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Abstract

The present research investigated whether age-related differences in connectedness with nature in adolescence are associated with pro-environmental behavior across two cultures, Canada ($N = 325$) and China ($N = 363$). While older adolescents demonstrated lower connectedness with nature in both countries, pro-environmental behavior was inversely associated with age only in Canada but not in China. To investigate this cultural difference, we conducted a moderated mediation analysis. Positive self-evaluative emotion expectancies (pride/satisfaction) for engaging in pro-environmental behavior were found to mediate the interaction effect of culture and age when predicting pro-environmental behavior for Chinese but not for Canadian adolescents. The present research suggests that the development of pro-environmental behavior is contextually bounded and multi-directional. Effective promotion of pro-environmental behavior in adolescence should target culturally specific mechanisms, may it be connectedness with nature or moral emotions.

Key Words: nature connectedness, pro-environmental behaviors, sustainability, moral emotions, cultural differences

Feelings of connectedness with nature come in many different forms. They may manifest in the enjoyment of experiencing nature with all five senses, in the scientific interest to explore and understand natural phenomena, or in a deep sense of communion with the natural world. Regardless of these various manifestations, it has been repeatedly demonstrated that feelings of connectedness with nature are substantially associated with pro-environmental behavior (e.g., Kals & Müller, 2012; Mackay & Schmitt, 2019). This relationship holds across the life-span and applies similarly to children, adolescents, and adults (Cheng & Monroe, 2010; Collado, Evans, Corraliza, & Sorrel, 2015; Krettenauer, 2017; Müller, Kals, & Pansa, 2009; Mayer & Frantz, 2004, Brügger, Kaiser, & Roczen, 2011). At the same time, feelings of connectedness with nature are systematically related to age. Kaplan and Kaplan (2002) characterized adolescence as a "time out" in the human relationship with nature. Teenagers tend to enjoy nature less than children and adults. Correspondingly, feelings of connectedness with nature were found to be lower in the adolescent years (Krettenauer, 2017; Szagun & Mesenholl, 1993). This trend has been attributed to greater sensation seeking and peer-orientation of adolescents (Kaplan & Kaplan, 2002).

As feelings of connectedness with nature are lower in adolescence, pro-environmental behavior can be expected to be less frequent in this age-period, as well. Indeed, this expectation is supported directly and indirectly in multiple studies. Research repeatedly documented a generation gap between parents and their teenage offspring such that parents tend to be more committed to pro-environmental practices than their children (Grønhøj & Thøgersen, 2009, 2012; Casaló & Escario, 2016). The number of adolescents in a family household predicts electricity consumption above and beyond household size

suggesting higher energy consumption particularly in this age-group (Wallis, Nachreiner, & Matthies, 2016). Last but not least, large-scale cross-sectional studies with adolescents in the USA, Canada and Israel reported negative correlations between age and pro-environmental behaviors related to energy and water conservation, waste reduction and recycling (Krettenauer, 2017; Negev, Sagy, Garb, Salzberg, & Tal, 2008; Wray-Lake, Metzger & Syvertsen, 2017). Krettenauer (2017) found that age-related differences in pro-environmental behavior in Canadian adolescents were mediated by lower nature connectedness.

While there is a strong empirical association between feelings of connectedness with nature and pro-environmental behavior with some support for a causal relationship (Mackay & Schmitt, 2019), research is limited as it is almost exclusively based on studies conducted in Western societies. Correspondingly, it is unclear whether the age-related differences in nature connectedness and pro-environmental behavior in adolescence apply to countries outside the Western hemisphere, as well. The present study was designed to address this limitation by systematically comparing age-related differences in connectedness with nature and pro-environmental behavior of Canadian and Chinese adolescents. Three questions were addressed: (1) Do feelings of connectedness with nature follow the same age-related trend over the teenage years in Canada and China? In the past, lower feelings of connectedness with nature were described as a common feature of adolescent development that is largely culture-independent (Kaplan & Kaplan, 2002). However, this assumption has never been tested empirically. (2) If lower feelings of connectedness with nature characterize adolescent development in Canada and China alike, does this common trend imply a parallel age-related decrease in pro-environmental

behavior in both countries, as well? (3) What cultural factors may moderate the relationship between nature-connectedness in adolescence and pro-environmental behavior? In the present study, moral emotions such as pride, guilt and shame were considered a potential moderator that may offset the effect of declining nature connectedness on pro-environmental behavior in adolescence. Thus, while lower feelings of connectedness with nature in adolescence may be related to lower levels of pro-environmental behavior in both countries, this tendency may be counteracted by stronger positive effects of moral emotions on adolescent pro-environmental behavior in China. In the following, this assumption is further elaborated.

