



Holism and pro-environmental commitment: An examination on the mediating roles of affective and cognitive determinants[☆]



Kenichi Ito^a, Liman Man Wai Li^{b,*}

^a School of Social Sciences, Nanyang Technical University, Singapore

^b Department of Psychology and Centre for Psychosocial Health, the Education University of Hong Kong, Hong Kong Special Administrative Region, China

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ABSTRACT

To advance the understanding of great individual variations in pro-environmental tendencies, the current research examined the role of holistic versus analytic thinking, which is non-specific to environmental issues, and explored the underlying mechanisms via both affective and cognitive determinants, i.e., affective affinity toward nature and awareness of risk to nature, respectively. Study 1 found that stronger holistic (vs. analytic) thinking predicted greater pro-environmental commitment, and this relation was explained by greater affective affinity toward nature and greater awareness of risk to nature. Recruiting a larger community sample with diverse demographic characteristics, Study 2 replicated the patterns of Study 1. Study 3 manipulated thinking style and found some partial evidence for the relationships among the examined variables. This research highlights the importance of domain-general individual characteristics in environmental research.

1. Introduction

Great individual variations in pro-environmental tendencies have been observed (Müller, Kals, & Pansa, 2009). A lot of attempts have been made to better understand these individual variations. Pro-environmental norms, values, beliefs, and attitudes have been found to significantly predict individual difference in pro-environmental behavior (e.g., Dunlap, van Liere, Mertig, & Jones, 2000; Eom, Kim, Sherman, & Ishii, 2016; Fransson & Gärling, 1999; Gosling & Williams, 2010; Schultz, 2001; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007; Schultz, Shriver, Tabanico, & Khazian, 2004; Tam, 2013).

While the influence of psychological factors that are domain-specific to environmental issues continues to receive great attention in environmental research, research interests on the influence of domain-general psychological factors are surging recently. In addition to demographic factors, such as gender, age, and educational experience (for a review, Gifford & Nilsson, 2014), self-construal (Chuang, Xie, & Liu, 2016), dialectical beliefs (Li, Mei, Li, & Lee, 2018), the big five personality traits (Milfont & Sibley, 2012), and cosmopolitan orientation (Leung, Koh, & Tam, 2015) are found to be able to explain individual

difference in pro-environmental tendencies. Importantly, these domain-general psychological factors can bring significant incremental predictive power on pro-environmental behavior while the effect of environmental-specific variables such as pro-environmental worldviews and motivation is considered (Leung et al., 2015). This finding provides empirical support for significant and independent influences of domain-general psychological factors in environmental research.

To extend this new research direction further, the current research examined the influence of holistic versus analytic thinking style, a domain-general psychological factor, on pro-environmental commitment. In addition, to advance the understanding of how domain-general psychological factors affect pro-environmental tendencies, the current research further explored the underlying mechanisms of the influence of holistic versus analytic thinking style. In considering the independence between affective and cognitive processes suggested by previous work (e.g., Loewenstein, Weber, Hsee, & Welch, 2001; Slovic & Peters, 2006), the current research tested two potential mediating paths via affective affinity to nature, an affective determinant, and awareness of risk to nature, a cognitive determinant, simultaneously.

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* Corresponding author at: Department of Psychology and Centre for Psychosocial Health, The Education University of Hong Kong, Tai Po, Hong Kong Special Administrative Region, China.

E-mail address: mwli@eduhk.hk (L.M.W. Li).

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1.1. Holistic versus analytic thinking style and pro-environmental commitment

The construct of holistic versus analytic thinking style was derived from cross-cultural studies. Holistic thinking style refers to the tendency that people perceive different elements to be interconnected and interdependent while analytic thinking style refers to the tendency that people perceive different elements to be independent and separate from each other (Nisbett & Masuda, 2003). This fundamental difference makes people with a holistic thinking style (versus an analytic thinking style) more likely to consider the interconnected relationships between focal objects and contextual information (Masuda & Nisbett, 2001) and more aware of indirect and long-term consequences associated with a target event (Maddux & Yuki, 2006).

