SOCIAL EMOTIONS AND THEIR INFLUENCES

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SOCIAL EMOTIONS AND THEIR INFLUENCES

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"Watching Eyes" Triggers Third-Party Punishment: The Role of Emotion Within the Eyes

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Third-party punishment refers to a behavioral phenomenon whereby people punish wrongdoers even if their sanction incurs personal costs but yields no direct benefits. Given the eye cues demonstrated ability to convey signals of being observed, its effect on third-party punishment, driven by virtue of its effects on others' perceptions, was investigated. In addition, emotional message featured in the eye region is crucial in social interaction, whether the emotion within the eyes serves this effect with varying degrees of influence has rarely considered. The present study aimed at exploring (a) the watching eyes effect on the third-party punishment and (b) whether this effect varies from negative eyes to positive eyes. By two experiments using a modified Third-Party Dictator Game, we displayed either eye images or control images above the question on whether to punish the dictators or not. There was no emotional diversity of eye cues in Experiment 1, and most participants tended to punish for unfair offer. However, the appearance of eye images increased the punishment relative to control images. In Experiment 2, the eye cues were subdivided into positive and negative. The effect of watching eyes on the third-party punishment was significantly stronger when the eyes were negative than positive. Results revealed that eye cues play a role in promoting the third-party punishment and offer a potential insight into the mixed findings, such that the emotion within the eyes, especially the negative expression in the eyes, may influence the watching eyes effect.

Keywords: watching eyes, third-party punishment, emotion, reputation, eye cues

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INTRODUCTION

Third-party punishment (TPP), a behavior phenomenon that occurs in the situation of norm violation when the violator is punished by an individual whose interests have not been harmed (Fehr and Gächter, 2002; Fehr and Fischbacher, 2004a; Rodrigues et al., 2020), appears cross-culturally (Henrich et al., 2006), and in different ages (McAuliffe et al., 2015; Yang et al., 2018). It's obvious that punishing wrongdoers entail significant costs, as the time, money, and energy are expended, and the punisher may also be backfired occasionally (Dreber et al., 2008; Nikiforakis, 2008; Balafoutas et al., 2014). Nevertheless, people paying a cost to inflict punishment is common.

Numerous studies examining the potential motivations underlying TPP have suggested that people penalize for more self-oriented reasons as well as social norms maintenance (Rodrigues et al., 2020). One well-known finding in recent decades is that the visibility of third parties' punitive actions may affect their punishment behavior (Kamei, 2018), implying such behavior is designed to benefit the individual because of its effects on others' perceptions. Models are driven by reputation effect, such as the costly signaling model, suggesting the cognitive mechanisms underlying TPP

might have evolved because of their signaling benefits (Johnstone and Bshary, 2004; Kurzban et al., 2007), that is, individuals accept abandoning self-interests to inflict punishment in order to gain a positive appreciation with observers. As it's unlikely to bring direct benefits to the punisher, and TPP is usually beneficial to other group members, therefore, punitive actions are essentially equivalent to showing good qualities (Jordan and Rand, 2019; Chen and Yang, 2020), such as fairness and generosity (Nelissen, 2008), being trustworthy (Jordan et al., 2016), or willing to sacrifice for others (Jordan and Rand, 2017), and through the punitive action, TPP can, in the long run, help the punisher build a good reputation and improve the probability of getting help from others (Chen and Yang, 2020).

As a special clue, eyes can convey social information served as an implicit signal of being observed. Growing evidence suggests that people tend to adjust their behavior when a picture of eyes or stylized eye images is presented with eyes looking straight ahead (hereafter: eye cues, Bateson et al., 2006; Rigdon et al., 2009; Nettle et al., 2013). This effect, called the "watching eyes effect," suggests that just feeling watched may be able to make people modify their actions unconsciously (Keith et al., 2019). Although the eye cues have been shown to stimulate a great variety of cognitive processes and behaviors (Conty et al., 2016), whether the eye cues may also play a role in altering TPP was unknown. One interpretation on what triggers the watching eyes effect comes from "norm psychology," which demonstrates that individuals are sensitive to specific behavioral norms and tend to sanction deviation from these norms (Kallgren et al., 2000; Chudek and Henrich, 2011; Bateson et al., 2013). The interpretation is that pro-social acts are performed since eye cues enhanced the adherence to norms via the awareness of others (Oda et al., 2015). Fairness is a social norm, and people tend to follow fairness norms and are willing to pay a cost to sanction fairness violations (Fehr and Fischbacher, 2004a; Chen et al., 2020). Given this logic, it's reasonable that eye cues, offering a rich signal value, might well-lead people to inflict punishment and help them build a positive reputation. Indeed, evidence demonstrates that even without having eye images, people impose costly TPP when their punishment acts are made known by others (e.g., Kurzban et al., 2007; Kamei, 2018), whose intention may be driven by similar physiological effects to watching eyes effects. Accordingly, we assumed that third parties take more punitive action against those who violated fairness norms when being "watched" by eye images.

The watching eyes effect was initially demonstrated setting stylized eye spots on a computer screen (Haley and Fessler, 2005), but other studies operating such effects by posting eye posters on the wall (Bateson et al., 2006), or displaying robot eye graphics (Burnham and Hare, 2007), or subtle artificial eye images (Baillon et al., 2013), or even three dots similar to human faces (Rigdon et al., 2009; Xin et al., 2016) on the computer screen. However, different settings of eye cues may be responsible for inconsistent watching eyes effect (e.g., Raihani and Bshary, 2012; Bush et al., 2016; Northover et al., 2016); for example, an image of watching eyes did not decrease dishonest behavior (Cai et al., 2015) and did not increase the charitable giving in field research (Ekström, 2011). The main interpretation on why eye cues can increase pro-sociality is that one's behavior observed by others entails social consequences (Oda et al., 2011; Powell et al., 2012). Moreover, researchers stated that human eyes are unique to enhance the signal of being watched, which makes human eyes an important tool for communication (Kobayashi and Kohshima, 2001). Human eyes as a critical region to convey rich emotional and social information can express and recognize the complex mental states, generally called "language of the eyes" in the literature (e.g., Baron-Cohen et al., 1997). To date, empirical studies of how individuals modify their actions when feeling watched have neglected the emotion expressed in their eyes. Emotion-associated eyes, which are frequently used in social interactions, refer to those containing emotional messages and expressing mental states (Wagenbreth et al., 2014). Given that emotion-associated eyes can induce automatic implicit emotional processing (Fox and Damjanovic, 2006; Wagenbreth et al., 2014), it is reasonable to speculate that the watching eyes effect occurs, not only because the appearance of eye cues makes us feel watched, but also because another aspect of eye cues is playing a part. Therefore, in this study, we used ecological valid human eye pictures and further examined whether the emotion within eyes serves watching eyes effect with varying degrees of influence.

Previous studies demonstrated that the punitive action to norm violations is under the influence of the perceived emotional facial expressions of others (Mussel et al., 2018). Given the fact that eyes can make people aware of the existence of others and accordingly, it is unsurprising that different emotion-associated eyes lead a varying influence on watching eyes effect. In agreement with the perspective from reputation-based partner-choice models that pro-social behavior is conducted with the expectation of being chosen for reciprocal interactions in the future (Roberts, 1998; Barclay, 2004; Sylwester and Roberts, 2010), partner-choice makes pro-social behaviors worth performing. Eyes have evolved to be valid cues, which increase the likelihood of future partner-choice. Negative eyes (e.g., eyes expressing anger), which may convey negative social meaning such as blaming or intimidating, usually are understood as a message of non-approval and confrontation in terms of their actions (Hess et al., 2000; Rozin and Royzman, 2001; Horstmann, 2003; Fox and Damjanovic, 2006). Therefore, it is possible that negative eyes are capable of motivating individuals to perform pro-social behaviors to avoid such blame and increase the likelihood of future partner-choice. In this regard, we assumed that the presence of eyes with negative expression, implying the possibility of being blamed or criticized, would increase punishment on violators than positive-associated eyes.

To summarize, theoretical models and experimental evidence in this area support the view that people are concerned about impressions on others, and this may potentially influence third parties' punishment behaviors. The question remained whether the watching eyes effect, always been explicated as a response that reputation is at stake (Oda et al., 2011), was also occurred to TPP. Furthermore, it is also unclear whether the emotion expressed in the eyes causes a varying watching eyes effect. In this research, we conducted two experiments to investigate the impact of eye cues on TPP and the role of emotion within eyes in watching the eyes effect. We adapted the Third-Party Dictator

Game (TP-DG) task in the experiment, which is typically used by Fehr and Fischbacher (2004b), wherein the participants made a decision to either punish or non-punish the dictator.

Therefore, the primary aim of the current study was to investigate the influence of eye cues on TPP. Specifically, we expected that the presence of eyes would increase the punitive actions of those who proposed unfair offers (Hypothesis 1). The secondary aim was to examine whether eyes within specific emotions, such as happiness or anger, will have a different impact on the effects of watching eyes on TPP. Consistent with Mussel et al. (2013), which demonstrated that positive and negative facial expressions of others would have different influences on decision making, we expected that eyes within the negative emotions would result in more punitive actions than positive emotions (Hypothesis 2).

EXPERIMENT 1

Method

Participants

A total of 56 college students were recruited using posters on campus and online forum. When recruiting participants, they were told that the initial remuneration was CNY 15, but the final amount was related to their performance in the money game, the more coins they saved, the more they got paid (in fact, the final payoff each person received after the experiment was CNY 20, about USD 3.12, which is not related to the coins they saved. See 2.1.3 Design and Procedure part for details). As there is a data storage error of one person, 55 participants' data (40 females, 15 males) were used in our final analysis. They were aged between 20 and 26, with an average age of 23.28 ($SD = 1.37$ years), and all of them were right-handed, with normal or corrected vision. Each participant read and signed the informed consent before the experiment. Ethical approval for the experiment was obtained from the Ethical Committee of the School of Psychology at Shanghai Normal University.

Materials

Images of eyes, as stimulus materials, were extracted from photographs of faces picked from the Chinese Facial Affective Picture System (CFAPS, Gong et al., 2011). For the present experiment, we chose six different persons out of CFAPS (three male, three female) with neutral facial expressions. The pictures were then adjusted and cut so that the eye regions were visible, which finally was presented in a size of 220 × 80 mm. Then we invited 29 college students who did not participate the formal experiment rated the arousal for each of the pictures on a scale of "1" (low) to "7" (high arousing) and valence on a scale of "1" (extremely unpleasant) to "7" (extremely pleasant). The results showed the arousal of pictures of eyes (3.31 ± 1.88) and clouds (3.08 ± 1.83) and the valence of eyes (3.58 ± 1.30) and clouds (3.94 ± 1.38). Paired t-test revealed that there was no difference between the eyes and clouds, whether arousal or valence ($ps > 0.05$).

