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Abstract: Despite extensive works examining the influence of personal values on environmental engagements, scarce research has examined the influence of group values that are perceived as important in the society. To address this lacuna and recent calls for more cross-cultural environmental research, we investigated whether and how culture, via collectivistic orientation, influences the roles of personal values and perceived group values, namely egoistic and biospheric values, in motivating environmental engagements in a Western (the U.S.; N = 469) and an Asian (Singapore; N = 410) country. To highlight a few findings, the study showed that personal values and perceived group values differentially predicted environmental engagements. Counter to our hypotheses, biospheric group values discouraged environmental volunteerism and were not related to other environmental engagement measures. Interestingly, culturally shaped collectivistic orientation attenuated biospheric group values' negative relationship and strengthened egoistic group values' positive relationship with public behavioral intentions. Collectivistic orientation also strengthened the positive influence of personal egoistic values, but not personal biospheric values, on public behavioral intentions and policy support. We discuss how these findings advance knowledge regarding the ways in which personal and perceived group values, coupled with culturally motivated collectivistic orientation, would encourage pro-environmental actions.

Keywords: Biospheric values, Collectivistic orientation, Culture, Egoistic values, Environmental engagements, Perceived group values

1. Introduction

There is a strong scientific consensus that changes in the global climate are mostly driven by human activities via greenhouse gas emissions (IPCC, 2018). Under the Paris Agreement, nations have pledged to regulate greenhouse gas reductions so as to limit global temperature rise to 1.5 degrees Celsius to avoid irreversible damage. However, recent evidence abounds that global warming will likely exceed this crucial level in the early 2030s (IPCC, 2021). Given the global nature of the climate crisis, it is increasingly important to examine the motivational drivers underlying pro-environmental action among diverse populations across countries. This can promote understanding of how to better encourage people across the globe to take proactive actions to mitigate and adapt to climate change.

In this light, the current research examines how individuals' personal values and their perception of others' values shape environmental engagements in a Western (the U.S.) and a non-Western (Singapore) culture and offers a psychological account of cultural differences. Although the influence of personal values on environmental concern and behavior has been established (e.g., Schultz et al., 2005; Schultz & Zelezny, 1998; Steg & De Groot, 2012), how perceived group values contribute to environmental engagements has been understudied until recently (e.g., Bouman, Steg, & Zawadzki, 2020). In addition, according to recent reviews of the environmental psychology literature, the field lacks systematic cross-cultural research (Tam, Leung, & Clayton, 2021; Tam & Milfont, 2020). Aiming to fill these knowledge gaps, the present study set out to offer a cross-cultural analysis by comparing how personal values and perceived group values in the society influence environmental engagements in the U.S. and Singapore.

1.1. Personal values and environmental engagements

Values refer to broad desirable goals that motivate people's actions and serve as guiding principles in their life (Schwartz & Bilsky, 1987). For example, values can influence people's perceived appeal of alternative courses of action (Feather, 1995), choice of strategies (De Dreu & Boles, 1998), and sense-making of information (Sattler & Kerr, 1991). In addition, values differ in their importance to individuals. The more strongly people prioritize a value, the more driven they are to achieve the goal (Roccas & Sagiv, 2010) or behave in ways that align with these values (Lee et al., 2021).

The values people hold shape their climate change beliefs and behaviors. Four types of values have been identified as particularly relevant in the environmental domain (Bouman, Steg, & Perlaviciute, 2021; Steg, Perlaviciute, van der Werff, & Lurvink, 2014). Egoistic values motivate people to maximize outcomes for themselves (e.g., promoting personal wealth). Hedonic values motivate people to maximize their pleasure (e.g., gratifying personal desires). Altruistic values motivate people to maximize outcomes for other people (e.g., encouraging prosocial behaviors). Biospheric values motivate people to maximize outcomes for non-human species and the ecosystem (e.g., helping endangered species). Notably, egoistic and biospheric values present sufficiently distinct and useful bases to understand environmental engagements (De Groot & Steg, 2008, 2009). Thus, the study of egoistic and biospheric values is the focus of the present research.

People who are motivated by egoistic values tend to weigh personal costs against benefits during decision-making (De Groot & Steg, 2008). When perceived personal benefits (e.g., enriched status, financial gain) outweigh costs (e.g., inconvenience, effort), they are more likely to act pro-environmentally. When perceived personal benefits are not commensurate with costs, they are less likely to do so. In contrast, people who are motivated by biospheric values are more likely to engage in pro-environmental actions because these actions bring about benefits more than costs to nature and the ecosystem (Steg & De Groot, 2012).

Research generally documents positive associations between biospheric values and environmental beliefs and behaviors in different cultures (Bouman, Verschoor, et al., 2020; Schultz & Zelezny, 1998; Steg, 2016). However, there is mixed evidence, with either positive, negative, or null associations being observed between egoistic values and environmental tendencies within and across cultures (De Groot & Steg, 2007; Schultz & Zelezny, 1998; Sloot, Kutlaca, Medugorac, & Carman, 2018). Due to these inconsistent findings, researchers have called for more studies examining the role of egoistic values in a wider range of pro-environmental domains (Bouman, Steg, & Kiers, 2018). Thus, the present research measured a comprehensive scope of environmental engagements, including private and public pro-environmental behavioral intentions, policy support, and environmental volunteerism intentions. This is to test if the pro-environmental impact of egoistic and biospheric values is similar or different across varying forms of pro-environmental actions (Bouman et al., 2018; Bouman, Steg, & Zawadzki, 2020).

Viewed more broadly, the self-interested nature of egoistic values does not necessarily impede pro-environmental action (Bouman, Steg, & Perlaviciute, 2021; Kollmuss & Agyeman, 2002). Some pro-environmental behaviors can result in personal gains beyond incurring costs to oneself and accruing benefits to the environment (Bouman, van der Werff, Perlaviciute, & Steg, 2021). Accordingly, when there are self-enhancing benefits but not solely self-transcendent (pro-environmental) benefits, studies revealed that individuals who show an egoistic orientation are more likely to engage in pro-environmental behaviors (De Dominicis, Schultz, & Bonaiuto, 2017). For instance, people who endorse egoistic values may be motivated to pursue pro-environmental behaviors to satisfy self-interested concerns such as boosting their social status (Braun Kohlová & Urban, 2020) and signaling their positive traits (e.g., cooperative, Barclay & Barker, 2020; altruistic, Griskevicius, Tybur, & Van den Bergh, 2010). Further, some pro-environmental behaviors can yield financial benefits, such as conserving energy can save money (Steg, Perlaviciute, & van der Werff, 2015), and thereby also fulfil egoistic motivations (e.g., valuing financial gains). As such, we do not have a strong hypothesis for the direction of personal egoistic values' impact on environmental engagements. With multiple dependent measures, the current research explored whether there are differential impacts of personal egoistic values on different types of environmental engagements. In contrast, as biospheric values attest to a genuine concern for the natural environment and the ecosystem, we expect that:

Hypothesis 1. Personal biospheric values will be positively associated with environmental engagements.

1.2. Perceived group values and environmental engagements

When certain values are perceived as widely shared in society, these values can also guide how people in the society feel, think, and behave, regardless of whether they personally endorse these values or not (Bernard, Gebauer, & Maio, 2006; Bouman, Steg, & Perlaviciute, 2021; Schwartz, 2014). In the environmental psychology literature, compared to research on the association between personal values and environmental engagements, there has been little research on the association between perceived group values and environmental engagements (Bouman, Steg, & Zawadzki, 2020; Wang, van der Werff, Bouman, Harder, & Steg, 2021).

Albeit not directly examining perceived group values, there is abundant evidence on the roles of descriptive and injunctive norms in encouraging pro-environmental behaviors (Farrow, Grolleau, & Ibanez, 2017; Miller & Prentice, 2016). This research stream emphasizes how one's belief about the way most people behave (i.e., descriptive norms) or about the way most people *should* behave (i.e., injunctive norms) can motivate pro-environmental behaviors (Cialdini, Reno, & Kallgren, 1990; Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008). Individuals are more inclined to behave pro-environmentally when they believe that others in the society frequently engage in pro-environmental behaviors or approve of these behaviors. This demonstrates how norms convey a standard against which people are driven to comply with because this standard either provides informational value (i.e., suggesting which course of action is appropriate or common) or normative value (i.e., suggesting which course of action is socially approved; Abrams, Wetherell, Cochrane, Hogg, & Turner, 1990; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007).

Recent studies have started to consider the role of perceived group values in environmental engagements. So far, this area of study focused on perceived biospheric values endorsed by the group. One research showed that when employees perceived their organization to be committed towards corporate environmentally responsible goals, which potentially signalled the importance of biospheric values in the organization, they tended to behave more pro-environmentally at work (Ruepert, Keizer, & Steg, 2017). Another study revealed that perceiving stronger biospheric group values endorsed by other Americans or members of their political party encouraged people's willingness and intended behavior to save energy (Bouman, Steg, & Zawadzki, 2020). Yet another study showed that students' perceived prioritization of biospheric values by other fellow students was positively associated with their tendency to engage in pro-environmental actions (Wang et al., 2021). A complementary account suggests that people's awareness of similar others' pro-environmental actions can promote their environmental engagements through increasing the efficacy belief that their actions can make a difference to the environment (Doherty & Webler, 2016; Thøgersen, 2014).

There are a few reasons why studying perceived group values is theoretically novel for the field of environmental psychology. First, whereas prior environmental research has examined the role of social norms (descriptive and injunctive norms) in facilitating environmental

engagements, very limited research has looked into the environmental benefits of perceived group values. It is important to note that although perceived group values bear similarity to social norms as to how they can serve as behavioral guides, perceived group values are theoretically distinguishable from social norms (Bouman, Steg, & Zawadzki, 2020; Bouman, van der Werff, et al., 2021). Social norms mainly make explicit whether a specific behavior is typical or appropriate within a social group (Cialdini et al., 1990; Farrow et al., 2017), but not why such a behavior is prevalent or approved. Going beyond the narrower focus of social norms governing only a specific behavior, perceived group values can constitute the broader or overarching reasons that drive group members to engage in numerous value-congruent behaviors (vs. a specific behavior). Hence, perceived group values, as a higher-order principle, can be deemed more effective than social norms to drive a wider range of behaviors to benefit an environmental cause (Bouman, Steg, & Zawadzki, 2020).

Second, the study of perceived group values is in line with the intersubjective approach to values (Chiu, Gelfand, Yamagishi, Shteynberg, & Wan, 2010; Shteynberg, Gelfand, & Kim, 2009; Zou et al., 2009). According to this approach, people may choose not to act on their personally endorsed values, but act on the values they perceive to be important in their culture. Studies have shown that normative pressures can diminish the association between people's personal values and behaviors (Bardi & Schwartz, 2003).

Third, it is conceivable that a misalignment can exist between personal values and perceived group values (Shteynberg et al., 2009; Wan, Chiu, Peng, & Tam, 2007). When this happens, people can choose to either act on their personal values or their perceived group values. Some people may take a middle stance that balances their personal values and perceived group values. Practically speaking, these possibilities suggest ways to induce behavioral changes through changing people's perception of group values (Bouman & Steg, 2019, 2020) as opposed to changing their relatively more stable personal values.

Research on the relationship between perceived group values and environmental engagements so far has been limited to perceived biospheric values in the group (e.g., Bouman, Steg, & Zawadzki, 2020; Wang et al., 2021). It remains an empirical question to test how perceived egoistic group values influence environmental engagements. On the one hand, perceived egoistic group values may be less likely to result in environmental engagements. When people believe that others in the society generally consider egoistic values to be important, they may ask, "If others care about self-interests rather than group or environmental interests, why should I bother?", thus deterring them from engaging in pro-environmental actions. On the other hand, perceived egoistic group values may spur environmental engagements, as people may feel the need to compensate for the anticipated lack of environmental engagements in the community. For example, people who perceive large-scale organizations (e.g., governments) to fall short of their environmental responsibility are often more willing to engage in energy conservation behaviors (Buchanan & Russo, 2015). This need to compensate might be more apparent for climate policy support, particularly if people feel worried about climate change and see climate policies as an effective way to induce society-wide pro-environmental actions (Bouman, Verschoor, et al., 2020). Therefore, similar to personal egoistic values, we also do not have a strong hypothesis for the direction of perceived egoistic group values' impact on environmental engagements.