Holistic versus analytic thinking style shapes how people think and behave across a variety of domains, including emotional judgment (e.g., Ito, Masuda, & Li, 2013), information processing (e.g., Li, Masuda, & Russell, 2014), decision making (e.g., Li, Masuda, Hamamura, & Ishii, 2018), and artwork production (e.g., Senzaki, Masuda, & Nand, 2014). Previous work demonstrates that holistic versus analytic thinking style is able to explain not only cultural differences between East Asians and Westerners (for a review, see Nisbett, Peng, Choi, & Norenzayan, 2001) but also individual variations (e.g., Choi, Koo, & Choi, 2007; Konrath, Bushman, & Grove, 2009; Monga & John, 2010) across various domains.

As stated previously, compared to people who adopt an analytic thinking style, people who adopt a holistic thinking style are more likely to perceive the interconnected relationships between focal objects and contextual features (Masuda & Nisbett, 2001; Nisbett et al., 2001). Putting it onto the relation between human (i.e., the focal objects) and nature (i.e., the context), holistic people may be more likely to perceive their connection to nature, which is found related to stronger pro-environmental tendencies (Gosling & Williams, 2010; Mayer & Frantz, 2004). Thus a stronger holistic (relative to analytic) thinking style is likely to promote stronger pro-environmental commitment. Although no studies have directly tested this possibility to the best of our knowledge, there is evidence suggesting the importance of perceived connectedness among elements on pro-environmental motivation. Systems thinking, which emphasizes the interrelatedness and interdependence among elements in a given system, such as the relation between human and nature in the ecological system (Gunderson & Holling, 2002; Stave, 2002), was found to be positively correlated with pro-environmental tendencies (Davis & Stroink, 2016).

To advance the understanding of how holistic versus analytic thinking style, which is a domain-general psychological factor, can affect people's pro-environmental commitment, we examined the underlying mechanisms by exploring the potential mediating role of both affective and cognitive determinants. Stronger pro-environmental tendencies are found to be cultivated through changing people's cognitive reasoning to environmental issues or through strengthening people's affective experiences with nature (e.g., Collado, Staats, & Corraliza, 2013; Hinds & Sparks, 2008). Importantly, in line with other research realms (Loewenstein et al., 2001; Slovic & Peters, 2006), it is found that affective and cognitive processes have independent influences on shaping people's pro-environmental tendencies, with some findings showing that affective experiences have a stronger influence (e.g., Collado et al., 2013; Müller et al., 2009). The current research focused on exploring the mediating role of one affective determinant, i.e., affective affinity toward nature, and one cognitive determinant, i.e., awareness of risk to nature. These two factors have been identified to be independent significant determinants of pro-environmental commitment (Müller et al., 2009).

1.1.1. Affective affinity toward nature

There are four important aspects in affective affinity toward nature: love of nature, feeling of freedom in nature, feelings of security in

nature, and feelings of oneness with nature (Kals, Schumacher, & Montada, 1999). Several theorists propose that affective affinity is essential in promoting stronger pro-environmental tendencies (Eagly & Chaiken, 1993), which is supported by empirical evidence (e.g., Mayer & Frantz, 2004). Specifically, Müller et al. (2009) found that stronger affective affinity toward nature predicted stronger pro-environmental commitment. When considering the role of holistic versus analytic thinking style, people with a stronger holistic thinking style, who pay attention to interconnectedness, may perceive a stronger connection between human (the focal objects) and nature (the context), which promotes a sense of oneness with nature, which may, in turn, result in stronger affective affinity toward nature.

1.1.2. Awareness of risk to nature

According to Stern (2000), the awareness of aversive consequences for nature, which is regarded as a valuable object by humans, is likely to cultivate a sense of strong responsibility, which can result in stronger pro-environmental tendencies. Supporting this notion, prior work demonstrated a positive association between awareness of risk to nature and pro-environmental commitment (Müller et al., 2009). When considering the role of holistic versus analytic thinking style, compared to people with a stronger analytic thinking style, people with a stronger holistic thinking style are more likely to generate indirect and long-term consequences associated with an environmental change (Maddux & Yuki, 2006). This finding may suggest that holistic thinkers are more aware of the risk to nature, as they are sensitive to the detrimental long-term and indirect impacts of human activities on the environment.

1.2. Overview of Studies

We expected that a stronger holistic thinking style (relative to analytic thinking style) would be related to stronger pro-environmental commitment, which would be explained by greater affective affinity toward nature and greater awareness of risk to nature. To test the hypotheses, we first asked participants to complete an online survey in Study 1. To provide further evidence, we tested the hypotheses recruiting a large community sample with diverse demographic characteristic in Study 2. Finally, we manipulated holistic and analytic thinking styles in Study 3 to examine the causal relation between holistic versus analytic thinking style and pro-environmental commitment.