Design and Procedure

The design was a two-factor within-subject design. One refers to the eye cues (picture with eyes or control picture), and the other refers to the degree of the unfairness of the dictator's decision (50:50–100:0). Our experiment adopted a modified TP-DG task with a total of 100 coins. Proposer A decides how to place 100 coins between A and recipient B. No matter how A decides the allocation, B can only accept it. The subject C, as the third-party, has 50 coins at the beginning of each penalty game, and the first witnessed the distribution of 100 coins between two players. If the subject feels that the distribution plan given by A is unreasonable, he/she could punish A; if so, C will pay 15 coins and A will lose triple coins as a result; if C agrees with the offer, he/she can keep all the coins, and the coins earned by A and B will be distributed according to A's proposal. In this experiment, A and B are virtual characters, and all allocation plans are presented randomly by a computer. Six types of splits in the experiment characterize equitable sharing (i.e., 50:50) to complete selfish (i.e., 100:0). Punishment in this game is costly because participants were informed that the coins they saved are linear related to the extra cash rewards (a maximum of CNY 10) in final payoff.

The experiment was carried out one by one. Upon arriving at the quiet laboratory, each participant was seated in an individual cubicle about 60 cm in front of the computer monitor. **Figure 1** shows the structure of one experimental game (taking a 90:10 allocation plan as an example). In each round of the game, a fixation of 500 ms was first shown and then anonymous avatar A (dictator) and B (recipient) were presented for 1,000 ms. To balance the possible influence of gender, male and female photos will alternately be presented as dictators and recipients, and each pair of photos of A and B matches the split (50:50–100:0). After witnessing the initial allocation scheme of 100 coins between two players, a response stage of F/J underneath the watching-eyes picture was shown, at which the participants need to execute the decision they made according to the instruction to press keys ("F" for Punish and "J" for Non-punish) without time limitation. Finally, the numbers of coins obtained by A, B, and subjects are presented separately with a time of 1,000 ms. This is one trial of the task. The formal experiment was arranged in two blocks, and there were 36 trials in each block. Eye cues were equally probable (36 trials each), while cloud cues were also equally probable (36 trials each), and the entire experiment would take up to 15 min for the participants. After each block, the participants were required to answer the question "During the experiment, did you notice any eyes pictures?", as a manipulation check for eye cues, on a 7-point scale: "1" = no attention at all, "7" = entirely noticed. After finishing the whole experiment, they had enough time to get rest.

Results and Discussion

Manipulation Check

A one-sample t-test was used to test whether the manipulation is effective. The result showed that mean attention of eyes was higher ($M \pm SD = 4.82 \pm 1.06$) than the midpoint (4) of the 7-point Likert scale, $t_{(54)} = 5.78$, $p < 0.001$, which means that the eye cues were really noticed by participants.

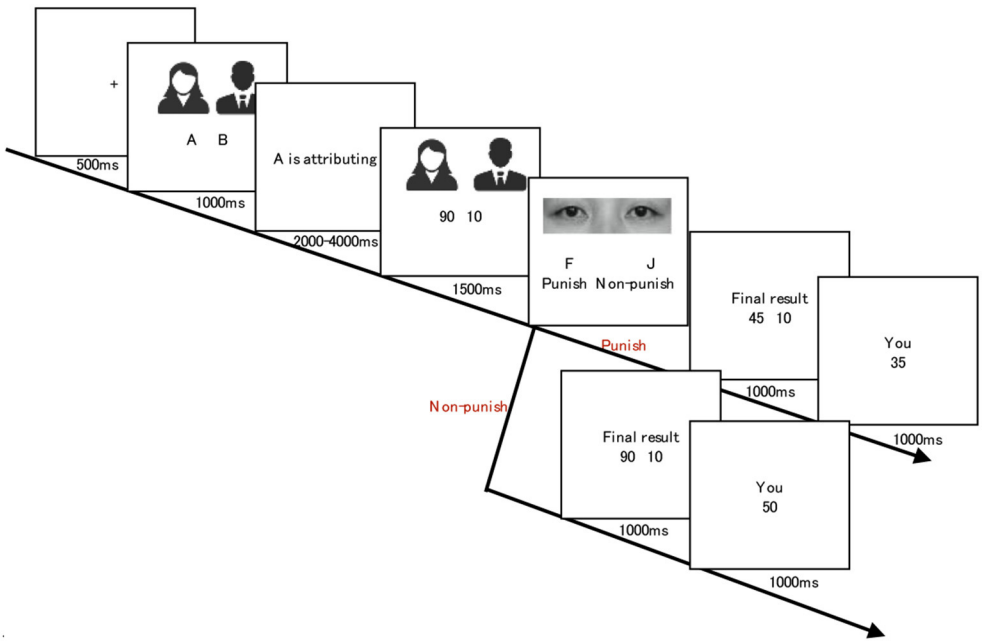

FIGURE 1 | Example of one trial. The picture shows in eyes condition, results of punish or non-punish.

Third-Party Punishment

Across the sequential TP-DG tasks, each and every split from 50:50 to 100:0 occurred 660 times, half of which are eye pictures and the other half are control pictures. The percentages of punishment decisions followed a similar increase for both cues as decisions of the dictator became more selfish [$\chi^2_{(5)} = 202.09$, $p < 0.001$, see **Figure 2**]. Our core hypotheses is that the punitive behavior in eyes pictures could be more than that in control pictures. In the punishment round, there are 48% of punishment decisions in the control pictures, while there are 63% of punishment decisions in the eye pictures. The picture of eyes strongly increased the proportions of punishment (Mann–Whitney, $z = 2.46$, $p = 0.014$).

Considering that the experiment is based on a within-subject design, we then analyzed parameters studying the role of eye pictures by carrying out binary logistic regressions with the decision (to vs. not to punish the dictator) as the dichotomous criterion variable, and eye cues, splits, and gender as categorical predictors. Results (see **Table 1**) showed a main effect of splits, Wald (5) = 572.74, $p < 0.001$. The main effect of interaction was significant, Wald (5) = 11.48, $p < 0.05$. Neither the gender effect nor the main effect of eye cues was significant ($ps > 0.05$).

The aim of the present experiment was to test whether the presentation of eye cues would elicit greater TPP than other cues. Consistent with prior research, with the increasing degree of inequality, third parties tended to punish allocators more, even they must pay a price (Fehr and Fischbacher, 2004a; Sun et al., 2015). However, eye cues appeared to influence TPP, in that participants in a modified TP-DG task inflict significantly more punishment when "watched" by eyes picture. In particular, individuals exposed to the pictures of eyes were more likely to punish the dictators under the splits at 60:40, 70:30, 80:20, with 2.52, 2.29, 3.31 times penalty rate, respectively, than participants exposed to the control pictures (supported Hypothesis 1).

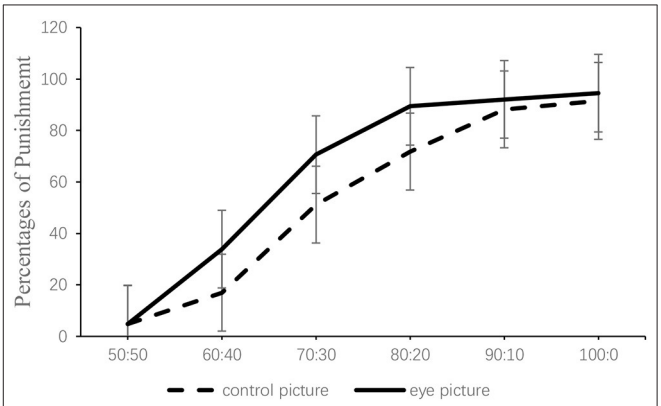

FIGURE 2 | Percentages of punishment as a function of eye cues and the dictator's splits in Experiment 1. Error bars represent the 1-σ standard deviation intervals.

These results replicated the third-party punishment and extended the boundary of the watching eyes effect on pro-social behavior (Haley and Fessler, 2005; Powell et al., 2012) to the third-party punishment. In the task, participants were informed that they can keep the extra money they gain during the game, and they can also spend their own coins to alter the unfair allocation to reach the fair. According to the mainstream economic model of the self-regarding or behavioral economic model of other-regarding preference, there would be

TABLE 1 | The logistic regressions analysis of punishments in Experiment 1.

		OR (95%CI)	*P*-value
Gender			
	Female	1.00	
	Male	0.88 (0.73–1.06)	=0.18
Splits			
	50:50	1.00	
	60:40	4.01 (2.25–7.16)	<0.001
	70:30	20.63 (11.94–35.65)	<0.001
	80:20	50.13 (28.73–87.48)	<0.001
	90:10	146.86 (80.32–268.54)	<0.001
	100:0	212.32 (112.59–400.39)	<0.001
Eye cues			
	Control picture	1.00	
	Eye picture	1.00 (0.49–2.04)	=1.00
Eye cues * Splits			
	By 50:50	1.00	
	By 60:40	2.52 (1.13–5.60)	<0.05
	By 70:30	2.29 (1.05–4.99)	<0.05
	By 80:20	3.31 (1.45–7.57)	<0.01
	By 90:10	1.57 (0.65–3.78)	=0.32
	By 100:0	1.61 (0.63–4.11)	=0.32

no difference of punishment either with the picture of eyes or with the control picture (Bolton, 1991; Ledyard and Palfrey, 1994; Fehr and Gächter, 2002; Fehr and Fischbacher, 2004a; Kim et al., 2013). Surprisingly, watching eyes did promote third party's irrational punishment, even though there is a conflict between a desire for fairness and self-interest. In this way, our results could be taken as evidence that eye cues promote the disapproval of unfair, selfish acts, consistent with prior work showing that people impose costly TPP when their punishment acts are made known by others (e.g., Kurzban et al., 2007; Kamei, 2018). The reason why eye cues are effective in increasing TPP can be interpreted with the main motivation of third-party behaviors, maintaining the social norms. Based on the punishment under the unfair offer, it could be inferred that the eye cues promote the disapproval of unfair, selfish acts. It can be interpreted that unfair distribution is a kind of violation of the norm of fair sharing. The presence of eyes can capture attention naturally and increase adherence to norms (Oda et al., 2015). Therefore, eye cues appeared to intensify the punishment for norm violation. However, this effect only occurred when the dictator's decisions are less selfish. It can be interpreted that, in the cases of complete fairness (50:50), there is no need to make TPP, and in the case of extreme unfairness (100:0, 90:10), the behavior of punishment has a ceiling effect. The present study extends our understanding of pro-social behavior by the focus on social cues in TPP.

In sum, the association between the presence of eye cues and TPP was significant, which examined that the eye cues played a role in TPP. In Experiment 1, we focused on whether there were eye cues or not, but we did not take the emotions within the eyes into account. After the eye cues were subdivided, how would the positive and negative pictures of eyes affect TPP? Previous research has shown there is comprehensive variance to different emotional expressions. On this basis, we wonder what kind of emotional expression within the eyes particularly makes an impact on third parties. Two meaningful expressions are considered, "happiness" for positive and "anger" for negative. Anger is identified as an adaptable emotional reaction in the situation of violations for moral standards, fairness, or equality, also called moral outrage, which is effective to motivate individuals to maintain social norms (Batson et al., 2007; Van Doorn et al., 2014; Gummerum et al., 2016; Rodrigues et al., 2020). Therefore, we assumed that eyes within the negative emotions would result in more punitive actions than positive emotion, and we tested this assumption in Experiment 2.

