                                         | .31*** | .16*** | .11**            | 2.83**                  | .01, .09                |
| <i>Study 5</i>                 |                                                |        |        |                  |                         |                         |
|                                | Anthropomorphism of nonhuman animals           |        |        |                  |                         |                         |
| Environmental movement support | .23*                                           | .37*** | .30**  | .21*             | 1.94*                   | .01, .22                |
| Green behavior frequency       | .23*                                           | .27**  | .27**  | .20**            | 1.86 <sup>+</sup>       | .01, .17                |
|                                | Anthropomorphism of nonanimal natural entities |        |        |                  |                         |                         |
| Environmental movement support | .19*                                           | .40*** | .15*   | .08              | 2.07*                   | .02, .19                |
| Green behavior frequency       | .19*                                           | .29**  | .15*   | .09              | 1.99*                   | .01, .13                |
|                                | Anthropomorphism of nature                     |        |        |                  |                         |                         |
| Environmental movement support | .23**                                          | .39*** | .18*   | .09              | 2.31*                   | .02, .22                |
| Green behavior frequency       | .23**                                          | .28**  | .18**  | .11 <sup>+</sup> | 2.17*                   | .02, .16                |

Notes. \*\*\* $p < .001$ . \*\* $p < .01$ . \* $p < .05$ . <sup>+</sup> $p < .10$ . Path a refers to the path from the predictor to DEN. Path b refers to the path from DEN to the outcome variable (when the predictor was controlled). Path c refers to the path from the predictor to the outcome variable. Path c' refers to the path from the predictor to the outcome variable (when DEN was controlled).

partial mediation by DEN. This indirect effect was also significant (i.e., the BC 95% C.I. not including 0) when the bootstrapping analysis was used.

It is noteworthy that a set of exploratory analyses revealed that the reverse direction of the path tested earlier could be true (see Table 4). When DEN was used as the predictor and connection to nature as the mediator instead, paths a–c, and c' were all significant, and there was a drop from path c to path c'. Sobel tests and bootstrapping analyses similarly revealed significant indirect effects by connection to nature. The implication of this reverse path (connection to nature as the mediator) will be discussed in General Discussion.

## 8. Study 5

The objective of Study 5 was to test Proposition 4. Propositions 1 and 2 were also tested.

### 8.1. Method

Seventy-eight ethnic Chinese undergraduates (54 males and 24 females;  $M_{\text{age}} = 20.55$  and  $SD_{\text{age}} = 1.51$  years) in Hong Kong participated for partial course fulfillment. These participants had not participated in Studies 1 and 4. All materials were in English. Apart from the DENS and the two conservation behavior measures ( $\alpha_s = .88$ , and  $.86$ , respectively; a 7-point scale was used for green behavior frequency), participants completed the 15-item Individual Differences in Anthropomorphism Questionnaire (Waytz et al., 2010). For each item, participants indicated to what extent a

nonhuman entity has a human characteristic (e.g., a mind of its own, emotional experience). Five entities pertained to technological devices (e.g., TV set, robot), five to nonhuman animals (e.g., fish, cow), and five to nonanimal natural entities (e.g., tree, wind). A factor analysis revealed a neat 3-factor structure; an average score was therefore computed for each factor. Also, to examine participants' tendency to anthropomorphize the general notion of nature, participants answered another set of five items regarding nature ("To what extent does nature have a mind of its own/intentions/free will/consciousness/emotional experience?"). In a separate series of studies, these items were found to be valid and predictive of conservation behavior (Tam, 2013; Tam, in press). These various scales of anthropomorphism were reliable ( $\alpha_s = .79$ ,  $.80$ ,  $.91$ , and  $.90$ , respectively).

### 8.2. Results and discussion

The one-factor structure of the DENS was replicated. As shown in Table 1, both factor loadings and internal reliability were high.

Supporting Proposition 1, DEN was significantly correlated with both environmental movement support,  $r = .44$ ,  $p < .01$ , and green behavior frequency,  $r = .41$ ,  $p < .01$ .