2. Study 1

2.1. Method

2.1.1. Participants

We recruited 100 American participants through Amazon Mechanical Turk (MTurk). The sample size was adequate because a priori analysis showed that a correlational analysis with an expected medium effect size ($r = 0.30$) requires 82 participants to obtain 80% power. Participants' age ranged from 21 to 77 years old ($M = 35.29$, $SD = 10.69$), 43% of them were female, and 80% of them had associate's degree or above. All responses were included in the reported analyses. This study was approved by the Institutional Review Board (IRB) at the first author's institution (IRB-2018-10-030).

2.1.2. Scales

Participants responded to online randomly ordered questionnaires that measure their holistic versus analytic thinking style, affective affinity toward nature, awareness of risk to nature, and pro-environmental commitment.

2.1.2.1. Analytic and holistic scale. A validated 24-item questionnaire captures the four core characteristics of thinking style (Choi et al., 2007). Locus of attention refers to one's tendency to allocate attention to a focal object or to a relationship between objects. An example of

items includes, “It is more important to pay attention to the whole context rather than the details.” Causality refers to one’s tendency to explain the causes of behavior based on the actor’s dispositions or interaction between an actor and her surrounding circumstances. An example of items includes, “Everything in the universe is somehow related to each other.” Attitude toward contradiction refers to one’s tendency to accept contradictions and reach a compromised solution in contrast to a tendency to rely on formal logic to select a better solution. An example of items includes, “It is more desirable to take the middle ground than go to extremes.” Perception of change refers to one’s tendency to expect a trend at one point in time to change cyclically overtime against a tendency to expect the trend to persist over time. An example of items includes, “Current situations can change at any time.” Participants rated their agreement on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The order of questionnaire items was randomized. We aggregated the means of subscales for analyses with a higher score indicating a stronger holistic thinking style (relative to analytic thinking style).

2.1.2.2. Affective affinity toward nature. We used a validated 11-item scale, the Emotional Affinity toward Nature scale, developed by Müller et al. (2009). The scale consists of four components: love of nature (e.g., Whenever I spend time in nature I do not experience a close connection to it; Reverse item), feelings of freedom in nature (e.g., I have the feeling I can live my life to the full in nature), feelings of security in nature (e.g., Sometimes when I feel unhappy I find solace in nature), and feelings of openness with nature (e.g., By direct contact with nature I feel respect for its uniqueness). Participants rated their agreement on a 6-point Likert scale ranging from 1 (completely disagree) to 6 (completely agree). The order of questionnaire items was randomized. We averaged the score of all items with a higher score indicating greater affective affinity toward nature.

2.1.2.3. Awareness of risk to nature. In measuring the awareness of environmental risk, we used a validated 9-item scale developed by Müller et al. (2009). Examples of item include, “Contamination and pollution are increasingly becoming a problem,” and “Nuclear power plants and radioactive waste are less dangerous than proclaimed to the public” (reverse item). Participants rated their agreement on a 6-point Likert scale ranging from 1 (completely disagree) to 6 (completely agree). The order of questionnaire items was randomized. We averaged the score of all items with a higher score indicating greater awareness of risk to nature.

2.1.2.4. Pro-environmental commitment. In measuring commitment to pro-environmental behavior, we used a validated 8-item scale developed by Müller et al. (2009). Participants indicated their willingness to behave environmentally friendly on a 6-point Likert scale ranging from 1 (completely disagree) to 6 (completely agree). Pro-environmental behaviors range from general behaviors (e.g., I am willing to take action for the protection of natural resources) to specific ones (e.g., I am willing to buy products that are bio-compatible with animals and plants (e.g., soap, detergent) provided it’s good value for money). The order of questionnaire items was randomized. We averaged the score of all items with a higher score indicating stronger pro-environmental commitment.

2.2. Results

Following past research on pro-environmental behavior (Gifford & Nilsson, 2014), we entered participants’ age, gender, and educational attainment as covariates for all analyses that involved pro-environmental commitment in this paper. Table 1 shows the descriptive statistics and zero-order correlations among key variables.

