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How does COVID-19 emergency cognition influence public pro-environmental behavioral intentions? An affective event perspective

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ABSTRACT

Social impacts and serious damages caused by the COVID-19 pandemic have resulted in public introspection on the issue of ecological environmental protection. However, whether the public cognition of COVID-19 can promote pro-environmental behavioral intentions (PEBI) has not yet been determined; this is crucial for studying the ecological significance of the pandemic. Based on the affective events theory (AET), this study investigated the mechanism by which COVID-19 emergency cognition influences public PEBI. Following an analysis of 873 public questionnaires, the results reveal that public cognition of COVID-19 emergency can significantly promote PEBI. Among them, the effect of emergency coping is stronger than that of emergency relevance. Besides, the positive and negative environmental affective reactions aroused by COVID-19 pandemic play a mediating role between the emergency cognition and PEBI. Moreover, the positive environmental affective reactions show a stronger positive effect on household-sphere PEBI. However, the negative environmental affective reactions are more prominent in promoting public-sphere PEBI. This research aims to bridge a research gap by establishing a link between COVID-19 pandemic and PEBI. The findings can provide useful recommendations for policymakers to find the opportunity behind the COVID-19 emergency to promote public PEBI.

1. Introduction

Public health and environmental sustainability are daunting global challenges of our society (Martin et al., 2020; WHO,2015; Tilman and Clark, 2014). The COVID-19 outbreak has spread in many countries and regions. As of August 11th, 2020, COVID-19 has caused 19,936,210 cases and 732,499 deaths worldwide (WHO, 2020). Based on the available evidence, several types of wild animals have been found to be natural reservoir hosts of COVID-19 (Zhou et al., 2020). The activities of illegal slaughter and trade of wild animals have posed potential hazards to public health and safety. Moreover, the latest research proves that environmental issues, such as air pollution and climate change, also have a significant impact on the spread of the COVID-19 virus and related mortality (Shakil et al., 2020). For example, areas with high levels of air pollution suffered more serious damage by COVID-19. Long-term exposure to pollutants such as $PM_{2.5}$, PM_{10}, and NO_2 could accelerate the spread of COVID-19 (Zhu et al., 2020) and increase the

mortality rate (Ogen, 2020). It can be observed that ecological degradation and environmental pollution have exacerbated the threat of COVID-19 to public life and health, which has urged people to reassess and rethink the relationship between humans and nature (Shakil et al., 2020; van Staden, 2020). A growing number of people have realized that the uncontrolled demands of our modern society have harmed the ecological balance and damaged the ecological environment. It also has brought serious retribution to human survival and sustainable development at the same time (Chakraborty and Maity, 2020). Therefore, transforming this crisis into an opportunity to promote environmental protection, and consequent enhancing public PEBI, this could provide a new approach for sustainable development.

To effectively stimulate public pro-environment behavior (PEB), exploring the antecedents of PEB has been widely investigated in the fields of psychology and environmental management. Previous studies have mainly focused on the effects of individual psychological variables, socio-demographic factors, and external contextual factors on PEB as

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well as PEBI (D. D. Li et al., 2019; Steg and Vlek, 2009). With regard to individual psychological factors, such as personal values (Ling and Xu, 2020; Mi et al., 2020), environmental awareness (Young et al., 2015), subjective norms (Ru et al., 2018), control beliefs (Park et al., 2020), and self-identity (Gkargkavouzi et al., 2019), have received attention; socio-demographic factors, such as gender (J. J. Li et al., 2019), age (Hughes et al., 2019),and educational attainment (Meyer, 2015) were paid attention to. In the external environment of individuals, scholars pay attention to reference group (Mi et al., 2019b), social norm (Young et al., 2017; Sun et al., 2018), leadership style (Mi et al., 2019a), and pro-environment climates (Zientara and Zamojska, 2018). However, the important events in the external context have not been paid enough attention to in promoting individual PEBI. Johns (2017) and Morgeson et al.(F.P. 2015) pointed out in event system research that events in the external contexts of the entity have been considered as a valuable research perspective that is different from the internal characteristics of the entity. Recently, scholars have begun to pay attention to the effects of climate change events on public environmental attitudes and behavioral tendencies (Deng et al., 2017; Wu et al., 2020). For ordinary people, climate change events (such as typhoon events) seem to be distant in space and time and occur in the "future", in "other" places, or to "other" people (Spence et al., 2012). However, damage caused by the COVID-19 pandemic is spreading globally and is closely related to everyone's health, daily life, and work. People have been perceiving and experiencing the huge impact caused by COVID-19. Therefore, exploring how COVID-19 emergency cognition influences public PEBI can provide new insights for predicting PEBI.

The affective events theory (AET) originated in the field of organizational behavior, providing an effective framework for understanding the influence of specific events on individual attitudes and behaviors (Weiss and Cropanzano, 1996; Weiss and Beal, 2015). The AET believes that employees' behaviors do not always come from rational factors, but are often influenced by affective reactions; work events (such as job promotion, layoff, leadership turnover, etc.) can lead to positive or negative affective reactions. These affective reactions could further shape the employees' attitudes and behaviors, and have an important impact on their performance (Weiss and Cropanzano, 1996). In the past, most research on pro-environmental behavior has been based on the theory of planned behavior (TPB) (Yuriev et al., 2020). The TPB mainly focuses on the influence of individual intrinsic psychological motivation on goal-oriented behavior. Because the TPB is based on the "Rational Man" hypothesis, irrational affective reactions factors have not been considered (Ajzen, 1991). However, the existing research on the AET proves that the affective reactions induced by work events are an important antecedent that could determine the individual's work attitudes and behaviors, even throughout the entire work process (Judge et al., 2006; Todorova et al., 2014). Existing research on the AET focuses on the influence of internal work events and pays less attention to external events (Butts et al., 2015).