Supporting Proposition 2, female participants had stronger DEN than did male participants ( $M = 4.60$  vs.  $4.12$ ), and this difference was marginally significant,  $t(76) = 1.87$ ,  $p = .06$ . Also, compared to males, females reported more environmental movement support ( $M = 4.86$  vs.  $4.27$ ),  $t(76) = 2.40$ ,  $p < .05$ , but not green behavior frequency ( $M = 4.40$  vs.  $4.06$ ). Replicating Studies 1–4, mediational

**Table 4**  
Mediational analyses with DEN as the predictor and connection to nature as the mediator (Study 4).

| Outcome variables              | Unstandardized regression coefficients |        |        |         | Sobel test Z statistics | Bootstrapping BC 95% CI |
|--------------------------------|----------------------------------------|--------|--------|---------|-------------------------|-------------------------|
|                                | Path a                                 | Path b | Path c | Path c' |                         |                         |
|                                | Connectedness to nature                |        |        |         |                         |                         |
| Environmental movement support | .45***                                 | .41*** | .49*** | .30***  | 3.91***                 | .09, .30                |
| Green behavior frequency       | .45***                                 | .33**  | .36*** | .21**   | 3.11**                  | .06, .25                |
|                                | Inclusion of nature in self            |        |        |         |                         |                         |
| Environmental movement support | .47***                                 | .12*** | .49*** | .43***  | 2.48*                   | .02, .12                |
| Green behavior frequency       | .47***                                 | .11**  | .36*** | .31**   | 2.29*                   | .01, .11                |

Notes. \*\*\* $p < .001$ . \*\* $p < .01$ . \* $p < .05$ . Path a refers to the path from DEN to the mediator. Path b refers to the path from the mediator to the outcome variable (when DEN was controlled). Path c refers to the path from DEN to the outcome variable. Path c' refers to the path from DEN to the outcome variable (when the mediator was controlled).

analyses revealed a significant, partial mediation by DEN in this gender difference (see Table 2).

Supporting Proposition 4, DEN was significantly correlated with nature-related anthropomorphism: It was correlated with anthropomorphism of nonhuman animals,  $r = .25$ ,  $p < .05$ , that of nonanimal natural entities,  $r = .27$ ,  $p < .05$ , and that of nature,  $r = .32$ ,  $p < .01$ . Expectedly, DEN was not correlated with anthropomorphism of technological devices,  $r = .10$ . Anthropomorphism of nature predicted conservation behavior. Anthropomorphism of nonhuman animals was correlated with environmental movement support,  $r = .33$ ,  $p < .01$ , and green behavior frequency,  $r = .36$ ,  $p < .01$ . The same was found for anthropomorphism of nonanimal natural entities ( $r = .23$ ,  $p < .05$ , and  $r = .27$ ,  $p < .05$ , respectively), and that of nature ( $r = .25$ ,  $p < .05$ , and  $r = .30$ ,  $p < .01$ , respectively). Anthropomorphism of technological devices was not correlated with conservation behavior ( $r = .12$ , and  $r = .17$ , respectively). The two mediational analytic approaches were used to test if DEN mediated the effect of anthropomorphism on conservation behavior (see Table 3). Regardless of which form of anthropomorphism and conservation behavior were considered, paths a–c were all significant, and path c' was significant some of the time. There was a significant drop from path c to path c', indicating a mediation by DEN (partial for anthropomorphism of nonhuman animals, and complete for anthropomorphism of natural entities and nature). This indirect effect was also significant (i.e., the BC 95% C.I. not including 0) when the bootstrapping analysis was considered.

## 9. Meta-analyses

The multiple-sample design of the present research renders a meta-analysis to combine the findings across studies possible. This analysis can estimate the overall size of the effect in the population, and check if this effect varies across the diverse samples used (Hedges & Olkin, 1985). Regarding Proposition 1, as for environmental movement support, the weighted mean correlation was .44. A fixed-effects meta-analysis with Fisher  $z$  as the effect size statistic revealed a weighted mean  $z$  of .47, 95% CI [.40, .54],  $Z = 13.31$ ,  $p < .001$ ; this effect was not heterogeneous across samples,  $Q_w(4) = 4.45$ ,  $p = .35$ . A similar finding was obtained for green behavior frequency (weighted mean correlation = .35; weighted mean  $z = .37$ , 95% CI [.30, .44],  $Z = 10.44$ ,  $p < .001$ ;  $Q_w(4) = 6.69$ ,  $p = .15$ ). Regarding Proposition 2, the weighted mean gender difference was .40. A fixed-effects meta-analysis with Hedge's  $g$  as the effect size statistic revealed a weighted mean  $g$  of .39, 95% CI [.25, .53],  $Z = 5.37$ ,  $p < .001$ ; this effect was not heterogeneous across samples,  $Q_w(4) = 3.58$ ,  $p = .47$ . Using random-effects analyses or other effect size indicators generated similar results. Based on these findings, it can be concluded that there is a moderate to strong association between DEN and conservation behavior in the population, and a significant gender difference of DEN in the population. These effects manifested homogeneously in the diverse samples used.

## 10. General discussion

Although the primacy of empathy with nature in conservation efforts has been suggested (e.g., Guergachi et al., 2010; Sobel, 1996), an elaborate understanding of it, particularly from the personality perspective, has been lacking. The present research fills this void.