Preliminary analyses showed good reliability for most measures: the analytic-holistic scale: $\alpha = 0.74$; the scale for affective affinity toward

nature: $\alpha = 0.85$; and the scale for the awareness of risk to nature: $\alpha = 0.86$. The internal consistency of the scale for pro-environmental commitment was moderate ($\alpha = 0.59$). Low consistency was due to negative item-total correlation for a reverse item, “I am willing to insist, in discussions, on the fact that we do not have to worry about natural resources because they are abundant.” To keep consistency with previous work and to allow possible comparisons in future studies, we computed final scores based on all items of this scale.

We tested whether holism score would be positively correlated with pro-environmental commitment and whether this relation would be explained via affective affinity toward nature and awareness of risk to nature simultaneously. We conducted mediation analyses with 5000 bootstrap samples using PROCESS (Model 4, Hayes, 2013).

When emotional affinity toward nature and awareness of risk to nature were entered as multiple mediators, a stronger holistic thinking style predicted greater affective affinity to nature, $b = 0.470$, $SE = 0.151$, $p = .002$, and greater awareness of risk to nature, $b = 0.529$, $SE = 0.186$, $p = .005$. Greater affective affinity to nature, $b = 0.450$, $SE = 0.063$, $p < .001$, and greater awareness of risk to nature, $b = 0.121$, $SE = 0.059$, $p = .043$, predicted greater pro-environmental commitment. With considering the effect of the two mediators, the relation between holistic thinking style and pro-environmental commitment became non-significant, $b = 0.111$, $SE = 0.095$, $p = .247$ (from $b = 0.385$, $SE = 0.118$, $p = .001$). Indirect pathways through the affective affinity toward nature, indirect effect = 0.212 ($SE_{Boot} = 0.079$), 95% CI_{Boot} [0.059, 0.371], and the awareness of risk to nature, indirect effect = 0.064 ($SE_{Boot} = 0.039$), 95% CI_{Boot} [0.008, 0.175], significantly explained the relation between holistic thinking style and willingness to behave pro-environmentally (see Fig. 1).

2.3. Discussion

Study 1 provided evidence to support our hypothesis. The mediation analysis showed that the positive relation between holistic thinking and pro-environmental commitment was explained by both affective affinity toward nature and awareness of risk to nature.

3. Study 2

Study 1 provided initial evidence supporting the important role of holistic thinking style on people’s pro-environmental tendencies. Study 2 aimed to replicate the patterns with a large community sample from a different culture, Singapore. Singapore is a highly developed country in Southeast Asia where people with Chinese, Indian or Malay ethnic background live. Replicating the Study 1 results obtained from American participants with Singaporean community samples would increase our confidence in the hypothesized model. Identical to Study 1, we hypothesized that holistic thinking style would be related to greater affective affinity toward nature and greater awareness of risk to nature, which would be related to stronger pro-environmental commitment.

3.1. Method

3.1.1. Participants and procedure

As a part of a large study on pro-environmental behavior, we recruited 959 Singaporeans in collaboration with a marketing company in Singapore. Six participants were excluded from analysis due to incomplete responses. Participants’ age ranged from 13 to 65 years old ($M = 35.50$, $SD = 11.73$), half of the participants were female (50.4%), most participants were full-time (71.8%) or part-time employees (8.9%) or students (11.1%). Participants completed a battery of questionnaires that measure various determinants of pro-environmental behaviors. This study targeted the same set of questionnaires used in Study 1: the scale for analytic and holistic thinking (Choi et al., 2007), the scale for affective affinity toward nature (Müller et al., 2009), the scale for

Table 1
Means, standard deviations, and zero-order correlations for scales used for studies 1–3.

	Mean (SD)	1	2	3	4
Study 1					
1. Analytic-Holistic scale	4.81 (0.55)	–			
2. Affective affinity toward nature	4.56 (0.86)	0.301**	–		
3. Awareness of risk to nature	4.43 (1.06)	0.277**	0.414***	–	
4. Pro-environmental commitment	4.47 (0.66)	0.311**	0.666***	0.366***	–
Study 2					
1. Analytic-Holistic scale	4.91 (0.46)	–			
2. Affective affinity toward nature	4.41 (0.86)	0.340***	–		
3. Awareness of risk to nature	4.52 (0.88)	0.409***	0.377***	–	
4. Pro-environmental commitment	4.24 (0.66)	0.371***	0.629***	0.472***	–
Study 3					
1. Analytic-Holistic scale	4.77 (0.51)	–			
2. Affective affinity toward nature	4.66 (0.94)	0.360***	–		
3. Awareness of risk to nature	4.57 (1.08)	0.328***	0.390***	–	
4. Pro-environmental commitment	4.43 (0.92)	0.543***	0.537***	0.577***	–

Note.
** $p < .01$.
*** $p < .001$.

awareness of risk to nature (Müller et al., 2009), and the scale for pro-environmental commitment (Müller et al., 2009). The order of questionnaire items was randomized within each questionnaire. This study was approved by the IRB at the first author's institution (IRB-2017-05-032-1).