A major cultural difference between China and Canada is in the fact that China qualifies as a collectivistic culture whereas Canada is deemed individualistic (Oyserman, Coon, & Kemmelmeier, 2002). This difference likely has important implications for the development of environmental behavior as the individualism-collectivism distinction reflects important differences in the way social norms function in people's everyday life. Riemer, Shavitt, Koo, and Markus (2014) emphasized that in Western individualistic cultures individuals' attitudes towards any object, group or activity are strongly based on personal preferences (likes or dislikes), whereas in collectivistic cultures an attitude signals a normative concern that is shared with others. Consequently, many social behaviors that are considered at people's personal discretion in Western countries are normatively regulated in collectivistic cultural contexts.

Considering this cultural difference, it seems plausible that pro-environmental behavior is more strongly associated with personal concerns in individualistic countries compared to collectivistic countries as was demonstrated in previous research (Eom,

Kim, Sherman, & Ishii, 2016; Tam & Chan, 2017). Reversely, social norms were demonstrated to be a better predictor of pro-environmental behavior in collectivistic cultural contexts (Eom et al. 2016). Thus, the collectivism-individualism distinction potentially moderates the influence of norms on pro-environmental behavior. Pro-environmental behavior may be more strongly influenced by social norms in a collectivistic cultural context as compared to individualistic cultures, in particular when social norms to protect the environment are actively promoted and publicly endorsed as is the case in China (Harris, 2008). In line with this view, Chinese university students were found to report stronger injunctive and descriptive pro-environmental norms as compared to British university students (Smith et al., 2012).

In environmental psychology, social norms play a pivotal role in explaining pro-environmental behavior (Steg & Vlek, 2009). According to the Theory of Planned Behavior (Ajzen, 1991), subjective norms, i.e., perceived expectations of significant others such as friends or parents are crucial for predicting behavioral intentions in addition to attitudes and perceived behavioral control. Value-belief-norm theory stresses the importance of norm-activation (Stern, 2000). Correspondingly, social norms need to be activated and experienced as personally binding before effectively influencing behavior (e.g., Milfont, Sibley & Duckitt, 2009). This process of norm activation is closely associated with moral emotions. Moral emotions such as pride, guilt and shame can indicate that a pro-environmental norm is active (Bamberg & Möser, 2007; Rezvani, Jansson, & Bengtsson, 2017). In line with this view, research demonstrated that measures of moral emotions are an important predictor of pro-environmental behavior in individualistic and collectivistic cultures (Bamberg, Hunecke, & Blo, 2007; Kaiser, 2006;

Kaiser, Schultz, Berenguer, Corral-Verdugo, & Tankha, 2008; Onwezen, Antonides, & Bartels, 2013; Onwezen, Bartels, & Antonides, 2014).

In the present study, it was assumed that pro-environmental norms are more strongly associated with pro-environmental behavior in Chinese adolescents than Canadians. As a consequence, the age-related decline in pro-environmental behavior in adolescence that is associated with lower feelings of connectedness with nature may turn out to be less marked in the Chinese context as compared to Canada. Specifically, the following findings were expected:

- (H1) Feelings of connectedness with nature are negatively correlated with age in the adolescent years in Canada as well as China.
- (H2) The age-related decline in connectedness with nature is paralleled by a decline in pro-environmental behavior in Canadian adolescents but less so in China.
- (H3) Stronger moral emotion expectancies related to pro-environmental behavior account for a less marked decline in pro-environmental behavior in Chinese adolescents as compared to Canadians.

In the present study we relied on moral emotions individuals anticipate when engaging in pro-environmental behavior (or failing to do so) as an indicator pro-environmental norm activation. Anticipated emotions provide important affective cues about the adequacy of future behaviors and constitute an important feedback mechanism for individuals' decision-making and behavior regulation (Baumeister, Vohs, DeWall, & Zhang, 2007). It is important to note that moral emotions are not limited to self-evaluative emotions such as guilt and pride but include other-evaluative emotions such as outrage and admiration (Tangney, Stuewig, & Mashek, 2007). Other-evaluative emotions

signal that the obligatory nature of pro-environmental norms is expanded beyond the self. In a study with German adults that included a group of environmental activists, Kals, Schumacher, and Montada (1999) found that other-evaluative emotions were a stronger predictor for readiness to engage in pro-environmental behavior than feelings of connectedness with nature. In the present study, we included both self- and other-evaluative emotion expectancies as predictors of pro-environmental behavior while differentiating between positive (e.g., pride, admiration) and negative emotions (e.g., guilt, outrage). We considered it an open question, what type of emotion expectancy (self- or other-evaluative, positive or negative) would best account for pro-environmental behavior of adolescents.