EXPERIMENT 2

Method

Participants

We initially recruited 40 college students, and one was excluded from the data analysis because he figured out the purpose of the experiment. Hence, 39 participants (28 females, mean age = 23.0 years, SD = 1.77 years) entered our analysis. All participants were Chinese native speakers, who reported no physical or mental illness. The study protocol was approved by the Ethical Committee of the School of Psychology at Shanghai Normal University. Participants were told before the experiment that they would get basic monetary compensation of CNY40 and had a chance of receiving extra cash rewards, which is linearly related to the coins they saved during the game. However, all of them got CNY 50 after the experiment, regardless of the coins they saved in the game. Each of the participants signed informed consent prior to the beginning of the experiment.

Materials

The materials for Experiment 2 were nearly identical to those used in Experiment 1. A critical difference involved the eye cues with the emotion expressed in the eyes. Emotional-associated eyes, as stimulus material, were selected from CFAPS and grouped into two affective stimulus categories: positive (happy, $M_{\text{arousal}} = 5.03 \pm 1.52$, $M_{\text{valence}} = 4.51 \pm 1.93$) and negative expression (angry: $M_{\text{arousal}} = 5.84 \pm 1.27$, $M_{\text{valence}} = 2.91 \pm 2.28$). Each affective category contained six pictures. Paired t-test revealed that there was a significant difference between the valence for each eye [$t_{(28)}$ =3.05, $p < 0.01$], and not significant between arousal for each eye ($p > 0.05$). More precisely, we invited 27 post-graduates to identify each emotional expression of eyes pictures. Participants indicated on a 5-point Likert scale (ranging from 1 = extremely disagree to 5 = extremely agree) to what extent they agree with the identification for happy or angry expression. A one-sample t-test results showed that mean agreement on happy expression was higher ($M \pm SD = 3.94 \pm 0.74$) than the midpoint (3) of the 5-point Likert scale, $t_{(26)}$ =6.54, $p < 0.001$; and angry expression ($M \pm SD = 4.28 \pm 0.63$), $t_{(26)}$ = 10.50, $p < 0.001$. The result shows that the emotional-associated eyes we extracted from the facial picture can indeed convey a specific emotion.

Design and Procedure

The design was a two-factor within-subject design. One refers to the eyes with emotions (positive, negative), and the other refers to the degree of the unfairness of the dictator's decision (50:50–100:0). The third-party punishment game followed the same format as before, with the exception that emotional cues interposed between the allocation stage and the response stage. The formal experiment was arranged in five blocks, and there were 60 trials in each block. Negative cues were equally probable (150 trial each), while positive cues were also equally probable (150 trial each). After each block, they had enough time to relax.

Results and Discussion

Data from the TP-DG task showed that the third-party punishment increased as the offer becomes unfair $\chi^2_{(5)} = 132.98$, $p < 0.001$, and that TPP of negative condition (45%) was significantly more than that of positive condition (33%), Mann–Whitney, $z = -2.22$, $p = 0.027$. To test for the main effects of emotion within the eyes and unfairness of dictator's decision, we performed a binary logistic regression with the decision (to vs. not to punish the dictator) as the dichotomous criterion variable, and emotion, splits, and gender as categorical predictors. Results (see **Table 2**) revealed a main effect of the splits, Wald (5) = 545.72, $p < 0.001$. There was a main effect of emotional condition, Wald (1) = 25.86, $p < 0.001$, and there was a main effect of gender, Wald (1) = 10.17, $p < 0.01$. Results also revealed a significant gender × splits interaction effect, Wald (5) = 53.05, $p < 0.001$, as well as gender × emotions interaction effect, Wald (1) = 12.91, $p < 0.001$. There were no significant interaction effects of the emotion and splits ($p = 0.980$).

TABLE 2 | The logistic regressions analysis of punishments in Experiment 2.

		OR (95%CI)	*P*-value
Gender			
	Male	1.00	
	Female	1.59 (1.20–2.13)	<0.01
Splits			
	50:50	1.00	
	60:40	5.56 (3.43–9.32)	<0.001
	70:30	42.05 (25.78–68.60)	<0.001
	80:20	181.09 (105.39–311.16)	<0.001
	90:10	117.77 (65.94–210.33)	<0.001
	100:0	64.60 (35.83–117.02)	<0.001
Emotion			
	Positive	1.00	
	Negative	2.55 (1.77–3.66)	<0.001
Emotion * Gender			
	By male	1.00	
	By female	0.70 (0.58–0.85)	<0.001
Gender * Splits			
	By 50:50	1.00	
	By 60:40	0.63 (0.45–0.88)	<0.01
	By 70:30	0.46 (0.33–0.63)	<0.001
	By 80:20	0.36 (0.25–0.51)	<0.001
	By 90:10	0.65 (0.43–0.96)	<0.05
	By 100:0	1.07 (0.70–1.62)	=0.77

Experiment 2 aimed to test whether the emotion within the eyes affected the watching eyes effect on TPP. First, a linear trend again showed that TPP would rise as splits became more selfish, and males would engage in greater third-party punishment than females except in the extremely selfish case. Second, we found the watching eyes effect was significantly greater when the eye cues were negative. Individuals exposed to negative eyes are 2.55 times more likely to punish than those exposed to positive eyes, and this negative effect was larger for males. Our novel hypothesis that the watching eyes effect on TPP was affected by the emotion within eyes was confirmed to some degree.

These results provide a first evidence that emotions expressed in the eyes influenced the watching eyes effect on TPP with varying degrees. Moreover, our results tentatively suggest that the eyes that contain emotional messages are particularly effective for eliciting moralistic punishment. The emotion-associated eyes in our experiment allowed us to examine whether the punitive action is influenced by the socioemotional cues. Angry eyes signal that others are angry about unfair distributions and lead to more punishment (Hess et al., 2000; Horstmann, 2003). One interpretation has been indicated based on the motivation of individuals to punish the norm violators (Van Doorn et al., 2014) that negative feelings of third parties, experienced as reactions to unfair sharing, motivates them to rebuild equality through punishment (Nelissen and Zeelenberg, 2009). Following this argumentation, emotion-associated eyes appeared to have the potential to induce a similar feeling to subjects. Thus, negative eyes would make participants increase TPP irrespective of the self-expense. As regards the finding of gender difference that females were less likely to punish in negative eyes than males, it might be speculated that males exposed to anger were more likely to trigger an angry or aggressive reaction. As such, we provide evidence that emotion expressed in the eyes leads to a varying watching eyes effect. The results extend previous research which neglected some certain factors like emotion. Watching eyes effect, as a peculiar phenomenon whereby the appearance of eyes will change behavior, does not appear under some circumstances. As emotional expression featured in eye regions is critical in social interaction, it is necessary to take further studies considering the difference of these emotional messages.

GENERAL DISCUSSION

In this research, we conducted two experiments to investigate whether the appearance of eye cues affects third parties' punishment on the violator of the norm of fair sharing (Experiment 1), and we attempted to examine whether the emotion within eyes affects watching eyes effect (Experiment 2). As far as we know, no previous research has investigated whether the eye cues influence TPP and the emotion within the eyes serve watching eyes effect with varying degrees of influence.

The results reported here clearly showed that the eye cues increased the frequency of punishment, even it requires

immediate costs. At first glance, such fact might seem unexpected, but it matches with related findings showing that eye cues can engender behaviors that, though seemed to be problematic for themselves, actually work to enhance pro-sociality (e.g., Burnham and Hare, 2007; Sénémeaud et al., 2017). Prior work studying the decision-making process in the dictator game suggested that such decisions are led by two-step process. The players generate an automatic, intuitive proposal immediately and then go through a more deliberative phase, in which they adjust the initial proposal based on motivation and cognitive resources, a process that is influenced by social context (Cornelissen et al., 2007; Cappelletti et al., 2011; Rand et al., 2012). Following the two-step process model, our finding suggests that the watching eyes effect on TPP occurs in the second phase with the cognitive conflict. Results in this regard showed that eye cues lead to a greater punishment than other cues, that is to say, punishment tended to be automatically taken when it was likely to be witnessed. A potential explanation centers on pro-social motivation based on reputation (Mifune et al., 2010; Raihani and Bshary, 2015). Eye cues offering a rich signal value can capture attention nationally and trigger self-referential process, which induces individuals to moderate their behavior and unconsciously heighten concern over how they were socially evaluated (Oda et al., 2011; Conty et al., 2016). As such, people are more likely to sanction norm violations in order to gain a positive reputation and, consequently, intensify their TPP actions accordingly.

Concerning the finding that the watching eyes effect was significantly greater when the eye cues is negative, it can be explained by reputation psychology to some extent. People are willing to sanction those who break social norms (Fehr and Fischbacher, 2004a), which was regarded as a major driving force for maintaining pro-sociality in human societies (Gintis et al., 2003). Thus, individuals who did not respond to selfish or unfair behavior in the situation of norm violations will be identified as a lack of sense of justice (Gardner, 2019). In this way, the negative eyes appeared signaled negative appraisal about disregarding unfair behavior intentionally. An interpretation is based upon reputation-based partner-choice theories, which indicated that pro-social acts are performed to increase the probability of being chosen by others for reciprocal behavior in the future (Roberts, 1998; Barclay, 2004; Sylwester and Roberts, 2010). Considering that members of a group would interact with each other, in this way a reputation is transmitted interpersonally. A negative appraisal of someone may lead him not to be chosen in future interactions. Thus, individuals have evolved to be psychologically sensitive to negative appraisals (Baumeister et al., 2001) and tend to avoid negative signals about themselves for others to gossip about, rather than to seek to provide positive signals to be talked about positively (Keith et al., 2019). These factors may explain why participants take more pro-social behavior like punishing norm violators while they were "watched" angrily. Our results are consistent with the studies showing that the watching eyes effect promoted concerns about reputation, and people were more motivated to avoid a bad reputation than gain a good reputation (Oda et al., 2015). Admittedly, those interpretations are not consistent with the findings of Rigdon et al. (2009) and Xin et al. (2016) that even a simple dot pattern as weak social cues increased the individuals' pro-sociality, or the explanations of Pillutla and Murnighan (1996) and Yamagishi et al. (2012) that anger might trigger an angry or aggressive reaction. However, our results may explain why some studies have successfully found a meaningful effect (e.g., Nettle et al., 2012; manipulating the eye cues with the words: "Cycle thieves, we are watching you" underneath the angry eyes, a useful intervention against bicycle theft) and why eye spots do not increase generosity or altruism (e.g., Vogt et al., 2015; Northover et al., 2016). Thus, additional studies are needed to further explore the effects of watching eyes as well as its emotion on people's decision making.