### 10.1. Theory of empathy with nature

Several tenets formulate what is known thus far about empathy with nature. First, empathy with nature is a distinct construct; it is not reducible to empathy with humans, general dispositions (e.g.,

traits, values), and other environmental concepts (e.g., emotional involvement with nature, connection to nature). Second, empathy with nature, either dispositional or induced, motivates efforts to protect nature. Third, some dispositional factors (e.g., gender, connection to nature, anthropomorphism of nature) account for individual differences in the dispositional tendency to engage in empathy with nature. Fourth, stronger empathy with nature appears to be a reason why females, individuals who feel connected to nature, and people who consider nature to be sentient are more proenvironmental.

The theory of empathy with nature is still in its infant stage. To further develop this theory, three directions for future studies are thus discussed next.

#### 10.1.1. Deriving new propositions

The present investigation was set up with close reference to extant understanding about empathy with humans. The two forms of empathy, though distinct, appear to have some similarities. Both motivate protective behavior, and both are stronger among individuals who have a more expanded self. Also, connectedness to other beings and recognition of their sentience antecede both forms of empathy. It appears that the psychological processes known to be associated with empathy with humans apply to empathy with nature too, though the exact parameters in these processes are target-specific. For instance, given that connectedness (e.g., interpersonal closeness) enhances empathy toward other people (e.g., Gutsell & Inzlicht, *in press*), connectedness to the natural world should promote empathy with nature, as demonstrated. Apparently, one can further develop the theory of empathy with nature by deriving other propositions from existing, more established knowledge about empathy with humans. An illustration is provided here.

Empathy is separable from personal distress. Nevertheless, it is possible that under some circumstances empathy could lead to personal distress. When an individual empathizes with a suffering victim, he or she experiences the victim's distress as if it was his or her own. However, when the victim's distress becomes too intense and unbearable, the empathizing individual may turn away from the victim's perspective, and shift to his or her own anxiety, discomfort, and welfare. This phenomenon is referred to as empathic overarousal (Hoffman, 2008). One possible consequence of empathic overarousal is that the empathizing individual stops empathizing and offering help. Hoffman (2008) pointed out that people are particularly vulnerable to empathic overarousal when they feel unable to help the victim (see also Belman & Flanagan, 2010; Myers et al., 2009). One may derive a new proposition regarding empathy with nature accordingly. Although generally empathizing with nature can motivate conservation behavior, a belief in the effectiveness of one's actions in helping the natural environment is imperative too. This belief has been referred to as perceived consumer effectiveness (e.g., Ellen, Wiener, & Cobb-Walgreen, 1991) or environmental self-efficacy (e.g., Homburg & Stolberg, 2006). Future survey studies may test if DEN predicts conservation behavior only among individuals who possess a strong sense of efficacy. Experiments may test if intention to perform conservation behavior is strongest among participants who take the perspective of nature and at the same time believe that their actions make a difference. Studies like these certainly enable more intricate theoretical understanding of empathy with nature.

#### 10.1.2. Comparing empathy with humans and empathy with nature

Some studies showed that dispositional empathy with humans (measured by the IRI) predict environmental attitude and behavior. For instance, Schultz (2001) showed that both perspective taking

and empathic concern predicted biospheric concern. Study 3 in the present research also revealed that perspective taking and empathic concern were positively correlated with environmental movement support ( $r = .26, p < .01$ , and  $r = .37, p < .001$ , respectively), and green behavior frequency ( $r = .26, p < .01$ , and  $r = .24, p < .01$ , respectively); these relationships were still significant, though weakened, when DEN was controlled for. However, it is noteworthy that some studies did not find this pattern. For instance, *Sevillano et al. (2007)* showed that perspective taking did not predict environmental concern, while empathic concern even negatively predicted biospheric concern. How can this inconsistency be reconciled?

A speculative account is proposed here: For some individuals, the boundary between humans and nature is blurred, and therefore the distinction between dispositional empathy with humans and DEN is less clear-cut. Some individuals consider themselves to be part of nature (e.g., individuals who feel connected to nature; *Mayer & Frantz, 2004; Schultz, 2000*), while some consider humans to be separate, or even above, nature (e.g., individuals who reject new ecological paradigm; *Stern, Dietz, & Guagnano, 1995*). Also, some individuals consider nature to be humanlike (e.g., anthropomorphism; *Tam, 2013; Tam, in press; Tam, Lee, & Chao, 2013*), while some do not. It is conceivable to expect that among those individuals to whom the boundary between humans and nature is blurred, empathy with humans actually entails empathy with nature, and the vice versa, while among other individuals, this is not the case. Thus, it is expected that for the former group of individuals, dispositional empathy with humans and DEN are more inter-related, and both predict conservation behavior, while for the latter group, the two forms of empathy are less inter-related, and only DEN predict conservation behavior. This account, though speculative, is potentially useful in further delineating the relationship between the two forms of empathy. Future studies to verify this account are needed.