Sample

We report how we determined our sample size, all manipulations, and all measures in the study.

Fritz and MacKinnon (2007) recommended a minimum sample size of $N = 462$ for detecting mediation using bias-corrected bootstrap confidence interval for small effect sizes and .8 power. We aimed for collecting data with approximately 600 participants but deliberately oversampled in order to compensate for potential dropouts and incomplete data. In the Chinese sample, 379 questionnaires were administered and a total of 363 completed questionnaires were received back. In the Canadian sample, 325 questionnaires were handed out to participants and all were successfully completed. We did not exclude data from any participants.

The final sample included 688 participants (325 Canadian and 363 Chinese) covering the age range from late childhood/early adolescence (9 years) to late

adolescence/early adulthood (21 years). Mean age in the sample was 15.42 years, $SD = 4.32$. The Chinese sample was slightly younger on average than the Canadian sample, $M = 15.08$ years, $SD = 4.79$ vs. $M = 15.81$ years, $SD = 4.68$, $t(687) = 2.21$, $p < .05$.

Female/male gender ratio in each country was approximately equal, 174 female participants (53.7%) in Canada and 173 female participants (47.92%) in China. Five participants did not report gender.

Canadian participants were from South-West Ontario (Waterloo Region), while Chinese participants were from three larger cities in East China (Wuhan, Hangzhou, and Changchun). The cities were chosen based on pre-existing contacts to researchers and teachers at various locations. To ensure comparability of culture groups, similar recruitment strategies were employed in both countries. Participants in both countries were recruited in elementary schools, high-schools of the public school system, and introductory psychology and business classes in public universities. University students in both countries received research credits for their participation.

Participants in both countries were living in urban environments with comparable levels of economic development. Waterloo Region's Gross Domestic Product (GDP per capita) ranked 11th among 43 Canadian metropolitan areas in 2015 (Statistics Canada, 2017). The cities of Wuhan, Hangzhou, and Changchun ranked 8th, 9th and 20th for their economic development in 2017 among 77 major Chinese cities (National Bureau of Statistics of China, 2018). All three Chinese cities are provincial capitals with comparable population sizes (Wuhan: 8.54 million, Hangzhou: 7.54 million, Changchun: 7.49 million; National Bureau of Statistics of China, 2018). In all three cities, participating schools were drawn from central city areas characterized by an urban

environment.

Measures

All survey measures were based on previously developed instruments that had been tested and validated with Canadian teenagers (Krettenauer, 2017; Krettenauer & Jia, 2013). For the purpose of comparing Chinese and Canadian adolescents, English-language measures were translated into Mandarin and back-translated by two bilingual speakers. Inconsistencies of individual items due to translation issues were discussed and addressed. Moreover, all items were scrutinized for applicability in the Chinese cultural context by two members of the research team who had been living in China and Canada for extended periods of time. This process resulted in cross-cultural adjustments for some measures as detailed below.

Connectedness with nature. For measuring connectedness with nature the scale as described in Krettenauer (2017) was used. This scale is a shortened and adapted version of the instrument developed by Brügger, Kaiser, and Roczen (2011). The shortened version included only those items of the original instrument that deemed suitable for adolescents (for details see Krettenauer, 2017). For the present study, one item (out of 27) was omitted from the Chinese version of the instrument (I feed animals in my backyard (e.g., birdfeeder) because feeding wildlife is not common practice in China.

The instrument as developed by Brügger et al. (2011) is based on a Rasch model. Rasch models currently provide the highest standards of excellence for cross-cultural research (Fischer & Poortinga, 2018). Due to specific objectivity of items it is not required that the same set of items is presented to all participants (Kaiser, Merten, &

Wetzel, 2018), thus, allowing for greater cross-cultural flexibility. On the flip side, standard criteria and procedures for assessing measurement equivalence, as for instance outlined in Milfont and Fischer (2010), are not readily available for measures based on Rasch models.

In the present study, we followed three steps to investigate measurement equivalence of the scale *connectedness with nature*. First, we run separate Rasch analyses for the two cultural groups investigating whether items are uni-dimensional in both countries. Second, we investigated differential item functioning (DIF) for the two cultural groups, thus, checking whether item parameters differ across countries. Third, we calibrated the measure by using those items with invariant item curve characteristics across countries as anchors. Detailed results of these Rasch analyses including individual item statistics are reported in the supplemental material for this publication.

Overall, Rasch analyses confirmed uni-dimensionality of the scale in both cultural groups. Seven out of 26 items demonstrated differential item functioning. Person reliability of the scale (a coefficient comparable to Cronbach's alpha) was .81. In line with the Rasch model, person scores were derived as maximum likelihood estimates expressed in logits (natural logarithm of the ratio between the probabilities of low (0) versus high (1) item endorsement). The smaller the logit the lower the person feels connected with nature. In the sample, grand mean of connectedness with nature was $M = 0.81$, $SD = 1.39$.

