



The role of emotions in climate change communication: Examining the effects of strategy and issue framing on emotional responses and online climate action intentions

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Abstract

The way in which climate change-related information is framed can influence not only cognitive outcomes but also emotional responses. This web-based experiment ($n=331$) investigated the effects of strategy framing and issue framing on emotions and online climate action intentions in the context of climate relationship between China and the United States. Results indicated that strategy framing increased negative emotions (i.e., anxiety and anger), whereas issue framing triggered more positive emotions (i.e., pride and excitement). No significant difference was observed regarding climate action intentions between two groups. Additionally, anxiety and anger mediated the effects of message framing on online climate action intentions. Habitual worry about climate change and attitude toward China-U.S. climate collaboration moderated the effects of strategy framing and issue framing on discrete emotions. The findings offer theoretical insights regarding emotional responses to strategy framing and practical implications on climate communication.

Keywords Strategy framing · Online experiment · Climate change · Emotion · Media effect

As an issue with global significance, climate change and associated policy making have significant implications for a country's economic development and its strategic status on the international stage (e.g., Ciplet et al., 2015). Consequently, media coverage on climate initiatives may focus on different countries' strategic maneuvers to gain advantage in the climate race (the *strategic* purpose; e.g., Milman, 2022) as opposed to collaborations to address the climate crisis (focus on the substantial *issue* itself). In other words, strategy framing of climate change in international politics highlights countries as competitive actors and their political motivations, strategies, and tactics (Liu et al., 2023), whereas issue framing focuses on substantial climate policymaking and solutions among countries (Aalberg et al., 2017; Cappella & Jamieson, 1997). Different frames may arouse distinct emotional responses, which has

been seldomly examined in the strategy framing literature (De Vreese & Lecheler, 2012). Investigating how strategy framing influences individuals' climate action intentions through emotions can contribute to theoretical understanding about emotional mechanisms in cognitive processes and behavioral activation (Brosch, 2021; Ortony et al., 2022) as well as practical insights on effective climate change communication through emotional appeals (e.g., Roeser, 2012; Skurka et al., 2018).

As the world's two largest green gas emitters, China and the United States (U.S.) play critical roles in addressing the climate crisis. Over the past years, both countries implemented a series of policies to mitigate climate change (Milman, 2022). Meanwhile, there are growing concerns that climate issues are used as a bargaining chip to advance geopolitical and technological interests (Kashwan et al., 2023), making it an appropriate context to examine the effects of strategy framing on emotions and subsequent climate action intentions. Specifically, we (a) investigated the effects of strategy and issue framing of the China-U.S. climate relationship on the emotions of anxiety, anger, pride, and excitement and (b) examined the mediating role of emotions in the effects of strategy/issue framing

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on online climate actions— an emerging and increasingly important channel through which climate information is disseminated and platform where climate activism such as the #FridaysForFuture movement took place (e.g., Schäfer, 2012; Tosun & Schoenefeld, 2017). Additionally, the effects of strategy/issue framing on emotions may vary depending on individual differences. Therefore, we also (c) tested whether habitual worry about climate change and attitude toward China-U.S. climate collaboration would moderate such effects. In what follows, we review relevant literature regarding the effects of framing on emotions.

Literature review

Framing and framing effects on emotions

Framing refers to a perspective by which people understand and interpret the surrounding issues. For example, Goffman (1974) defined framing as the “schema of interpretation” through which people could process what they see and hear in everyday life. Entman (1993, p.52) conceptualized framing as selecting and emphasizing particular aspects of reality to “define problem,” “diagnose causes,” “make moral judgments,” and “suggest remedies.” Much of framing research focused on the effects of framing on individuals’ cognition, attitude, and behavior, as framing can shape our reasoning process by activating certain frameworks in mind to form opinions or make judgements (Lee et al., 2008).

More recently, researchers started to examine framing effects on emotions (Amsalem & Zoizner, 2022). Drawing on cognitive appraisal theory of emotion, Gross and D’Ambrosio (2004) proposed that emotions experienced by individuals are not random, but rather a product of cognitive assessments of a given situation. Emotions are influenced by the information available to the person, their pre-existing beliefs and values, as well as whether the situation aligns with those beliefs and values. In other words, framing can alter individuals’ cognitive evaluations and consequently affect emotions. Furthermore, Nabi (2003) posited that emotions can be thought of as frames or perspectives through which individuals interpret different stimuli. Previous research also examined possible emotional responses toward framing. For example, Gross and Brewer (2007) found that conflict frame, characterized as divisions in policy debate, induced heightened feelings of anger and disgust. Nabi et al. (2018) showed that gain frame (i.e., highlighting the benefits of specific actions) in climate change communication resulted in greater feelings of hope, whereas loss frame (i.e., highlighting the negative consequences of not acting) incited more disappointment. However, limited research focused on emotional responses

to strategy framing against the backdrop of international competition, limiting theoretical understanding about possible mechanisms through which strategy versus issue framing may influence emotions and subsequent actions.

Strategy framing in international politics

Strategy framing, or game framing, takes politics as a horse-race game and addresses politicians’ personal motivations, tactics, styles, as well as winning or losing in a given competition (e.g., election; Cappella & Jamieson, 1997). For example, presidential campaigns or policy debates framed with strategic elements commonly highlight benefits to the politician themselves rather than the public goods. In contrast, issue framing addresses substantial elements related to the issue under consideration, such as policy content, politicians’ opinions on policy-making, and possible solutions to social problems (Cappella & Jamieson, 1997).

Most studies on strategy framing were conducted in Western domestic political contexts (e.g., Cappella & Jamieson, 1997; Valentino et al., 2001). Recent work on strategy framing suggested that strategy framing also can be used to analyze regional or international political coverage by taking different political entities (e.g., party, country) as competitive actors (Liu et al., 2023; Jackson, 2011). Specifically, Liu and Boukes (2023) drew on structural power theory from the international political economy field and conceptualized strategy framing based on its two levels: the national and the personal level. The former emphasizes the competitive elements between different countries, including countries’ political motivations, strategies and tactics, and winning or losing in the international competition, whereas the latter highlights politicians’ personal motives, styles and purposes in dealing with foreign policy issues. In a recent empirical study, Liu and colleagues (2023) conducted a comparative content analysis of national strategy framing in news coverage of the China-U.S. trade conflict across four countries: China, the U.S., Singapore, and Ireland, suggesting that strategy framing is applicable for analyzing news contents not only within Western democratic countries, but also in non-Western contexts with different political systems (e.g., one-party dominant countries).