In contrast, it is expected that perceived biospheric group values will result in more pro-environmental benefits because people recognize that others are working collectively toward benefitting nature and the ecosystem that is larger than themselves. Perceiving strong biospheric group values leads to a stronger adherence to these normatively valued and anticipated behaviors in their group (Bouman, Steg, & Zawadzki, 2020; Ruepert et al., 2017; Wang et al., 2021). The present research hypothesized that:

Hypothesis 2. Perceived biospheric group values will be positively associated with environmental engagements.

1.3. Culture moderates value-engagement link via collectivistic orientation

Some cultures emphasize collectivistic practices or behaviors more than other cultures. Such emphasis on collectivism signifies the extent to which a culture prioritizes group goals and motives over personal goals and motives (Hofstede, 1980; Triandis, 1999). As such, collectivism increases the importance of fitting in or accommodating to social contexts (Kim & Markus, 1999; Yates & de Oliveira, 2016) and decreases the importance of expressing one's personal values (Kim & Sherman, 2007) and enacting (personal) value-consistent behaviors (Chan, 2020). In this light, we contend that people who uphold a stronger (vs. weaker) orientation toward adhering to collectivistic practices or behaviors (e.g., maintaining group harmony, respecting group decisions) are more motivated to act according to perceived group values (Tam, Lee, Kim, Li, & Chao, 2012).

In line with this theorizing, studies have demonstrated that personal environmental concerns and values are less predictive of pro-environmental behavioral intentions in collectivistic societies, such as Japan (Chan, 2020; Eom, Kim, Sherman, & Ishii, 2016; Tam & Chan, 2017). Instead, perceived social norms are more predictive of pro-environmental intentions in collectivistic societies (Eom et al., 2016). A recent study (Wang et al., 2021) showed that perceived biospheric group values more strongly promoted pro-environmental behaviors via enhancing environmental group identity for participants from China (a more collectivistic country) than those from the Netherlands (a more individualistic country). However, personal biospheric values predicted pro-environmental behaviors via enhancing environmental self-identity in both countries.

Extending these works and answering calls for more empirical research to enhance cross-cultural understanding of environmentally responsible actions (Eom, Papadakis, Sherman, & Kim, 2019; Tam et al., 2021; Tam & Milfont, 2020), the current research examined whether the strength of associations between personal or group values and environmental engagements differs between two cultures (Singapore, the U.S.) and whether these differences might be explained by the different extents that people from these cultures endorse a collectivistic orientation (Hofstede, 1980). We argue that the influence of perceived group values would be more pronounced in collectivistic cultures. It is because social factors, such as normative cues and collective goals, tend to bear greater relevance to and serve as pertinent guides for members in collectivistic cultures (Cialdini, Wosinska, Barrett, Butner, & Gornik-Durose, 1999; Markus & Kitayama, 1991; Riemer, Shavitt, Koo, & Markus, 2014). Importantly, instead of assuming that higher (lower) collectivism applies to every individual in Singapore (the U.S.), we measured individual-level collectivistic orientation (see Leung & Cohen, 2011), which captures how strongly people endorse collectivistic practices (Chirkov, Ryan, Kim, & Kaplan, 2003).

There are two key rationales for measuring individuals' collectivistic orientation. First, this affords a more focused test to confirm that collectivistic orientation is one of the psychological characteristics that contributes to the predicted cross-cultural effect. Second, with this approach, we acknowledge that culture does not homogenize people in the same culture. Collectivism is not a static attribute of a culture, and individuals within a culture are not always a prototypical member of the culture or a passive recipient of cultural influences (Leung & Cohen, 2011; Matsumoto, Kudoh, & Takeuchi, 1996; Triandis, 2001). In this light, the expected cross-cultural effect can be further explained by varying levels of collectivistic orientation espoused by Singaporeans and Americans.

As we expect that people who perceive higher (vs. lower) levels of biospheric group values will show more environmental engagements (Hypothesis 2), we also expect that this relationship would be strengthened among Singaporeans (vs. Americans) because their

collectivistic orientation tends to be stronger. Thus, the study tested whether the predicted cross-cultural difference in the value-engagement link is explained by individuals' collectivistic orientation. Together, we theorize a mediated moderation model (Fig. 1):

Hypothesis 3. Singaporeans hold higher levels of collectivistic orientation than do Americans, which moderates (strengthens) the positive relationship between perceived biospheric group values and environmental engagements.

We clarify that as we do not hypothesize specifically for personal and perceived egoistic group values, we also do not have a strong prediction for culture or collectivistic orientation to moderate the relationship between these values and environmental engagements. If anything, we expect that culture, via collectivistic orientation, can weaken the influence of personal egoistic values and strengthen the influence of perceived egoistic group values because collectivistic individuals tend to prioritize collective concerns and motives more than personal concerns and motives. In addition, as for personal biospheric values, because these values attest to people's genuine care about nature and their overarching goal to transcend beyond oneself to benefit the environment, we do not expect culturally shaped collectivistic orientation to modulate its effect.

2. The present research

To investigate the interplay among egoistic and biospheric values, culture, individuals' collectivistic orientation, and different domains of environmental engagement, the present research examined a mediated moderation model with culture (the U.S. vs. Singapore) moderating the relationships between personal values or perceived group values and environmental engagements as mediated via collectivistic orientation (see Fig. 1). To test this model, we adopted the mediated cultural moderation approach (e.g., Eom, Saad, & Kim, 2021; Kim & Sherman, 2007; Uskul, Sherman, & Fitzgibbon, 2009). This approach is based on the mediated moderation analysis (Muller, Judd, & Yzerbyt, 2005), contrived to uncover how the moderating effect of a more distal sociocultural variable (e.g., culture) might be explained by a more proximal psychological variable (e.g., individuals' collectivistic orientation).

We assessed four types of environmental engagement—intentions for public- and private-sphere pro-environmental behaviors, support for pro-environmental policies, and environmental volunteerism. The use of multiple measures can cover a more nuanced and comprehensive scope of environmental engagements and afford a more robust test of the hypotheses.

The research was preregistered prior to data collection (https://osf.io/te467/?view_only=2d9cbb59c9fe485db5afcfded09d7dc4). The preregistered hypotheses primarily focused on perceived biospheric group values (termed as perceived normative biospheric values in the preregistration), which are the focal hypotheses we postulated. To examine biospheric values in comparison to egoistic values and the relationship between values and environmental engagements more broadly, we went beyond the preregistration and tested below the full mediated moderation models for each of the four values (personal egoistic and biospheric values; perceived egoistic and biospheric group values). We believe that testing and reporting the full model (see Fig. 1) will allow a more complete understanding of the studied variables across the two cultural samples.

2.1. Participants

As no prior research has directly investigated the proposed model, we drew on our previous study to derive sample size estimates for the present study. Our previous study (N = 956) explored the effects of environmental message framing, personal and perceived group values, and cosmopolitan orientation on environmental engagements. This study revealed significant interactions between two individual-level values (personal biospheric values and perceived biospheric group values) for both public-sphere ($\beta = -.169$, $p < .001$) and private-sphere pro-environmental behavioral intentions (β = -.143, $p < .001$). As the current research also tested an interaction between two individual-level orientations (egoistic/biospheric values and collectivistic orientation), we based on our earlier finding to conduct an a priori power analysis using G*Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009). It recommended 502 participants for the latter (relatively weaker) interaction effect with 0.90 power ($\alpha = 0.05$). As the current study involved two cultures, we aimed to recruit 500 participants in each culture.

U.S. citizens were recruited via Prolific and Singaporean citizens were recruited via Dynata to complete a 15-min survey on values and perceptions pertaining to environmental consciousness in exchange for a cash token. A total of 1178 unique responses were collected (503 Americans and 675 Singaporeans). Data quality was assessed based on a quality check administered at the start of the survey, an attention check, and an honesty check at the end of the survey. Based on these criteria, we identified 18 poor quality responses in the American sample and 263 poor quality responses[1] in the Singaporean sample, which were removed from subsequent analyses. As some of the environmental engagement measures (pro-environmental behavioral intentions and policy support) presume the belief that climate change is occurring, we excluded participants who expressed climate change skepticism[2] (16 in the American sample and 2 in the Singaporean sample). This resulted in a total of 469 valid responses in the American sample (50.3% female, 1.1% indicated "others" for gender; M_{age} = 45.57 years, SD_{age} = 16.08; 69.0% White Americans[3]; median annual household income[4] = US$50,001-US $75,000) and 410 valid responses in the Singaporean sample (51.2% female; M_{age} = 41.61 years, SD_{age} = 13.31; 69.8% Chinese Singaporeans; median annual household income[4] = SG$75,001-SG$100,000). We requested for representative samples when recruiting our American and Singaporean samples through Prolific and Dynata respectively (the ethnic representation of the Singaporean sample generally matches the proportions in the population and the ethnic distribution between White vs. non-White of the American sample generally matches that in the population).

2.2. Procedures and materials

The online survey started with the collectivistic orientation measure. Next, participants rated the personal and perceived group value scales in a randomized order, with the ratings of egoistic and biospheric value items also being randomly presented. They then completed the four

[1] For the Singaporean sample, the rate of poor quality data was high because many participants failed the relatively demanding attention check item. The attention check required participants to ignore a question about personality traits and to choose the "Other" option among a list of 12 options. We used this attention check item to ensure that we retain participants who were attentive when completing the survey.

[2] To assess climate change skepticism, participants selected one of the three statements that best reflects their views about climate change. Two statements reflect a belief in climate change (either due to anthropogenic or non-anthropogenic causes) and the remaining statement reflects a disbelief in climate change ("I do not believe climate change is occurring"). Participants who chose the latter statement were excluded from analyses.

[3] Ethnicity was administered as an open-ended measure for the American sample and as a multiple-choice measure for the Singaporean sample. White American participants were classified according to the United States Census Bureau guidelines (U.S. Census Bureau, 2021). For the American sample, 20 participants provided ambiguous answers (e.g., "American") and were not coded as White, and 1 participant misanswered and specified their religion ("Christian"). Thus, we excluded these participants in reporting the percentage of White Americans.

[4] Annual household income was measured using eight income categories from "US/SG$15,000 or less" to "US/SG$150,000 or more".

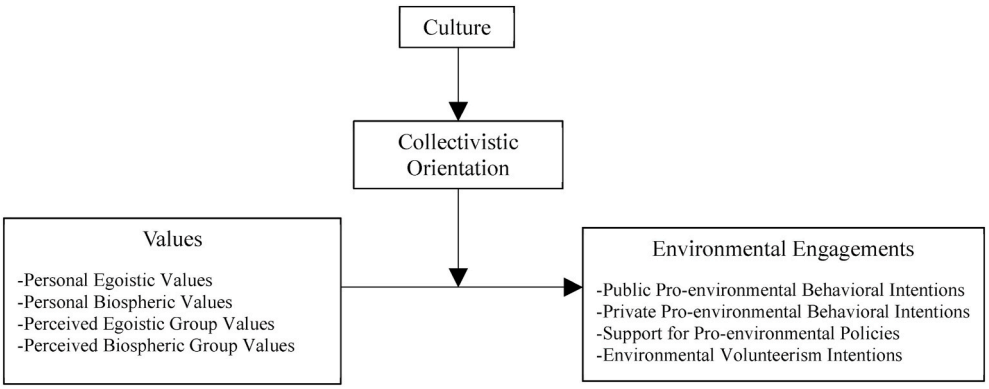

Fig. 1. Mediated moderation model with culture predicting collectivistic orientation and collectivistic orientation, in turn, moderating the relationship between values and environmental engagements.

environmental engagement measures. The order of engagement measures was randomized, with public and private pro-environmental behavioral intentions in one section (items for each type were shown and randomized on separate pages), pro-environmental policy support in one section (items were also randomized), and environmental volunteerism in another section. Finally, participants provided their demographic information and were thanked. Data collection of this research had been approved by the institutional ethics review board (IRB approval number: IRB-19-012-A024-M3(820)). The full measurement scales can be found in the appendix. Table 1 presents the descriptive and reliability statistics for all measures.