Pro-environmental behavior. Similar to connectedness with nature, pro-environmental behavior was assessed using an adapted version of the General Ecological Behavior Scale (GEB) that was developed by Kaiser and Wilson (2004) based on Rasch

analyses. Again, in the present context, only behaviors of the original instrument were used that adolescents can realistically engage in, effectively excluding behaviors adolescents have little control over, such as "buying a fuel-efficient car" or "improving house insulation" (for details see Krettenauer, 2017). Moreover, some cultural adaptations were required. Recycling behavior such as separating paper, glass, metal etc. and disposing of these materials in separate garbage bins is common in Canada and Europe, whereas Chinese municipalities do not run similar waste management programs. Therefore, items referring to these behaviors were omitted in the Chinese context and partially replaced by items indicating re-use of materials (e.g., I keep and reuse good-on-one-side paper). At the same time, domestic waste pollution and littering are important environmental issues in Chinese society that have been widely publicized. We therefore added items describing littering behavior in the Chinese context (e.g., I throw small pieces of garbage on the street). Overall, the scale for assessing pro-environmental behavior included 36 items. Twenty of these items were presented to both Canadian and Chinese participants, nine items to Canadians only and seven items to Chinese participants only. Again, Rasch analyses were run for scaling items and calculating overall scores. Detailed results and item statistics are reported in the supplemental material for this publication.

Separate Rasch analyses for both cultural groups demonstrated uni-dimensionality of the scale in both countries, while 11 out of 20 items showed differential item functioning. Person reliability of the scale was .74. Person scores were calculated as logits of the ratio of the probabilities of low versus high engagement in pro-environmental behavior. In the present study, the grand mean was $M = 0.14$, $SD = 1.00$.

Moral emotion expectancies. As described in the introduction, we relied on measures of moral emotion expectancies when engaging in pro-environmental behavior (or failing to do so) as a measure of pro-environmental norms. A common way of assessing moral emotion expectancies is by use of scenario techniques where participants are asked to anticipate emotional reactions to various hypothetical behaviors. It is important to note that these measures do not aim at assessing actual emotions as they were experienced in past situations. Instead, the goal is to measure anticipated emotions for future behaviors.

To assess moral emotion expectancies, the scenario technique developed by Krettenauer and Jia (2013) was used. Scenarios described everyday pro-environmental actions adolescents and their families easily can engage in (e.g., turning off lights that are not in use, using public transportation, using refillable water bottles). All activities were described as behaviors of entire families rather than single individuals within the family. This appeared more realistic particularly for younger teenagers as they rarely decide about environmental behaviors at home completely independently from parents. Still, even as part of a family, teenagers perform individual actions that potentially can trigger positive or negative self-evaluative emotions. At the same time, the description of various environmental behaviors as a common practice of one's family expanded participants' responsibility beyond single acts of omission or commission and allowed them to express positive or negative feelings for (not) encouraging family members to engage in pro-environmental behaviors.

Overall, scenarios were related to six different environmental topics: (a) energy conservation by walking, cycling and use of public transportation, (b) energy

conservation at home by turning off lights and other electronic devices not in use, or by using air-conditioning and home heating more efficiently, (c) waste reduction, (d) recycling, (e) proper disposal of hazardous household waste, and (f) littering. Note, that not all topics were presented to both cultural groups. As separating waste and recycling is not common in China, topics (d) and (e) were omitted in the Chinese survey. These topics were replaced by scenarios that address domestic waste pollution (littering). Scenarios had two different targets (either self or others) as well as two different outcomes (either successfully engaging in pro-environmental behaviors or failure to do so). Target and outcome were counterbalanced with topic. Thus, each topic was represented by four differences scenarios (self-success, self-failure, others-success, others-failure). In the self-related stories participants were asked to imagine that their own family would engage in the described behaviors, whereas other-related stories were about a hypothetical family living nearby. Sample scenarios that exemplify the variation across topics, target and outcome are presented in the supplemental material for this study.