Effects of strategy framing in international politics

Strategy framing can influence cognitive outcomes by activating complex cognitive speculative reasoning processes (Rhee, 1997). For example, a substantial body of research suggested that strategy framing in Western political communication has an impact on outcomes such as political cynicism and trust in government (e.g., Cappella & Jamieson, 1997; Valentino et al., 2001). Specifically, individuals

tend to compare strategy-framed information with their own assumption about politics—that politicians are expected to act in public interest. The contrast between what was expected (i.e., politicians should serve public interest) and what occurred (i.e., politicians have their own personal agenda) can result in cognitive dissonance, potentially increasing political cynicism and reducing trust in government (De Vreese & Semetko, 2002).

Although these studies provided valuable insights regarding the effects of strategy framing on what the public *think* about politics, whether strategy frame can influence how the public *feel* has largely been neglected. Previous research showed that framing can shape citizens’ cognitive attitudes and emotions of political candidates during elections and influence their political behaviors (Amsalem & Zoizner, 2022). Extending this line of research, this study focused on the possible effects of national-level strategy and issue framing on emotional responses in the context of China-U.S. climate relationship.

Strategy framing in climate change communication

Climate change is a global crisis that requires coordinated actions from different countries, but policies aiming at mitigating climate risks can possibly impact a country’s economic performance and competitiveness (Kashwan et al., 2023). For example, in the China-U.S. climate relationship, addressing climate change is often intertwined with

domestic priorities and strategic calculations (Milman, 2022). The tension between global climate concerns and national self-interest reflects the logic of national-level strategy and serves as an appropriate context to test the effects of strategy framing on emotions.

Specifically, messages with national-level strategy framing typically contain competitive elements about international climate politics, which may give rise to a sense of threat to a country’s public interests in climate initiatives. The threat perception may subsequently incite anxiety (Gutiérrez-García & Contreras, 2013). Additionally, feelings of anger may arise from perceived discrepancy between the government’s purported role in addressing climate issues and their strategic focus on winning in zero-sum competition. In contrast, issue framing addresses substantial policymaking and solutions to climate threats and thus can construct a mindset of controllability and productive efforts, which is associated with pride, or feelings of accomplishment and confidence (Tracy & Robins, 2007). Concrete policy solutions to climate problems in issue-framed messages also can contribute to a sense of excitement, as individuals may feel empowered and motivated to take actions to address issues related to climate change (Glassman & Hadad, 2013). Therefore, we posit (see Fig. 1 for a summary of proposed hypotheses):

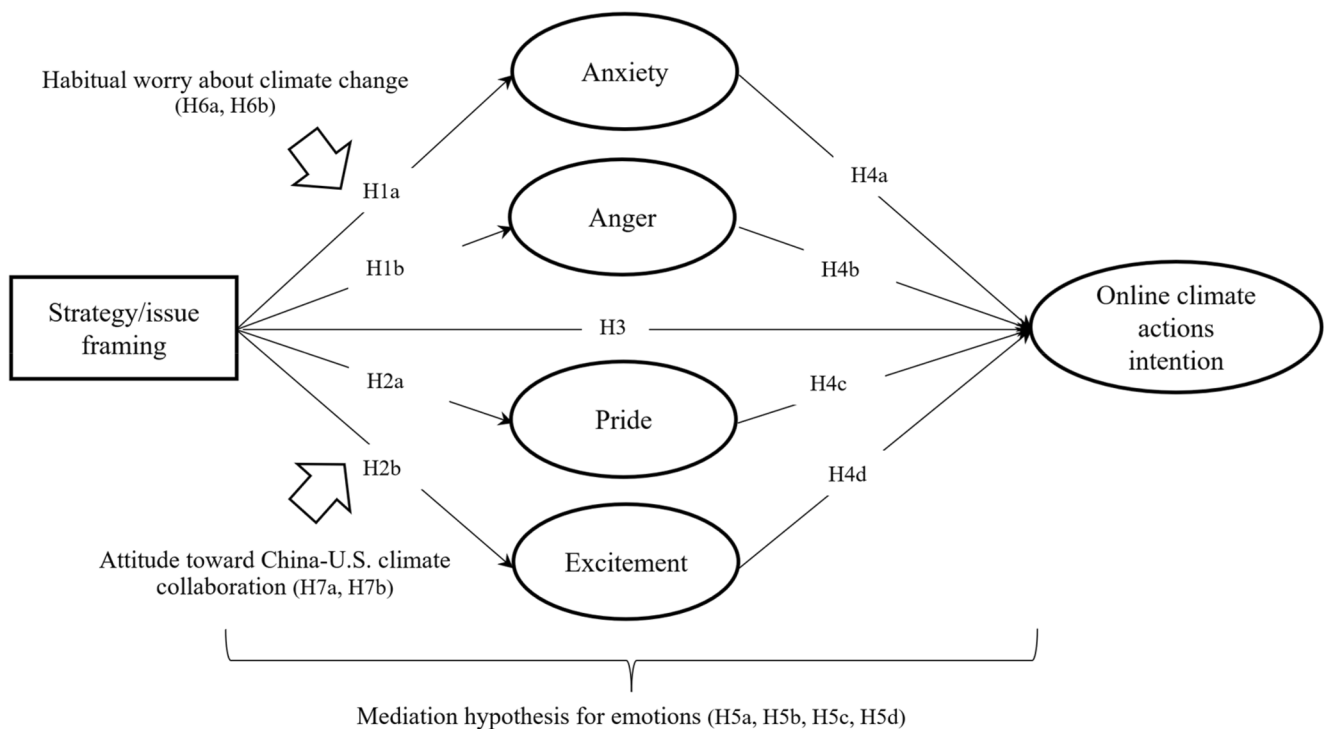


Fig. 1 Conceptual model summarizing hypotheses

H1 Participants in the strategy framing group will report higher levels of (a) anxiety and (b) anger compared to those in the issue framing group.

H2 Participants in the issue framing group will report higher levels of (a) pride and (b) excitement compared to those in the strategy framing group.

Compared to issue framing, strategy framing also may lower individual willingness to take climate actions. Strategic elements in international politics highlight national interests and in-group identities in the global fight against climate change. Such an emphasis might promote national protectionism and favouritism and thereby reduce support for climate mitigation due to perceived threats to national resources sovereignty and competitive positioning (McCright & Dunlap, 2011). In addition, strategic competition between countries may cultivate higher levels of scepticism toward climate change itself, which in turn, fuel perceptions that participation in climate action is less likely to yield significant changes (Borah, 2014; Valentino et al., 2001). Bogado's study (2024) in the U.S. context showed that nationalist framing would engender more nationalist thought, thereby dampening support for climate mitigation and augmenting climate scepticism. In contrast, issue framing may boost climate actions by conveying a sense of urgency related to the climate crisis and delineating specific interventions and policies to tackle climate issues (Valentino et al., 2001). Therefore, we propose that:

H3 Participants in the strategy framing group will report lower levels of online climate action intentions compared to those in the issue framing group.