In addition, this study has several limitations that we need to note briefly. First, when we observe one person treating another person unfairly, there are at least two options to react to this norm violation, either punishing the offender or helping the victim. But in our experiments, third parties could only decide to punish or not, we didn't take the third-party help into consideration. Previous studies indicated that, compared to third-party punishers, third-party helpers were more likely to be rewarded (Li et al., 2018). Therefore, future research can explore the watching eyes effects on the third parties upon help. In addition, in the second experiment, we merely compared "happiness" and "anger" expressions to see which emotion has more influence on the watching eyes effect. Because it did not include a condition of neutral emotion within the eyes as a control, it should be more cautious about explaining the main effect in the present study and should not be overinterpreted. Moreover, since there are a variety of human emotional expressions in social contexts, future studies should investigate this effect on more emotional expression categories.

To conclude, the current study uses a modified TP-DG task to demonstrate the watching eyes effect on the third-party punishment, and such effect is significantly greater while the watching eyes contain negative emotions than positive ones. We revealed for the first time that even eye cues could trigger third parties to take a punitive decision. We extended the boundary of the watching eyes effect on pro-social behavior to the third-party punishment, and moreover, we offered a potential insight into the inconsistent findings across both laboratory and field experiments of watching eyes effect that the emotion within the eyes, especially the negative expression in the eyes, may influence the watching eyes effect.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by School of Psychology at Shanghai Normal

University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ML: contributions to conceptualization, acquisition, collection, analysis, interpretation, and drafting. CS: contributions to conceptualization, interpretation. HS: contributions to interpretation and revision of the work. JL: contributions to supervision and validation. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

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Emotion Regulation in Close Relationships: The Role of Individual Differences and Situational Context

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A substantial amount of research has examined the role of individual differences in the regulation of emotion and the impact of emotion regulation on mental health; however, few studies have covered the role of situational context in the selection of emotion regulation strategies. In this paper, we investigate the extent to which an individual's choice of emotion regulation strategy is affected by factors such as emotional intelligence, the person with whom one is in conflict, situational sense of control, and the individual's aim in dealing with the conflict. A total of 300 participants (46.67% female) between the ages of 21 and 35 were recruited from the community (female's mean age = 28.14, SD = 4.49; male's mean age = 28.12, SD = 4.32). Participants filled out a set of questionnaires related to their emotion intelligence and emotion regulations they used in two interpersonal incidents with parents and partner. Structural equation modeling was used for data analyses. Results showed that positive correlation between emotional intelligence and cognitive reappraisal, in contrast to previous studies, a positive correlation between emotional intelligence and repression was found. Moreover, the person one is interacting with influences the degree to which one's sense of control impacts the choice of emotion regulation strategy. For example, in the event of conflict with one's parents, the degree of situational control has little impact on emotion regulation; however, in conflicts with spouses or partners, women have more situational control and are more likely to use cognitive reappraisal or suppression. Regarding the relationship between the goal of emotion regulation and the strategies used, this study found that they are moderated by gender and the persons involved; for example, when maintaining the relationship is the primary goal of emotion regulation, cognitive reappraisal is more likely the strategy of choice for men involved in a conflict with their partner and for women involved in a conflict with their parents. Overall, the results confirm that emotion regulation is affected by both individual and situational factors, indicating the importance of adopting a dynamic approach when investigating emotion regulation.

Keywords: emotion regulation, close relationships, situational context, perception of control, relational goal, emotion intelligence

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INTRODUCTION

The establishment of close interpersonal relationships is an important task in early adulthood (Conger et al., 2000; Dinero et al., 2008), and maintaining stable close relationships at this stage of life has been found to influence psychological health during later life stages (Kiecolt-Glaser and Newton, 2001; Schulenberg et al., 2004; Lehnart et al., 2010). Emotion plays an important role in our relationships (Keltner and Haidt, 1999), and a close relational context in particular shapes our experience of emotion. For example, when a son expresses apprehension over an upcoming exam, his parents can respond adequately by validating his feeling. Such exchanges between the son and his parents may strengthen their relationship. A woman who feels she is perceived negatively by her intimate partner may become increasingly dissatisfied with the relationship. Studies have found that how we deal with conflict in a relationship and how we regulate the emotions resulting from those conflicts affect not only the quality and longevity of the relationship (Zaki and Williams, 2013; Marroquín and Nolen-Hoeksema, 2015) but also our mental health (Duvila et al., 2003; Fingerman et al., 2008).

Individual differences, such as attachment style (Pace et al., 2016) personality traits (Ong et al., 2006; Ng and Diener, 2009; Eldesouky and English, 2019), emotional intelligence (EI) (Bucich and MacCann, 2019), gender (Nolen-Hoeksema and Aldao, 2011; Kwon et al., 2013), and cultural background (Butler et al., 2007; Matsumoto et al., 2008) may influence the use of a particular emotion regulation strategy. For example, individuals with high EI are more likely to use cognitive reappraisal (Bucich and MacCann, 2019), women tend to employ a greater variety of emotion regulation strategies than men do (Nolen-Hoeksema and Aldao, 2011), and individuals in cultures that emphasize harmonious social relationships tend to suppress negative emotions (Butler et al., 2007).

Among the numerous previous studies on the impact of individual and contextual factors on emotion regulation, few have considered situational factors. The many factors found to affect interpersonal interactions include the person with whom one is interacting and one's sense of control in the situation (Troy et al., 2013) and the goal of emotion regulation (English et al., 2017), all of which may affect an individual's choice of emotion regulation strategy. In discussions of various emotion regulation techniques, it is helpful to see each one as an integral whole, used by a particular kind of person (personality traits, etc.) in a specific situation (the people involved, the level of control, etc.) and flexibly applied to deal with stress and solve problems (Bonanno et al., 2004; Sheppes et al., 2011; Aldao and Nolen-Hoeksema, 2012). Surprisingly, very few studies have touched on the impact of situational factors on an individual's choice of emotion regulation strategy (Wenzel et al., 2019). Thus, the purpose of the present study is to investigate from a dynamic perspective the choice of an emotion regulation strategy when conflict occurs in a close relationship, taking into account both individual factors and the overall context, including the people involved, level of control, and goal of emotion regulation.

Emotion Regulation

In the process model of emotion regulation, emotion regulation refers to the process by which an individual consciously or unconsciously monitors and adjusts his or her emotions (Gross and John, 2003). Emotion regulation can be divided into two types. The first type is when the individual responds to changes in the external environment or in his or her internal mental state by adjusting his or her emotions. This type occurs at the stage of emotion generation, so it is called antecedent-focused emotion regulation and includes situation selection, situation modification, attentional deployment, and cognitive change. The other type is when the individual weakens or enhances his or her emotional response by means such as expressive suppression, exercise, drugs, or relaxation training. This type occurs after the emotional response is generated, so it is called response-focused emotion regulation (Gross, 1998). Among the various means of emotion regulation, the two that have received the most attention have been reappraisal (a form of antecedent-focused emotion regulation) and suppression (a form of response-focused emotion regulation).

Cognitive reappraisal refers to modifying the significance one assigns to an event so as to reduce its emotional impact; for example, one may tell himself or herself, "This won't be easy, but I'll give it a try, and if I encounter any difficulties, I'll find a way to solve them." By contrast, suppression refers to holding one's emotional reaction in check while experiencing that emotion, for example, feeling frustrated inside but inhibiting its corresponding outward expression (Gross and Levenson, 1993; Gross, 1998). Studies have found that people who tend to adopt avoidance and suppression in response to negative emotions are more likely to experience psychological problems (Pace and Muzi, 2017; Velotti and Rogier, 2021). Conversely, individuals who are able to reappraise emotional events or take positive actions to deal with problematic situations are better at adapting to the vicissitudes of life (Mauss et al., 2007; Hofmann et al., 2012; Webb et al., 2012; Carl et al., 2013; Pace et al., 2018).

While the process model provides a simple and clear explanation of emotion regulation, it fails to take into account various contextual factors found to influence which emotion regulation strategies an individual tends to use (Young and Suri, 2019). For example, in a conflict with one's partner or in a situation in which one has a sense of situational control or is otherwise motivated to exercise emotion regulation, he or she is more likely to use cognitive reappraisal. However, in another situation, the individual may intentionally choose to refrain from controlling negative emotions, thereby highlighting the conflict, to make it necessary to face the problem. The above examples show that an individual's valuation of the situation affects his or her mode of emotion regulation, and the difference between the results of emotion regulation and the expected outcome may affect one's subsequent use of emotion regulation, forming an interactive process between the individual and the situation that continually evolves over time (Gross, 2015). To emphasize this dynamic, research needs to systematically examine individual differences and analyze how different situations affect a person's choice of emotion regulation strategy.

Situational Context and Emotion Regulation

In Sheppes et al. (2015) study, they propose that whether emotion regulation would occur depends on individual's evaluation of current goals or expectation. Recent research on emotion regulation has begun to focus more on the contextual and situational factors at play in emotion regulation (McRae et al., 2011; Troy et al., 2013; Sheppes et al., 2015; Haines et al., 2016; English et al., 2017; Kobyliǹska and Kusev, 2019), including the person one is interacting with and one's sense of control over the situation. A person's approach to emotion regulation tends to differ depending on whether they are interacting with a partner or a colleague (Gross et al., 2006), and the less close the relationship, the more likely one is to adopt expressive suppression (English et al., 2017). In Eastern Asia, such as Taiwan, Confucianism had significant influence upon people's daily lives. In Confucian teaching, interpersonal relationships-close relationships in particular-are characterized by kinship value and respect for seniority (Hill, 2007). We are interested to examine whether the use of emotion regulation varies across different close relationship (such as parents or partner). In addition, one's level of situational control is significantly correlated with the emotion regulation strategy used (Troy et al., 2013; Haines et al., 2016). When the individual has little control over the situation, cognitive reappraisal tends to be regarded as a more appropriate mode of emotion regulation, in contrast to situations in which the individual has greater control (Cheng, 2001; Troy et al., 2013).

Another situational factor is the goal of emotion regulation; the emotion regulation strategy adopted tends to differ when the primary goal is to make a good impression on the other party, as opposed to a situation in which the chief goal is to foster mutual understanding (English et al., 2017). For example, a person experiencing conflict with his or her parents due to differing views is likely to be socially motivated to suppress his or her anger so as to avoid straining the relationship (Tamir, 2016). However, if the person's primary motivation is to ward off excessive control by his or her parents, he or she is more likely to express anger and other negative emotions (Tamir and Ford, 2012). One of the central Confucian ideologies is the maintenance of interpersonal harmony (Matsumoto et al., 2008), which is also deeply embedded in the value of Taiwanese society. Therefore, we are interested to investigate the extent to which individuals regulate their emotions during the conflict in order to maintain harmony in their close relationship.

Individual Differences in Emotion Regulation

How an individual responds to or expresses emotions is affected by socialization (McRae et al., 2011), in which the individual learns gender-compliant modes of emotion regulation (Ryan et al., 2005). Generally, men are expected to not be overly emotional, especially in regard to negative emotions such as sadness and dejection (Sloan, 2012). Furthermore, emotion regulation studies have found that men use repression more often than women in their emotional reactions in daily life (Gross and John, 2003; Campbell-Sills et al., 2006), while women are more likely to use repression as they age (Nolen-Hoeksema and Aldao, 2011). Moreover, women verbally express their feelings more often than men do and are more likely to change their living situation to ease their anger or sadness (Rivers et al., 2007).