Following each scenario, participants were asked to indicate how they would feel about the described situation by rating eight different emotions *satisfied*, *annoyed*, *guilty*, *proud*, *shameful*, *admiring*, *outraged*, and *respectful* on a 9-point scale (1 = *not at all* to 9 = *very strongly*). Krettenauer and Jia (2013) demonstrated that positive and negative, self- and other-evaluative emotion expectancies are represented by different pairs of emotions on this list. Pride and satisfaction represent positive self-evaluative emotions, whereas negative self-evaluative emotions are represented by guilt and shame. Positive other-evaluative emotions are reflected by admiration and respect, whereas annoyance and outrage represent negatively charged other-evaluative emotions. For all subsequent

analyses, participants' emotion ratings were averaged across those scenarios that were a priori considered most relevant for the emotions at hand. Emotion ratings that were not relevant in the context of a particular scenario were disregarded. For instance, positive self-evaluative emotion ratings of pride and self-satisfaction were considered only in the context of scenarios depicting one's own family as actively engaged in pro-environmental behavior. By contrast, emotion ratings for anger and outrage were only considered in the context of scenarios that described other families failing to engage in pro-environmental behaviors.

In order to test whether the emotions included in the present study consistently represent the four different types of moral emotion expectancies across cultures, multigroup confirmatory factor analysis was run. Results of this analysis are summarized in the supplemental material of this study. The various pairs of emotions (guilt-shame, pride-satisfaction, annoyance-outrage, admiration-respect) represented the four types of emotions equally well in both cultural groups. Consequently, factor scores for each emotion construct were used to assess positive and negative self- and other evaluative emotion expectancies.

Results

Descriptive statistics and bivariate correlations

Table 1 summarizes descriptive statistics and bivariate correlations for all study variables separately for the two cultural groups. Connectedness with nature and moral emotion expectancies were positively correlated with pro-environmental behavior in the Chinese and Canadian samples. Moreover, connectedness with nature was negatively correlated with age in both groups. Different correlational patterns emerged for age and

pro-environmental behavior: the two variables were negatively correlated in the Canadian sample but unrelated in the Chinese sample. Conversely, positive self- and other-evaluative emotion expectancies were positively correlated with age in the Chinese sample but unrelated to age in the Canadian group. Besides these differences in bivariate correlations, there were also differences in mean levels. Chinese participants scored higher in connectedness with nature relative to Canadians but lower in all types of moral emotion expectancies, except for positive self-evaluative emotions (inferential statistics for these group differences are reported in Table 2).

Moderated mediation

To investigate the moderating and mediating relationships between age (X), culture (moderator), connectedness with nature (mediator), moral emotion expectancies (mediators) and pro-environmental behavior (Y) as outlined in the introduction, we conducted a moderated mediation analysis (model 8) using the PROCESS 2.16 macro for SPSS (Hayes, 2013). Data were bootstrapped (5,000 samples) and 95% confidence intervals were computed for the upper and lower limits of the effects. Figure 1 presents a conceptual summary of the regression models tested within the moderated mediation analysis. Table 2 summarizes coefficients of these models. In the following results are reported along the three major hypotheses as specified in the introduction.

Age and connectedness with nature (H1). Theoretically, it was expected that feelings of connectedness with nature showed an age-related decline over the course of adolescence in Canada as well as China. In line with this expectation, age was inversely associated with connectedness with nature, $R^2 = .08$, $F(3, 660) = 17.59$, $p < .01$, whereas the interaction between age and culture was not significant (for details see Table 2-A).

Age, pro-environmental behavior and culture (H2). In theory, we expected that the decline in connectedness with nature is paralleled by a decline in pro-environmental behavior in Canadian adolescents but less so in China. Accordingly, the regression demonstrated a negative effect of age on pro-environmental behavior that was moderated by culture (see Table 2-F). In the Canadian sample, the effect of age on pro-environmental behavior was negative, $b = -.05$, $t = -4.35$, $p < .001$, 95% CI $[-.07, -.03]$, whereas in the Chinese sample it was not different from zero, $b = .01$, $t = 0.94$, $p = .35$, 95% CI $[-.01, .04]$. Note, that this interaction effect was present regardless of whether the various mediators were included in the regression or not. Additionally, connectedness with nature and positive self-evaluative emotion expectancies when engaging in pro-environmental behavior were associated with pro-environmental behavior. Age, culture, connectedness with nature and moral emotions together yielded an R^2 of .29, $F(8, 655) = 26.57$, $p < .001$ when entered as predictors of pro-environmental behavior.

Age, moral emotion expectancies, pro-environmental behavior, and culture (H3). We expected that stronger moral emotion expectancies for engaging in pro-environmental behavior account for a less marked decline in pro-environmental behavior in Chinese adolescents as compared to Canadians. Accordingly, the mediation effect of moral emotion expectancies on the relation between age and pro-environmental behavior would depend on culture.