In fact, personal decision-making behaviors are influenced not only by internal work events, but also by external contextual events (Ashton-James and Ashkanasy, 2005). In particular, the COVID-19 pandemic, which is defined as a Public Health Emergency of International Concern (PHEIC) (WHO,2020), has a subversive impact on public affective reactions and behaviors. While people feel moved, introspective, or other types of positive affective reactions, negative affective reactions such as fear and worry linger as well (Sun et al., 2020). The evidence shows that COVID-19 originated from nature (Andersen et al., 2020), and severe environmental issues such as air pollution have intensified the transmission speed and mortality rate of COVID-19 (Shakil et al., 2020). So, whether the pandemic experienced and recognized by individuals can stimulate public environmental affective reactions? How do different environmental affective reactions influence the household-sphere PEBI, workplace PEBI, and public-sphere PEBI? To answer these questions, based on the AET, this paper explores the mechanism of COVID-19 emergency cognition on public PEBI, which

would be a potential way for policymakers to promote PEB and learn from the COVID-19 pandemic.

The contributions of this study include the following: First, this study represents an effective attempt to expand the application field of the AET and introduce the AET from work events to external public health emergencies, providing a new perspective for analyzing the psychological mechanism of external emergencies on public PEBI. Second, in response to the researchers' appeals for integration of COVID-19 pandemic and environmental sustainability, we link the COVID-19 emergency cognition with three spheres of PEBI, including household-sphere PEBI, workplace PEBI, and public-sphere PEBI. This provides a new way to promote PEBI with the introspection derived from the COVID-19 pandemic. It is also an important supplement to previous studies on the antecedents of PEBI that paid little attention to the impact of external public health emergencies. Finally, the findings provide useful recommendations for policymakers to find the opportunity behind the COVID-19 emergency to promote public PEBI.

The rest of this paper is structured as follows. Section 2 provides a literature review and research hypotheses. Section 3 details the research procedures and methods. Section 4 presents the results. Section 5 offers a discussion, and Section 6 draws conclusions, provides suggestions, and discusses the limitations of the study.

2. Literature review and research hypotheses

2.1. COVID-19 emergency cognition and environmental affective reactions

According to the affective events theory (AET), the affective reactions triggered by an individual's event cognition are the decisive force of his/her subsequent attitude and behavior. Event Cognition is defined as individuals' cognitive appraisal of their relationship with the external environment. Affective reactions are indispensable mediating variable between event cognition and behavior. Event cognition is the key antecedent to stimulate different affective reactions (Weiss and Cropanzano, 1996). Lazarus (1991) divided the individual's event cognition into two dimensions: event relevance and event coping. Among them, event relevance was also called primary appraisal, focuses on whether and how events are related to human well-being. Event coping, also known as secondary appraisal, focuses on personal resources and the options for coping with an event.

The COVID-19 pandemic is defined as a Public Health Emergency of International Concern (PHEIC). To assess public cognition of the COVID-19 emergency, based on the AET and Lazarus' research, this paper divides emergency cognition into two dimensions: emergency relevance (ER) and emergency coping (EC). The specific definitions are as follows:

- ER refers to whether and to what extent an individual thinks an emergency is relevant to his or her well-being.
- EC refers to an individual's cognition of whether he or she has enough ability and resources to deal and cope with the COVID-19 pandemic.

Affective reactions are the experience of emotions or moods and tied to the appraisal of the external environment (Lazarus, 1991; Weiss and Cropanzano, 1996). Watson et al. (1988) divide affective reactions into two dimensions: positive affective reactions and negative affective reactions. Positive affective reactions reflect the extent to which a person feels enthusiastic, active, and alert, while negative affective reactions are subjective unpleasant experiences which subsumes a variety of aversive emotional state. Similarly, environmental affective reactions are also divided into positive environmental and negative (Bissing-Olson et al., 2016; Harth et al., 2013). Positive environmental affective reactions refer to the positive psychology states, such as joy, enthusiasm, and pride enabling an individual to experience or participate in environmental protection. Negative environmental affective reactions

include an individual's worries and anxiety about the deterioration of environment, or anger, guilt, and other negative affective states about the environmental pollution caused by human destructive behavior. In the COVID-19 pandemic, people's emergency cognition has stimulated different environmental affective reactions. For example, the pandemic may stimulate individual's positive environmental affective reactions such as encouragement, inspiration, and pride in strengthening efforts to protect the ecological environment; as well as negative environmental affective reactions such as anger, worry, and scare toward the behaviors and consequences of destroying the ecological environment and killing wild animals.

Studies based on the AET have found that event cognition may stimulate both positive and negative affective reactions. The affective reactions are the key antecedents that influence an individual's subsequent attitude and behavior (Weiss and Cropanzano, 1996). For example, Choi et al.(2011) found that when employees face innovative activities at work, they will feel cheer or delight because of the benefits brought by innovation, and also feel anxious or helpless when facing new things. For setting up open-plan offices, an internal workplace event, employees also experience positive or negative social-related affective reactions, such as positive affective concerns for colleagues or negative affective reactions like tensions of privacy violation (Ashkanasy et al., 2014; Zoghbi-Manrique-de-Lara and Sharifiatashgah, 2020). Therefore, these work events can trigger both positive and negative affective reactions. Moreover, the more important the event is, the stronger the affective reactions will be. However, since these events are internal events of the organization, the impact on an individual's work and life is limited. It is important to note that most of the studies did not test the mechanisms of ER and EC on positive and negative affective reactions.

Although some scholars call for expanding the AET from internal events to external events, there are only a few studies that focus on the influence of affective reactions caused by external events on individual attitudes and behaviors (Ashton-James and Ashkanasy, 2005). Especially for the COVID-19 pandemic, as a major PHEIC, everyone's life and work have been seriously influenced. Pandemic control measures, such as stay-at-home orders, maintaining social distance, and closure of public places issued by government, have made the public realize that COVID-19 is closely related to everyone. Previous studies have shown that the cognition of event relevance can trigger different affective reactions, and influence subsequent behaviors (Butts et al., 2015). Therefore, an individual's ER toward COVID-19 pandemic may also be an important antecedent of environmental affective reactions. In addition, when facing an event, the individuals' cognition of event coping would also produce different affective reactions (Folkman et al., 1986). For example, the additional requirements for online working conditions and processes in telework make some individuals feel anxiety and burnout (Chong et al., 2020). In particular, COVID-19 pandemic might, to a certain extent, be viewed as a disaster caused by artificial ecological environment exploitation. Environmental issues such as air pollution and climate change were proven to have a significant impact on the spread and mortality of COVID-19 (Shakil et al., 2020). This has caused an increasing number of the public to pay attention to the relationship between humans and the ecological environment on Chinese social media. For example, people began to rethink how to better protect wild animals (Wang et al., 2020) and how to effectively reduce the conflict between economic activities and the environment (Sarkodie and Owusu, 2020). Therefore, the public's various affective reactions to the COVID-19 pandemic may also include positive or negative affective reactions to environmental issues. In summary, this study infers that an individual's emergency relevance (ER) and emergency coping (EC) toward the COVID-19 pandemic will be important antecedents of positive or negative environmental affective reactions. On these bases, we propose the following hypotheses:

H1. COVID-19 emergency cognition has a positive effect on positive environmental affective reactions.