2.2.1. Collectivistic orientation

Collectivistic orientation was measured using Chirkov et al.'s (2003) scale.[5] Participants rated the personal importance of a list of 12 collectivistic practices from 1 (*not important at all*) to 5 (*very important*). Sample practices include "to maintain harmony within any group that one belongs to" and "to respect decisions made by one's group/-collective". These items were aggregated to assess collectivistic orientation.[6]

Table 1
Descriptive statistics and reliability indices of the focal variables for the American ($N = 469$) and Singaporean samples ($N = 410$).

#	Variable	M_{US}	M_{SG}	SD_{US}	SD_{SG}	α_{US}	α_{SG}
1	Collectivistic Orientation	3.33	3.47	0.68	0.62	0.86	0.87
2	Personal Egoistic Values	3.82	4.65	1.46	1.45	0.79	0.84
3	Personal Biospheric Values	5.83	5.57	1.68	1.53	0.92	0.92
4	Perceived Egoistic Group Values	5.3	5.14	1.36	1.37	0.76	0.84
5	Perceived Biospheric Group Values	4.22	4.92	1.92	1.76	0.95	0.94
6	Public Pro-environmental Behavioral Intentions	2.69	2.73	1.02	1.07	0.93	0.95
7	Private Pro-environmental Behavioral Intentions	3.61	3.71	0.77	0.71	0.85	0.87
8	Support for Pro-environmental Policies	3.59	3.62	0.71	0.57	0.85	0.79
9	Environmental Volunteerism Intentions	7.07	7.86	7.04	6.47	0.46	0.52

Note. Reliabilities for public and private behavioral intentions are based on listwise omission of missing values.

2.2.2. Value endorsements

Participants were urged to vary ratings as much as possible and to only rate a few values as extremely important from −1 (*opposed to my values*), 0 (*not important*), to 7 (*extremely important*). Ratings were recoded to range from 0 to 8. The order of presenting personal and perceived group value measures was randomized. The measures differ only in the instructions that either focus on the personal importance or perceived importance of the value in the American or Singaporean society. Items measuring each value type were aggregated to form a composite score.

Personal egoistic values. Participants rated the importance of five egoistic values (De Groot & Steg, 2007) that they personally regard and prioritize as a guiding principle in their life. The values include social power, wealth, authority, influential, and ambitious.

Personal biospheric values. Participants indicated the importance of four biospheric values in their life (De Groot & Steg, 2007), which include preventing pollution, respecting the earth, unity with nature, and protecting the environment.

Perceived egoistic group values. Participants rated the importance of the same five egoistic values to the people residing in their society (the U.S. or Singapore), based on their observation and understanding.

Perceived biospheric group values. Participants indicated the importance of the same four biospheric values to the people residing in their society (the U.S. or Singapore).

2.2.3. Environmental engagements

Public pro-environmental behavioral intentions. Participants rated their likelihood of performing a list of 12 public-sphere behaviors (Bain et al., 2016) in the next 12 months from 1 (*not at all likely*) to 5 (*very likely*), or N.A. (*not applicable*). Examples include signing an environmental petition and posting pro-environmental messages on social media.

Private pro-environmental behavioral intentions. Using the same instructions and scale anchors for public-sphere behavioral intentions, participants indicated the likelihood of engaging in a list of 12 private-sphere behaviors (Bain et al., 2016). Examples include purchasing

[5] We administered Chirkov et al.'s (2003) scale that comprises both horizontal and vertical dimensions of collectivistic orientation. Horizontal collectivism captures the tendency to view oneself as belonging to a collective and to view members of this collective as equal. Vertical collectivism reflects the tendency to embrace hierarchical or subordinate relationships within the collective. As we did not have specific theoretical predictions about different types of collectivism, we aggregated both dimensions to form an overall collectivistic orientation score.

[6] For transparency purpose, we want to disclose that we also included a scale measuring participants' perceived cultural tightness/looseness (i.e., the degree to which the society has strong norms and low tolerance of deviant behavior; Gelfand et al., 2011). However, due to space constraints and the research focus of the current paper, we only presented the findings regarding the role of collectivistic orientation. Given the data overlap, we will not publish the findings pertaining to tightness/looseness as the mediator for cultural differences in value-engagement relationships.

environmentally friendly products and engaging in environmentally friendly practices such as recycling and reducing car travel. Together, we covered two types of behavioral intentions, with public-sphere behaviors (e.g., signing a petition) making an environmental impact via politically or collectively mediated actions and private-sphere behaviors (e.g., green consumerism) making an impact via individual choices and actions (Stern, 2000). For both behavioral intention scales, "N.A." responses were coded as missing prior to forming composite scores. This resulted in a total of 879 non-missing responses (missing responses: $n_{US} = 2$, $n_{SG} = 5$) and 878 non-missing responses (missing responses: $n_{US} = 0$, n_{SG} $n = 1$) for public and private behavioral intentions respectively.

Support for pro-environmental policies. Using Harring et al.'s (2017) measure, participants rated the extent that they supported 11 policies such as "reduced tax on fuels that do not affect the world's climate" and "increased information about the effects of transportation on the climate" (1 = *a very bad suggestion* to 3 = *a neither good nor bad suggestion* to 5 = *a very good suggestion*).

Environmental volunteerism intentions. To assess willingness to volunteer for environmental causes, participants completed a hypothetical time allocation charity task (adapted from Margetts & Kashima, 2017). They were asked to freely allocate 30 hours to volunteer at six charities (including two charities with environmental causes) and/or spend for personal or recreation purposes. We listed real charity organizations along with their mission statement. The nature of these charities was matched between the two countries (e.g., The Alzheimer's Foundation of America in the U.S. and The Alzheimer's Disease Association in Singapore for the pro-health charity). To form a measure of environmental volunteerism intentions, we summed the time allocated towards volunteering at the two environmental charities (The Sierra Club and The Nature Conservancy in the U.S.; The Wilderness Society and Nature Society in Singapore).

2.3. Results

Table 2 presents the bivariate correlations of the measures for the two samples. Correlational patterns indicated that the relationships among personal (egoistic, biospheric) values, perceived (egoistic, biospheric) group values, and environmental engagements are generally associated with each other across the two cultural samples. When conducting the analyses on a given value, the other values on the outcome measure were controlled in the model.

2.3.1. Analytical strategy

To test our hypothesized mediated cultural moderation models (Fig. 1, Muller et al., 2005), we examined whether collectivistic orientation could explain the moderating effect of culture on the value-engagement associations. In other words, we tested a mediated moderation effect wherein culture predicted collectivistic orientation, which in turn moderated the relationship between a given value and environmental engagement. In a series of multiple regression analyses, we first examined if culture moderated the relationship between a given value and an environmental engagement measure. Next, we examined whether collectivistic orientation moderated the same relationship between value and environmental engagement. If collectivistic orientation could explain the moderating effect of culture on the value-engagement association, then collectivistic orientation should likewise moderate this association in the same direction. Finally, we included both interactions between culture and value and between collectivistic orientation and value on environmental engagement in the model. If we observed that culture predicted collectivistic orientation and that the magnitude of the interaction between culture and value decreased, while the interaction between collectivistic orientation and value continued to significantly predict environmental engagement, then it would indicate that collectivistic orientation mediated the moderating effect of culture on the relationship between value and environmental engagement (Muller et al., 2005).

In these analyses, culture was dummy-coded (0 = the U.S., 1 = Singapore) and all key variables (values, collectivistic orientation) and interaction terms were mean-centered. Separate sets of regression analyses were performed for each of the four environmental engagement outcome measures. To test the effect of one type of value (e.g., personal biospheric values), independent from other values (i.e., personal egoistic values, perceived egoistic group values, and perceived biospheric group values), the effects of these other values on the dependent measures of environmental engagement were included as covariates. We decided to control for other values in the analyses because correlations were detected among the four personal and perceived group values (*r*s ranged from −.19 to .39 for the American sample and .13 to .65 for the Singaporean sample). By controlling the effects of the other three values on the outcome measures when a given value was examined, the results can potentially speak to the incremental validity of that value beyond the effect of other values. However, we want to note two things with regard to this procedure. First, controlling for other value covariates may result in the relatively small effect sizes observed in the present study (see Wang et al., 2021). Second and more importantly, the relationship between a given value and environmental engagements could change from examining only their bivariate correlations to regressing environmental engagements on that value with other value covariates controlled. This occurs because regressions have controlled some shared variances between different values. We want to acknowledge that the current results should be interpreted by noting that regression analyses including intercorrelated covariates may increase Type I errors (see Sanderson et al., 2019). With a much larger sample size, future research can consider taking the Structural Equation Modeling approach instead of the regression approach to account for measurement errors and to detect unique incremental effects with greater confidence (Westfall & Yarkoni, 2016).

For the analyses reported below, we excluded responses indicating climate change skepticism in the analyses. Nevertheless, findings remained mostly consistent with the inclusion of climate change skeptics.[7] To recall, the analyses with biospheric values were confirmatory tests based on the hypotheses specified in the introduction and those with egoistic values were primarily exploratory tests. Also, although we only predicted the mediated cultural moderation hypothesis for perceived biospheric group values, we proceeded to test this full

[7] We also repeated the analyses by including the participants who indicated climate change skepticism. The findings remained mostly consistent, except for some slight discrepancies. a. There was a significant interaction between culture and personal biospheric values to predict policy support ($b = -0.054$, $SE = 0.025$, $p = .029$), which was not significant when climate skeptical responses were excluded. Personal biospheric values more strongly predicted policy support among American participants ($b = 0.201$, $SE_{boot} = 0.016$, $p < .001$, 95% CI_{boot} [0.169, 0.233]) than among Singaporean participants ($b = 0.147$, $SE_{boot} = 0.021$, $p < .001$, 95% CI_{boot} [0.105, 0.188]). Nevertheless, collectivistic orientation did not interact with personal biospheric values to predict policy support ($b = 0.020$, $SE = 0.016$, $p = .219$). b. Perceived biospheric group values negatively and significantly (vs. marginally) predicted public-sphere behavioral intentions at low levels of collectivistic orientation ($b = -0.063$, $SE_{boot} = 0.027$, $p = .023$, 95% CI_{boot} [-0.117, −0.009]). c. Results still provided support for mediated moderation for perceived biospheric group values and public-sphere behavioral intentions. By including the interaction between collectivistic orientation and perceived biospheric group values, the interaction between culture and perceived biospheric group values remained significant but its magnitude did decrease ($b = 0.067$, $SE = 0.033$, $p = .041$). d. The interaction between culture and personal egoistic values did not significantly predict policy support ($b = 0.049$, $SE = 0.028$, $p = .081$), which was significant when climate skeptical responses were excluded. e. We observed stronger evidence of mediated moderation for perceived egoistic group values and policy support. After entering the interaction term between collectivistic orientation and perceived egoistic group values in the model, the magnitude of the interaction between culture and perceived egoistic group values did not only decrease but also became non-significant ($b = 0.047$, $SE = 0.029$, $p = .110$).

Table 2
Correlations between all focal variables in the model. Statistics below the diagonal are for the American sample ($N = 469$); statistics above the diagonal are for the Singaporean sample ($N = 410$).

Variable	1	2	3	4	5	6	7	8	9
1. Collectivistic Orientation	–	.48***	.40***	.38***	.46***	.47***	.50***	.37***	.03
2. Personal Egoistic Values	.39***	–	.32***	.65***	.42***	.52***	.31***	.31***	.06
3. Personal Biospheric Values	.32***	.04	–	.29***	.56***	.40***	.53***	.40***	.16**
4. Perceived Egoistic Group Values	.12*	.36***	.17***	–	.13**	.35***	.23***	.40***	.03
5. Perceived Biospheric Group Values	.42***	.39***	.36***	-.19***	–	.40***	.40***	.20***	.08
6. Public Pro-environmental Behavioral Intentions	.35***	.15**	.52***	.15***	.22***	–	.50***	.38***	.20***
7. Private Pro-environmental Behavioral Intentions	.37***	.09*	.52***	.14**	.26***	.65***	–	.44***	.22***
8. Support for Pro-environmental Policies	.19***	-.02	.43***	.18***	.04	.54***	.50***	–	.10*
9. Environmental Volunteerism Intentions	.05	-.06	.34***	.04	.006	.37***	.29***	.30***	–

Note. $^{*}p < .05$; $^{**}p < .01$; $^{***}p \leq .001$. Correlations for public and private behavioral intentions are based on pairwise omission of missing values.

mediated moderation model for the other three values as part of the exploratory analyses. In the next section, we report the confirmatory analyses on biospheric values before reporting the exploratory ones on egoistic values.