When moral emotion expectancies were used as outcome variables in the regression models (see Tables 2-B to 2-E), a significant interaction between age and culture was found for positive self-evaluative (pride/satisfaction) and positive other-evaluative emotions (admiration/respect) but not for negative emotions. Age was

positively related to positive self-evaluative and positive other-evaluative emotions in China but not in Canada. However, only positive self-evaluative emotions further predicted pro-environmental behavior (Table 2-F). Correspondingly, for positive self-evaluative emotions, a significant effect for moderated mediation was found, whereas no other type of emotions yielded a significant effect (for details see Table 2-B to 2-E). Thus, positively charged self-evaluative emotion expectancies mediated the effect of adolescents' age on pro-environmental behavior only in China, indirect effect = .02, $SE = .01$, 95% CI [.01, .03], but not in Canada, indirect effect = -.01, $SE = .00$, 95% CI [-.02, .001]. The index of moderated mediation was significant ($b = .02$, $SE = .01$, 95% CI [.01, .04]), suggesting that the indirect effects of positive self-evaluative emotion expectancies differed significantly in the two cultural groups. Note, that this mediation effect did not fully account for the moderating effect of culture as the direct moderation effect of culture still was significant after controlling for positive self-evaluative emotions (Table 2-F).

Discussion

Adolescence has been characterized as a "time out" in the human relationship with nature. Correspondingly, feelings of connectedness with nature were found to be negatively correlated with age in previous studies with teenagers (Krettenauer, 2017, Szagun & Mesenholl, 1993). However, it has not been examined up to date whether this trend applies across cultures. In the present study, we investigated age-related differences in connectedness with nature cross-culturally by comparing a sample of Chinese and Canadian adolescents. In line with the notion a "time out" in nature connectedness as a universal feature of adolescence, we found age-related differences in both cultural

groups. Connectedness with nature was significantly related to pro-environmental behavior in Canada as well as China.

We proposed that moral emotions may have a stronger impact on individuals' pro-environmental behavior in collectivistic cultures than in individualistic cultures. In line with this assumption, we found that culture moderated the relationship between age and pro-environmental behavior. At the same time, positive self-evaluative emotions were positively correlated with adolescents' age in China, but not in Canada. The moderating effect of culture on the relationship between age and pro-environmental behavior was mediated by the anticipation of positive self-evaluative emotions when engaging in pro-environmental behavior. Thus, depending on the cultural context, moral emotion expectancies attenuate age-related differences in pro-environmental behavior that are associated with lower feelings of nature connectedness.

While the overall level of moral emotion expectancies was not higher in China as compared to Canada, it specifically was the positive correlation between anticipated positive self-evaluative emotions and age in the Chinese sample that accounted for the moderating effect of culture when using age as a predictor of pro-environmental behavior. It is an open question what factors accounted for this positive correlation between age and positive self-evaluative emotions in Chinese adolescents. Research shows that interpersonal responsibilities (such as helping a sibling or a colleague in need) are considered more obligatory and less contingent on personal preferences (e.g., liking the recipient) in collectivistic cultures as compared to individualistic cultures (Miller & Bersoff, 1998). Meeting these social responsibilities is a greater source of pride and satisfaction in collectivistic cultural contexts (Miller, Goyal, & Wice, 2017). Similar

mechanisms may apply to pro-environmental behavior. As a consequence, Chinese adolescents may experience more positive self-evaluative emotions when complying with pro-environmental norms as they grow older. It is important to note that this interpretation remains speculative as the study did not include measures for assessing pro-environmental norms.

Limitations of the present study are in the cross-sectional and correlational design, which confounds age differences with cohort effects and does not warrant causal conclusions. Moreover, the sampling of the two cultural groups was by convenience and not representative. While the Canadian sample was drawn from one geographical region, the Chinese sample originated from three different cities. In addition, we were not able to compare more than two cultural groups. Therefore, it remains an open question whether the cultural differences documented in the study are unique to the two countries or represent more general factors applicable to a broader spectrum of cultures. While we focused on the collectivism-individualism distinction, there might be other factors that produced the differences between Canadian and Chinese samples (e.g., Milfont et al., 2018; Tam & Chan, 2017; 2018).

Although it is important to keep these limitations in mind, the present study is not without merit. It opens up a new field of inquiry as it suggests that pro-environmental behavior is not static and unchangeable but a developmental dimension that is contextually bounded and multi-directional. The findings resonate with a dynamic systems view on development, where development is viewed as multiply determined, context-dependent and malleable (Lerner, 2006). It is thus the developmental context in which children and adolescents grow up that determines whether they will establish pro-

environmental behavior patterns or not. Even if adolescents feel less inclined to engage in pro-environmental behavior because of lower feelings of connectedness with nature, moral emotions such as feelings of pride, guilt and shame potentially can make up for such a decline if the cultural context supports such compensatory mechanisms.