#### 10.1.3. Understanding empathic joy

As noted, the present research centers on the distress of the natural world for three pragmatic reasons: This focus renders close reference to existing understanding of empathy of humans possible; this focus connects the present research to previous works on IEN; and the notion of empathy with nature has usually been discussed in the context of environmental degradation. This focus on distress is also justified on a theoretical reason: People's empathic reactions appear to be more readily aroused by the distress in others than its positive counterpart, and this asymmetry seems to be biologically based (see *Royzman & Kumar, 2001*). Nevertheless, these reasons do not completely rule out the possibility that people empathize with nature when events beneficial to the natural world happen. Future studies may therefore study empathy with nature in a positive context instead. One may add items to the DENS that capture respondents' tendency to take the perspective of certain natural entities facing positive events and to share their emotions. It will be important to explore whether responses to the negative and positive items fall into one factor or two factors. If two factors emerge, then there is a need to examine whether positive empathy also predicts conservation behavior as well as the current formulation of DEN does.

#### 10.2. Contributions to understanding conservation behavior

The construct of DEN contributes to the understanding of conservation behavior by shedding new light on three under-explored theoretical issues. First, although the robust gender gap in environmentalism has been attributed to the gender difference in socialization (e.g., *McCright, 2010*), the more proximal mediating

mechanism underlying this gap is not yet well understood (see *Zelezny et al. 2000*). The present studies identify empathy as a possible mechanism. It appears that females, who are more socialized to value other beings' needs than are males, empathize with the natural world to a larger extent, and in turn exhibit more nature-protecting behavior. Second, although connection to nature is known to be a robust determinant of proenvironmental behavior (e.g., *Mayer & Frantz, 2004*), its mediating mechanism has rarely been studied (see *Gosling & Williams, 2010*). The present research shows that one mechanism may reside in DEN. It seems that individuals who feel connected to nature empathize with nature to a larger extent, and in turn show more conservation behavior. The exploratory findings from Study 4 suggest that empathy with nature could also enhance connection to nature. This implies the possibility that DEN and connection to nature mutually influence each other. Because of its non-experimental design, the present research falls short in testing this bidirectionality. Longitudinal or experimental designs could be useful in future testing of this bidirectional model (see *Frazier, Tix, & Barron, 2004*). Third, although anthropomorphism of nature is prevalent across cultures (e.g., *Epley et al., 2007; Guthrie, 1993*), there has been little evidence about its effect on conservation behavior. Joining the rare past studies (*Atran et al., 2002; Gebhard et al., 2003; Waytz et al., 2010*), the present research provides this evidence, and identifies DEN as the mediating mechanism.

#### 10.3. Implications for environmental promotion

Some have identified the role of emotions in environmental promotion (*Kals et al., 1999; McKnight, 2010; Sobel, 1996*). To this end, empathy training, particularly during childhood, can be effective (*Chawla, 2009; Hoffman, 2000*). DEN can be instilled into children through educational programs. One thing educators can do is to couple contact with nature with perspective taking exercises. *Sobel (1996)* showed that through exploring in the natural environment in a camp and exchanging perspectives with animals, children developed more empathy toward nature. There are other innovative methods for perspective taking exercises to take place when the natural environment is not accessible. For instance, *McKnight (2010)* proposed that story-like narratives which connect children to an animal can provide a simulated encounter with animals. Also, *Belman and Flanagan (2010)* discussed the use of computer games that allow players to inhabit the roles of other members in the natural world in an immersive manner. It is noteworthy that on top of cultivating empathy, it is also crucial to build up a sense of efficacy because, as discussed, empathy may lead to overarousal when an individual feels unable to help change the victim's situation (*Hoffman, 2008*). Efficacy enhancement, or empowerment, can be achieved through experience-based education. For instance, *Monroe (2003)* suggested that students, teachers, and other parties at stake can work together to identify, plan, and solve a local environmental problem; through this experience the various parties can learn firsthand how their actions make a difference. *Monroe (2003)* further suggested this actual experience can be supplemented by stories or examples of other people's successful experience.