H1a. Emergency relevance has a positive effect on positive environmental affective reactions regarding COVID-19.

H1b. Emergency coping has a positive effect on positive environmental affective reactions regarding COVID-19.

H2. COVID-19 emergency cognition has a positive effect on negative environmental affective reactions.

H2a. Emergency relevance has a positive effect on negative environmental affective reactions regarding COVID-19.

H2b. Emergency coping has a positive effect on negative environmental affective reactions regarding COVID-19.

2.2. Environmental affective reactions and pro-environmental behavioral intentions (PEBI)

Because of the temporary pause of economic and social activities due to the COVID-19 pandemic, it is difficult to observe and measure pro-environmental behavior during this period. Some pro-environmental behaviors (such as taking public transportation, organizing large-scale offline environmental protection activities, etc.) are unlikely to occur under the restrictions of remote working and lockdowns. Therefore, this study focuses on people's PEBI. Previous studies have confirmed that PEBI is a powerful predictor of pro-environmental behavior (Chen et al., 2020; Si et al., 2020; Zahedi et al., 2019). When an appropriate behavioral intention is obtained, it can provide a more accurate behavioral prediction (Ajzen, 1991). Therefore, in this study, it is suitable to measure PEBI rather than the actual pro-environmental behavior.

Stern (2000) defined pro-environmental behavior as human activities to protect the environment or prevent environmental degradation, and Stern (2000) further divided pro-environmental behavior into environmental activism, nonactivist behaviors in the public sphere, private-sphere environmentalism, and other environmentally significant behaviors (influencing the actions of the organization). In recent years, with the expansion and migration of research scope and objectives, the division of pro-environmental behavior structure has become more diverse and multidimensional. Larson et al.(L.R. 2015) divided pro-environmental behavior into four dimensions: conservation lifestyle (household action), land stewardship (supporting wildlife habitat protection), social environmentalism (citizens' participation in public-sphere), and environmental citizenship (environmental communication among citizens). Mi et al. (2020) pointed out that pro-environmental behavior could be divided into two dimensions: private-sphere PEB (initiatives in the household and workplace) and public-sphere PEB (actions influencing government and social organizations). Based on the existing research, this study divides the PEBI into household-sphere PEBI, workplace PEBI, and public-sphere PEBI according to the space field of the occurrence of the pro-environmental behavior. Among them, household-sphere PEBI refers to the willingness of individuals to protect the environment through their efforts in their daily life to directly influence the quality of the environment (Stern, 2000). Workplace PEBI refers to the willingness of the public to influence the environment through the environmental behaviors implemented in the organization. For example, in a company, the technical staff is willing to design products in a way that is beneficial to the environment (Bissing-Olson et al., 2013; Stern, 2000). Public-sphere PEBI means that the public is willing to make a voice in public space to indirectly promote environmental protection, such as participating in the public hearing on environmental protection topics and actively reporting environmental violations to the government departments (Mi et al., 2020).

The AET points out that behaviors come directly from affective reactions, which are directly influenced by the cognitive process of events (Weiss and Cropanzano, 1996). Past studies have focused on the influence of environmental affective reactions on pro-environmental behavior, especially the stimulation of some negative affective reactions on environmental protection. For example, Graham-Rowe et al. (2015) found that anticipating regret helps predict residents' intentions to reduce household food waste. Later, Chang et al.(2019) used evidence in neuroscience technology to show that negative environmental affective reactions caused by viewing negative environmental pictures (such as cracked land) were significantly positively correlated with pro-environmental behavioral intentions. Recently, Salem et al. (2020) affirmed the role of affective reactions in an individual's garbage collection behaviors. At the same time, Salem et al. (2020) pointed out that even if lacking environmental knowledge, residents who live in refugee camps are willing to pay for solid waste disposal because they are worried about the health hazards caused by environmental problems. It is important to note that these studies focus more on negative affective reactions instead of the role of positive affective reactions.

However, in the global resisting pandemic process triggered by COVID-19, the Chinese government has strengthened law enforcement to protect the ecological environment, intensified the crackdown on wildlife smuggling and poaching. These measures have greatly inspired the public and triggered their awareness about environmental protection. Whether positive environmental affective reactions are a powerful factor in stimulating PEBI is also worth testing further. Therefore, we conjecture that in the context of the COVID-19 emergency, the positive and negative environmental affective reactions induced by the pandemic will directly influence PEBI. Based on the above analysis, the proposed hypotheses are shown below:

H3. Positive environmental affective reactions have a positive effect on PEBI.

H3a. Positive environmental affective reactions regarding COVID-19 emergency have a positive effect on household-sphere PEBI.

H3b. Positive environmental affective reactions regarding COVID-19 emergency have a positive effect on workplace PEBI.

H3c. Positive environmental affective reactions regarding COVID-19 emergency have a positive effect on public-sphere PEBI.

H4. Negative environmental affective reactions have a positive effect on PEBI.

H4a. Negative environmental affective reactions regarding COVID-19 emergency have a positive effect on private-sphere PEBI.

H4b. Negative environmental affective reactions regarding COVID-19 emergency have a positive effect on workplace PEBI.

H4c. Negative environmental affective reactions regarding COVID-19 emergency have a positive effect on public-sphere PEBI.

To summarize the above hypotheses, the research model is shown in Fig. 1.