3.2. Results

Preliminary analyses showed good reliability for all measures: the analytic-holistic scale: $\alpha = 0.74$; the scale for affective affinity toward nature: $\alpha = 0.88$; the scale for the awareness of risk to nature: $\alpha = 0.81$; and the scale for pro-environmental commitment: $\alpha = 0.79$. Table 1 presents the descriptive statistics and zero-order correlations among key variables.

Similar to Study 1, we tested the multiple mediation effect using PROCESS (Model 4; Hayes, 2013) by entering affective affinity toward nature and awareness of risk to nature as mediators. The results showed that, a stronger holistic thinking style predicted greater affective affinity to nature, $b = 0.630$, $SE = 0.057$, $p < .001$, and greater awareness of risk to nature, $b = 0.765$, $SE = 0.056$, $p < .001$. Greater affective affinity toward nature, $b = 0.388$, $SE = 0.020$, $p < .001$, and greater awareness of risk to nature, $b = 0.178$, $SE = 0.020$, $p < .001$, predicted greater pro-environmental commitment. With considering the effect of the two mediators, the relation between holistic thinking style and pro-environmental commitment was weakened, $b = 0.146$, $SE = 0.038$, $p < .001$ (from $b = 0.528$, $SE = 0.043$, $p < .001$). Indirect pathways through affective affinity toward nature, indirect effect = 0.245 ($SE_{Boot} = 0.027$), 95%CI_{Boot} [0.195, 0.303], and the

awareness of risk to nature, indirect effect = 0.136 ($SE_{Boot} = 0.020$), 95%CI_{Boot} [0.100, 0.180], significantly mediated the relation between holistic thinking style and pro-environmental commitment (see Fig. 2).

3.3. Discussion

Study 2 using a larger community sample with diverse demographic characteristics in Singapore replicated the findings obtained in Study 1. In general, stronger holistic thinking predicted greater pro-environmental commitment, and this relation was explained by greater affective affinity toward nature and greater awareness of risk to nature.

4. Study 3

Studies 1 and 2 provided consistent evidence with correlational data. To examine whether holistic versus analytic thinking has a causal relation with pro-environmental commitment, we experimentally manipulated the thinking style in Study 3.

4.1. Method

4.1.1. Participants

We recruited 282 MTurk participants, as a priori power analysis showed that an experimental method with two independent groups requires 260 participants to detect a small-to-medium effect size ($d = 0.35$) with 80% power. Participants' age ranged from 21 to 71 years old ($M = 37.21$, $SD = 11.50$), 54% of them were female, and 72% of them had associate's degree or above. All responses were

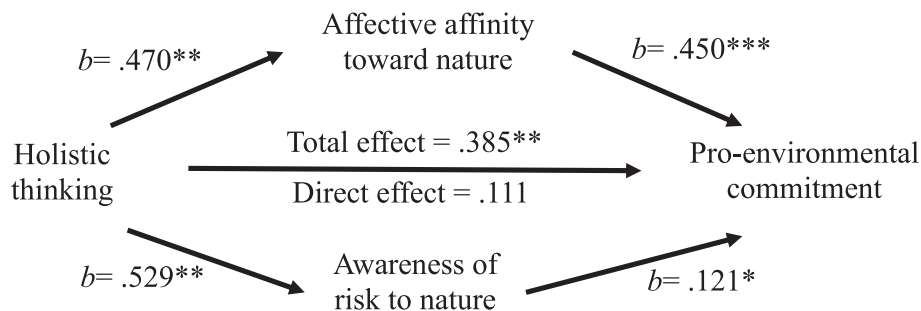


Fig. 1. A multiple mediation analysis for the effect of holistic thinking style on pro-environmental commitment via affective affinity toward nature and awareness of risk to nature with controlling the effect of age, gender, and educational level in Study 1. Unstandardized coefficients are reported. * $p < .05$, ** $p < .01$, *** $p < .001$.