It should be noted that the effectiveness of the aforementioned programs (e.g., *McKnight, 2010; Sobel, 1996*) was not assessed with a standard validated measure. It is thus impossible to compare their efficacy. The DENS, which proves to be reliable and valid, may be useful in this regard. However, to what extent the DENS is useful for children or other populations not covered in the present research is unknown. Future works may focus on validating the DENS in these populations. When needed, adaptation or revision could be performed.

Study 5 in the present research implies that anthropomorphizing nature could be an efficacious strategy in environmental promotion. Nevertheless, there has been a debate among scientists about the merits or drawbacks of promoting anthropomorphism (see Mitchell, Thompson, & Miles, 1997). On the one hand, some consider anthropomorphism to be invalid, and thus fear that it may hinder people from acquiring objective, scientific knowledge about nature. On the other hand, some suggest that anthropomorphism has heuristic value, as it helps people understand and predict nonhumans' behavior. Should anthropomorphism be promoted or dismissed? As Gebhard et al. (2003) noted, if anthropomorphism really permits nature to be moralized, then it might be something to be nurtured rather than eliminated. Rather than completely dismissing or unquestioningly embracing anthropomorphism, perhaps educators need to consider how to flexibly use scientific and anthropomorphic representations in different contexts, for different purposes, and for different audiences.

#### 10.4. Other considerations

The DENS orients respondents to the suffering experienced by animals and plants but not other entities. This design is justifiable because animals and plants are representative of people's mental images on the natural world (e.g., van den Born et al., 2001), and reactions toward animate entities are generalizable to nature as a whole (e.g., Myers et al., 2004). The present research also shows that the DENS are correlated with other concepts regarding nature as a whole. Still, it is worthwhile for future studies to extend the DENS to inanimate entities, and check if one overall factor, or two factors (i.e., animate and inanimate entities), shows up.

Because the present research centers on the distress of nature, one may question whether the DENS merely assesses compassion. Compassion is typically measured by such adjectives as sympathetic, warm, compassionate, and tender (e.g., Batson et al., 1997). Indeed, two of the six items related to empathic concern in the DENS refer to these adjectives. Because empathy with another being in distress often leads to compassion toward that being (Batson, 1991), it is conceivable to include items that measure compassion. However, empathy does not equal compassion, and compassion could originate from other sources too. For example, compassion could result from religious duties, innate impulses, or even self-interest (see Wuthnow, 1991). Thus, the other items in the DENS do not refer to compassion. Rather, they focus on whether the respondent shares the pain of the animals and plants; this emotional sharing is the key in defining the affective component of empathy. One may also wonder if the negative focus in the DENS artificially primed respondents to be more proenvironmental. Although this effect is plausible, it does not compromise the validity of the findings in the present research, as it would have acted against, not favored, the hypotheses. If the DENS primed environmental concern, then the natural variation in conservation behavior among participants would have been masked; this would have weakened the correlation between DEN and conservation behavior. The fact that this correlation was still robust across the five studies implies that the priming effect of the DENS, even if present, was not consequential. That said, introducing positive items into the DENS in future may help alleviate this concern.

A merit of the present research is the use of multiple samples. The relationships between DEN and other variables are highly stable across these samples. However, one may feel interested in knowing whether the absolute level of DEN varies across cultures, as it has been argued that empathy is more prevalent in collectivist than individualist cultures (Markus & Kitayama, 1991). Although a stringent test of mean differences is not possible in the present research (as the two cultural samples differed in many respects), a

rough comparison showed that DEN was indeed weaker in the U.S. sample than in the Chinese samples (see Table 1). This finding highlights the need for a more rigorous cross-cultural comparison (e.g., using matched samples from multiple cultures), which could be useful in testing if the cross-cultural variation of DEN explains the known cultural difference in environmentalism (Milfont, 2012).

#### 11. Concluding remarks

While empathy toward humans has been studied for several decades already, research on the notion of empathy toward non-humans—the natural world in particular—is still green. The present research successfully demonstrates that many rich theoretical and practical implications can be drawn from the study of empathy with nature. Researchers interested in how humans relate to nature are recommended to take the construct of empathy seriously.

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#### Appendix

List of items in the measure of green behavior frequency

1. Looking for ways to reuse things
2. Recycling things (e.g., papers, cans or bottles)
3. Encouraging friends or family to recycle
4. Purchasing products in reusable containers
5. Writing a letter to the government to support an environmental issue
6. Volunteering time to help an environmentalist group
7. Buying environmentally friendly products even if they may not work as well as competing products
8. Purchasing something made of recycled materials even though it is more expensive
9. Buying products only from companies that have a strong record of protecting the environment
10. Contacting a government agency to complain about environmental problems
11. Taking a shorter shower to conserve water
12. Using energy-efficient household devices such as light bulbs

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