2.3.2. Personal biospheric values and environmental engagements

To recap, we hypothesized that personal biospheric values would positively predict environmental engagements (Hypothesis 1). Although we did not hypothesize a moderation of personal biospheric values by culture, we tested the mediated moderation models for exploratory purposes. We conducted regression analyses on the relationship between personal biospheric values and environmental engagements while including all other values as covariates.

First, in support of Hypothesis 1, results indicated that personal biospheric values were positively associated with all environmental engagement measures: public-sphere behavioral intentions ($b = 0.296$, $SE = 0.027$, $p < .001$), private-sphere behavioral intentions ($b = 0.214$, $SE = 0.019$, $p < .001$), policy support ($b = 0.183$, $SE = 0.017$, $p < .001$), and environmental volunteerism ($b = 1.642$, $SE = 0.196$, $p < .001$).

Results revealed that culture significantly moderated the positive associations between personal biospheric values and public-sphere behavioral intentions ($b = -0.087$, $SE = 0.039$, $p = .024$; Fig. 2a) and environmental volunteerism ($b = -0.683$, $SE = 0.280$, $p = .015$; Fig. 2b), but not private-sphere behavioral intentions ($b = -0.006$, $SE = 0.027$, $p = .839$) and policy support ($b = -0.036$, $SE = 0.025$, $p = .146$). Personal biospheric values more strongly predicted public-sphere behavioral intentions and environmental volunteerism among American participants ($b = 0.296$, $SE_{boot} = 0.027$, $p < .001$, 95% CI_{boot} [0.244, 0.349] and $b = 1.642$, $SE_{boot} = 0.196$, $p < .001$, 95% CI_{boot} [1.257, 2.026], respectively) than among Singaporean participants ($b = 0.209$, $SE_{boot} = 0.033$, $p < .001$, 95% CI_{boot} [0.145, 0.273] and $b = 0.959$, $SE_{boot} = 0.236$, $p < .001$, 95% CI_{boot} [0.495, 1.423], respectively; see Table 3).

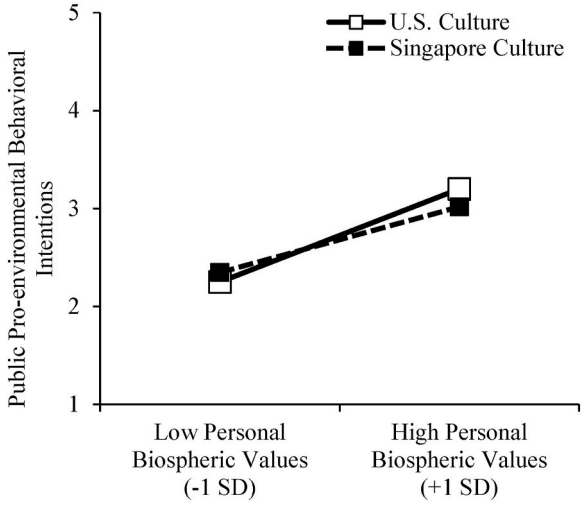

Fig. 2a. Public pro-environmental behavioral intentions as a function of culture and personal biospheric values.

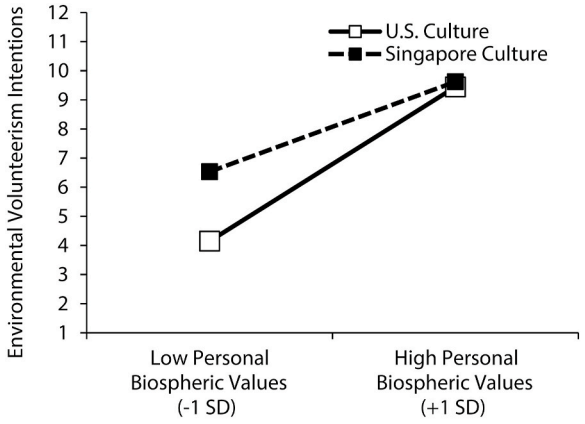

Fig. 2b. Environmental volunteerism intentions as a function of culture and personal biospheric values.

Following up on these significant interactions, we examined whether collectivistic orientation similarly moderated these relationships; see Table S1). Results indicated that collectivistic orientation did not significantly interact with personal biospheric values to predict public-sphere behavioral intentions ($b = 0.033$, $SE = 0.025$, $p = .194$) or environmental volunteerism ($b = -0.244$, $SE = 0.191$, $p = .202$). Hence, collectivistic orientation did not explain the cultural difference in the beneficial role of personal biospheric values in motivating intentions for public-sphere behaviors and environmental volunteerism.

Interim Summary. To summarize, there was a positive association between personal biospheric values and people's intentions for all environmental engagement measures. We found cultural differences in the value-engagement link for public pro-environmental behaviors and environmental volunteerism, with personal biospheric values more strongly encouraging these two forms of environmental engagement among American (vs. Singaporean) participants. However, these cultural differences were not explained by the extent that people hold a collectivistic orientation.

2.3.3. Perceived biospheric group values and environmental engagements

For perceived biospheric group values, we hypothesized a positive

Table 3
Multiple regression analysis for interaction between personal biospheric values and culture on environmental engagement outcomes.

	Outcome: Public PEBs	Outcome: Private PEBs	Outcome: Policy Support	Outcome: EV Intentions
Constant	2.724***	3.604***	3.557***	6.794***
	(0.042)	(0.030)	(0.028)	(0.310)
Personal Biospheric Values	0.296***	0.214***	0.183***	1.642***
	(0.027)	(0.019)	(0.017)	(0.196)
Culture (0 = U.S., 1 = Singapore)	−0.043	0.113*	0.096*	1.281**
	(0.064)	(0.045)	(0.042)	(0.471)
Personal Biospheric Values × Culture	−0.087*	−0.006	−0.036	−0.683*
	(0.039)	(0.027)	(0.025)	(0.280)
Personal Egoistic Values	0.162***	0.025	0.000	0.121
	(0.028)	(0.020)	(0.018)	(0.205)
Perceived Egoistic Group Values	0.043	0.036	0.084***	−0.265
	(0.028)	(0.020)	(0.018)	(0.207)
Perceived Biospheric Group Values	0.026	0.042**	−0.025	−0.416**
	(0.022)	(0.015)	(0.014)	(0.159)
R^2	0.287	0.295	0.216	0.089
F	58.011***	60.853***	40.041***	14.190***

Notes. PEBs = pro-environmental behavioral intentions, EV = environmental volunteerism. Standard errors are presented in parentheses. *$p < .05$; **$p < .01$; ***$p \leq .001$.

association with environmental engagements (Hypothesis 2; preregistered) and that culture would strengthen the positive associations via collectivistic orientation (Hypothesis 3; preregistered). Unexpectedly, perceived biospheric group values negatively predicted environmental volunteerism ($b = -0.477$, $SE = 0.191$, $p = .013$). Perceived biospheric group values also did not predict public-sphere ($b = -0.007$, $SE = 0.026$, $p = .792$) and private-sphere behavioral intentions ($b = 0.034$, $SE = 0.018$, $p = .065$), nor support for pro-environmental policies ($b = -0.027$, $SE = 0.017$, $p = .117$). Hence, Hypotheses 2 and 3 were not supported.

Results revealed that culture significantly moderated the association between perceived biospheric group values and public-sphere behavioral intentions ($b = 0.070$, $SE = 0.034$, $p = .037$; Fig. 3). However, this interaction did not emerge for private-sphere behavioral intentions ($b = 0.018$, $SE = 0.024$, $p = .456$), policy support ($b = 0.001$, $SE = 0.022$, $p = .979$), and environmental volunteerism ($b = 0.082$, $SE = 0.246$, $p = .739$). Perceived biospheric group values positively predicted public-sphere behavioral intentions among Singaporean participants ($b = 0.063$, $SE_{boot} = 0.029$, $p = .030$, 95% CI_{boot} [0.006, 0.120]) but not American participants ($b = -0.007$, $SE_{boot} = 0.026$, $p = .792$, 95% CI_{boot} [−0.058, 0.044]; see Table S2).

Next, we proceeded to test whether collectivistic orientation similarly moderated the association between perceived biospheric group values and public-sphere behavioral intentions. Results confirmed an interaction effect, $b = 0.064$, $SE = 0.024$, $p = .007$ (Fig. 4, see Table S3). Perceived biospheric group values negatively (albeit marginally) predicted public-sphere behavioral intentions at low levels of collectivistic orientation (−1 *SD;* $b = -0.055$, $SE = 0.028$, $p = .051$, 95% CI_{boot} [−0.109, 0.000]), but not at moderate ($b = -0.012$, $SE = 0.022$, $p = .573$, 95% CI_{boot} [−0.055, 0.031]) and high levels of collectivistic orientation (+1 *SD;* $b = 0.030$, $SE = 0.026$, $p = .246$, 95% CI_{boot} [−0.021, 0.080]). Thus, there was a trend that perceived biospheric group values had a negative impact on public-sphere behavioral intentions for those endorsing lower collectivistic orientation, but not for those endorsing higher collectivistic orientation.

Lastly, we examined whether culture moderated the association between perceived biospheric group values and public-sphere behavioral intentions via collectivistic orientation (see Table 4). The mediated moderation was significant ($b = 0.008$, $SE = 0.004$, 95% CI_{boot} [0.002, 0.019]). Culture predicted collectivistic orientation, with Singaporeans holding a stronger collectivistic orientation than Americans. Collectivistic orientation interacted with perceived biospheric group values to predict public-sphere behavioral intentions ($b = 0.059$, $SE = 0.024$, $p = .014$). Specifically, perceived biospheric group values had a trend to negatively predict public-sphere behavioral intentions at lower levels of collectivistic orientation ($p = .055$), but not at higher levels of collectivistic orientation ($p = .238$). Importantly, after entering the interaction between collectivistic orientation and perceived biospheric group values in the model, the original interaction between culture and perceived biospheric group values was no longer significant ($b = 0.064$, $SE = 0.033$, $p = .053$).

Interim Summary. Overall, the findings suggest that through holding a stronger collectivistic orientation, Singaporean participants perceiving stronger biospheric group values in the society did not lower their public-sphere pro-environmental behavioral intentions as their American counterparts did. Although the negative relationship between biospheric group values and environmental engagements did not support the hypothesized (positive) relationship, the findings are somewhat compatible with the expectation that perceiving stronger biospheric group norms does not harm environmental engagements when people hold higher (vs. lower) levels of collectivistic orientation.

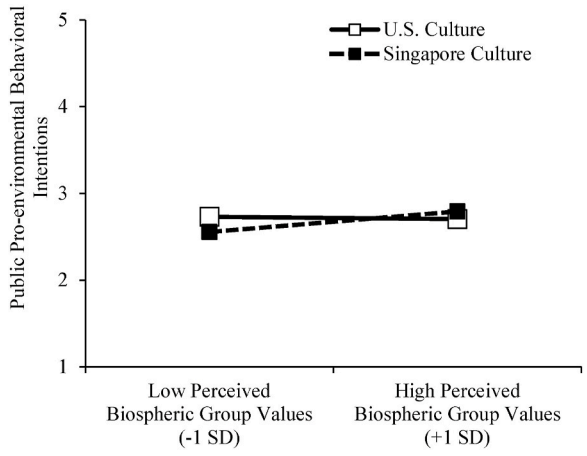

Fig. 3. Public pro-environmental behavioral intentions as a function of culture and perceived biospheric group values.