3. Research procedures and methods

3.1. Survey samples and procedures

The survey of this research was conducted in March 2020. Since China was still at a critical juncture in the control of the pandemic, the public has been discouraged nonessential travel. Limited by the delay in returning to work and telework, the data collection was conducted through online survey.

With reference to the data collection procedure in the research of Wang et al. (2021), Si et al. (2020), and Ru et al. (2018), this research released formal questionnaires on China's largest online survey platform "Questionnaire Star". To maximize response rates and quality, we set rewards for each participant. To contact the public from all regions as widely as possible, the questionnaire uses the "questionnaire star" paid service, and distributed through WeChat (China's largest social network application), QQ (China's largest instant messaging software), Weibo (China's largest social media platforms), Baidu Tieba (China's largest social forum). Moreover, the questionnaire also was spread through 7 alumni groups. We also encourage participants to further spread through social networks such as friends or colleagues' groups to attract more participants. To partially overcome social desirability bias (Gnambs and Kaspar, 2015), eliminate the privacy concerns, and obtain real survey data, the participants were clearly informed this survey is anonymous; and all personal responses were only used for academic purposes. During the strict lockdown, an online survey allows participants to participate in our research as easily as possible, and also allows us to contact the public from all regions as widely as possible. Considering population size, time, and cost, convenience sampling is considered acceptable (Kapoor and Dwivedi, 2020).

A total of 1123 questionnaires were received. In the questionnaire screening process, considering that pro-environmental behavioral intentions (PEBI) are divided into three dimensions: household-sphere PEBI, workplace PEBI, and public-sphere PEBI, we deleted 191 samples of students without work experience, retired, and unemployed participants, and then further eliminated 59 incomplete questionnaires (Among the 59 deleted incomplete survey data, response time of 57 questionnaires was less than 30 s, The other 2 questionnaires' filling time was exceeded 7 h. Too short and too long response time implied
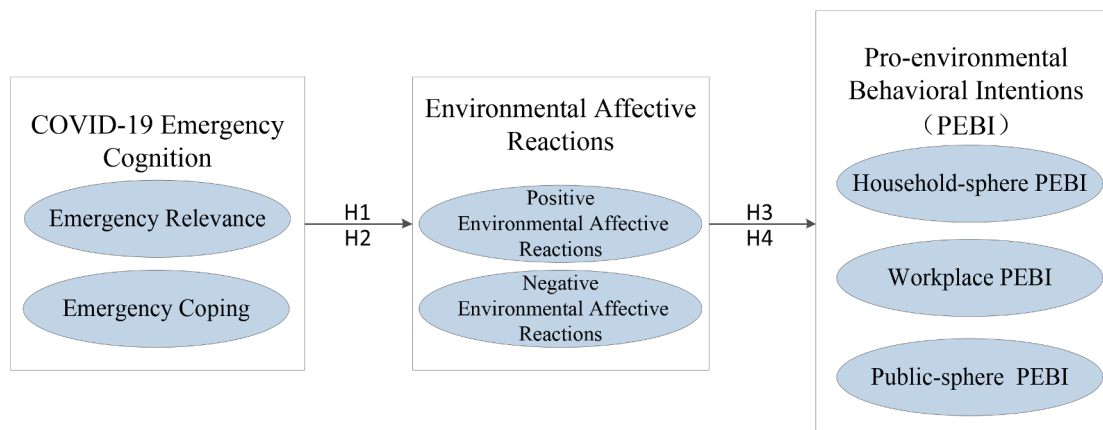

Fig. 1. Model of hypotheses.

that participants may be careless or inattentive during the survey (Huang et al., 2015)). Finally, 873 effective questionnaires were collected, distributed in 30 provincial-level administrative regions of China, and the efficiency of the questionnaire was 77.73%. The sample size meets the 10 samples/ 1 item ratio advocated by Kline (2015) and the structural equation model index requirements proposed by Mueller (1997) (the ratio between the number of samples and measured items is at least 10:1 to 15:1). **Table 1** lists the basic characteristics of the sample. In general, our samples have the representation to the Chinese, especially those who are active on online social platforms.

3.2. Variable measurement

All the constructs in this study were based on established scales, and the items were appropriately modified according to the COVID-19 emergency. All variables were measured using five-point Likert scales (1 = strongly disagree, 5 = strongly agree). **Appendix A** shows the complete questionnaire.

3.2.1. COVID-19 emergency cognition
The scale of COVID-19 emergency cognition was primarily based on Lazarus (1991) and Folkman et al. (1986), and was revised to fit with the COVID-19 pandemic. The scale included two dimensions: emergency relevance and emergency coping. The emergency relevance scale included three items (e.g. "COVID-19 emergency threatened my health or safety"); emergency coping was assessed by three items (e.g. "I can protect myself from the threat of COVID-19 emergency").

3.2.2. Environmental affective reactions
In this study, we selected the scale developed by Watson et al. (1988) and Lazarus (2006, 1991), and adapted the scale to reflect public environmental affective reactions toward COVID-19. The positive environmental affective reactions scale included three items (e.g. "I am inspired that COVID-19 emergency cognition has prompted the public to pay attention to the ecological environment"), and the negative environmental affective reactions scale was evaluated using four items (e.g. "The cognition of COVID-19 emergency makes me feel angry about the destruction of the ecological environment by others").

3.2.3. Pro-environmental behavioral intentions (PEBI)
By modifying the existing measurement scales of Stern (2000), L.R. Larson et al. (2015), and Bissing-Olson et al. (2013), we used nine items to measure PEBI. The revised scale included three dimensions: household-sphere PEBI, workplace PEBI, and public-sphere PEBI. Among them, the household-sphere PEBI scale included three items (e.g. "I would buy environmentally-friendly products"). The workplace PEBI was measured by three items (e.g. "I would fulfill responsibilities specified in my job description in environmentally-friendly ways"). The public-sphere PEBI scale contained three items (e.g. "I would express my views on an environmental issue to deputies to the National People's Congress or government officials").