Mediating role of emotions

Emotions are typically short-lived and can vary in intensity (Fiske & Taylor, 1991), serving as internal mental states that reflect evaluative and valenced reactions to different frames (Ortony et al., 2022). Once an emotion is triggered, it can impact how individuals interpret and respond to external stimuli. Recent empirical and meta-analytic research suggested that emotions experienced toward climate change are among the most important predictors of climate change-related behaviors and decision-makings (Brosch, 2021). This is applicable both to positive emotions such as pride and hope (Ojala, 2015) and negative emotions such as anger and guilt (Harth et al., 2013). In line with this, we expect emotions can influence intentions to engage in online pro-environmental behaviors. Therefore, we propose:

H4 Higher levels of (a) anxiety, (b) anger, (c) pride, and (d) excitement will be associated with higher levels of intentions to engage in online climate actions.

Furthermore, functional theories of emotion (Izard, 1993) suggested that discrete emotions can mobilize and allocate mental and physical resources for specific attitudes and behaviours. Nabi's (2003) emotion-as-frame model also proposed that following the elicitation of an emotion, information consistent with that emotion would become more readily accessible from one's memory, leading individuals to seek out information that aligns with the emotion's motivational goals. Recent research provided support for the emotion-as-frames perspective, demonstrating that emotions can mediate the relationship between frames and attitudinal or behavioural outcomes in controversial issues. For example, Lecheler et al.'s (2015) study showed that hope, anger, enthusiasm, and compassion mediated the effects of immigration related frames on public opinions concerning immigration. Similarly, Nabi et al. (2018) found that hope and fear respectively mediated the relationship between gain and loss frames and the public's attitude toward climate change. Therefore, we propose that:

H5 (a) Anxiety, (b) anger, (c) pride, and (d) excitement will mediate the effects of strategy framing (in comparison to issue framing) on online climate action intentions.

Potential moderators

The effects of strategy framing on emotions may be moderated by individual differences. For example, habitual worry about climate change—the enduring, repetitive, and automatic anxiety about climate change (Verplanken et al., 2020)—may moderate how strategy and issue framing influence emotions. Individuals who tend to worry about climate change in general may be more likely to support climate actions compared to those who are not worried about climate change (Wang et al., 2018). In line with this, exposure to messages with issue framing focused on substantial environmental policy may lead to more positive feelings among the “climate anxious” individuals, as substantial actions and solutions could mitigate their worry. In contrast, when “climate anxious” individuals are exposed to messages framed with political strategies and tactics, they may experience even stronger negative emotions, as the national zero-sum competition highlighted in such messages could be associated with perceptions that the crisis will remain unaddressed, thereby exacerbating their worry about climate change (Brader, 2006). Therefore, we posit:

H6a The positive effects of strategy framing (in comparison to issue framing) on anxiety and anger will be stronger for participants with higher levels of habitual worry about climate change compared to those who are less worried.

H6b The negative effects of strategy framing (in comparison to issue framing) on pride and excitement will be stronger for participants with higher levels of habitual worry about climate change compared to those who are less worried.

In addition, participants' previous attitudes toward China-U.S. climate collaboration may moderate the effect of strategy framing on emotional responses. Specifically, for individuals who advocate that China and the U.S. should collaborate to address climate risks, exposure to message with strategic elements may exacerbate anxiety and anger, because the strategic political competition does not contribute to solving climate issues collaboratively and is dissonant with their pre-existing ideas (Gross & Brewer, 2007). In comparison, exposure to message framed with issue elements may generate more pride and excitement for those who think China and the U.S. should keep a collaborative relationship on climate issues, as the information is in line with their existing beliefs. In sum:

H7a The positive effects of strategy framing (in comparison to issue framing) on anxiety and anger will be stronger for participants with more positive attitude toward China-U.S. climate collaboration.

H7b The negative effects of strategy framing (in comparison to issue framing) on pride and excitement will be stronger for participants with more positive attitude toward China-U.S. climate collaboration.

Method

Procedure

Upon approval from the Research Ethics Committee of the School with which the authors were affiliated, an online experiment was conducted in August 2022. Participants over the age of 18 were recruited through an online survey platform, *Credamo*¹. In compliance with requirements for ethical research, informed consent and voluntary participation were obtained before participants joined the study. Participants first responded to items assessing their habitual worry about climate change and attitude toward China-U.S.

climate collaboration and were then randomly assigned to either (a) strategy-framing group (experimental group) or (b) issue-framing group (control group). Participants read a message about China-U.S. climate relationship in the context of the 26th United Nations Climate Change Conference (COP26). The two messages were constructed following experimental design of previous studies (Cappella & Jamieson, 1997; see Appendix A for experimental stimuli in Chinese and English). After exposure to the stimuli, participants responded to items of negative (i.e., anger, anxiety) and positive emotions (i.e., pride, excitement), as well as intention to engage in online climate actions. Demographic questions were presented at the end of the survey. Upon completion, participants were compensated 15 RMB². Sample size for the experiment was decided based on results of power analysis using G*Power 3.1.³

Manipulation check

A pilot study with 100 participants was first conducted to ensure the effectiveness of manipulation. Participants were randomly assigned to either the strategy framing or issue framing condition, read the message, then responded to items that assessed their perceived levels of strategy framing and issue framing in the message. Upon successful manipulation check, data from 234 additional participants were collected.

Participants

To guarantee the quality of data collected on crowdsourcing panels, we included attention check questions and checked for total response time, response time per page and straight-lining responses. Three responses were excluded based on these criteria, yielding a final sample of 331 responses, with 164 participants in the experimental group and 167 in the control group.

Average age of the final sample was 30.38 ($SD=7.39$, range=18–57). Male accounted for 36.3% ($n=120$), and female accounted for 63.7% ($n=211$). Majority of participants had obtained Bachelor's degree ($n=241$, 72.8%), followed by Master's degree or above ($n=44$, 13.3%), Associate's degree ($n=39$, 11.8%), and high school or below ($n=7$, 2.1%). Participants' relational status included

² This study was a part of a larger project. Measures not relevant to this study are not reported in this manuscript.

³ For medium-size differences between strategy framing and issue framing groups on target outcomes (i.e., Cohen's $d=0.5$; t-test for two groups comparing the difference between intercepts), a minimum of $n=88$ in each group was required to achieve 95% power level at $p<.05$ significance level. Therefore, we targeted at an overall sample size of 300 participants and ended up with a final sample of $n=331$ (we over sampled so that low quality data could be dropped if needed).