Regarding cognitive reappraisal strategies, the findings are more divergent. While some studies have found no significant difference between men and women in terms of cognitive reappraisal (Gross and John, 2003; Gross et al., 2006; McRae et al., 2008), others have found that women use cognitive reappraisal more often than men (McRae et al., 2011). Is it possible that this difference is due to the influence of situational factors on the selection of an emotion regulation strategy? This is a question requiring further research.

In addition to contextual factors, research shows that emotional traits can also partially explain a person's choice of emotion regulation strategy (Mikolajczak et al., 2008), which is seen by some scholars as a form of EI (Petrides and Furnham, 2003). In an effort to integrate two traditions of emotion research together, namely, emotion regulation and emotion intelligence, to provide a complete theoretical interpretation of emotion, Peña-Sarrionandia et al. (2015) use emotion regulation as a framework to conceptualize individual differences in the process and consequence of emotion regulation. Their review suggests that the use of emotion strategies significantly vary by the level of EI. Research has found that people with higher EI have higher life satisfaction (Di Fabio and Saklofske, 2014), better health (Schutte et al., 2007; Malouff et al., 2014), less emotional distress (Mikolajczak et al., 2014), and better performance at school or work (Van Rooy and Viswesvaran, 2004; O'Boyle et al., 2011).

Goleman (1995) suggested that EI is a crucial component in maintaining relationships. A number of studies have provided empirical evidence to support that individuals with higher EI tended to be more empathic (Mayer et al., 2008) and socially connected (Lopes et al., 2005), and to have better interpersonal relationships (Schutte et al., 2001). Based on this view, it is expected that that EI is positively related to maintenance of harmonious relationships when dealing with conflict with parents or intimate a partner.

According to Peña-Sarrionandia et al. (2015), rather than continuously regulating their emotions, high-EI individuals are better than low-EI individuals at flexibly selecting a suitable emotion regulation strategy when the situation requires it. To be sure, the selection and use of an emotion regulation strategy needs to be adjusted according to the situation, and EI appears to play a role in evaluating the situation and strategy employed.

The Present Study

The purpose of the present study is to elucidate how emotional competence and situational factors affect the selection of an emotion regulation strategy when dealing with conflict. Taking EI as an indicator of emotional competence, we hypothesize that individuals with higher EI would be better able to reevaluate a situation by looking at it from a different perspective and better at using cognitive reappraisal to regulate emotions during interpersonal conflict. We presume that there is a negative correlation between EI and suppression of emotion in response to interpersonal conflict. For situational factors, we expect that

both the sense of control over the conflict situation and the goal of dealing with the conflict influence one's selection of an emotion regulation strategy. When an individual has a high sense of control, we predict that he or she is more likely to take action to change the current situation and therefore less likely to use cognitive reappraisal or to suppress emotion. By contrast, if the individual sees maintaining the relationship as the goal of dealing with the conflict, he or she is more likely to use cognitive reappraisal and suppression. In this study, we focus on the extent to which the impact of situational factors on emotion regulation is influenced by gender and the person one is interacting with (parents vs. partners).

MATERIALS AND METHODS

Participants

A total of 300 participants between the ages of 21 and 35 were recruited from the community. Of these, 140 were women (mean age = 28.14, *SD* = 4.49), and 160 were men (mean age = 28.12, *SD* = 4.32). The majority of the sample had a college degree (60%), high school education (21%), and a graduate degree (19%). A large percentage of participants were single (71.0%), and another 27% were married. Approximately two thirds of the participants worked in a full-time job, including services and sales (18.7%), technical (14.7%), professional (12.2%), clerical (10%), and education (9.5%).

Potential participants were excluded if they (a) were below age 20 or above age 35, (b) had no in-person contact with their parents for the past 3 months, or (c) had not been in an intimate relationship during the past 3 months.

Procedure

After signing an informed consent form, participants were asked to complete a set of questionnaires including background information and measures of EI. Then, they were instructed to recall a recent conflict in which they experienced anger with (1) one of their parents and (2) an intimate partner. Next, participants were asked to evaluate their emotion regulation, perception of control over the situation, and goal of emotion regulation during that experience. Each participant was given a voucher worth $10 upon completion. This research was approved by the Research Ethics Committee of Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation (no. IRB106-72-B).

Measures

Emotion Intelligence

The Wong and Low Emotion Intelligence Scale (WLEIS; Wong and Law, 2002), a self-report scale, consists of four dimensions of trait EI. Each dimension has 4 items, for a total of 16 items. The four dimensions include (1) self-emotional appraisal, e.g., "I have a good sense of why I have certain feelings most of the time"; (2) others' emotional appraisal, e.g., "I am sensitive to the feeling and emotions of others"; (3) use of emotion, e.g., "I am able to control my temper and handle difficulties rationally"; and (4) regulation of emotion, e.g., "I have good control of my own emotions." The WLEIS is answered on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Prior research indicates that the WLEIS has good reliability and convergent and predictive validity (e.g., Fukuda et al., 2012; Li et al., 2012; Libbrecht et al., 2014; LaPalme et al., 2016). Cronbach's alphas for the scales of WLEIS in the present study range from 0.81 to 0.90.

Context-Specific Emotion Regulation

Participants were asked to recall a time during the past 3 months when they had felt anger resulting from a conflict with (1) their parents or (2) their intimate partner, respectively. After briefly describing each incident, the Emotion Regulation Questionnaire (ERQ; Gross and John, 2003) was used to assess the emotion regulation associated with the incident. The instructions given to the participants were: "We would like to ask you some questions about how you regulate your emotion during the conflict with your parents/partner, the questions below involve two distinct aspects of your emotion life. Please answer using the following scale."

The ERQ is a 10-item measure designed to assess cognitive reappraisal with six items (e.g., "When I want to feel more positive emotion, I change the way I'm thinking about the situation") and emotion suppression with 4 items ("I control my emotions by not expressing them"). Participants were asked to rate their emotion regulation in the two incidents with parents and partner, respectively. Each item was rated on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*), and the total score for each strategy was divided by the number of items, with higher scores indicating a greater tendency to use the strategy to regulate emotion. Cronbach's alphas for cognitive reappraisal in the present study were 0.89 and 0.91 for parents and intimate partners, respectively; for suppression, they were 0.75 and 0.79 for parents and intimate partners, respectively.

Perception of Control Over the Conflict

Perception of controllability was assessed by two items. Participants rated their sense of control over the (1) cause and (2) outcome of the conflict in each interpersonal context on a scale from 1 (not at all) to 7 (a great deal). The scale has good internal reliability, and Cronbach's alphas were 0.86 and 0.85 for parents and intimate partners, respectively.

Relational Goal of Emotion Regulation

Participants indicated the extent to which they regulated their emotions during the conflict in order to maintain a positive relationship (1 = *not at all* to 7 = *a great deal*).

Relational goals of emotion regulation for parents and intimate partners were assessed individually.

Data Analytic Plan

A series of independent and dependent samples *t* tests were conducted to test gender as well as within-person differences on emotion regulations in different interpersonal contexts. We adopted a two-step approach (Anderson and Gerbing, 1988; Anderson and Gerbing, 1992) of structural equation modeling to test the hypothetical models. Confirmatory factor analyses were conducted to examine whether the measurement models fit the data well. After an acceptable measurement model was

developed, the structural model was tested. The maximum likelihood estimation in AMOS 20.0 was used to estimate the parameters. Three goodness-of-fit indices recommended by Hu and Bentler (1999) were adopted to evaluate the mode fit: a confirmatory fit index (CFI) close to 0.96, a standardized root mean square residual (SRMR) less than 0.08, and a root mean square error of approximation (RMSEA) less than 0.06. The chi-squared (χ^2) test is another index to assess model fit, and a non-significant result indicates that the model fits the data adequately; however, this test is easily affected by the sample size. Kline (2005) suggested an acceptable ratio of chi square to degrees of freedom (χ^2/df). The analyses of multiple-group comparison were conducted to examine the invariance of path coefficients between gender differences. In one model, the path coefficients were constrained to be equal for female and male, and in the other model the path coefficients were allowed to vary. A chi-square test was examined to determine whether these two models were equivalent. A bootstrap method was adopted to verify the significance of indirect effect the structural model (MacKinnon et al., 2002).

RESULTS

Table 1 presents the means and standard deviations of the study variables for males and females. The results of the independent-sample *t*-test indicated that males were more likely than females to regulate their anger by using suppression in both interpersonal situations. We also compared reappraisal and suppression in the same interpersonal context by conducting dependent-sample *t*-tests to examine possible within-participant differences. The results showed that individuals tended to regulate anger by using more reappraisal than suppression in their close relationships, whether with parents (female, $t(139) = 7.08$, $p < 0.001$); male, $t(159) = 6.73$, $p < 0.001$) or with an intimate partner (female, $t(139) = 8.28$, $p < 0.001$); male, $t(159) = 6.39$, $p < 0.001$).

TABLE 1 | Means and standard deviations of the research variables for male and female groups.

Variable	Female (*n* = 140)		Male (*n* = 160)		
	M	*SD*	*M*	*SD*	*t*(298)
Emotion intelligence	57.32	10.14	59.69	10.87	−1.94
Parents					
Reappraisal	4.95	0.94	5.03	1.00	−72
Suppression	4.32	1.10	4.57	1.08	−1.98*
Controllability	9.17	2.94	9.52	2.69	−1.07
Relational goal	5.76	1.15	5.60	1.18	1.17
Intimate partner					
Reappraisal	4.96	1.08	5.18	0.99	−1.80
Suppression	4.21	1.20	4.70	1.18	−3.54***
Controllability	9.25	2.86	9.78	2.81	−1.62
Relational goal	5.90	1.20	5.81	1.16	0.64

*$p < 0.05$, ***$p < 0.001$.

Measurement Model

The latent variables with unidimensional measures (such as appraisal) were estimated using the item parceling technique (Russell et al., 1998). The items were ranked from high to low according to the corrected item-total correlation and then evenly distributed to three parcels for greater consistency of variance. The EI measurement indices were the scores of its four subscales, namely, self-emotion appraisal, others' emotion appraisal, use of emotion, and regulation of emotion. The measurement models were tested separately for the two types of close relationships. Each measurement model comprised three latent variables (see **Table 2**) and two measurement variables, and there were 12 observation indices.

The results indicated that the two models fit the data well parent model, (χ^2 (46; $N = 300$) = 97.28; $p < 0.00$; χ^2/df = 2.12; CFI = 0.97; RMSEA = 0.06; SRMR = 0.04; partner model, (χ^2 (46; $N = 300$) = 126.04; $p < 0.00$; χ^2/df = 2.74; CFI = 0.96; RMSEA = 0.07; SRMR = 0.04. The loadings of measured indicators on the latent variables were all statistically significant, and the coefficients of composite reliability of latent variables were all greater than 0.6, as suggested by Bagozzi and Yi (1988). All correlations among the variables within these two models were significant (see **Table 3**).