3.3. Scale test

Considering that the questionnaire was filled out by the same object, it may cause a common method bias. For this reason, Harman's single factor test was adopted to analyze the common method bias (Harman, 1976). The results of Harman's single factor test showed that the contribution rate of the largest factor precipitated is 36.79%, which was lower than the threshold value of 50%. This indicated that common method bias was unlikely to be a serious problem in this study (Podsakoff et al., 2003).

The reliability and validity of this study were tested using SPSS25.0 and Mplus7.4 (see **Table 2**). The reliability coefficients (Cronbach's α) of all constructs are greater than the critical value of 0.7 (ranging from 0.722 to 0.911). The composite reliability (CR) values of all scales are higher than the threshold value of 0.7, indicating that the scale is

Table 1
Sample demographic characteristics.

Variable	Category	Number	Percentage (%)
Gender	Male	449	51.4
	Female	424	48.6
Age	<20	43	4.9
	20–30	406	46.5
	31–40	235	26.9
	41–50	141	16.2
	>50	48	5.5
Education level	Below junior high school	42	4.8
	Senior high school or secondary school degree	104	11.9
	Bachelor degree	485	55.6
	Graduate degree	242	27.7
Number of family members	1	32	3.7
	2	101	11.6
	3	307	35.1
	4	248	28.4
	>5	185	21.2
Occupation	Government staff	74	8.5
	Enterprise manager	189	21.7
	General workers or service personnel	167	19.1
	Engineer	194	22.2
	Staff working in non-profit organizations such as scientific research, education, medical care and other fields	158	18.1
	Freelancers	63	7.2
	Others	28	3.2

Table 2
Reliability and validity analysis of the variables.

Variable	Item	Loadings	Cronbach's α	CR	AVE
Emergency Relevance	ER1	0.547	0.829	0.849	0.663
	ER2	0.923			
	ER3	0.915			
Emergency Coping	EC1	0.516	0.722	0.774	0.543
	EC2	0.802			
	EC3	0.849			
Positive Environmental Affective Reactions	PEAR1	0.851	0.874	0.880	0.712
	PEAR2	0.933			
	PEAR3	0.736			
Negative Environmental Affective Reactions	NEAR1	0.794	0.798	0.817	0.532
	NEAR2	0.840			
	NEAR3	0.580			
	NEAR4	0.674			
Household-sphere PEBI	Ho-PEBI 1	0.863	0.891	0.893	0.735
	Ho-PEBI 2	0.902			
	Ho-PEBI 3	0.805			
Workplace PEBI	Wo-PEBI 1	0.855	0.911	0.912	0.776
	Wo-PEBI 2	0.896			
	Wo-PEBI 3	0.891			
Public-sphere PEBI	Pu-PEBI 1	0.855	0.853	0.857	0.666
	Pu-PEBI 2	0.896			
	Pu-PEBI 3	0.891			

Note: ER = emergency relevance; EC = emergency coping; PEAR = positive environmental affective reactions; NEAR = negative environmental affective reactions; Ho-PEBI = household-sphere PEBI; Wo-PEBI = workplace PEBI; Pu-PEBI = public-sphere PEBI.

reliable (Hair et al., 1998). Standardized factor loadings of scale items are greater than 0.50 (ranging from 0.516 to 0.933), and the average variance extracted (AVE) exceeded 0.50 (ranging from 0.532 to 0.776), supporting the convergent validity of the scale items. Moreover, as shown in Table 4, the diagonal values indicating the square root of the AVE for each construct are larger than the off-diagonal values representing the square of the correlation coefficient of each construct, which indicates that the constructs have good discriminant validity (Fornell and Larcker, 1981).

A confirmatory factor analysis was conducted in Mplus7.4. Four different models were compared in this study: one-factor model, in which all items measured the same factor; double-factor model, that is, PEBI measured one factor, while COVID-19 emergency cognition and environmental affective reactions measured the other one; triple-factor model, in which COVID-19 emergency cognition, environmental affective reactions, and PEBI measured one factor respectively; seven-factor model, in which emergency relevance, emergency coping, positive environmental affective reactions, negative environmental affective reactions, household-sphere PEBI, workplace PEBI, and public-sphere PEBI measured one factor respectively. Table 3 shows that compared to the other models, the seven-factor model demonstrated an acceptable fit. This result indicates a good distinction among these variables.

4. Results

4.1. Descriptive analysis and correlation analysis

Descriptive statistics are presented in Table 4, including means (M), standard deviations (SD). Table 4 also shows significant correlations among the variables and provides the basis for the following analysis.

4.2. Structural results and mediating effect analysis

To test our hypotheses, we used Mplus7.4 to validate the complete model. Following the fit indexes suggested by Hair et al. (1998) and Kline (2015), the results show that the model's fit indexes are acceptable (χ^2 = 560.651, DF=188, χ^2/DF=2.982, CFI=0.968, TLI=0.961, RMSEA=0.048, SRMR=0.047). Table 5 and Table 6 show the results of the direct effect and indirect effect paths between COVID-19 emergency cognition and PEBI respectively.

As shown in Table 5, the results indicate that ER is positively related to positive environmental affective reactions ($p < 0.001$) and negative environmental affective reactions ($p < 0.001$), and the standardized path values are 0.139 and 0.293 respectively; thus, H1a and H1b are supported. Moreover, EC has positive influences on positive environmental affective reactions ($p < 0.001$) and negative environmental affective reactions ($p < 0.001$), and the standardized path values are 0.564 and 0.364 respectively; therefore, H2a and H2b are supported.

Table 3
Results of confirmatory factor analysis of variable discriminant validity.

Fit index Evaluation standard	χ^2	DF	CMIN/ DF <3	CFI >0.9	TLI >0.9	RMSEA <0.08	SRMR <0.08
One –factor model	5330.018	209	25.502	0.559	0.513	0.168	0.113
Double–factor model	4257.590	208	20.469	0.651	0.613	0.149	0.133
Triple–factor model	3233.606	206	15.697	0.739	0.708	0.130	0.124
Seven –factor model	560.651	188	2.982	0.968	0.961	0.048	0.047

Notes: χ^2 = chi-square statistic; DF = degree of freedom; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = the root mean squared error of approximation; SRMR = standardized root mean square residual; evaluation standard is according to (Kline, 2015).