¹ *Credamo* is a Chinese data platform based on 2.8 million participants.

married ($n=214$, 64.7%), not married but in a relationship ($n=41$, 12.4%), single ($n=74$, 22.4%), and separated/divorce ($n=2$, 0.6%). The sample was fairly geographically diverse, with participants living in 28 of China’s 34 provincial level administrative divisions. Participants’ self-reported monthly household income ranged from 2000 RMB and below ($n=28$, 8.5%), 2000–5000 RMB ($n=50$, 15.1%), 5000–8000 RMB ($n=91$, 27.5%), 8000–15,000 RMB ($n=110$, 33.2%), 15,000–30,000 RMB ($n=48$, 14.5%), to 50,000 RMB and above ($n=3$, 0.9%; one chose not to answer). Most respondents lived in urban areas ($n=270$, 81.6%).

Measures

For all study variables, higher scores indicated higher values of the variable. Reliability of variables were assessed using McDonald’s omega (ω). Confirmatory factor analyses (CFAs) were conducted for variables with four or more items. Model fit was considered good if the root mean squared error of approximation (RMSEA) was less than 0.06 and the Comparative Fit Index (CFI) was above 0.95; model fit was considered acceptable if the RMSEA was between 0.06 and 0.08 and the CFI was between 0.90 and 0.95 (Hu & Bentler, 1999). Table 1 presents descriptive statistics (M , SD , range, and ω) for study variables (see Appendix B for all measures in English and Chinese).

Emotions

Three items adapted from Richins (1997) were used to measure excitement (i.e., “How much did the message make you feel excited/thrilled/enthusiastic?”). Two items adapted from Tracy and Robins (2007) were employed to assess pride (confident/fulfilled). Anxiety (nervous/worried/tense) and anger (frustrated/angry/irritated) were assessed with three items adapted from Richins (1997). Participants rated their responses on 10-point Likert scales (1 = *not at all* to 10 = *extremely*).

Online climate action intention

Five items for online climate action intention were adapted from Shah et al. (2019) and Adams (2018) (e.g., “I will upload crisis-related information, video, pictures on social networking sites during climate crisis”; “I will comment and share information and posts on social network sites to help people during global warming crisis”). Participants rated their responses on 6-point Likert scales (1 = *extremely unlikely*; 6 = *extremely likely*). CFA results suggested that the five items formed a unidimensional factor online

Table 1 Descriptive statistics and bivariate correlations of study variables

	ω ($C_{I_0.5}$)	Range	M		SD		Strategy Frame		Issue Frame		Skewness	Kurtosis	1	2	3	4	5	6	
			M	SD	M	SD	M	SD											
1. Anxiety	0.94 (0.92, 0.95)	1–10	4.41	2.71	5.86	2.52	2.99	2.06	0.27	-1.19	-	-	-	-	-	-	-	-	-
2. Anger	0.95 (0.94, 0.96)	1–10	3.40	2.63	5.04	2.56	1.80	1.45	0.67	-0.73	0.83***	-	-	-	-	-	-	-	-
3. Pride	.75 ^a	1–10	5.90	2.48	4.81	2.39	6.96	2.07	-0.45	-0.78	-0.62***	-0.58***	-	-	-	-	-	-	-
4. Excited	0.91 (0.89, 0.92)	1–10	5.74	2.41	4.82	2.35	6.65	2.10	-0.40	-0.96	-0.49***	-0.51***	0.80***	-	-	-	-	-	-
5. Intention	0.75 (0.68, 0.80)	1–6	4.99	0.62	5.05	0.54	4.93	0.69	-1.36	2.21	0.19***	0.11*	0.18**	0.17***	-	-	-	-	-
6. Worry	0.86 (0.83, 0.88)	1–7	4.14	1.03	-	-	-	-	-0.47	-1.79	0.22***	0.25***	0.05	0.15**	0.38***	-	-	-	-
7. Attitude	-	0–1	0.61	0.49	-	-	-	-	0.15	-0.64	0.04	0.05	0.02	0.08	0.06	0.23***	-	-	-

$n=331$. ω = McDonald’s omegas ($C_{I_0.5}$ = 95% Confidence Interval). Intention = online action intention. Worry = habitual climate worry. Attitude = attitude toward China-U.S. climate collaboration

^a Spearman correlation (r) between the two items used to measure pride. * $p < .05$. ** $p < .01$. *** $p < .001$

climate action: $\chi^2(4)=6.21$, $\chi^2/df=1.55$, CFI=0.997, RMSEA=0.04, SRMR=0.03.

Habitual worry about climate change

Eight items adapted from Clayton and Karazsia (2020) were used to measure participants' habitual worry about climate change (e.g., "Thinking about global warming makes it difficult for me to concentrate"; "My friends say I think about global warming too much"). Participants rated their responses using a 7-point Likert scale (1=*strongly disagree* to 7=*strongly agree*). CFA results suggested that the eight items formed a unidimensional factor for habitual worry about climate change: $\chi^2(17)=53.79$, $\chi^2/df=3.16$, CFI=0.994, RMSEA=0.08, SRMR=0.05.

Attitude toward China-US climate collaboration

One item adapted from Asia Society Policy Institute (2021) was used to measure attitude towards China-U.S. climate collaboration. Participants responded to the following question: "Regarding China's strategy to manage China's relationship with the U.S. on the issue of global warming, which approach comes closer to your view, even if neither is exactly right?". Then, they were asked to choose one which best reflected their point of view: "China should work closely with the U.S. on climate and other important global issues" (coded as "0") or "China should work with the U.S. conditionally or should not work with the U.S. on climate because the U.S. will not play by the rules" (coded as "1").

Results

Results of manipulation check

Results of manipulation check showed that participants in the strategy framing group ($n=50$) reporting higher levels of perceived strategy framing ($M=5.64$, $SD=0.89$, $n=50$) than participants who read issue framing message ($M=4.16$, $SD=1.15$, $n=50$), $t(98)=7.18$, $p<.001$, Cohen's $d=1.44$ and participants in the issue framing group ($n=50$) reporting higher levels of perceived issue framing ($M=5.67$, $SD=0.80$, $n=50$) than participants exposed to strategy framing ($M=4.71$, $SD=1.33$, $n=50$), $t(98)=4.34$, $p<.001$, Cohen's $d=0.87$.