Following this view, the question is not whether pro-environmental behavior can be positively influenced in the course of development. Instead, we should pose a set of interrelated "what" questions (Lerner, 2006): What attributes of individuals (?) in relation to what contextual/cultural conditions (?), at what point in time (?) foster what forms of pro-environmental development (?). Finding the right answers to these questions may be crucial for promoting pro-environmental behaviors in future generations. In

individualistic cultures, pro-environmental behavior might be successfully promoted in the teenage years particularly by increasing feelings of connectedness with nature through engaging activities (Otto & Pensini, 2017), while moralizing pro-environmental behavior might be less effective. In collectivistic cultural contexts, by contrast, fostering moral emotions that are associated with pro-environmental behavior appears more promising.

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Table 1.

Descriptive statistics and bivariate correlations of study variables for Canadian and Chinese samples

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Mean	SD
(1) Age (in years)		-.22**	.38**	-.06	.29**	-.03	0.03	15.08	4.79
(2) Connectedness with nature	-.13*		.09	.22**	.19**	.24**	.42**	1.12	1.44
(3) Positive self-evaluative emotions	-.06	.39**		.46**	.56**	.45**	.28**	5.00	1.46
(4) Negative self-evaluative emotions	-.03	.25**	.73**		.49**	.78**	.19*	4.32	1.98
(5) Positive other-evaluative emotions	-.06	.36**	.92**	.76**		.49**	.27**	5.15	1.74
(6) Negative other-evaluative emotions	-.13*	.29**	.79**	.89**	.79**		.19**	4.70	1.95
(7) Pro-environmental behavior	-.26**	.49**	.32**	.24**	.27**	.27**		0.35	1.06
Mean	15.81	0.46	5.63	4.65	5.23	5.95	-0.09		
SD	3.69	1.25	1.49	1.87	1.54	1.89	0.88		

Note. Numbers below the main diagonal represent values for Canadian sample ($N = 317$), above diagonal for Chinese sample ($N = 352$).

* $p < .05$, ** $p < .01$

Table 2. Summary of moderated mediation analysis

(A) Connectedness with nature	<i>b</i>	<i>SE</i>	<i>LLCI</i>	<i>ULCI</i>	<i>t</i>	<i>p</i>
Constant	.7872	.05	.6861	.8884	15.28	.000
Age	-.0501	.01	-.0755	-.0247	-3.87	.000
Culture	.6072	.10	.4060	.8085	5.92	.000
Age x Culture	-.0316	.03	-.0830	.0199	-1.21	.229
Index of moderated mediation:	-.0090	.01	-.0243	.0061		
(B) Neg. other-evaluative emotions	<i>b</i>	<i>SE</i>	<i>LLCI</i>	<i>ULCI</i>	<i>t</i>	<i>p</i>
Constant	4.8761	.07	4.7293	5.0228	65.24	.000
Age	-.0367	.02	-.0721	-.0014	-2.04	.041
Culture	-.3902	.15	-.6840	-.0965	-2.61	.009
Age x Culture	.0528	.04	-.0189	.1244	1.45	.149
Index of moderated mediation:	-.0030	.00	-.0152	.0013		
(C) Pos. other-evaluative emotions	<i>b</i>	<i>SE</i>	<i>LLCI</i>	<i>ULCI</i>	<i>t</i>	<i>p</i>
Constant	5.2093	.06	5.0854	5.3331	82.59	.000
Age	.0406	.01	.0127	.0685	2.86	.004
Culture	-.0688	.13	-.3161	.1785	-.546	.585
Age x Culture	.1271	.03	.0705	.1836	4.41	.000
Index of moderated mediation:	-.0039	.01	-.0160	.0070		
(D) Neg. self-evaluative emotions	<i>b</i>	<i>SE</i>	<i>LLCI</i>	<i>ULCI</i>	<i>t</i>	<i>p</i>
Constant	4.4759	.08	4.3278	4.6241	59.32	.000
Age	-.0277	.02	-.0628	.0075	-1.55	.123
Culture	-.3650	.15	-.6613	-.0686	-2.42	.016
Age x Culture	.0088	.04	-.0624	.0801	0.24	.808
Index moderated mediation:	.0002	.00	-.0024	.0067		
(E) Pos. self-evaluative emotions	<i>b</i>	<i>SE</i>	<i>LLCI</i>	<i>ULCI</i>	<i>t</i>	<i>p</i>
Constant	5.3194	.06	5.2094	5.4294	94.99	.000
Age	.0334	.01	.0077	.0592	2.55	.011
Culture	-.6174	.11	-.8384	-.3965	-5.49	.000
Age x Culture	.1260	.03	.0737	.1784	4.72	.000
Index of moderated mediation:	.0231	.01	.0090	.0439		
(F) Pro-environmental behavior	<i>b</i>	<i>SE</i>	<i>LLCI</i>	<i>ULCI</i>	<i>t</i>	<i>p</i>
Constant	-.7462	.12	-.9909	-.5014	-5.99	.000
Connectedness with nature	.2856	.03	.2176	.3537	8.24	.000
Negative other	-.0561	.05	-.1542	.0419	-1.12	.261
Positive other	-.0309	.04	-.1156	.0538	-0.72	.475
Negative self	.0262	.05	-.0646	.1171	0.57	.571
Positive self	.1834	.01	.0724	.2944	3.24	.001
Age	-.0171	.01	-.0335	-.0007	-2.05	.041
Culture	.3044	.08	.1554	.4533	4.01	.000
Age x Culture	.0595	.02	.0277	.0913	3.68	.000