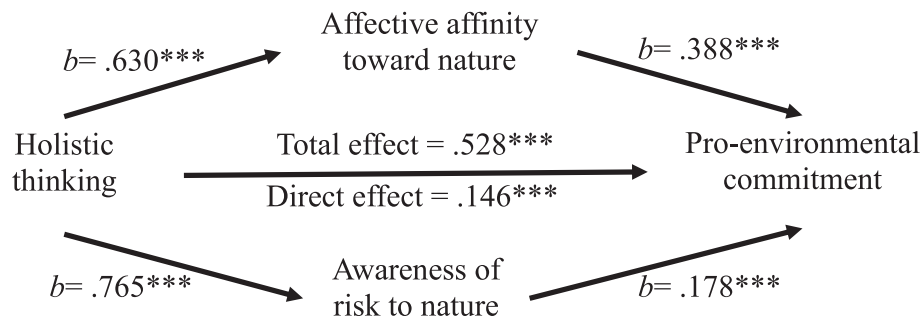


Fig. 2. A multiple mediation analysis for the effect of holistic thinking style on pro-environmental commitment via affective affinity toward nature and awareness of risk to nature with controlling the effect of age, gender, and educational level in Study 2. Unstandardized coefficients are reported. *** $p < .001$.

included in the analysis. This study was approved by the IRB at the first author's institution (IRB-2018-10-030).

4.1.2. Manipulation and procedure

Following past studies, we used scenarios to activate participants' holistic and analytic thinking style (Li, Masuda, et al., 2018). Both scenarios describe a person's experience of meditation and revelation. In the holistic thinking condition, the person became aware that the universe is made of interdependent forces, and all entities in the world are linked and inseparable. By contrast, in the analytic thinking condition, the person became aware that the universe is made of independent, unrelated forces, and all entities in the world are unique and self-contained. Similar method of manipulation was used in previous research (Maddux, Lau, Chiu, Hong, & Yuki, 2019). Following Li, Masuda, et al. (2018), we asked participants to summarize the paragraphs and describe two events that were congruent with what they had read. Then, participants completed a distraction task, in which they computed simple calculations (Bargh & Chartrand, 2000).

After the manipulation, they completed the following measures: the scale for affective affinity toward nature, the scale for awareness of risk to nature, the scale for pro-environmental commitment (Müller et al., 2009), and the scale for analytic-holistic thinking style (Choi et al., 2007). The order of questionnaire items was randomized within each questionnaire.

4.2. Results

Preliminary analyses showed good reliability for all measures: the affective affinity toward nature: $\alpha = 0.90$; the awareness of risk to nature: $\alpha = 0.87$; pro-environmental commitment: $\alpha = 0.77$; and the analytic and holistic thinking scale: $\alpha = 0.71$. Table 1 presents the descriptive statistics and zero-order correlations among key variables.

4.2.1. Manipulation check

We compared participants' response to the analytic-holistic scale after the manipulation. The results showed a non-significant trend for participants in the holistic thinking condition reporting higher endorsement of holistic thinking style compared to those in the analytic thinking condition, $F(1, 280) = 0.820$, $p = .336$. Unexpectedly, the manipulation condition was significantly interacted with gender, $F(1, 278) = 7.157$, $p = .008$, in which the manipulation was only effective among female participants, $F(1, 278) = 6.344$, $p = .012$ (holistic thinking condition: $M = 4.90$, $SD = 0.50$; analytic thinking condition: $M = 4.69$, $SD = 0.52$), but not among male participants (who even demonstrated an unexpected direction), $F(1, 278) = 1.760$, $p = .186$.

4.2.2. Hypothesis testing

Since only female participants demonstrated a successful manipulation effect, we conducted further analyses by including female participants only. The results showed that the main effect of manipulation was not significant in predicting affective affinity toward nature, $F(1,$

149) = 0.332, $p = .565$, awareness of risk to nature, $F(1, 149) = 0.823$, $p = .366$, and pro-environmental commitment, $F(1, 149) < 0.001$, $p = .987$, although the direction was consistent with our expectation.