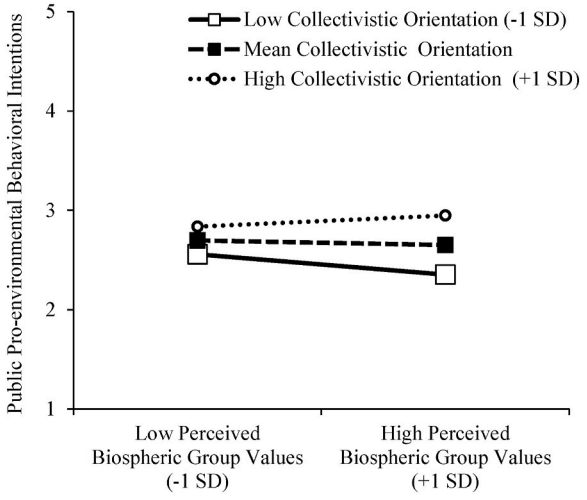

Fig. 4. Public pro-environmental behavioral intentions as a function of collectivistic orientation and perceived biospheric group values.

Table 4
Summary of the separate multiple regression analyses for the mediated moderation model for perceived biospheric group values and environmental engagement outcomes.

	Outcome: Public PEBs	
	Collectivistic Orientation	Public PEBs
Constant	−0.065* (0.030)	2.684*** (0.044)
Culture (0 = U.S., 1 = Singapore)	0.139** (0.044)	−0.040 (0.063)
Collectivistic Orientation		0.334*** (0.054)
Perceived Biospheric Group Values		−0.039 (0.026)
Perceived Biospheric Group Values × Collectivistic Orientation		0.059* (0.024)
Perceived Biospheric Group Values × Culture		0.064 (0.033)
Personal Egoistic Values		0.123*** (0.028)
Personal Biospheric Values		0.237*** (0.022)
Perceived Egoistic Group Values		0.009 (0.029)
R^2	0.011	0.319
F	9.881**	50.450***

Notes. PEBs = pro-environmental behavioral intentions. Standard errors are presented in parentheses. *$p < .05$; **$p < .01$; ***$p \leq .001$.

2.3.4. Personal egoistic values and environmental engagements

Recall that we did not have specific hypotheses for personal egoistic values (both main effect and interaction effect with culture). However, to explore how the variables were related, we still tested the mediated cultural moderation models with personal egoistic values as the predictor, while controlling for other values. For brevity of reports, we mainly presented the full mediated moderation results and referred readers to the tables and figures for the personal egoistic values × culture and personal egoistic values × collectivistic orientation interaction analyses.

Results indicated that personal egoistic values were positively associated with public-sphere behavioral intentions ($b = 0.071$, $SE = 0.033$, $p = .030$), but not with private-sphere behavioral intentions ($b = 0.008$, $SE = 0.023$, $p = .722$), policy support ($b = -0.027$, $SE = 0.021$, $p = .203$), and environmental volunteerism ($b = -0.022$, $SE = 0.241$, $p = .929$). As both culture (Fig. 5a and b; Table S4) and collectivistic orientation (Fig. 6a and b; Table S5) independently and similarly moderated the relationships between personal egoistic values and public-sphere behavioral intentions and policy support, we tested whether collectivistic orientation mediated the moderating effects of culture (Table 5). The mediated moderation effects were significant (public-sphere behaviors: $b = 0.013$, $SE = 0.006$, 95% CI_{boot} [0.005, 0.027]; policy support: $b = 0.010$, $SE = 0.004$, 95% CI_{boot} [0.003, 0.020]). Culture predicted collectivistic orientation, with Singaporeans (vs. Americans) holding a stronger collectivistic orientation ($ps < .01$). Collectivistic orientation, in turn, moderated the relationship between personal egoistic values and public-sphere behavioral intentions ($b = 0.097$, $SE = 0.028$, $p < .001$) and policy support ($b = 0.074$, $SE = 0.018$, $p < .001$). The simple slopes probing the interactions revealed that personal egoistic values did not predict public behavioral intentions and

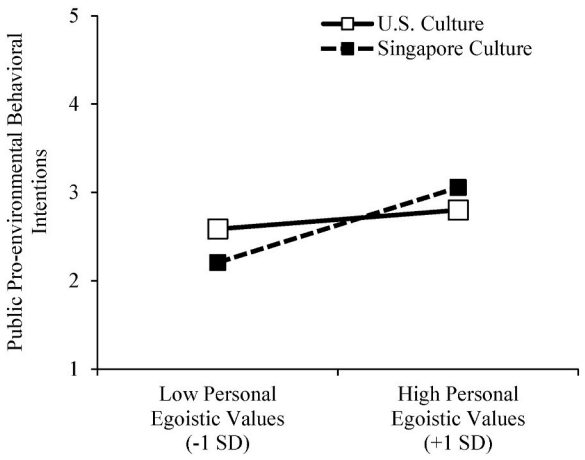

Fig. 5a. Public pro-environmental behavioral intentions as a function of culture and personal egoistic values.

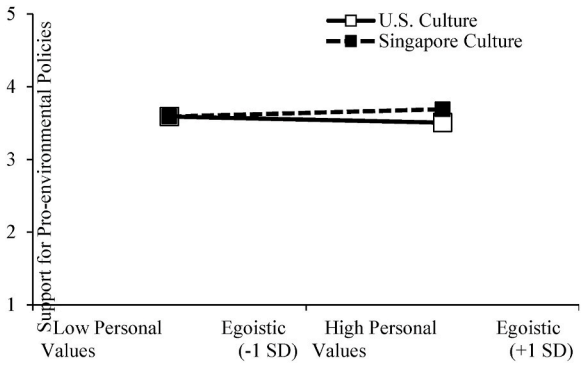

Fig. 5b. Pro-environmental policy support as a function of culture and personal egoistic values.

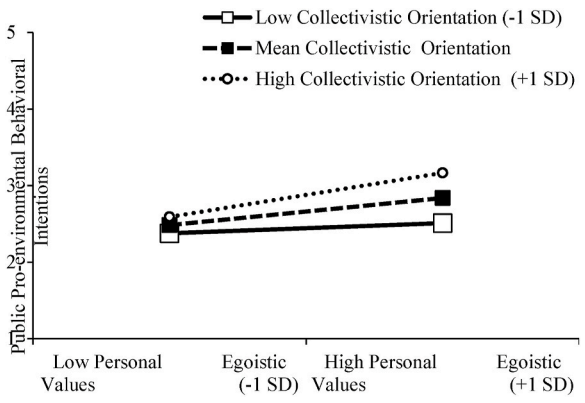

Fig. 6a. Public pro-environmental behavioral intentions as a function of collectivistic orientation and personal egoistic values.

reduced policy support at lower levels of collectivistic orientation. At higher levels of collectivistic orientation, personal egoistic values were positively associated with public behavioral intentions and policy support (but the positive association with policy support did not reach statistical significance, $p = .146$). Notably, after entering collectivistic orientation in the model, the original interaction between culture and personal egoistic values on policy support became non-significant ($b = 0.049$, $SE = 0.027$, $p = .070$) and the magnitude of this original interaction on public behavioral intentions ($b = 0.194$, $SE = 0.041$, $p < .001$) decreased (i.e., 0.194 vs. 0.211). Overall, collectivistic orientation

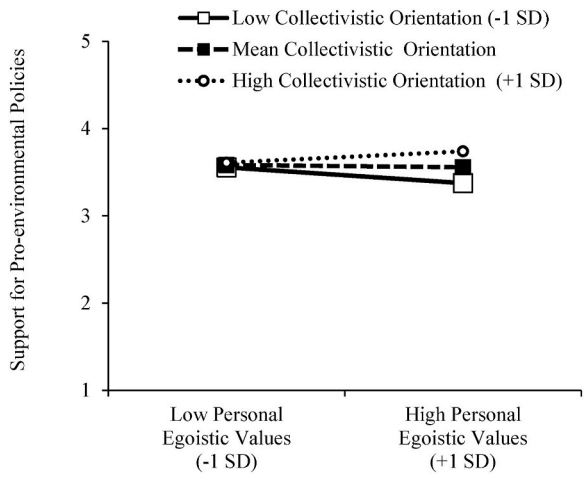

Fig. 6b. Pro-environmental policy support as a function of collectivistic orientation and personal egoistic values.

Table 5
Summary of the separate multiple regression analyses for the mediated moderation model for personal egoistic values and environmental engagement outcomes.

	Outcome: Public PEBs		Outcome: Policy Support	
	Collectivistic Orientation	Public PEBs	Collectivistic Orientation	Policy Support
Constant	−0.065*	2.656***	−0.062*	3.520***
	(0.030)	(0.043)	(0.030)	(0.028)
Culture (0 = U.S., 1 = Singapore)	0.139**	−0.063	0.134**	0.090*
	(0.044)	(0.062)	(0.044)	(0.041)
Collectivistic Orientation		0.330***		0.159***
		(0.053)		(0.035)
Personal Egoistic Values		0.042		−0.039
		(0.032)		(0.021)
Personal Egoistic Values × Collectivistic Orientation		0.097***		0.074***
		(0.028)		(0.018)
Personal Egoistic Values × Culture		0.194***		0.049
		(0.041)		(0.027)
Personal Biospheric Values		0.228***		0.154***
		(0.022)		(0.014)
Perceived Egoistic Group Values		−0.001		0.063***
		(0.028)		(0.018)
Perceived Biospheric Group Values		−0.015		−0.046***
		(0.022)		(0.014)
R^2	0.011	0.340	0.010	0.249
F	9.881**	55.529***	9.160**	35.988***

Notes. PEBs = pro-environmental behavioral intentions. Standard errors are presented in parentheses. *$p < .05$; **$p < .01$; ***$p \leq .001$.

mediated (explained) the moderating effects of culture on the relationships between personal egoistic values and these two forms of environmental engagement (policy support and public-sphere behaviors).

Interim Summary. Together, the results indicated that the more people adopt personal egoistic values, the more likely they intend to perform public pro-environmental behaviors. However, this positive relationship was not observed for private pro-environmental behavioral intentions, policy support, and intended volunteerism for environmental causes; if anything, their relationship (except for private behavioral intentions) with personal egoistic values was negative (albeit not significant). As discussed, the existing literature reveals an inconclusive relationship between egoistic values and pro-environmental actions. The current findings add to the literature by suggesting that whether egoistic values benefit or hamper pro-environmentalism may depend on the nature of pro-environmental actions in question. It is reasonable to argue that egoistic values are more likely to motivate public (vs. private) pro-environmental behaviors (e.g., posting pro-environmental messages on social media) because performing such behaviors publicly may also benefit the self in certain ways (e.g., positive self-presentation, impression management). Even if performing these visible behaviors incurs costs, such behaviors can also bring about benefits by signaling people's desirable qualities and accessibility to resources (e.g., cooperativeness, social status; Barclay & Barker, 2020; Braun Kohlová & Urban, 2020). In addition, such public display of environmental actions tends to be more motivationally appealing to individuals with a stronger collectivistic orientation who are more likely to regard social valuations more highly. This point is evident in the current finding that personal egoistic values encouraged public pro-environmental behaviors more strongly among Singaporean (vs. American) participants and this cultural difference was explained by Singaporeans' higher collectivistic orientation.

2.3.5. *Perceived egoistic group values and environmental engagements*

Similar to personal egoistic values, we did not have specific hypotheses for perceived egoistic group values and we conducted exploratory tests. Again, we reported the mediated moderation results below and referred readers to the tables and figures for the full analyses.