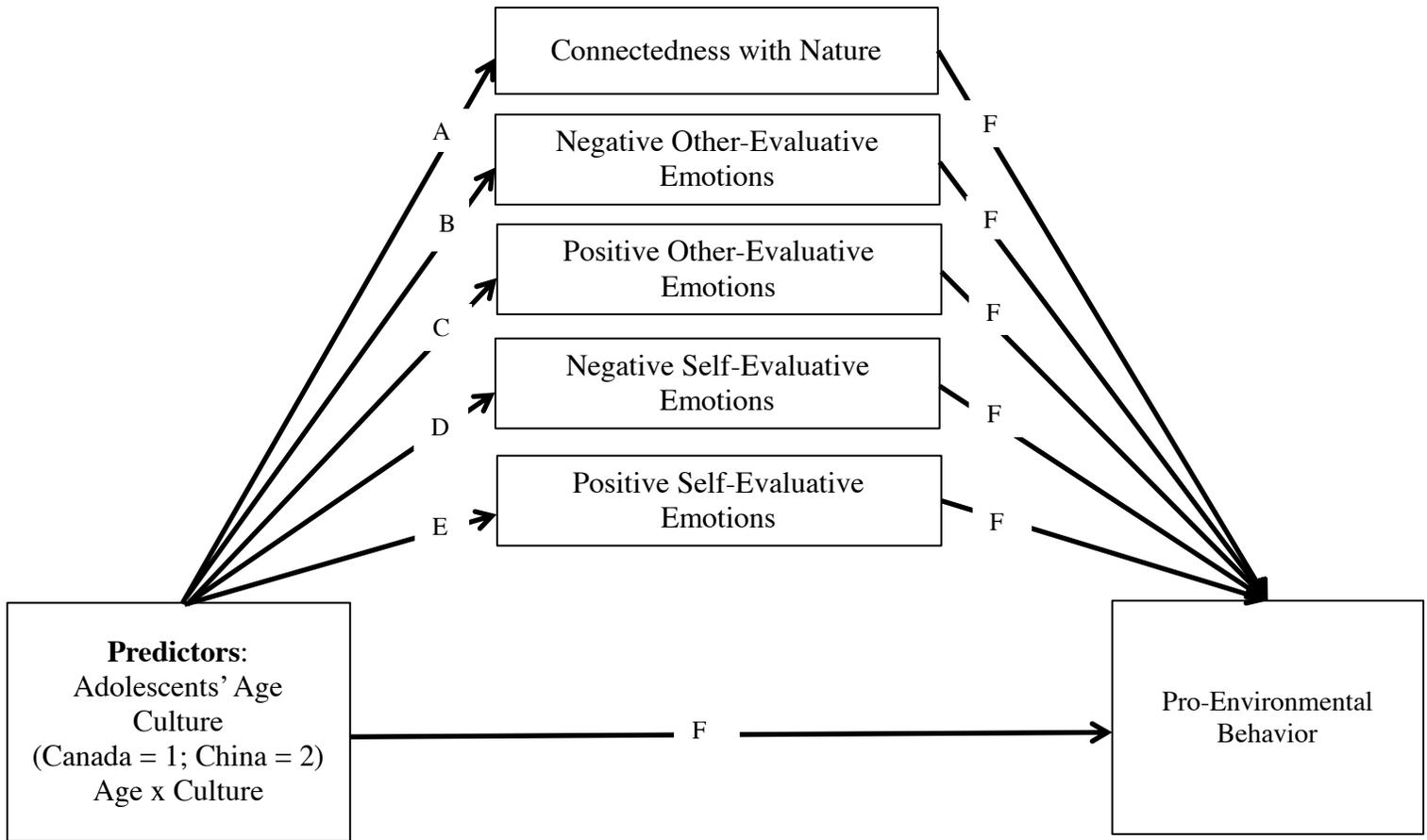


Figure 1. Conceptual presentation of the regression models in the moderated mediation analysis.