Comparisons between strategy and issue framing on emotional reactions

Independent samples t -tests were employed to compare mean scores between strategy framing group and issue framing

group regarding emotions (anxiety, anger, excitement and pride), as well as online climate action intentions. Study variables were checked for assumptions of normal distributions. All variables were approximately normal except for one (i.e., online climate action intention). Scores on online climate action intentions were transformed (Tabachnick & Fidell, 2007). Results for analyses with transformed versus non-transformed scores were consistent. Therefore, results with raw scores were reported below.

H1 predicted that strategy-framed message would evoke higher levels of (a) anxiety and (b) anger than issue-framed message, whereas H2 predicted issue-framed message would incite higher levels of (a) pride and (b) excitement than strategy-framed message. Levene's test for equality of variances suggested unequal variances among participants' scores of anxiety, anger, pride, excitement, online climate actions between strategy framing and issue framing groups (see Table 1). Results for t -tests with unequal variances showed that exposure to strategy frame generated higher levels of anxiety ($M=5.86$, $SD=2.52$, $t(314)=11.31$, $p<.001$, Cohen's $d=1.25$) and anger ($M=5.04$, $SD=2.56$, $t(257)=14.12$, $p<.001$, Cohen's $d=1.56$) compared to exposure to issue frame ($M=2.99$, $SD=2.06$ for anxiety; $M=1.80$, $SD=1.45$ for anger). The mean difference between strategy framing and issue framing group was -2.87 [$CI_{95} = -3.36, -2.37$] for anxiety and -3.24 [$CI_{95} = -3.69, -2.78$] for anger. H1a and H1b were supported.

Participants in the issue framing group reported higher levels of excitement ($M=6.65$, $SD=2.10$, $t(324)=7.48$, $p<.001$, Cohen's $d=0.82$) and pride ($M=6.96$, $SD=2.07$, $t(321)=8.74$, $p<.001$, Cohen's $d=0.96$) than those in strategy framing group ($M=4.82$, $SD=2.35$ for excitement; $M=4.81$, $SD=2.39$ for pride). The mean difference between issue framing and strategy framing group on excitement was 1.83 [$CI_{95} = 1.35, 2.32$] and 2.15 [$CI_{95} = 1.67, 2.63$] on pride. Therefore, H2a and H2b were supported.

H3 predicted that strategy framing of China-US climate relationship would result in lower online climate action intentions compared to issue framing. Findings indicated that online climate action intentions did not differ between the strategy frame group ($M=5.05$, $SD=0.54$, $t(314)=1.68$, $p=.10$, Cohen's $d=0.18$) and the issue frame group ($M=4.93$, $SD=0.69$). Therefore, H3 was not supported.

Mediating role of emotion

The mediating roles of emotions between message framing and online climate action intentions were examined by structural equation modeling (SEM), with message framing as the exogenous variable, emotions as the mediating variables, and online climate action intentions as the latent endogenous variables. Analyses were conducted using

lavaan (0.6–12) in *R*. Mediation analyses were tested by computing bias-corrected bootstrapped confidence intervals with 1000 random samples. The full information maximum likelihood estimator was used to handle missing data (Graham, 2009).

The measurement model obtained good fit: $\chi^2(93)=210.68$, $\chi^2/df=2.27$, $p<.001$, CFI=0.97, RMSEA=0.06 [$CI_{95}=0.049, 0.075$], SRMR=0.04. Demographic variables, including gender, age, educational level, marriage, income residential area, and online media usage were controlled in the structural model as covariates (only significant covariates were kept in the final model). Results for the structural model suggested acceptable fit, $\chi^2(147)=282.17$, $\chi^2/df=1.92$, $p<.001$, CFI=0.97, RMSEA=0.05 [$CI_{95}=0.042, 0.064$], SRMR=0.04.

H4a-H4b predicted that both negative emotions (anxiety and anger) and positive (pride and excitement) would be positively associated with intentions to engage in climate actions online. However, the results suggested that anxiety ($b=0.75$, $SE=0.25$, $p=.002$, $CI_{95}=0.30, 1.10$) was positively associated with individuals' intentions to engage in online climate actions, whereas anger was negatively associated with climate action intentions ($b=-0.38$, $SE=0.16$, $p=.02$, $CI_{95}=-0.68, -0.09$). Pride ($b=0.39$, $SE=0.53$, $p=.75$, $CI_{95}=-0.58, 1.32$) and excitement ($b=-0.08$,

$SE=0.42$, $p=.85$, $CI_{95}=-0.81, 0.67$) were not significantly associated with climate action intentions. Therefore, H4a was supported, whereas H4b-H4d were not supported (see Fig. 2 for model results with standardized path coefficients).

H5 predicted that the effects of message framing on climate action intentions would be mediated by anxiety (H5a) and anger (H5b) as well as pride (H5c) and excitement (H5d). Results of mediation analyses showed that the association between strategy framing and online climate action intentions was positively mediated by anxiety ($b=0.98$, $SE=0.33$, $p=.003$, $CI_{95}=0.16, 0.61$) and negatively mediated by anger ($b=-0.63$, $SE=0.27$, $p=.02$, $CI_{95}=-0.43, -0.06$). Therefore, H5a and H5b were supported. The excitement ($b=0.08$, $SE=0.40$, $p=.85$, $CI_{95}=-0.29, 0.35$) and pride ($b=-0.49$, $SE=0.66$, $p=.46$, $CI_{95}=-0.68, 0.30$) did not mediate the association between message framing and climate action intentions. Thus, H5c and H5d were not supported.

Moderation analyses

Moderation analyses were tested using Hayes' (2017) PROCESS macro in SPSS. Statistically significant interactions were investigated with simple slope analyses at the mean and one SD above and below the moderator mean.