Including only female participants in the analyses reduced statistical power. To compensate it, we adopted the analytic strategy recommended by Preacher, Rucker, MacCallum, and Nicewander (2005) that can afford more statistical power with an experimental design that manipulates a high versus low level of an independent variable (i.e., one type of extreme groups). That is, we entered the continuous scores of analytic-holistic thinking (i.e., the manipulation-check scale) instead of the manipulation condition (holistic vs. analytic condition) as the independent variable in the analysis. Following the procedure in Studies 1 and 2, we tested the simultaneous mediation effect using PROCESS (Model 4; Hayes, 2013) by entering affective affinity toward nature and awareness of risk to nature as multiple mediators.

The analysis showed that, a stronger holistic thinking style predicted greater affective affinity to nature, $b = 0.733$, $SE = 0.131$, $p < .001$, and greater awareness of risk to nature, $b = 0.832$, $SE = 0.143$, $p < .001$. Greater affective affinity toward nature, $b = 0.252$, $SE = 0.067$, $p < .001$, and greater awareness of risk to nature, $b = 0.334$, $SE = 0.061$, $p < .001$, predicted greater pro-environmental commitment. With considering the effect of the two mediators, the relation between holistic thinking style and pro-environmental commitment was weakened, $b = 0.636$, $SE = 0.112$, $p < .001$ (from $b = 1.071$, $SE = 0.119$, $p < .001$). Indirect pathways through affective affinity toward nature, indirect effect = 0.185 ($SE_{Boot} = 0.066$), 95%CI_{Boot} [0.075, 0.334], and the awareness of risk to nature, indirect effect = 0.278 ($SE_{Boot} = 0.077$), 95%CI_{Boot} [0.146, 0.459], significantly mediated the relation between holistic thinking style and pro-environmental commitment.

4.3. Discussion

The analyses using the continuous scores of holistic versus analytic thinking among female participants, who demonstrated a successful manipulation effect, replicated the findings. Holistic thinking scores, which were induced by the manipulation condition, predicted greater affective affinity toward nature and greater awareness of risk to nature, which were positively associated with pro-environmental commitment.

However, cautions are needed when interpreting causal relations among the examined variables. Between the two manipulation conditions, we did not find significant differences in affective affinity toward nature, awareness of risk to nature, and pro-environmental commitment. Some speculations were made. One possibility could be that the unexpected interaction effect between gender and manipulation weakened the power of the analyses. Another possibility could be that holistic versus analytic thinking style is a complex construct that consists of multiple components (Choi et al., 2007; Nisbett et al., 2001). The adopted manipulation paradigm may not be able to activate all components of holistic versus analytic thinking style, which may weaken the observed effect of thinking style on pro-environmental

commitment. The third possibility could be that the relation between holistic versus analytic thinking style and pro-environmental tendency is more complex than we expect. Multiple mechanisms that have opposing relations with pro-environmental tendency may exist, leading to a non-significant manipulation of thinking style. In line with this speculation, previous findings revealed a weak but significant negative relation between dialectical beliefs, which are a closely related construct to holistic versus analytic thinking style but emphasize on tolerance of contradictions and ambivalence more, and pro-environmental tendency (Li, Mei, et al., 2018). Future studies should carefully examine these possibilities.

5. General discussion

A strong pro-environmental tendency is important for reducing the detrimental impacts of human activities on the environment. Despite the great efforts of worldwide pro-environmental campaigns, great individual variations exist within and across societies. To better understand the great individual variation in pro-environmental tendency, we examined the relation between holistic versus analytic thinking, a domain-general psychological factor, and pro-environmental commitment and further explored the underlying mechanisms by focusing on affective affinity toward nature and awareness of risk to nature in three studies. Using correlational data, Studies 1 and 2 found that stronger holistic thinking predicted greater pro-environmental commitment, and this relation was explained by greater affective affinity toward nature and greater awareness of risk to nature among Americans (Study 1) and Singaporeans (Study 2). However, Study 3 manipulated thinking style and failed to find direct evidence for a significant main effect of manipulation on the examined variables.