Perceived egoistic group values were positively associated with policy support ($b = 0.050$, $SE = 0.022$, $p = .027$), but not public- ($b = -0.001$, $SE = 0.035$, $p = .986$) and private-sphere behavioral intentions ($b = 0.034$, $SE = 0.024$, $p = .169$) and environmental volunteerism ($b = -0.267$, $SE = 0.255$, $p = .296$). As both culture (Fig. 7a and b; Table S6) and collectivistic orientation (Fig. 8a and b; Table S7) independently and similarly moderated the relationships between perceived egoistic group values and public-sphere behavioral intentions and policy support, we tested whether collectivistic orientation mediated the moderating effects of culture. The mediated moderation effects (Table 6) were significant (public-sphere behaviors: $b = 0.014$, $SE = 0.006$, 95% CI_{boot} [0.004, 0.028]; policy support: $b = 0.008$, $SE = 0.004$, 95% CI_{boot} [0.002, 0.017]). Singaporeans endorsed a stronger collectivistic orientation than did Americans. In turn, collectivistic orientation moderated

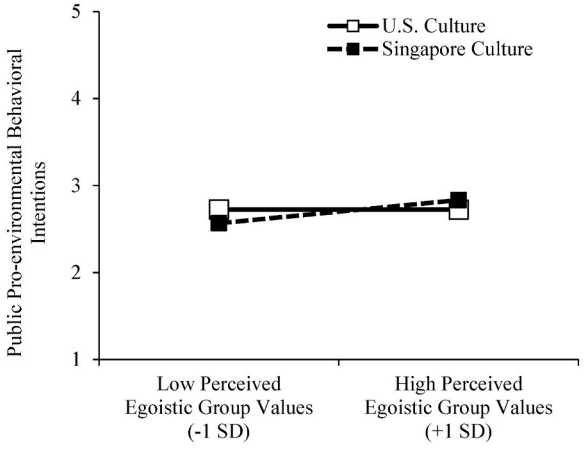

Fig. 7a. Public pro-environmental behavioral intentions as a function of culture and perceived egoistic group values.

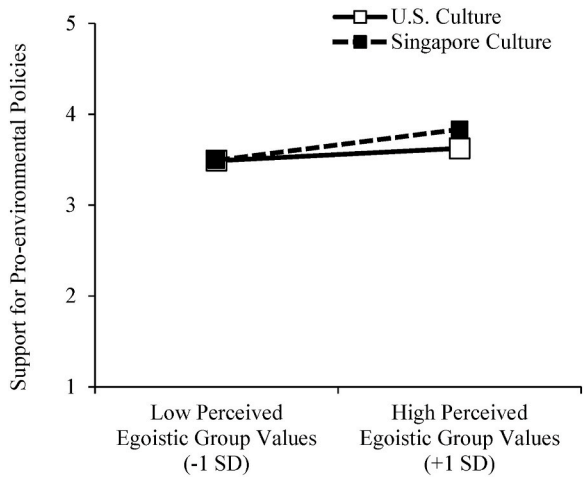

Fig. 7b. Pro-environmental policy support as a function of culture and perceived egoistic group values.

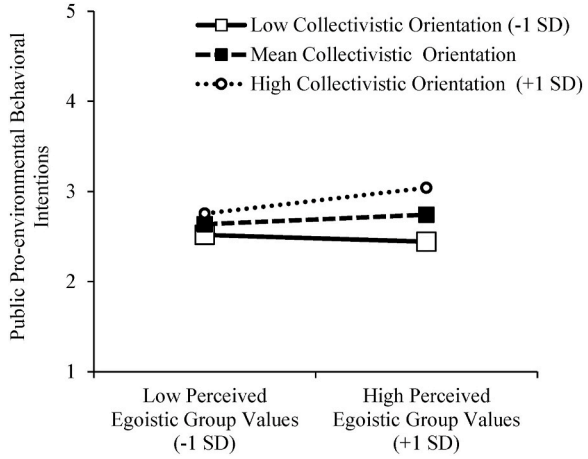

Fig. 8a. Public pro-environmental behavioral intentions as a function of collectivistic orientation and perceived egoistic group values.

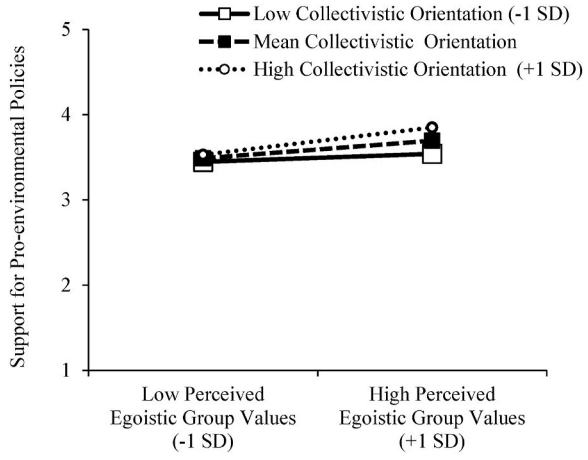

Fig. 8b. Pro-environmental policy support as a function of collectivistic orientation and perceived egoistic group values.

the relationships between perceived egoistic group values and public-sphere behavioral intentions ($b = 0.097$, $SE = 0.032$, $p = .002$) and policy support ($b = 0.058$, $SE = 0.021$, $p = .006$). Among participants who hold a stronger (but not weaker) collectivistic orientation, perceiving egoistic group values positively predicted their public-sphere behavioral intentions and policy support. Of import, after including the interaction between collectivistic orientation and perceived egoistic group values, the original interaction between culture and perceived egoistic group values on public-sphere behavioral intentions ($b = 0.075$, $SE = 0.045$, $p = .091$) became non-significant and the magnitude of this original interaction on policy support ($b = 0.064$, $SE = 0.029$, $p = .027$) decreased (i.e., 0.064 vs. 0.075).

Table 6
Summary of the separate multiple regression analyses for the mediated moderation model for perceived egoistic group values and environmental engagement outcomes.

	Outcome: Public PEBs		Outcome: Policy Support	
	Collectivistic Orientation	Public PEBs	Collectivistic Orientation	Policy Support
Constant	−0.065*	2.707***	−0.062*	3.547***
	(0.030)	(0.042)	(0.030)	(0.027)
Culture (0 = U.S., 1 = Singapore)	0.139**	−0.031	0.134**	0.102*
	(0.044)	(0.063)	(0.044)	(0.041)
Collectivistic Orientation		0.315***		0.147***
		(0.054)		(0.035)
Perceived Egoistic Group Values		0.003		0.053*
		(0.034)		(0.022)
Perceived Egoistic Group Values × Collectivistic Orientation		0.097**		0.058**
		(0.032)		(0.021)
Perceived Egoistic Group Values × Culture		0.075		0.064*
		(0.045)		(0.029)
Personal Egoistic Values		0.109***		−0.028
		(0.028)		(0.018)
Personal Biospheric Values		0.244***		0.160***
		(0.022)		(0.015)
Perceived Biospheric Group Values		−0.019		−0.048***
		(0.022)		(0.014)
R^2	0.011	0.320	0.010	0.242
F	9.881**	50.839***	9.160**	34.666***

Notes. PEBs = pro-environmental behavioral intentions. Standard errors are presented in parentheses. *$p < .05$; **$p < .01$; ***$p \leq .001$.

Interim Summary. To sum up, the findings showed a positive association between perceived egoistic group values and policy support. Also, collectivistic orientation strengthened the positive relationships between perceived egoistic group values and public-sphere behavioral intentions and policy support. Through holding a stronger collectivistic orientation, Singaporean (vs. American) participants who perceived higher levels of egoistic group values showed more public-sphere behavioral intentions and policy support.

3. General discussion

The present findings enrich existing research on the roles of egoistic and biospheric values in motivating environmental engagements. Specifically, it sheds new light on the impacts of personal value endorsements and perceptions of group values prevalent in the society on environmental engagements via culturally shaped collectivistic orientation across a Western (American) sample and an Asian (Singaporean) sample. As predicted, Singaporean participants showed higher levels of collectivistic orientation than did American participants. The key

findings of the current research can be summarized as follows.

1. Confirming Hypothesis 1, personal biospheric values motivate all environmental engagement measures. Culture plays a moderating role in that personal biospheric values more strongly predict public-sphere behavioral intentions and environmental volunteerism among Americans than among Singaporeans. However, these cultural differences are not explained by collectivistic orientation.
2. Not supporting Hypothesis 2, perceived biospheric group values discourage environmental volunteerism and are not associated with other environmental engagement measures. Interestingly, there was a trend that culturally shaped collectivistic orientation attenuates biospheric group values' negative relationship with public pro-environmental behavioral intentions. This is somewhat compatible with Hypothesis 3 that higher levels of collectivistic orientation pose a less harmful impact on environmental engagements (albeit not a beneficial impact).
3. Personal egoistic values encourage public pro-environmental behavioral intentions, and such a positive link is more pronounced among Singaporeans than Americans and emerges only under higher levels of collectivistic orientation. Also, personal egoistic values encourage policy support under higher levels of collectivistic orientation, but discourage policy support under lower levels of collectivistic orientation. Collectivistic orientation can explain the observed U.S.-Singapore difference in the relationships between personal egoistic values and these environmental engagement measures.
4. Perceived egoistic group values encourage pro-environmental policy support and this is more so among Singaporeans than Americans. Also, perceived egoistic group values positively predicted public behavioral intentions among Singaporeans, but not Americans. Moreover, these cultural differences are explained by collectivistic orientation.

In this light, these findings offer preliminary support that perceiving either strong egoistic or biospheric group values in the society may bring about pro-environmental benefits or mitigate pro-environmental harms when people hold a stronger than weaker collectivistic orientation. Notably, due to the exploratory nature regarding personal and perceived egoistic group values, as well as the role of values in different domains of environmental engagement, the corresponding findings should be interpreted with caution. As we also foresaw by including a wider array of pro-environmental outcome measures, there were differences in effects depending on which environmental engagement outcomes were tested. We discuss these findings by drawing on prior works to offer some plausible explanations.

Another cautionary note about interpreting the findings pertains to the observed associations between perceived biospheric group values and environmental engagements. Zero-order correlations suggested that perceived biospheric group values are positively associated with some of the environmental engagements (e.g., public and private behavioral intentions) in both country samples. Yet, when controlling for other values (e.g., personal biospheric values), regression analyses showed that perceived biospheric group values are either negatively or not associated with environmental engagements.

Given these findings, we acknowledge that there might be alternative interpretations. For instance, a mediation interpretation (see Baron & Kenny, 1986) may suggest that personal biospheric values can serve as a mediator in the relationship between perceived biospheric group values and environmental engagements. This interpretation would mean that a mediation analysis may show (a) a negative or null direct effect (i.e., the effect of biospheric group values on environmental engagements that is not explained by personal biospheric values after controlling for it) as observed in the current regression analyses, (b) a positive indirect effect (i.e., the effect of biospheric group values on environmental engagements via strengthening personal biospheric values), and (c) a positive total effect (i.e., the sum of the indirect and direct effects where the positive indirect effect is larger in magnitude than the negative or null direct effect). Together, this may explain why the zero-order correlations that capture the overall total effects showed a positive relationship between perceived biospheric group values and some environmental engagements, but the regression analyses (after controlling for other values) showed a negative or null relationship.

Although we see some merit in this alternative interpretation, we want to add two points. First, we tested the relationships between a given value and environmental engagements while controlling for all other values. Therefore, whereas it is theoretically reasonable that biospheric group values may impact environmental engagements via personal biospheric values, it is theoretically unclear how personal egoistic values and perceived egoistic group values act as mediators in the link between biospheric group values and environmental engagements. In other words, we do not have a strong theoretical basis for the mediation explanation when different values are considered as mediators. Second, the measurement order of personal values and perceived group values was randomized. Given this study procedure (i.e., a randomized order), evidence is not strong to support that mediation inferences can account for the observed findings (Baron & Kenny, 1986; MacKinnon, Cheong, & Pirlott, 2012).

The current findings hold promise for providing incremental knowledge on the understudied relationships between personal and perceived group values and environmental engagements across cultures. Nevertheless, we want to emphasize that future research is clearly needed for bringing further insights to the rich findings observed in the current study and confirming their replicability.

3.1. Theoretical insights from present findings

3.1.1. Personal biospheric values and environmental engagements

Confirming Hypothesis 1, personal biospheric values motivate all measures of environmental engagement examined in the current research. These results corroborate the extant literature supporting strong positive associations between personal biospheric concerns and pro-environmental tendencies (Steg, 2016; Steg & De Groot, 2012). Moreover, the current research revealed that the benefit of personal biospheric values on public behavioral intentions and environmental volunteerism was greater among Americans than Singaporeans. This finding appears to be largely consistent with a prior research showing that personal environmental concern was less predictive of environmentally friendly consumer choices in collectivistic cultures as compared to individualistic cultures (Eom et al., 2016). It is because collectivistic cultures generally place relatively lower importance on expressing personally held orientations and beliefs (vs. adhering to societal norms), and therefore these internal attributes predict behaviors less well.