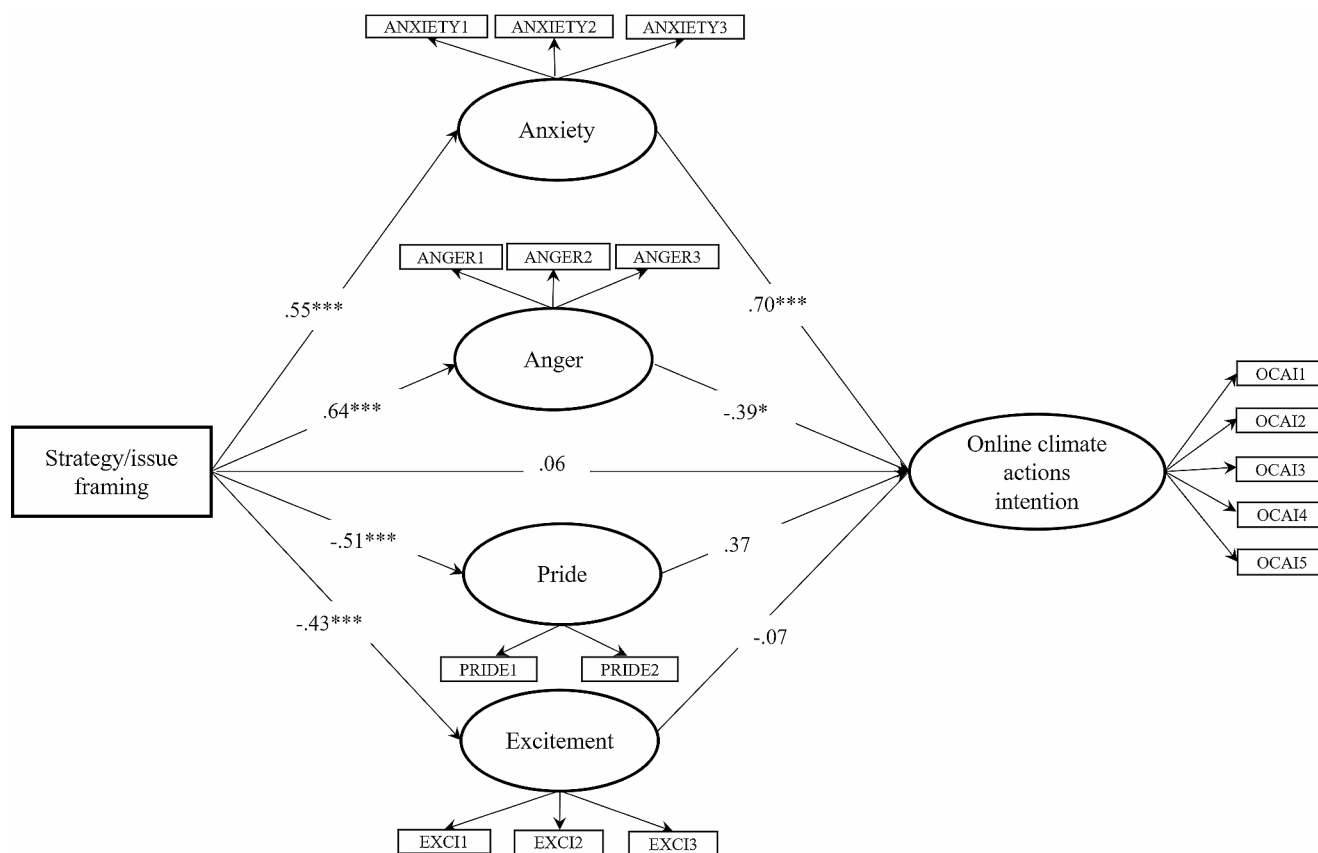


Fig. 2 Structural equation model with standardized path coefficients. *Note.* See Appendix C for item factor loadings

The Johnson-Neyman technique was used to determine the values of a moderator at which the association between the independent and dependent variables is statistically significant.

Regarding H6a and H6b, results indicated that participants' habitual worry about climate change significantly moderated the effect of message framing on anxiety ($b=0.59, SE=0.24, p=.02, CI_{95}=0.11, 1.06, R^2=0.01$; see Fig. 3A). Specifically, the positive effects of strategy framing on anxiety (in comparison to issue framing) was stronger for those with higher levels of habitual worry about climate change ($b=3.38, SE=0.35, p<.001, CI_{95}=2.69, 4.07$) compared to those who reported medium levels ($b=2.78, SE=0.25, p<.001, CI_{95}=2.29, 3.26$) and lower levels of habitual worry about climate change ($b=2.18, SE=0.35, p<.001, CI_{95}=1.48, 2.87$). Additionally, habitual worry also moderated the effect of strategy framing on pride ($b=-0.49, SE=0.24, p=.04, CI_{95}=-0.96, -0.02, R^2=0.01$; see Fig. 3B). Specifically, the negative effect of strategy framing (in comparison to issue framing) was stronger for participants who, in general, were more worried about climate change ($b = -2.69, SE=0.35, p<.001, CI_{95} = -3.37, -2.01$) compared to those with medium level ($b = -2.19, SE=0.24, p<.001, CI_{95} = -2.67, -1.71$) and lower level ($b = -1.69, SE=0.35, p<.001, CI_{95} = -2.37, -1.00$) of habitual worry. Habitual worry did not moderate the effects of strategy framing on anger ($b=0.33, SE=0.22, p=.13, CI_{95}=-0.09, 0.76$) or excitement ($b=-0.31, SE=0.24, p=.18, CI_{95}=-0.78, 0.15$). Therefore, H6a and H6b were partially supported.

Regarding H7a and H7b, results revealed that attitude toward China-U.S. climate collaboration moderated the

effects of message framing on anxiety ($b = -1.10, SE=0.53, p=.04, CI_{95} = -2.14, -0.06, R^2=0.01$; see Fig. 4A) and anger ($b = -1.74, SE=0.47, p<.001, CI_{95} = -2.66, -0.81, R^2=0.03$). In similar patterns, the positive effects of strategy framing (in comparison to issue framing) on anxiety ($b=3.52, SE=0.41, p<.001, CI_{95}=2.70, 4.33$) and anger ($b=4.29, SE=0.37, p<.001, CI_{95}=3.56, 5.01$) were stronger for participants who supported China-U.S. climate collaboration compared to those who were hesitant about such collaboration (for anxiety: $b=2.42, SE=0.33, p<.001, CI_{95}=1.77, 3.06$; for anger: $b=2.55, SE=0.29, p<.001, CI_{95}=1.98, 3.12$). Additionally, attitude toward China-U.S. climate collaboration also moderated the effect of strategy framing on excitement ($b=1.18, SE=0.50, p=.02, CI_{95}=0.19, 2.16, R^2=0.01$; see Fig. 4B). Excitement tended to be more negatively affected by strategy framing (in comparison to issue framing) among participants who supported China-U.S. climate collaboration ($b = -2.59, SE=0.39, p<.001, CI_{95} = -3.37, -1.82$) than for those who were not as supportive ($b = -1.42, SE=0.31, p<.001, CI_{95} = -2.03, -0.81$). Attitude toward China-U.S. climate collaboration did not moderate the effect of strategy framing on pride ($b=0.71, SE=0.51, p=.16, CI_{95} = -0.29, 1.72$). Therefore, H7a and H7b were partially supported.

Discussion

Situated within the context of China-U.S. climate change collaboration and competition, this study sought to advance theoretical understanding about how emotions function in strategy framing effects in international political contexts.