Structural Model

The results of our hypothetical models (see **Figures 1**, **2**) showed good fits of the models to the data [parent model, χ^2 (48;

TABLE 2 | Factor loadings for the Measurement Model.

Latent variable and indicator	*ß*	*SE*	Z	95% CI
Emotion intelligence				
Self-emotional appraisal	0.80***			(0.74, 0.85)
Others' emotional appraisal	0.79***	0.076	14.67	(0.73, 0.84)
Use of emotion	0.74***	0.078	13.58	(0.67, 0.80)
Regulation of emotion	0.88***	0.077	16.55	(0.83, 0.92)
Parents appraisal				
Parcel 1	0.87***			(0.82, 0.91)
Parcel 2	0.89***	0.048	19.99	(0.84, 0.93)
Parcel 3	0.80***	0.056	17.06	(0.72, 0.87)
Partner suppression				
Item 2	0.72***			(0.62, 0.82)
Item 4	0.73***	0.083	10.58	(0.73, 0.83)
Item 6	0.82***	0.094	12.48	(0.75, 0.88)
Item 9	0.82***	0.085	12.45	(0.74, 0.88)
Partner appraisal				
Parcel 1	0.88***			(0.84, 0.92)
Parcel 2	0.85***	0.048	19.34	(0.79, 0.90)
Parcel 3	0.90***	0.051	21.29	(0.84, 0.94)
Partner suppression				
Item 2	0.78***			(0.69, 0.85)
Item 4	0.76***	0.074	11.73	(0.68, 0.83)
Item 6	0.80***	0.075	13.48	(0.71, 0.87)
Item 9	0.82***	0.074	17.74	(0.74, 0.89)

95% CI is presented for standardized factor loadings.
***$p < 0.001$.

TABLE 3 | Correlations among variables in the measurement model.

Latent variable	1	2	3	4	5
1. Emotion intelligence		0.34**	0.40**	0.68**	0.43**
2. Controllability	0.36**		0.47**	0.37**	0.14*
3. Relational goal	0.30**	0.41**		0.53*	0.19**
4. Reappraisal	0.51**	0.46**	0.42**		0.62**
5. Suppression	0.30**	0.28**	0.18**	0.63**	

Correlations above the diagonal are for parents model; correlations below the diagonal are for intimate partner model.
$^{*}p < 0.05$, $^{**}p < 0.01$.

N = 300) = 143.85; $p < 0.00$; χ^2/df = 2.99; CFI = 0.97; RMSEA = 0.05; SRMR = 0.03; partner model, χ^2 (48; N = 300) = 140.93; $p < 0.00$; χ^2/df = 2.93; CFI = 0.96; RMSEA = 0.06; SRMR = 0.04]. A moderating effect of gender (female vs. male) was also evaluated. Comparisons of the unconstrained and constrained models using chi-square differences showed significant results parent model, $\Delta\chi^2$(df = 6) = 13.57, $p < 0.05$; partner model, $\Delta\chi^2$(df = 6) = 14.74, $p < 0.05$. The results indicated that the coefficients across groups were not equal for males and females. The standardized coefficients are presented in **Figure 1** (parent model) and **Figure 2** (partner model). Additionally, indirect effects of EI on emotion regulation strategies through a sense of controllability and goals for conflict management were tested. The bootstrap resampling method (MacKinnon et al., 2002) was used by taking a sample of the original data to obtain 1,000 samples to calculate the 95% confidence intervals (CIs) of indirect effects.

The bootstrap results indicated that EI had a significant indirect effect on reappraisal through the sense of controllability and goal for conflict management in the parent model (female β = 0.12, SE = 0.05, 95% CI = 0.05, 0.22; male β = 0.13, SE = 0.05, 95% CI = 0.04, 0.22) and partner model (female β = 0.09, SE = 0.05, 95% CI = 0.01, 0.18; male β = 0.24, SE = 0.06, 95%

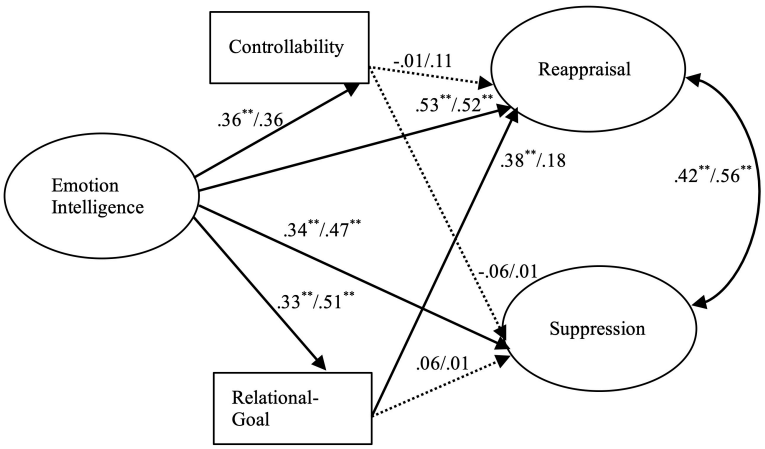

FIGURE 1 | The structural mode of emotion regulation with parents. Dashed lines indicate non-significant paths. The values are the path coefficients for females (left side) and males (right side). N = 300. $^{*}p < 0.05$. $^{**}p < 0.01$.

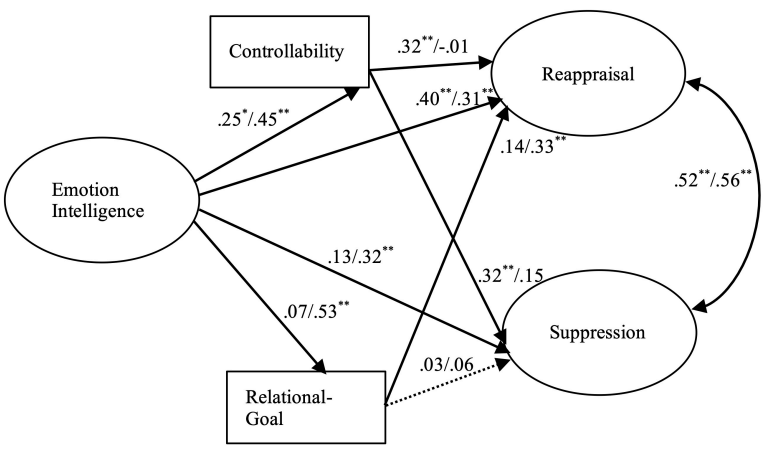

FIGURE 2 | The structural mode of emotion regulation with partners. Dashed lines indicate non-significant paths. The values are the path coefficients for females (left side) and males (right side). N = 300. $^{*}p < 0.05$. $^{**}p < 0.01$.

CI = 0.04, 0.22), whereas EI had a significant indirect effect on suppression through the sense of controllability and goal for conflict management only for females in relations with partners (β = 0.08, SE = 0.04, 95% CI = 0.03, 0.16). EI did not have significant effects on suppression in the parent model (female β = 0.01, SE = 0.05, 95% CI = 0.01, 0.07; male β = 0.13, SE = 0.05, 95% CI = -0.08, 0.10) or partner model for males (β = 0.01, SE = 0.05, 95% CI = -0.08, 0.00).

DISCUSSION AND CONCLUSION

This study explores how an individual's choice of emotion regulation strategy in a conflict situation is influenced by factors such as EI, the person one is interacting with, perceived level of control, and the individual's primary goal in dealing with the conflict. The results showed that in dealing with conflict with their partner or parents, the participants used cognitive reappraisal much more frequently than suppression, and the men used suppression more frequently than the women. Both of these findings are consistent with the results of most previous studies (Brody and Hall, 1993; Gross and John, 2003; Matsumoto et al., 2016; Goubet and Chrysikou, 2019), including previous research that found that in various types of situations, men are much more likely to use expressive suppression (Goubet and Chrysikou, 2019). However, our results differ from those of Nolen-Hoeksema and Aldao (2011), who found no significant correlation between gender and use of repression in their community sample. This discrepancy may have arisen because Nolen-Hoeksema and Aldao's definition of suppression consisted of emotional, thought, and expressive suppression, whereas in the present study and other studies with similar results (e.g., Gross and John, 2003; Matsumoto et al., 2016), the measurement of suppression included only expressive suppression, leaving the question of gender differences in terms of emotional and thought suppression as a matter requiring further study.

When we compare our results with previous studies that have also used the ERQ, the participants' scores for expressive suppression were significantly higher than those of clinical and non-clinical samples in Western countries (Joormann and Gotlib, 2010; Ludwig et al., 2020) but similar to those of other non-Western samples (Matsumoto et al., 2016; Zhou et al., 2016). Studies have shown that, in comparison with West, East Asian societies give more importance to rules for emotion display (Matsumoto et al., 1998; Safdar et al., 2009). The suppression of negative emotion in certain situations is often aimed at protecting the feelings of others (Butler et al., 2007; Ford and Mauss, 2015), and those who are adept at suppressing the overt expression of negative emotions are typically esteemed for their self-control and good social skills (Zhou et al., 2016). In addition, suppression of negative emotion is a reliable predictor of better interpersonal skills (Wei et al., 2013); conversely, the suppression of positive emotions is a good predictor of poor psychosocial skills (Zhou et al., 2016).

As expected, we found a positive correlation between EI and cognitive reappraisal, indicating that those with higher EI are better at reassessing problems and looking at a situation from a different point of view; examples include reducing negative emotions by recasting a negative situation in a positive light or by reevaluating a stressful situation from a different perspective. This finding supports those of several previous studies (Mikolajczak and Luminet, 2008; Schutte et al., 2009; Moradi et al., 2011). In contrast to previous studies, we found a positive correlation between EI and the use of expressive suppression, except among women dealing with conflict in an intimate relationship. The negative correlation between EI and the use of expressive suppression found in past studies (Mikolajczak et al., 2007; Austin et al., 2008) might have been observed because those with higher EI give more importance to consistency between emotion and its expression (Peña-Sarrionandia et al., 2015), making them less likely to use expressive suppression. However, studies have also found that people with high EI are more flexible in selecting an emotion regulation strategy to suit a particular situational context (English et al., 2017; Kobylińska and Kusev, 2019). Notably, members of societies that value interdependence and interpersonal harmony, such as Taiwan, are more likely to suppress negative emotions that arise in close relationships to maintain harmony and avoid straining the relationship (Butler et al., 2007), and this also applies to those with a relatively high degree of EI.

We also found a positive correlation between EI and sense of control in situations of conflict, regardless of whether the conflict is in relation to one's parents or partner, but the influence of this sense of control on emotion regulation varies depending on the type of interpersonal relationship one is dealing with. In conflicts with one's parents, sense of control was not significantly correlated with the use of either cognitive reappraisal or expressive suppression. Confucian societies such as Taiwan give overarching importance to family ties and the hierarchical relationship between parents and children, such that when differing points of view give rise to conflict between parents and children, directly refusing to accept parents' perspective or overtly expressing strong negative emotions are generally considered to be egregiously unfilial behavior (Hwang, 2000). Thus, we conjectured that in any conflict with parents, the participants, regardless of their sense of control, would report exercising a high degree of emotion regulation, including both cognitive reappraisal and expressive suppression.