Positive environmental affective reactions can significantly promote household-sphere PEBI ($p < 0.001$), workplace PEBI ($p < 0.001$), and public-sphere PEBI ($p < 0.001$), and the standardized path values are 0.446, 0.371, and 0.440 respectively; thus, H3a, H3b and H3c are supported. Additionally, negative environmental affective reactions have a positive effect on household-sphere PEBI ($p < 0.05$), workplace PEBI ($p < 0.001$), and public-sphere PEBI ($p < 0.05$), the standardized path values are 0.139, 0.193, and 0.230 respectively; thus, H4a, H4b, and H4c are supported. Environmental affective reactions may be potential mediators in the relationship between the COVID-19 and PEBI. Therefore, we further analyzed the possible mediating effects.

Using the bootstrapping method, we repeated the sampling 2000 times in a 95% confidence interval (CI) for path analysis to test the mediating role of environmental affective reactions (Preacher and Hayes, 2008). As shown in Table 6, ER has a significant indirect effect on three dimensions of PEBI via both positive and negative environmental affective reactions. EC shows a significant indirect effect on three dimensions of PEBI via both positive and negative environmental affective reactions, and the specific indirect effect through positive environmental affective reactions is stronger than that of negative environmental affective reactions. Obviously, environmental affective reactions are of great significance to the relationship between the COVID-19 emergency cognition and PEBI.

According to the results of the structural equation model, the final operating results of the structural equation model are shown in Fig. 2.

5. Discussion

This study expands affective events theory (AET) from the focus of internal work events to external emergencies. It can be applied to explain the relationship between the COVID-19 emergency and PEBI. It also provides a novel perspective for promoting pro-environmental behavior. The main findings are shown below.

First, in line with our prediction, the public COVID-19 emergency cognition stimulates environmental affective reactions. The effects of emergency coping (EC) on environmental affective reactions are significantly stronger than that of emergency relevance (ER). ER only focuses on the consistency or conflict between the emergency and personal goals or values, which reflects the judgment of the interest relationship between the emergency and the public. EC is more meaningful for analyzing the consequences of the emergency and evaluating whether the individual has enough resources to deal with the emergency. This is consistent with previous studies based on cognitive appraisal theory, which divides event cognition into two levels: primary appraisal and secondary appraisal. According to this theory, ER belongs to primary appraisal, while EC belongs to secondary appraisal. With the deepening of the level and depth of individual cognition of events, affective reactions would be naturally strengthened (Lazarus, 1991). Previous studies have proved that the cognition of coping is an important driver of affective reactions. Planned problem-solving and active coping cognition help to improve affective states, while confrontation and alienation seem to make affective states worse (Folkman and Lazarus, 1988). The public usually relies on the existing experience or clues in the social environment to infer their coping (Bandura, 1993). It has been proven that the public's reaction to risks is usually irrational. When encountering environmental risks that are uncontrolled and related to their interests, even if the risks are very small and the public can cope with the risks, they cannot tolerate risks (Frewer, 2001). This may be one of the reasons for the positive correlation between EC and negative environmental affective reactions. Thus, by experiencing a public emergency, the cognition of EC is the key to stimulate affective reactions, and then induce intentions and behaviors.

Second, we found that environmental affective reactions have a significant promoting effect on public PEBI. Although the level of negative environmental affective reactions during the pandemic is slightly higher than the positive one, the impacts of positive

Table 4
Descriptive statistical analysis.

Dim	M	SD	Discriminate Validity						
			1	2	3	4	5	6	7
ER	3.585	0.984	**0.814**						
EC	3.977	0.663	0.011	**0.737**					
PEAR	4.457	0.614	0.162**	0.338**	**0.844**				
NEAR	4.536	0.555	0.293**	0.188**	0.561**	**0.729**			
Ho-PEBI	4.105	0.715	0.120**	0.243**	0.561**	0.408**	**0.857**		
Pu-PEBI	4.404	0.621	0.114**	0.317**	0.495**	0.417**	0.447**	**0.816**	
Wo-PEBI	4.227	0.661	0.089**	0.303**	0.546**	0.434**	0.627**	0.688**	**0.881**

Note: ER = emergency relevance; EC = emergency coping; PEAR = positive environmental affective reactions; NEAR = negative environmental affective reactions; Ho-PEBI = household-sphere PEBI; Wo-PEBI = workplace PEBI; Pu-PEBI = public-sphere PEBI.
The numbers in the cells of the diagonal line are the square root of AVE; $N = 873$;.
** $p < 0.01$.

Table 5
Direct effect analysis results.

Direct Effect	Estimate	SE	Est./SE	P-Value	Supported
ER → PEAR	0.139***	0.034	4.081	0.000	YES
ER → NEAR	0.293***	0.043	6.779	0.000	YES
EC → PEAR	0.564***	0.089	6.323	0.000	YES
EC → NEAR	0.364***	0.076	4.757	0.000	YES
PEAR → Ho-PEBI	0.446***	0.074	6.021	0.000	YES
PEAR → Wo-PEBI	0.371***	0.064	5.791	0.000	YES
PEAR → Pu-PEBI	0.440***	0.076	5.770	0.000	YES
NEAR → Ho-PEBI	0.139*	0.054	2.571	0.010	YES
NEAR → Wo-PEBI	0.193***	0.052	3.705	0.000	YES
NEAR → Pu-PEBI	0.230**	0.071	3.219	0.001	YES

Note: ER = emergency relevance; EC = emergency coping; PEAR = positive environmental affective reactions; NEAR = negative environmental affective reactions; Ho-PEBI = household-sphere PEBI; Wo-PEBI = workplace PEBI; Pu-PEBI = public-sphere PEBI.
SE is the standardization error;.
* $p < 0.05$,.
** $p < 0.01$,.
*** $p < 0.001$.

Table 6
Indirect effect analysis.