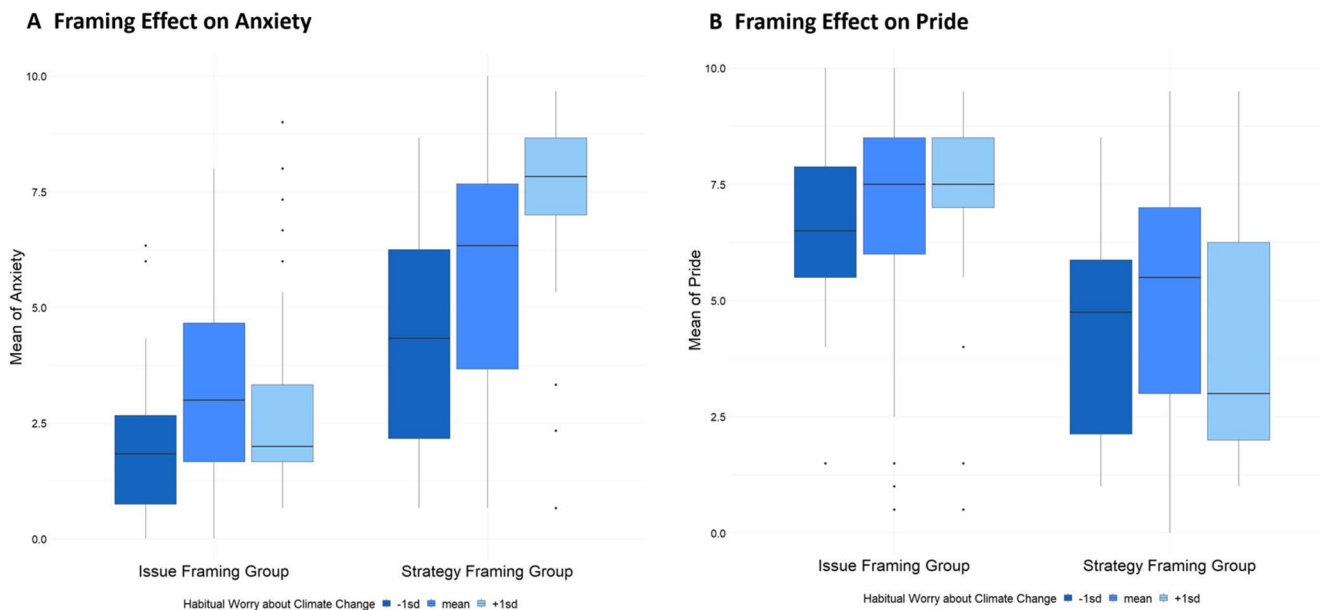


Fig. 3 Habitual worry about climate change as moderator for the effect of message framing on emotions

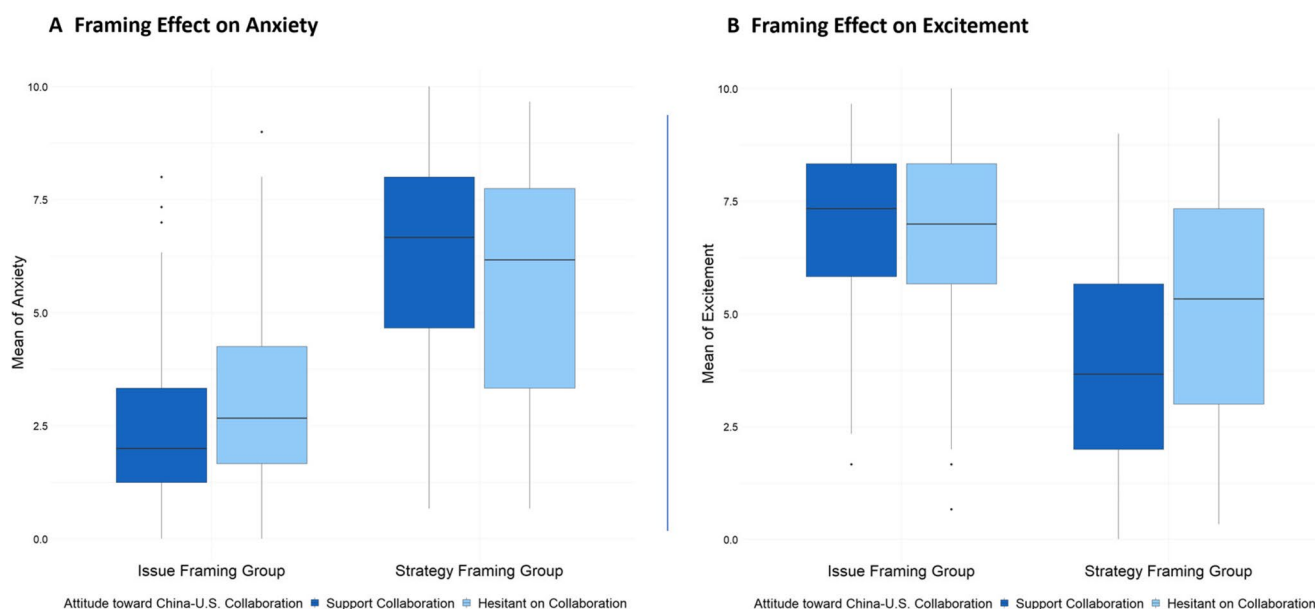


Fig. 4 Attitude toward China-U.S. climate collaboration as moderator for the effect of message framing on emotions

As expected, results indicated that China-U.S. climate relationship framed as national strategy evoked more negative emotions (anxiety and anger), whereas issue framing incited more positive emotions (pride and excitement). Anxiety was positively associated with climate action intention, whereas anger was negatively associated with the intention. Theoretical and practical implications are discussed below.

Theoretical contributions

First, following scholars' endeavours to extend the conceptualization and application of strategy framing from individual politicians within Western domestic settings to national strategies in global politics (Jackson, 2011; Liu et al., 2023), this study was the first to empirically investigate the effects of national-level strategy framing on emotional responses and subsequent climate action intentions in the context of global climate competition. The finding that strategy framing of climate competitions between two nations influenced online climate action intentions through affective mechanisms corresponds with recent calls to investigate the role of emotions in addition to emphasis on cognitions in framing effects (e.g., Lecheler et al., 2015; Ortony et al., 2022). Future research should continue to unpack how national-level strategy framing may influence individuals' beliefs, attitudes, and behaviors through cognitive as well as affective processes across different contexts and countries.