For the female participants in conflicts with their partners, we found a positive correlation between sense of control and the use of multiple emotion regulation strategies, including cognitive reappraisal and suppression of anger. This result is in contrast to the findings of previous studies reporting that those with a relatively high sense of control over the situation are more likely to engage in problem-solving or other proactive behaviors and less likely to use cognitive reappraisal or expressive suppression (Cheng, 2001; Haines et al., 2016). The positive correlation we found for women between their sense control and use of both cognitive reappraisal and expressive suppression may indicate that an increased sense of control makes them more likely to adopt a proactive strategy, for example, reducing the intensity of an emotion by reevaluating the situation from a different point of view prior to the emergence of the emotion or as soon as it arises. This finding is similar to the findings of Ouwehand et al. (2006)

in their study on the influence of situation-specific factors on emotion regulation. The general perception in Chinese societies is that when one is in a relatively favorable position, he or she is expected to make face-saving allowances for others and to avoid overtly expressing negative emotions (Soto et al., 2011).

As expected, a positive association between EI and relational goal was found, except among women dealing with conflict in an intimate relationship. In light of the previous studies reporting that the goal of emotion regulation influences the choice of strategy (Gross and Jazaieri, 2014), we paid particular attention to whether or not the choice of emotion regulation strategy is influenced by the person one is interacting with when the person's goal is to maintain the relationship. Indeed, we found that cognitive reappraisal is more likely to be used when maintaining the relationship is the goal of emotion regulation, but only in two scenarios: men in conflict with a partner and women in conflict with parents. In this regard, research has found that in both Eastern and Western societies, adult daughters spend more time with their parents than adult sons do (Birditt et al., 2009; Tao, 2014). To maintain a better relationship with their parents, daughters may engage in cognitive reappraisal prior to the emergence of an emotional response so as to reduce negative emotions. We also found that the male participants' efforts to regulate emotions were mainly aimed at mitigating the effects of conflict in their relationship with their partner, for which purpose they attempted to regulate their emotions relatively early, including by using cognitive reappraisal, to stem negative emotions.

For men in conflict with parents and women in conflict with a partner, the associations between reappraisal and maintenance of harmony in relationship are not significant but in a positive direction. The inconsistent results suggest that it is premature to conclude the effects of specific individual or contextual factors on the choice of emotion regulation strategies. More studies are needed.

This pioneering study takes individual differences and situational factors (sense of control and the goal of emotion regulation) into consideration and comprehensively discusses the choice of emotion regulation strategies, but the results are subject to a number of methodological limitations. First, although the self-reporting scales used for data collection have sound psychometric properties and are widely used by researchers, the participants' responses could have been skewed by various situational and individual factors, such as mood, level of interest, strength of memory, and answers in accordance with social expectations rather than in accordance with their actual experience; such factors could have affected the accuracy of the results. Thus, it would be desirable for future research to include the behavioral dimension of emotion regulation (Tottenham et al., 2011) by using a measurement tool that combines subjective (self-reporting) and objective (behavioral evaluation) evaluations so as to provide a more objective assessment of emotion regulation.

Second, the study only examined the effect of maintenance of relationship (as the goal of emotion regulation) on the association between EI and emotion regulation strategies. Future study could extend our conceptual model by examining other relevant goals of emotion regulation, such as prohedonic goals (Wilms et al., 2020) or performance goals (Tamir, 2016). Examining more comprehensive goals of emotion regulation is important because it would increase the reliability of outcomes.

Third, this study of young adults sought to determine to what extent their choice of emotion regulation strategy for dealing with conflict in a close relationship is affected by their sense of control of the situation and their goal in dealing with the conflict. Thus, the participants were asked to consider a recent incident in which they felt angry as a result of a conflict with either their parents or partner, and having the participants focus on a particular incident rather than answering in terms of their everyday experience constitutes one of the main contributions of this study. Nonetheless, the participants could have differed significantly in terms of the type of incident, its intensity, and the accuracy of their memories, all of which could have influenced their responses. Thus, we need to be especially cautious about making inferences based on these results. In view of the above research limitations, future studies need to apply more rigorous controls to ensure that the incidents the participants are referring to are similar in nature. It would also be desirable to measure the subjective stress levels experienced by participants in relation to the incident they are referring to. To improve the ecological validity of the measurement (Csikszentmihalyi and Larson, 1987), future research should adopt the experience-sampling method (Mehl and Conner, 2012), in which the participant is asked to record his or her emotional responses to various emotionally salient events that occur throughout the course of a typical day, including the nature of the event and the emotion regulation strategy employed.

An additional limitation of this study is that the participants were all young adults within a fairly narrow age range. Research on emotion regulation has found that age is an important background factor affecting emotion regulation (Urry and Gross, 2010), that young adults have greater emotional variability (Birditt and Fingerman, 2003), and that for older people, negative emotions are less intense and less frequent (Charles et al., 2009). In terms of strategies for regulating negative emotions, older people are more accommodating and accepting, while younger people tend to seek support and spend more time pondering their current situation (Blanchard-Fields and Coats, 2008), so we need to be cautious about extrapolating these results to other age groups. Thus, future studies on this topic should include a broad range of age groups and compare their use of emotion regulation strategies.

In this study, both individual differences and situational factors had a bearing on the participants' choice of emotion regulation strategy, a finding that has important implications for prevention and intervention strategies in the mental health field. In terms of intervention strategies, mental health professionals who seek to help a client select suitable emotion regulation strategies for dealing with interpersonal conflict need to give due consideration to situational factors such as the level of control, the people involved, and the client's goal in dealing with the conflict (Mauss and Tamir, 2013). For example, the therapist might want to advise the client to use cognitive reappraisal strategies such as reinterpreting the situation and adopting more

positive ways of thinking; the therapist might also advise the client to suppress the expression of negative emotions to maintain interpersonal harmony. For clients who have difficulty expressing emotions appropriately, the therapist should provide guidance on how to display emotion in a way that suits the situation. Clients accustomed to suppressing emotions may require help in recognizing the emotion regulation strategies they tend to use, in exploring the possible reasons for suppressing their emotions, and in considering the positive and negative effects these strategies have on their interpersonal relationships and on their physical and mental health.

In summary, the findings of this study indicate that the choice of an emotion regulation strategy results from the interaction between the individual and the situation. Individual differences such as EI affect how individuals engage in emotion regulation. To better understand the influence of emotion regulation on individual adaptation, future research should examine a wider range of emotion regulation strategies.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Research Ethics Committee, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

W-LC conceptualized the study, conduct the statistical analysis, and wrote the manuscript. WL assisted with the preparation of the manuscript. Both authors contributed to the article and approved the submitted version.

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How Adolescents and Adults Learn About Changes in the Trustworthiness of Others Through Dynamic Interaction

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Whether to trust or distrust another individual is a complex interpersonal challenge, especially when such individuals behave inconsistently. It is still unclear as to how individuals learn and adapt to fluctuations in the trustworthiness of others and how this process changes from adolescence to adulthood. To address these issues, we implemented repeated rounds of a trust game within the context of a complicated and changeable interpersonal environment. Specifically, adolescents and adults played the role of trustors who had to decide whether to invest money in two anonymous partners carrying the risk of no reciprocation. Unbeknownst to participants, these two partners had different trustworthiness profiles: one partner initially yielded a higher initial return rate (70%) while the other initially yielded a lower initial return rate (30%). Crucially, over repeated rounds, these two partners gradually changed their responses to the point where, finally, return rates were both neutral (50%). Results indicated that all participants showed less updating in the negative direction in response to good-to-neutral partners while more updating in the positive direction in response to the bad-to-neutral partner. Compared to adults, this behavioral disparity in responses to good-to-neutral and bad-to-neutral partners was less pronounced in adolescents. Based on the computational modeling approach, the potential mechanisms underlying their behavioral patterns were revealed: the higher learning rate promoted flexible adaptions in participants to untrustworthy trustees as they changed to neutral. The less pronounced distinction between good-to-neutral and bad-to-neutral partners in adolescents was related to their lower learning rate. Overall, our study extends the understanding of trust behavior to a fluctuating social context and highlights the role of social learning in social emotion and interaction.

Keywords: trust, trust game, adolescent, social learning, dynamic interaction, computational modeling

INTRODUCTION

The importance of interpersonal trust within a well-functioning society is immeasurable. Theories and researches have done much to advance our understanding of interpersonal trust which is considered to be a complex social behavior (Bellucci et al., 2017; Krueger and Meyer-Lindenberg, 2019). It relies on the interplay of at least three different factors including risk preferences, social preferences, and beliefs about others' trustworthiness (Coleman, 1990; Fehr, 2009; Bellucci et al., 2017). The first two factors have close links with the agent of trust behavior, i.e., the trustor, which have more influence on the baseline of trust behaviors. The main effect of trustee is reflected in the third factor which is emphasized in social learning theory. Social learning theory defined interpersonal trust as a generalized expectancy held by an individual or a group that the word, promise, verbal, or written statement of another individual or group can be relied upon (Rotter, 1967, 1971; Szcześniak et al., 2012). This "generalized expectancy" is related to beliefs about others' trustworthiness implying the influence from trustee to trustor. In this study, inspired by social learning theory, we focused on the social learning processing that updates beliefs about trustees' trustworthiness to optimize trust behaviors.

On the one hand, beliefs about others' trustworthiness built through social priors. For example, a trustee's identity, ethnicity, stereotyped image, facial appearance as well as the first impression, that they may can all affect an individual's expectancy of trustworthiness about them (van't Wout and Sanfey, 2008; Boero et al., 2009; Fouragnan et al., 2013; Yu et al., 2014; Cañadas et al., 2015; Lee et al., 2016; Bellucci et al., 2017; Telga et al., 2018). One study found that participants showed more trust-related behaviors towards partners with high social status who had made a promise compared with those of lower status who had made the same promise (Blue et al., 2020). Besides social status, the social relationship is also an important social prior that can influence trust behaviors as the following study. In an interactive trust game, participants acted as investors who were required to decide whether to share money with three trustees bearing distinct identities: a friend of the participant, an unacquainted confederate, and a nonsocial computer. Participants were shown to invest more frequently with their friends compared with the confederate and computer even they had equivalent reciprocation of collaborative decisions (Fareri et al., 2015). Human beings have a great ability to judge others' trustworthiness rely on the social prior even with limits of time and information. It is found that people are able to evaluate trustworthiness based on the first impression of faces within a very short time (100 ms; Willis and Todorov, 2006). Besides the above characteristics of which influences formed through socialization in real experience, it can be learned in a laboratory environment. This was demonstrated by a study that manipulated fictional partners to appear to be either good, bad, or neutral at performing a Cyberball game just before a trust game. Results showed that even though there was no overlap in behavior between the Cyberball game and the trust game and their return rates were equal, participants invested less in the bad partner who rarely passed the ball to themselves in the Cyberball game compared with the other two partners (Fareri et al., 2012). Taken together, these findings corroborate the claim that prior-based knowledge plays a pivotal role in trust behavior.