Indirect Effect	Estimate	SE	Est./SE	P-Value	95%CI	Supported
ER→ PEAR→ Ho-PEBI	0.062**	0.019	3.291	0.001	0.034-0.120	YES
ER→ PEAR→ Wo-PEBI	0.052**	0.016	3.211	0.001	0.028-0.098	YES
ER→ PEAR→ Pu-PEBI	0.061**	0.019	3.301	0.001	0.024-0.088	YES
ER→ NEAR→ Ho-PEBI	0.041*	0.017	2.447	0.014	0.011-0.088	YES
ER→ NEAR→ Wo-PEBI	0.057***	0.016	3.576	0.000	0.020-0.104	YES
ER→ NEAR→ Pu-PEBI	0.067**	0.021	3.259	0.001	0.026-0.095	YES
EC→ PEAR→ Ho-PEBI	0.251***	0.054	4.650	0.000	0.133-0.261	YES
EC→ PEAR→ Wo-EBI	0.210***	0.045	4.704	0.000	0.090-0.214	YES
EC→ PEAR→ Pu-PEBI	0.248***	0.059	4.193	0.000	0.086-0.205	YES
EC→ NEAR→ Ho-PEBI	0.051*	0.022	2.314	0.021	0.009-0.071	YES
EC→ NEAR→ Wo-PEBI	0.070**	0.024	2.885	0.004	0.014-0.087	YES
EC→ NEAR→ Pu-PEBI	0.084*	0.032	2.580	0.010	0.019-0.086	YES

Note: ER = emergency relevance; EC = emergency coping; PEAR = positive environmental affective reactions; NEAR = negative environmental affective reactions; Ho-PEBI = household-sphere PEBI; Wo-PEBI = workplace PEBI; Pu-PEBI = public-sphere PEBI.
SE is the standardization error;.
* p <0.05,.
** p <0.01,.
*** p <0.001.

environmental affective reactions on three spheres of PEBI are stronger than the impact of negative environmental affective reactions. In other words, positive environmental affective reactions play a more important role in promoting individual PEBI, as individuals tend to pursue positive affective reactions and avoid negative affective reactions by solving problems and implementing positive actions (Schlegelmilch et al., 1996). There are negative affective reactions such as anxiety and depression during the pandemic (Duan and Zhu, 2020). The severe consequences of the pandemic make people directly realize fear and anxiety about the destruction of ecological environment, as well as strengthened their anger and resistance against improper behaviors such as wildlife trade. However, when the government responds to the public appeal, strengthens the enforcement of environmental protection law, and cracks down on wildlife trade, positive environmental affective reactions can promote public PEBI more effectively. The results of this study contribute to the prediction of pro-environmental behavior from the perspective of affective events.

Further, it is discovered that public environmental affective reactions toward the pandemic emergency can directly promote PEBI, but the two dimensions of environmental affective reactions have different influencing paths and strengths on PEBI. Positive environmental affective reactions have the greatest driving force on household-sphere PEBI ($\beta = 0.446$, $p < 0.001$), followed by public-sphere PEBI ($\beta = 0.440$, $p < 0.001$), and the promoting effect on workplace PEBI is the smallest ($\beta = 0.371$, $p < 0.001$). The positive environmental affective reactions toward the pandemic not only promotes public PEBI and workplace PEBI, but also stimulates them to restrain themselves and protect the ecological environment through their efforts. This finding is consistent with the research of Fredrickson (1993), which suggests that positive affective

reactions build personal resources and facilitates helping behavior. Many convenient activities such as daily family routines have a significant impact on the environment (van der Werff et al., 2019). The public can directly influence the environment through pro-environmental behavior in the household-sphere (Qiu and He, 2018; Stern, 2000). Therefore, positive environmental affective reactions are more active in household-sphere PEBI.

For workplace PEBI, positive environmental affective reactions play a more important role than negative environmental affective reactions. This finding is similar to the results of previous studies. Xing and Starik (2017) believed that employees' pro-environmental passion will influence the required green behavior and voluntary green behavior. Employees in positive affective reactions are more likely to carry out their work in an environmentally friendly way, because they are more inclined to consider other positive ways of thinking and behaving and have more personal resources available for these actions (Bissing-Olson et al., 2013). These results confirm that positive environmental affective
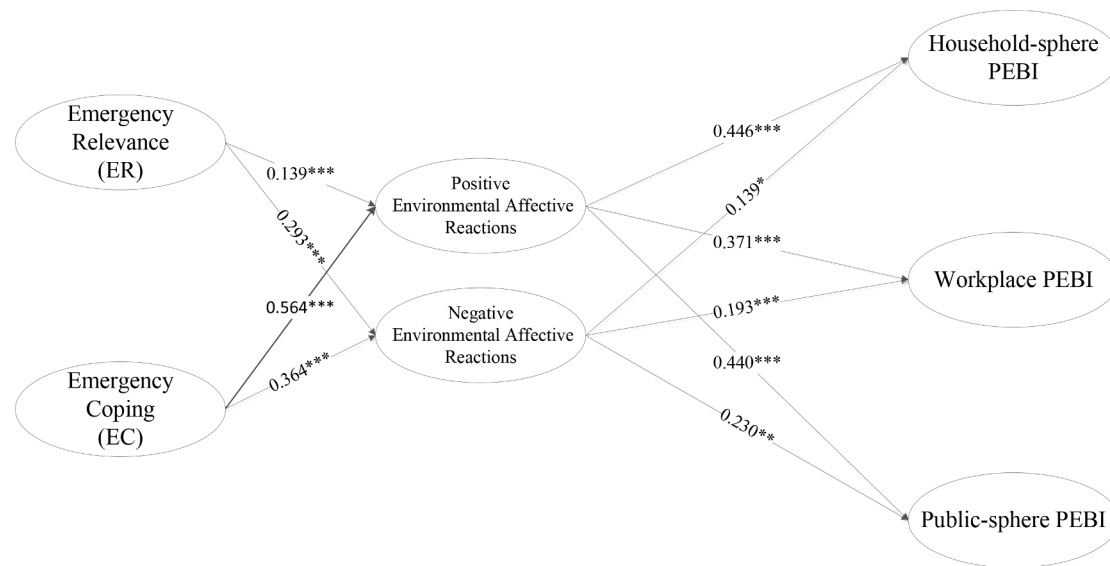
Fig. 2. Structural equation model and standardized estimate values.
Note: * p <0.05, ** p <0.01, *** p <0.001.

reactions can promote the public to engage in pro-environmental behavior at work.