Then the question is: Why was this cultural difference only observed for intentions for public pro-environmental behaviors and volunteerism? As public-sphere behaviors and environmental volunteerism are more visible displays of environmental engagement, we suspect that these more visible engagements are more susceptible to the influence of social norms than to the influence of people's personal biospheric beliefs and concerns in collectivistic cultures. It is because it is easier for people to discern social norms for visible, public behaviors than for private ones. Hence, this suggests an interesting avenue for future research to examine whether personal values versus social norms would differentially predict visible and less visible forms of environmental engagement across cultures.

3.1.2. Perceived biospheric group values and environmental engagements

In contrast with Hypothesis 2, perceived biospheric group values negatively predicted hours of environmental volunteerism and did not predict the other three environmental engagement measures. In addition, perceived biospheric group values interacted with culturally

shaped collectivistic orientation to discourage intentions for public-sphere behaviors at low levels but not at higher levels of collectivistic orientation.

To make sense of these findings, we drew on the literature on the free-rider effect (Heitzig, Lessmann, & Zou, 2011). The free-rider literature alludes to how a perceived pro-environmental norm can discourage pro-environmental behaviors as people may perceive that they can benefit or free-ride from the successful outcomes of collective pro-environmental actions by others, whether or not they personally contributed to these outcomes (Lubell, Vedlitz, Zahran, & Alston, 2006). People may infer from a biospheric group value (a positive norm) that many others are doing their part to tackle environmental problems, seeing efforts of others as sufficient and their own individual actions as having little additional impact. Hence, a perceived biospheric group norm may signal the opportunity for people to free-ride on the efforts of others, thus deterring their own intentions to take pro-environmental actions.

For people with a weaker collectivistic orientation and less concern with enacting collectivistic practices, when they perceive that the society shares a biospheric value, the decision to free-ride on others' efforts seems rational. However, for those with a stronger collectivistic orientation and value collective goals and harmony, perceiving a widespread biospheric value in the society does not necessarily motivate them to free-ride on the presumed pro-environmental efforts of others. Hence, this may explain the current finding that perceived biospheric group values did not negatively predict public-sphere behaviors at higher levels of collectivistic orientation.

As discussed in the introduction, a recent research found that when people perceive their group (other Americans or people in their political party) to prioritize biospheric values more strongly, they felt more morally obligated to behave pro-environmentally, showed higher willingness to save energy for the environment, and reported greater efforts to engage in energy saving behaviors (Bouman, Steg, & Zawadzki, 2020). Similarly, another recent study showed that people's perception of their group (other fellow students) prioritizing biospheric values was positively associated with their general pro-environmental behavioral tendency (Wang et al., 2021). These results appear to contradict the current findings that perceived biospheric group values either do not predict or negatively predict different measures of environmental engagement. One apparent distinction between the present research and these two studies lies in the nature of the environmental engagement outcomes. Bouman, Steg, et al.'s (2020) engagement measures focused on felt pro-environmental obligation in the specific domain of energy saving, whereas Wang et al.'s (2021) measure focused on the general tendency to engage in pro-environmental behaviors. In contrast to these two studies, our research captured a wider array of environmental engagements. As existing empirical research on perceived group values is scant, more research is needed to explain this discrepancy.

3.1.3. Personal egoistic values and environmental engagements

The current research provides precursory support that personal egoistic values can motivate intention for public-sphere pro-environmental behaviors. Although some prior findings showed a negative association between personal egoistic values and pro-environmental tendencies (Onel & Mukherjee, 2017; Steg, De Groot, Dreijerink, Abrahamse, & Siero, 2011, 2014), the current result is in line with other research recognizing that personal egoistic values do not necessarily hamper pro-environmentalism (De Dominicis et al., 2017); rather it can encourage public pro-environmental behaviors (Sloot et al., 2018).

Acting on personal egoistic values may encourage environmental engagements when personal benefits outweigh personal costs associated with these behaviors. When people's public images are relevant to the attainment of desired goals (e.g., social and material outcomes), they are motivated to regulate their image so that others would see them in a particular way (Leary & Kowalski, 1990). As such, engaging in public pro-environmental behaviors can be advantageous to help individuals display and maintain a positive image to others, thus serving egoistic goals (e.g., gaining reputation). Further, engaging in more costly forms of public pro-environmental behaviors can signal to others their desirable personal attributes and accessibility to resources (Uren, Roberts, Dzidic, & Leviston, 2021; Vesely & Klöckner, 2018), such as their social status and prosocial attitude (Braun Kohlová & Urban, 2020; Griskevicius et al., 2010), and cooperative intent (Barclay & Barker, 2020; Vesely, Klöckner, & Brick, 2020). These reputational benefits can advance egoistic motives. Engagement in highly visible pro-environmental actions can also achieve other egoistically motivated goals, such as social influence. For instance, one study found that personal egoistic values encouraged pro-environmental lobbying behaviors, which allow individuals to influence powerholders (e.g., governments, industries) to support their cause, by fulfilling their egoistic motives for social influence and ambition (Sloot et al., 2018). Compared to the visibility advantage of public-sphere behaviors, the self-benefits of private-sphere behaviors may be less substantial and largely limited to monetary savings. Taken together, personal egoistic values may motivate engagement in public pro-environmental behaviors more than private ones, which confer less visible prospective self-benefits.

The present results further showed that personal egoistic values promote public pro-environmental behaviors to a greater extent at higher levels of collectivistic orientation. The self-presentation interpretation can also be extended to appreciate this joint influence of personal egoistic values and collectivistic orientation on public-sphere behaviors. As collectivism emphasizes the importance of safeguarding social relationships and positive external valuations of the self (Triandis, 1995), maintaining a positive social image or avoiding a negative image is highly regarded (Lalwani, Shrum, & Chiu, 2009). Hence, individuals with a stronger collectivistic orientation who endorse egoistic values may better realize the strategic self-presentation benefits of engaging in public pro-environmental behaviors, thus showing a higher willingness to perform such behaviors.

Interestingly, we found personal egoistic values to encourage policy support at higher levels of collectivistic orientation but discourage policy support at lower levels of collectivistic orientation. To provide some speculations, we contend that similar to public behaviors, showing support for climate policies can serve self-image benefits particularly for more collectivistically oriented individuals. However, the current measure of policy support reflects a more passive role of the individuals as the policies concern taxes, subsidies, and regulations implemented by the state government (e.g., banning the sale of appliances that are not energy efficient, increasing tax on household electricity). It is likely that less collectivistically oriented individuals may value personal agency more. As these policies hinge heavily on the government or other legislative bodies' decisions, endorsing stronger personal egoistic values may lower policy support when these policies do not meet their agentic self-interested goals among less collectivistically oriented people.

3.1.4. Perceived egoistic group values and environmental engagements

The present findings offered preliminary evidence that perceiving egoistic values as more prevalent in the society predicted greater policy support. Also, perceived egoistic group values positively predicted intentions for public-sphere behaviors and policy support at higher levels but not lower levels of culturally shaped collectivistic orientation.

To shed light on these findings, we draw on the distinction between positive norms and negative norms (Bond, 1984; Hassell & Wyler, 2019). Positive descriptive norms inform people what others are doing, whereas negative descriptive norms inform people what others fail to do. In the pro-environmental realm, individuals may infer from positive norms that many people are working together to mitigate environmental problems and infer from negative norms that many people are failing to take action. Thus, perceiving egoistic values to be prevalent in the society is analogous to perceiving a negative norm, seeing others in the society to be more concerned with egocentric interests and so more can be done to promote environmental sustainability. As people with a

stronger collectivistic orientation tend to value collectivistic goals, perceiving widespread egoistic norms may propel them to protect and promote collective interests by taking pro-environmental actions. This may explain why culturally shaped collectivistic orientation strengthens the positive relationship between perceived egoistic group values and public-sphere behaviors and policy support.

Together, the current findings for both perceived egoistic and biospheric group values consistently demonstrate a potential reactance to group values (Brehm, 1966; Brehm & Brehm, 1981). Group values specify the goals and goal-congruent behaviors the society deems as important, which can threaten people's sense of autonomy when they adhere to the norms and relinquish their personal agency to act in a way that they personally deem as desirable. When group value perceptions evoke a reactance or contrast response, people may attempt to restore freedom and ease psychological tensions by acting in a manner that deviates from the (group) value-congruent behaviors (Miron & Brehm, 2006). This may provide another account for why the current research found that perceived egoistic group values could *encourage* environmental engagement (namely, policy support), whereas perceived biospheric group values could *discourage* environmental engagement (namely, environmental volunteerism). It is also worth noting that the present findings suggest a positive influence of collectivistic orientation on pro-environmental tendencies. While collectivistic orientation strengthens the benefit of perceived egoistic group values on environmental engagements, it attenuates the harm of perceived biospheric group values on environmental engagements.

3.2. Contributions to research on pro-environmental values

The present research advances knowledge in understanding the role of values in fostering pro-environmental tendencies. Theoretically, our results indicate the importance of distinguishing between one's personal values and perception of values that are important in the society. In this light, we found that both personal egoistic and biospheric values positively predict pro-environmental tendencies for some measures. Conversely, as perceived group values may evoke some form of reactance, egoistic group values can encourage but biospheric group values can discourage certain domains of environmental engagement.

By uncovering the nuances between values that people personally regard as important and values that people perceive the society regards as important across two cultures, the current research sheds fresh light on different types of values (personal and perceived group values) and their relationships with environmental engagements. The findings offer a novel perspective to reappraise the seemingly negative impact of egoistic values and the seemingly positive impact of biospheric values on motivating pro-environmental behaviors. It was revealed that personal egoistic values do not necessarily lead to lower environmental engagements. Instead, egoistic values may encourage more public-sphere pro-environmental actions, particularly when people embrace a stronger collectivistic orientation. Also interestingly, whereas we found a consistent pattern with the prior literature that personal biospheric values positively predict environmental engagements, the present results suggest that perceiving biospheric values to be important in the society can backfire. Together, personal egoistic values can either promote or hinder pro-environmental motivation depending on the pro-environmental domain in question. Also, what has been found about the positive relation between personal biospheric values and pro-environmentalism may not be directly translated into the relation between perceived biospheric group values and pro-environmentalism.

The current findings pertaining to group values also advance the psychological reactance literature. People experience an unpleasant arousal state (reactance) when they perceive a threat to or a loss of their freedom (Brehm & Brehm, 1981; Steindl, Jonas, Sittenthaler, Traut-Mattausch, & Greenberg, 2015). Such reactance response can explain the boomerang effect of social norm appeals, where using descriptive social norm messages as an intervention was found to lead to a decline in sustainable choices (Richter, Thøgersen, & Klöckner, 2018). Prior reactance research has largely demonstrated people's reactance to following the social norm governing a specific behavior. The current findings enrich the reactance literature by accentuating how reactance may also manifest in the form of lower engagement in (group) value-congruent behaviors when people perceive those values to be important in the society.

The current research not only responds to recent calls for examining group value perceptions (Bouman, Steg, & Zawadzki, 2020), but also unveils the importance of examining personal and group values in relation to individuals' collectivistic orientation across cultural contexts. In doing so, the present investigation sheds light on how the strength of value-engagement associations differs according to people's collectivistic orientation.

Notably, in the current research, it is evident that culturally shaped collectivistic orientation can operate as a moderator to promote pro-environmental engagements. For example, collectivistic orientation attenuated the negative influence of personal egoistic values and strengthened the positive influence of perceived egoistic group values on some environmental engagements (e.g., policy support), and weakened the negative influence of perceived biospheric group values on other environmental engagements (e.g., public-sphere behaviors). In that light, the results are consistent with existing studies supporting a positive relationship between collectivistic cultural orientations and pro-environmental tendencies (e.g., McCarty & Shrum, 2001; Xiang, Zhang, Geng, Zhou, & Wu, 2019). This further illuminates the pivotal role of collectivism in promoting pro-environmental and sustainable actions. A practical implication is that via encouraging a collectivistic orientation, people may be more driven to contribute their efforts to foster environmental sustainability and reduce their free-riding or social loafing tendencies for enhancing collective benefits.