The correlational data obtained from the two different societies, i.e., the United States and Singapore, showed consistent findings that stronger holistic thinking predicted greater pro-environmental commitment via enhancing affective affinity toward nature and awareness of risk to nature. People with stronger holistic thinking are likely to perceive the connectedness between human and nature (i.e., the relation between focal objects and the context; Nisbett et al., 2001), which is a core component of affective affinity toward nature (Eagly & Chaiken, 1993; Mayer & Frantz, 2004). In addition, people with stronger holistic thinking have a greater awareness of indirect and long-term consequences associated with an environmental change (Maddux & Yuki, 2006), which is likely to promote greater awareness of risk to nature. These tendencies among holistic people may, in turn, promote greater willingness for pro-environmental behavior (Müller et al., 2009). However, cautions for interpreting causal relations are required given the results obtained in Study 3, which manipulated thinking style but did not find significant differences in the three examined variables between the two manipulation conditions. Despite these weaknesses, one consistent finding was observed in the three studies: the positive relation between holistic thinking style (versus analytic thinking style) and pro-environmental commitment was explained by greater affective affinity toward nature and greater awareness of risk to nature.

5.1. Implications

Previous work provides converging evidence supporting that norms, values, and beliefs specific to environmental issues are significant predictors of pro-environmental tendencies (e.g., Eom et al., 2016; Fransson & Gärling, 1999; Gosling & Williams, 2010; Schultz, 2001; Schultz et al., 2004; Schultz et al., 2007), while the influence of domain-general factors is relatively less understudied. In addition to demographic factors (e.g., Gutteling & Wiegman, 1993; Swami, Chamorro-Premuzic, Snelgar, & Furnham, 2011), several domain-general psychological factors have been identified to be important in explaining individual difference in pro-environmental tendencies (e.g., Chuang et al., 2016; Leung et al., 2015; Li, Mei, et al., 2018; Milfont &

Sibley, 2012). Extending this line of research, the current research showed that holistic versus analytic thinking style is related to people's pro-environmental commitment through both cognitive and affective processes. The importance of these domain-general psychological factors in understanding people's pro-environmental tendency can be easily neglected, as their influences are extensive across different domains. Supported by previous work and the current research, these factors are crucial in understanding individual variations in pro-environmental tendency.

Consistent with previous work showing that cognitive and affective processes play an important independent role in promoting pro-environmental tendency (Collado et al., 2013; Hinds & Sparks, 2008; Müller et al., 2009), the current research found that affective affinity toward nature and the awareness of risk to nature were positively associated with pro-environmental commitment in all three studies. Extending previous work, we found that both cognitive and affective processes are important to explain the relation between domain-general factors and pro-environmental tendencies. Specifically, the current research found consistent patterns that holistic thinking style is positively related to pro-environmental commitment, which can be explained by both affective and cognitive processes. These findings are also in line with previous work showing that holistic versus analytic thinking style can influence both affective (e.g., Ito et al., 2013) and cognitive processes (Masuda & Nisbett, 2001). Future studies should further explore how different domain-general factors shape people's pro-environmental behavior with considering both cognitive and affective processes. Different perspectives may be needed to effectively modulate people's cognitive and affective processes (e.g., Loewenstein et al., 2001; Slovic & Peters, 2006) in order to reduce the beneficial or aversive influence of domain-general factors on pro-environmental behavior. This may provide important insights for developing effective pro-environmental campaigns.

5.2. Limitations

There were some limitations that required further consideration. First, we measured participants' willingness for pro-environmental behavior as an indicator of pro-environmental commitment in the three studies. Although previous work found that willingness for pro-environmental behavior was a significant predictor of actual pro-environmental tendency (Montada, Kals, & Becker, 2007), behavioral intention can be weakly correlated with actual behavior (Webb & Sheeran, 2006). Future studies should replicate the findings by assessing participants' actual pro-environmental behavioral engagement. Second, cautions for interpreting causal relations among the examined variables are needed. Although the results obtained in Studies 1 and 2 provided empirical support, mediational analyses using cross-sectional data did not provide causal evidence, as they did not exclude the possibility of bi-directional relations among the examined variables. In addition, despite the fact that the adopted manipulation paradigm was shown to be effective previously (e.g., Li, Masuda, et al., 2018; Maddux et al., 2019), Study 3 failed to find a significant main effect of the manipulation condition though the continuous scores of thinking style induced by the manipulation condition were significantly associated with the examined variables. One possible reason could be due to the unexpected moderating effect of gender on the manipulation of thinking style, with only female participants reporting a significant expected difference in holistic thinking between the two conditions. Thus the findings discussed in Study 3 were limited to female participants, which needs to be interpreted with caution. Future studies need to develop more effective and stronger manipulation paradigms for examining the causal role of holistic versus analytic thinking style in shaping people's pro-environmental tendencies.

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