There are also differences in the influence intensity of negative environmental affective reactions on PEBI. Ranking from the largest to the smallest, they are public-sphere PEBI (β = 0.230, $p < 0.05$), workplace PEBI (β = 0.193, $p < 0.001$), and household-sphere PEBI (β = 0.139, $p < 0.05$). During the pandemic, people are more willing to voice their opinions in the public-sphere, and actively put forward environmental protection suggestions due to concerns about the pandemic. The reason may be that protecting the environment is a typical "tragedy of the commons" (Ohler and Billger, 2014), and the serious consequences of environmental damage will influence everyone. Although the public has strong negative environmental affective reactions, they cannot rely on their personal ability to reduce environmental damage behaviors in "other" distant places. The impact of individual participation in the public-sphere can be significant, because individual voices in the public sphere can change the behavior of many people and organizations at the same time (Liao and Shi, 2018; Stern, 2000). Therefore, due to the strong negative environmental affective reactions during the COVID-19 outbreak, the public tends to support reliable government and organizations to minimize environmental damage.

6. Conclusion, suggestions, and limitations

In conclusion, the results of this study showed that public COVID-19 emergency cognition can stimulate different environmental affective reactions, so as to promote individual pro-environmental behavioral intentions. First, we found that the public's different cognition of COVID-19 emergency had different influences on environmental affective reactions. Second, by comparing the intensity of the positive and negative environmental affective reactions regarding the pandemic, we found that although the level of negative environmental affective reactions is slightly higher than the positive environmental affective reactions, the overall impact of positive environmental affective reactions on pro-environmental behavioral intentions is stronger than the negative environmental affective reactions. Finally, this study confirms that positive and negative environmental affective reactions have significantly different effects on public pro-environmental behavioral intentions. The positive environmental affective reactions toward the pandemic promoted the public to make more contributions in household-sphere and workplace, and the negative environmental affective reactions toward the pandemic induced the public to express

their opinions in public-sphere.

Existing scientific research shows that the pandemic has an important relationship with "nature". In essence, the pandemic is a reflection of humans ignoring the symbiotic relationship between humans and nature. The COVID-19 emergency has caused many negative consequences. Therefore, how to guide public behaviors would be the focus of environmental protection works. At present, environmental protection has attracted great attention, and effective publicity and guidance have become particularly important. Therefore, considering COVID-19 emergency as an opportunity to enhance the appeal of environmental protection works to stimulate public positive environmental affective reactions, and encourage people to adopt a green lifestyle. Thus, publicity and guidance can finally realize the sense of "Logic makes thinking, affective reactions make action".

This study has limitations that should be acknowledged. First, the study is cross-sectional. It is difficult to obtain the causal relationship of variables in the changing process. Since the pandemic is changing constantly, it is suggested to use a more comprehensive emergency description and to add "time" into the analysis in the future. Moreover, it will be an interesting research direction to study the changes in public environmental affective reactions and behaviors after the pandemic. Second, considering population size, time, and cost, convenience sampling is considered acceptable (Kapoor and Dwivedi, 2020). However, compared with random population sampling, there are still certain limitations. Therefore, further studies targeting specific regions or specific populations could be considered. Third, the cultural background of data collection may influence the research results; therefore, our results may not be directly applicable to other cultural backgrounds. More cross-cultural comparisons could be made in future research. Moreover, our study is mainly an individual-level research. In the future, large-scale sampling could be applied on provincial-level regions of China. By using hierarchical linear model (HML) to conduct cross-level analysis, we might investigate more commonalities and differences of PEBI for the public at different levels. Finally, the influence of personality characteristics is not been excluded in this study. Affective events theory points out that an individual high in trait negative or neuroticism tends to make stronger reactions when negative events occur. In other words, personality characteristics may influence the relationship between event cognition and affective reactions (Weiss and Beal, 2015). Future research could further investigate the impact of changes in personality characteristics activated by events on pro-environmental behavior.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.resconrec.2021.105467.

Appendix A

Variable	Item	Content
Emergency Relevance	ER1	COVID-19 emergency threatened my health or safety
	ER2	COVID-19 emergency hindered my achievement of important goals in my work
	ER3	COVID-19 emergency hindered my achievement of important goals in my life
Emergency Coping	EC1	I can protect myself from the threat of COVID-19 emergency
	EC2	I can cope with the inconvenience in my work caused by COVID-19 emergency
	EC3	I can overcome the inconvenience or difficulties in my life brought by COVID-19 emergency
Positive Environmental Affective Reactions	PEAR1	I am excited about the national measures to combat wildlife trade during COVID-19 emergency
	PEAR2	I am inspired that COVID-19 emergency cognition has prompted the public to pay attention to the ecological environment
	PEAR3	The cognition of COVID-19 emergency makes me proud of my past actions to protect the ecological environment
Negative Environmental Affective Reactions	NEAR1	The cognition of COVID-19 emergency makes me scared about the consequences of environmental damages
	NEAR2	The cognition of COVID-19 emergency makes me feel worried about the current situation of the relationship between human beings and nature
	NEAR3	The cognition of COVID-19 emergency makes me feel guilty for neglecting wildlife protection in the past
	NEAR4	The cognition of COVID-19 emergency makes me feel angry about the destruction of the ecological environment by others
Household-sphere PEBI	Ho-PEBI1	I would pay attention to conserving energy and choosing low-carbon transportations in my daily life
	Ho-PEBI2	I would pay attention to cultivating healthy and environmentally-friendly habits
	Ho-PEBI3	I would buy environmentally-friendly products
Workplace PEBI	Wo-PEBI1	I would fulfill responsibilities specified in my job description in environmentally-friendly ways
	Wo-PEB2	I would actively participate in environmental protection activities or plans organized by my company
	Wo-PEBI3	I would recommend to my colleagues a more environmentally friendly way of working
Public-sphere PEBI	Pu-PEBI 1	I would express my views on an environmental issue to deputies to the National People's Congress or government officials
	Pu-PEBI 2	I would donate to public welfare activities to improve the ecological environment
	Pu-PEBI 3	I would proactively report illegal activities damaging the ecological environment

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