3.3. Limitations and future directions

Our contributions should be interpreted in light of some limitations. The cross-sectional and correlational nature of our study precludes the possibility of making causal inferences. Although the direction of influence from values to environmental engagements is evident from previous research and makes the most theoretical sense, future experimental studies are needed to verify the causal influences of personal values and perceived group values on environmental engagements.

Another caveat of the present study is that the environmental engagement measures were self-reported. As we largely focused on people's intentions for engaging in pro-environmental actions, whether the influences of personal values and perceived group values translate into actual environmental engagements remain to be tested. Further, due to the susceptibility to social desirability responding, participants may over-report their pro-environmental intentions (Kormos & Gifford, 2014). To minimize this concern, we administered an honesty check at the end to encourage participants to disclose any dishonest responses, which would not jeopardize their research compensation. Another related potential methodological concern is common method variance (CMV). Although CMV may inflate bivariate correlations, many of our key findings involved interaction effects (interactions between values and collectivistic orientation, and between values and culture), which are not attributable to CMV (Chan, 2009; Cohen, Cohen, West, & Aiken, 2013; Siemsen, Roth, & Oliveira, 2010). Thus, our findings are unlikely to be an artifact of CMV alone. Nevertheless, future investigations would benefit from going beyond self-report measures and tapping on actual pro-environmental actions.

Being one of the early attempts to employ a cross-cultural approach to investigate the roles of personal values and perceived group values on pro-environmentalism, the study recruited community samples from only two cultures (the U.S., Singapore). Notwithstanding this caveat, we contend that the current research advances the agenda for cross-cultural environmental psychology (Eom et al., 2019; Tam et al., 2021; Tam &

Milfont, 2020). Our findings demonstrate how culture can shape the roles of personal values and perceived group values in different domains of environmental engagement via individuals' collectivistic orientation. The current research can set the stage for future cross-cultural replications by studying a wider range of countries or regions.

3.4. Conclusion

In response to calls for more systematic cross-cultural research on climate change (Tam et al., 2021; Tam & Milfont, 2020), our findings enrich understanding of how values can be modulated by culturally motivated collectivistic orientation to shape environmental engagements among Americans and Singaporeans. The present study demonstrated that values can differentially predict different domains of environmental engagement across the two cultures. It also further reveals the nuances of distinguishing people's personal values and their perception of the values that are important in the society. As values are overarching goals that provide the driving force for different value-congruent behaviors, value framing or communication could be deemed an effective strategy to mobilize pro-environmental actions. Together, the current findings hold much promise in unlocking some key pieces for understanding the important roles that personal and perceived group values play in helping people mitigate the global environmental crisis.

CRediT authorship contribution statement

Tengjiao Huang: Conceptualization, Methodology, Writing – original draft, Formal analysis. **Angela K.-y. Leung:** Conceptualization, Methodology, Writing – review & editing, Supervision. **Kimin Eom:** Conceptualization, Writing – review & editing. **Kim-Pong Tam:** Conceptualization, Writing – review & editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvp.2022.101774.

Appendix

List of Measurement Scales:
Collectivistic Orientation.
Instructions:
Please rate how important you find the following behaviors.
(1 = *not at all* important to 5 = *very important*)

1. To help a relative (within your means), if the relative has financial problems.
2. To maintain harmony within any group that one belongs to.
3. To do something to maintain coworkers'/classmates' well-being (such as caring for them or emotionally supporting them).
4. To consult close friends and get their ideas before making a decision.
5. To share little things (tools, kitchen stuff, books, etc.) with one's neighbors.
6. To cooperate with and spend time with others.
7. To do what would please one's family, even if one detests the activity.
8. To teach children to place duty before pleasure.
9. To sacrifice an activity that one enjoys very much (e.g., fishing, collecting, or other hobbies) if one's family did not approve of it.
10. To respect decisions made by one's group/collective.
11. To sacrifice self-interest for the benefit of group/collective.
12. To take care of one's family, even when one has to sacrifice what he/she wants.

Personal Values.
Instructions:
Please rate the importance of these values as a guiding principle in your life. Indicate your response with this scale: *1 = opposed to my values to 0 = not important to 7 = extremely important*.
Egoistic values.

1. Social power: control over others, dominance
2. Wealth: material possessions, money
3. Authority: right to lead or command
4. Influential: having an impact on people and events
5. Ambitious: hardworking, aspiring

Biospheric values.

1. Preventing pollution: protecting natural resources
2. Respecting the earth: harmony with other species
3. Unity with nature: fitting into nature
4. Protecting the environment: preserving nature

Perceived Group Values.
Instructions:
Based on your observation and understanding, please rate the importance of these values to the people residing in the U.S./Singapore in general. Indicate your response with this scale: *1 = opposed to my values to 0 = not important to 7 = extremely important*.
Egoistic values.

1. Social power: control over others, dominance
2. Wealth: material possessions, money
3. Authority: right to lead or command
4. Influential: having an impact on people and events
5. Ambitious: hardworking, aspiring

Biospheric values.

1. Preventing pollution: protecting natural resources
2. Respecting the earth: harmony with other species
3. Unity with nature: fitting into nature
4. Protecting the environment: preserving nature

Public Pro-environmental Behavioral Intentions.
Instructions:
How likely will you engage in the following activities in the next 12 months?
If it is not possible for you to perform an activity, please choose "Not applicable."
(1 = not at all likely to 5 = very likely to N.A. = not applicable).

1. Sign a petition in support of protecting the environment.
2. Join or renew membership of an environmental group.
3. Join public demonstrations or protests supporting environmental protection.
4. Write a letter to a Member of Parliament or government official to support environmental protection.
5. Donate money to an environmental group.
6. Read a newsletter, magazine, or other publication written by an environmental group.
7. Vote in favor of a political candidate because he or she was strongly in favor of environmental protection.
8. Write to a newspaper in support of protecting the environment.
9. Boycott companies that are not environmentally friendly.
10. Volunteer to help an environmental group or event.
11. Post pro-environmental messages or links on social media (e.g., Facebook, Twitter).

12. Speak in favor of pro-environmental policies in conversations with your friends or family.

Private Pro-environmental Behavioral Intentions.

Instructions:

How likely will you engage in the following activities in the next 12 months?

If it is not possible for you to perform an activity, please choose "Not applicable."

(1 = not at all likely to 5 = very likely to N.A. = not applicable).

1. Install products to save energy (e.g., low-energy light bulbs).
2. Buy environmentally-friendly products.
3. Conserve water at home (e.g., when cooking or showering).
4. Minimize use of air-conditioning or heating.
5. Reduce car travel (e.g., walk, cycle, or use public transportation).
6. Turn off lights and appliances when not in use.
7. Avoid or reduce eating meat.
8. Recycle.
9. Turn off electrical equipment rather than use “standby” mode.
10. Eat food which is locally-grown or in season.
11. Use car-sharing or car-pooling schemes.
12. Buy products with less packaging.

Support for Pro-environmental Policies.

Instructions:

What do you think about the following suggestions to protect the environment?

(1 = a very bad suggestion to 3 = a neither good nor bad suggestion to 5 = a very good suggestion)

1. Increased CO2 tax on petrol
2. Work more actively to ban environmentally hazardous products
3. Reduced tax on fuels that do not affect the world’s climate
4. Reduce the tax on foods with little environmental impact
5. Increased information about the effects of transportation on the climate
6. Focus more on environmental labelling of products
7. Focus more on information about how different foods affect the climate
8. Ban sale of appliances that are not energy efficient
9. Increased tax on vehicles with large engines (large cylinder volume)
10. Increase the tax on household electricity
11. Impose a meat tax to reduce the climatic effect of our food consumption

Environmental Volunteerism Intentions.

(Hypothetical Time Allocation Charity Task)

Instructions:

For the next task, imagine that you have a total of 30 h that you can decide how you would like to spend on volunteer work and/or personal or recreational activities.

You do not have to allocate all 30 h to one charity; you can decide to spend any combination of hours to volunteer at any of the 6 charities below. You can also decide to spend some or all of your 30 h on personal or recreational activities.

Please take some time reading the brief description and mission statements of the 6 charities below. Next, decide whether you would want to volunteer at any of the charities. If so, decide which one(s) you would like to volunteer at and the number of volunteering hours.

List of charities presented to the American sample.

RESULTS (United States): RESULTS (United States) is dedicated to raising awareness and finding long-term solutions to poverty through grassroots advocacy. Their mission statement is “to work to advance health, education, and economic opportunity for all in the U.S. and globally.”

The Salvation Army: The Salvation Army provides people in need with meals, provides beds to homeless people, offers rehabilitation to addicted people and refuge to victims of domestic abuse. Their mission statement is “We are one of the largest and most diverse social welfare providers in the world.”

The Sierra Club (United States) The Sierra Club (United States) is a United States-based grassroots environmental organization. Their mission statement is “To practice and promote the responsible use of the earth’s ecosystems and resources; to educate and enlist humanity to protect and restore the quality of the natural and human environment; and to use all lawful means to carry out these objectives.”

The Nature Conservancy (United States): The Nature Conservancy (United States) is a global non-government, non-profit organization that works with public and private partners to ensure the lands and waters are protected for future generations and for wildlife and nature habitats. Their mission statement is “To conserve the lands and waters on which all life depends. Our vision is a world where the diversity of life thrives, and people act to conserve nature for its own sake and its ability to fulfil our needs and enrich our lives.”

The Alzheimer’s Foundation of America: The Alzheimer’s Foundation of America is an American nonprofit organization that conducts research and provides resources for families affected by Alzheimer’s disease and other dementia-related illnesses. Their mission statement is “To provide support, services, and education to individuals, families and caregivers affected by Alzheimer’s disease and related dementias nationwide, and fund research for better treatment and a cure."

St. Jude Children’s Research Hospital: St. Jude Children’s Research Hospital conducts research and provides programs integral to the total care of seriously ill children. Their mission statement is “To advance cures, and means of prevention for pediatric catastrophic diseases through research and treatment.”

List of charities presented to the Singaporean sample.

One Singapore: One Singapore is dedicated to raising awareness and taking concrete actions to make poverty history and create the world we want. Their mission statement is “Each ONE of us can make a difference. Together as ONE, we can change the world. ONE by ONE. . . by ONE, we WILL Make Poverty History.”

The Salvation Army: The Salvation Army provides people in need with meals, provides beds to homeless people, offers rehabilitation to addicted people and refuge to victims of domestic abuse. Their mission statement is “We are one of the largest and most diverse social welfare providers in the world.”

The Wilderness Society: The Wilderness Society is a community-based environmental protection organisation. Their mission statement is “We work to safeguard our sources of clean water and air, to tackle devastating climate change, to create a safe future for life on Earth, and to give a better world to our children.”

Nature Society (Singapore): Nature Society (Singapore) is a non-government, non-profit organisation dedicated to the appreciation, conservation, study and enjoyment of the natural heritage in Singapore, Malaysia, and the surrounding region. Their mission statement is “To advocate conservation of the natural environment in Singapore, to forge participation and collaboration in local, regional, and international efforts in preserving Earth’s biodiversity, and to promote nature awareness and nature appreciation.”

The Alzheimer’s Disease Association: The Alzheimer’s Disease Association is a Singaporean non-profit organisation that provides resources and services for families affected by Alzheimer’s disease and other dementia-related illnesses. Their mission statement is “To be recognised as Singapore’s leading organisation in dementia care - a catalyst, enabler, educator and advocate - that inspires society to regard and respect persons living with dementia as individuals to lead purposeful and meaningful lives."

The Starlight Children’s **Foundation:** The Starlight Children’s Foundation provides programs integral to the total care of seriously ill

children. Their mission statement is "Starlight is there to lift the spirits of the child, giving them the opportunity to laugh, play and be a child again."

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