Regarding the hypotheses about discrete emotional reactions, consistent with previous research (e.g., Gross & Brewer, 2007) in Western domestic political contexts, exposure to national-level strategy framing was associated with anxiety and anger. It is possible that highlighting strategic

competition between countries can heighten a sense of uncertainty and uncontrollability, aggravating negative feelings. It should be noted that strategy framing commonly encompasses elements of both strategy and game framing (Aalberg et al., 2017), which may evoke distinct negative emotions. For example, game framing that highlights competitive battle may incite more anxiety, whereas strategy framing that focuses on self-serving motivations of political elites over public interests may trigger feelings of anger and unfairness. In comparison, exposure to issue framing was associated with positive emotions such as pride and excitement. Individuals may perceive the issue-framed policies as effective and capable of addressing social problems, which may enhance their sense of efficacy, instill optimism about the possibility of positive changes, and foster personal and collective control over societal issues (Anspach & Draguljić, 2019). It is important to note that strategy framing not only influenced average levels of anxiety, anger, pride, and excitement but also led to significantly more variance among participants in terms of their self-reported emotional responses (see Table 1). In other words, issue frame led to more homogeneous emotional responses whereas emotional responses to strategy framing showed more heterogeneity. Future research should examine distinct emotional responses toward strategy framing as well as factors that predict such heterogeneity to better understand the effects of framing on discrete emotions (e.g., Lecheler et al., 2015; Nabi, 2003). Importantly, within the context of climate change, different beliefs about the causes of climate change may be associated with distinct emotions. For example, Aguilar-Luzón et al. (2023) found that participants in the anthropogenic group (i.e., climate change considered

as the result of human action) showed more anxiety and anger compared to those believing that climate change was the result of the planet's natural activity. This suggests that different message frames (e.g., strategy framing and anthropogenic framing) may interact with each other in their influence on emotions, which deserves further investigation.

Moreover, the findings revealed that only anxious emotion was positively associated with greater inclination toward participating in online climate activities. Contrary to expectations, anger was associated with a reduced intention to take online actions about climate change. The unexpected outcome may be attributed to the specific context of international climate competition, where negative emotions are provoked not solely by the climate crisis itself but also by governmental policies on climate change. The perception of governmental use of public crises as political leverage generates a dual emotional response in the public. On one hand, there is an increase in anxious emotions, fostering a desire to take actions to address the issue. This finding corroborates the idea that emotional experiences can serve as a catalyst for engaging in pro-environmental behaviors (Aguilar-Luzón et al., 2023; Brosch, 2021). That is, emotions elicited by messages may create a sense of urgency and personal relevance, thereby boosting motivation and willingness to act regarding climate matters (Dunlop et al., 2008). On the other hand, there is a sentiment of anger towards governmental inaction and the perceived prioritization of political interests over a globally shared crisis. This anger may lead to a perception that individual actions toward climate change are futile and unnecessary. The findings suggest that when the public perceives and feels anger about the discrepancy between governmental policy and public benefits, they may be less inclined to exert efforts to address these issues.

Furthermore, positive emotions—excitement and pride—did not demonstrate a significant relationship with the intention to act on climate issues. The reason may be that the positive emotion might be linked to general support for environmental issues (Wang et al., 2018) but may not reach the threshold necessary to spur specific actions, especially when such actions require significant effort or change in behavior. That is, people might feel positive about climate actions and the idea of protecting the environment without the impetus that drives specific actions. Future research should continue to examine how emotions can motivate online and offline climate actions.

Notably, habitual worry about climate change moderated the causal relationship between strategy framing and anxiety, as well as between issue framing and pride. In other words, emotional responses to message frames are not universal, but can be amplified or attenuated depending on individual differences. Emotions can operate as an

adaptive filter that focalizes individuals' thought and actions on events that are relevant for their concerns and values (Brosch, 2021). For example, strategy framing embodies a great deal of uncertainty and volatility (D'Angelo et al., 2005), which could aggravate individuals' anxious feelings. Therefore, strategy framing messages may be particularly harmful for individuals with higher levels of habitual worry, possibly because these individuals are more likely to be influenced by uncertain and future-oriented threats (Gu et al., 2020). Similarly, issue framing with substantial policy content often encompasses decisive elements and offers a tangible solution to climate issues (Slothuus, 2008), which could alleviate feeling of uncertainty, unpredictability and uncontrollability for those who habitually worry about climate change. Future research should continue to examine how individual differences may impact emotional responses to strategy and issue framing.

Additionally, attitude toward China-U.S. collaboration also moderated the effect of message framing on anxiety, anger and excitement. Specifically, strategy framing messages evoked more anxiety and anger and less excitement among individuals who held a positive attitude toward China-U.S. climate collaboration compared to those who were hesitant or opposed to such collaboration. This may be due to the competitive and tactical elements in strategy framing, which conflicted with their pre-existing attitudes on this matter (i.e., pro-collaboration) and caused greater psychological dissonance. In contrast, individuals who did not support China-U.S. climate collaboration might have already been cognizant of relevant competitions between the two countries. As a result, their emotions were not influenced as much by message framing. This result aligns with the findings of Gross and D'Ambrosio (2004, p. 21) that "emotional reactions are conditioned by both predisposition and the information available in a given frame." Future research should continue to unpack conditional factors that may influence framing effects on emotions in different contexts.

Practical implications

Practically, findings of this study suggest important directions for message design in climate change communication. Specifically, audience segmentation based on individual differences such as habitual worry about climate change as well as attitude toward international climate collaborations should be considered when (international) non-governmental organizations design and evaluate communication initiatives to mobilize climate actions. It also will be important to design messages that may trigger appropriate emotions, which can motivate individuals to participate in online climate actions.

Limitations

Several limitations are worth noting. First, emotional responses were assessed through self-reported measures. Future research may consider using objective and unobtrusive methods to assess emotional reactions (Brosch, 2021). Second, this study focused on the emotions of pride, excitement, anxiety, and anger. The role of other emotions (e.g., empathy, hope, fear, humor; Roeser, 2012; Skurka et al., 2018) should be examined in the future. Third, attitude toward China-U.S. climate change relationship was measured using a dichotomous variable, which might not be able to capture the multifaceted nature of individual attitudes. Future research could consider using ordinal and interval levels of measurement that allow for a wider range of responses. Fourth, this study focused on online climate actions, such as dissemination of climate related information and engaging in online discussion, but not actual climate mitigation behaviors (e.g., cut down on food waste, use public transportation). Future research should examine whether and how strategy framing may influence different types of online and offline climate actions. Last, the distinctive political and social environments of China and the unique context of climate change might limit the ability to generalize our findings to other socio-political and cultural contexts and to other issues. Future research should examine the effects of national-level strategy framing and issue framing across different contexts. Despite these limitations, this study is one of the first to empirically test strategy framing effects in global climate change context and offers valuable insights regarding the effects of strategy framing on emotions as well as its application in climate communication.

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Data availability The data is available at <https://osf.io/a7eys/>. <https://doi.org/10.17605/OSF.IO/A7EYS>.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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