On the other hand, in addition to prior-based knowledge, socializing with a partner in a trust-related activity is another way to estimate their trustworthiness. An fMRI study explored the influence of both prior-based and interaction-based learning on trustworthiness. In that context, if a cue representing trustworthy or untrustworthy was provided, participants would obtain prior-based knowledge of trustees' trustworthiness before the trust game, while if no cues were provided, they had to learn trustees' trustworthiness based on the interaction during the trust game (Fouragnan et al., 2013). This study demonstrated that reinforcement learning patterns reflected in behavior correlated with striatal activation only when participants had to estimate the level of partners' trustworthiness without available prior. When prior knowledge was available, it oriented initial decisions and reflected in medial prefrontal cortex activity (Fouragnan et al., 2013). It is supported that the use of prior-based and interaction-based information in guiding trust behavior is implemented by different neural mechanisms.

In addition to the conflict between prior knowledge and current interaction, it is also possible to appear fluctuations for trustworthiness during the interaction. How people learn these fluctuations in trustworthiness from interaction has, until now, been unclear. In terms of changes in trustworthiness, a good or bad initial impression may act as two distinct learning reference frames which can then influence subsequent learning and updating processes, i.e., declining trustworthiness from a good initial frame, and increasing trustworthiness from a bad frame. In terms of impression formation, findings, based on diagnostic statements, showed that the influence of changes in the impression that shift from good to bad is greater than changes that shift from bad to good (Reeder and Coovert, 1986; Baumeister et al., 2001). With this disparity in mind, we can ask the following question. In natural interaction-based learning, how does the reference frame influence the process of learning? To investigate this, we employed a repeated trust game to create a situation that individuals learn to trust by evaluating feedbacks of repeated interactions.

Interaction-based trustworthiness learning embodies the social learning processing of interpersonal trust that is a main social emotion in daily interaction. These two key social functions mature gradually with development and socialization (Kilford et al., 2016) which led us to dig deep into this question from a developmental perspective. Development theory, supported by empirical evidence, has identified a close link between age and trust construction (Bernath and Feshbach, 1995; Kilford et al., 2016). Psychologists maintain that the construction of trust can be placed along a developing track throughout the human lifespan (Erikson, 1993, 1994; Sakai, 2010). One study examined how trust develops across time by recruiting participants ranging in age from eight years old to retirement age to play the trust game. They found that trust changed as a function

of age from early childhood to early adulthood and then stayed constant during the rest of adulthood (Sutter and Kocher, 2007). The same pattern of age-related changes was also found with respect to reciprocity, the probability of returning money to trustors increases with age when participants as trustees in the trust game (van den Bos et al., 2010). An increase in trust behavior and trustworthiness was observed in lockstep with age. This phenomenon suggests that improvements in social function have close links with corresponding increases in socialization (van den Bos et al., 2010, 2011).

Although these findings offer important insights into age differences in trust behavior, they do not tell the whole story. When trustees show varied and changing levels of trustworthiness, we are yet to establish what role of age plays in the construction of trust. In this study, we explored this issue by examining both adolescents and adults to gain insights into their reaction patterns. From adolescence, individuals begin to experience a more complicated social life (Belli et al., 2012). Negative elements, which parents were previously able to filter out, become more commonplace than before. As adolescents, these individuals spend less time within an environment that is managed by parents and, as a consequence, they begin to face more mixed and changeable information. As such, adolescents need to begin to apply their own way of dealing with changeable situations and intricate relationships. At the same time, adolescents are experiencing important transitions across physical, social, behavioral, and cognitive domains and gradually they are moving to their adulthoods (Steinberg, 2005; Kilford et al., 2016). Thus, from adolescence to adulthood, this is a key period of social cognitive development. It is still unclear as to how these maturing adolescents learn about changes in the trustworthiness of others and deal with complicated interpersonal trust problems and what is the development trend in this issue from adolescence to adulthood. By studying both adolescents and adults, the second aim of the current study is to address this gap in the literature.

Taken together, this study highlights two key issues. The focus of this study was in part driven by the question of cognitive conflict in interaction-based learning: specifically whereby a trustworthy agent can become less trustworthy and an untrustworthy agent can become less untrustworthy over a period of interaction. In repeated rounds of the trust game, participants played as trustors against two anonymous trustees with changeable return rates. By preprogramming trustees' return rates, we were able to track the behaviors of participants within two learning reference frames. That is a reference frame in which the partner reciprocated from 70 to 50% of the time, and another in which the partner reciprocated from 30 to 50% of the time. Next, we focused on the different behavioral patterns between adolescents and adults and compared their performance in the above dynamic interaction. The difference between these two age groups implies the development trend of reactive patterns to changeable interpersonal trust from adolescence to adulthood.

In addition, running repeated rounds of the trust game offered the prospect of gaining more insights through computational modeling. This approach has previously been used in studies to explore underlying mechanisms in the overt behaviors associated with a variety of social decision making and social learning phenomena (Fareri et al., 2012, 2015; van Baar et al., 2019). It is helpful to build an explanatory cognitive mechanism and a framework with which to predict behavioral performance (Konovalov et al., 2018; Lockwood and Klein-Flügge, 2020). In view of the advantages afforded by computational modeling, we used a reinforcement learning model with the aim of decoding trust construction processing in two reference frames across the two age groups.

MATERIALS AND METHODS

Participants

The sample size was determined by two priori power analyses using G*power (Faul et al., 2007). One analysis was conducted for learning reference frame effect (one-sample t-test, two-tailed), it indicated a required sample size of $N = 34$ of each age group to be able to find an effect of at least $d = 0.5$ at $\alpha = 0.05$ with a standard statistical power of 0.8. The other is for age effect (within-between interaction in repeated-measures ANOVA), at least 17 participants were required in each age group to be able to find an effect of at least $f = 0.25$ at $\alpha = 0.05$ with a standard statistical power of 0.8. Considering possible exclusion, a total of 74 healthy participants were recruited from a university (adult sample) and a mainstream school (adolescent sample). Participants and their guardians (for the adolescent group) read the instruction and signed the informed consent. Two participants were excluded from analyses because one participant was interrupted during the experiment, and the other participant misunderstood the task. The remaining 72 participants were divided into two age groups: 36 adults (20 females, $M = 21.86$ years, SD = 2.09, range = 19–29) and 36 adolescents (19 females, $M = 15.75$ years, SD = 1.14, range = 14–18).

Experimental Paradigm

The experiment was conducted online by E-Prime 2.0. Following the preparation, participants completed a two-phase trust game interspersed with three trustworthiness ratings (**Figure 1**). We implemented the multishot binary version of the trust game in this study in which trustors were expected to do a binomial forced-choice, i.e., with an endowment by the experimenter, the trustor chose to keep all the money or share all the money to the trustee in each trial. The percentage of trials in which trustors shared on average across the experiment condition captures trust. This variation of the typical trust game and the operational definition of trust have been validated by many studies (Delgado et al., 2005; Evans and Krueger, 2010; Aimone and Houser, 2012, 2013; Fareri et al., 2012, 2015; Fouragnan et al., 2013; Cañadas et al., 2015). In this study, participants were informed that they would play as Player A (i.e., trustors) to interact with participants from earlier sessions of this experiment who played as Player B (i.e., trustees). They were required to decide whether to invest in two

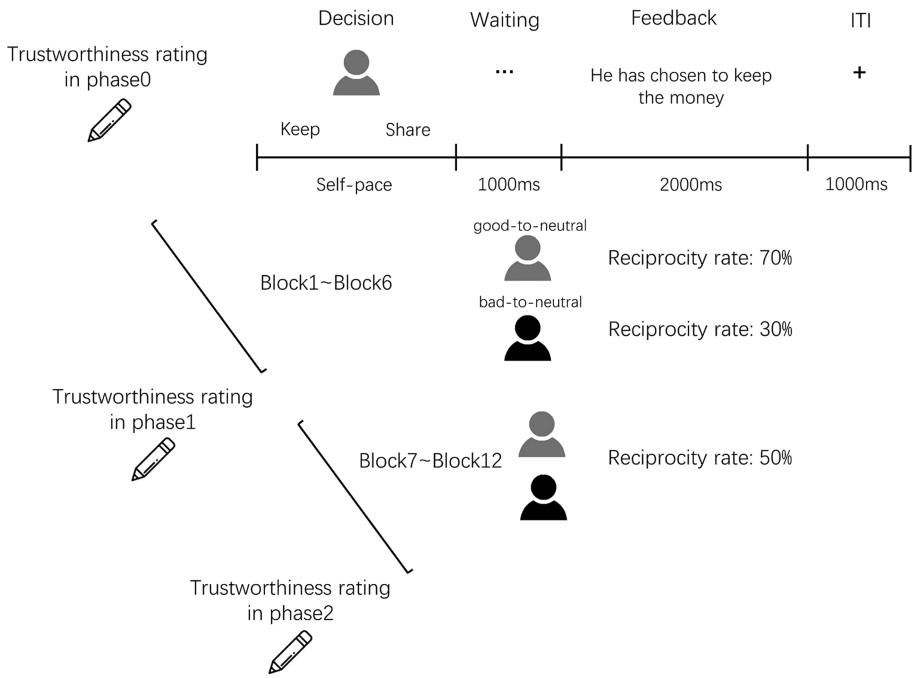

FIGURE 1 | Experiment schematic. Participants completed a two-phase trust game interspersed with three trustworthiness ratings (i.e., phase0: before the trust game, phase1: at the end of Block6, phase2: at the end of Block12). Participants as trustors interacted with two trustees. The good-to-neutral trustee yielded a higher initial return rate (70%) while the bad-to-neutral trustee yielded a lower initial return rate (30%) in Block1 to 6. In Block7 to 12, these two trustees changed their return rates both to neutral (50%).

same-gender anonymous fictional partners (facial stimuli taken from the Chicago face database; Ma et al., 2015).

At the start of the trust game, participants firstly made a trustworthiness rating for each partner on a 9-point Likert scale (1=not at all, 9=a lot). In the following trust game, participants were endowed with 5 yuan before starting a trial. Each trial was composed of two stages, first step was to measure the trust in which the initiative was seized by the trustor. They needed to decide whether to share money with a trustee. A choice to share money was described as an investment, resulting in a tripling of the money to 15 yuan for the trustee on a given trial. If they decided to give money to a trustee, that trustee would obtain 15 yuan and triggered the second step. So that the trustee can decide whether to reciprocate the trustor. If the trustee decided to reciprocate, himself/herself and the trustor (participant) would gain half of the 15 yuan separately. Otherwise, the trustee may keep all of 15 yuan, meanwhile, the trustor would obtain nothing. If participants decided to keep the money in the first step, signaling the end of the trial in the first step, the trustee obtained nothing in that round. After participants made their decisions, they were presented with one of three possible feedbacks based on their responses: "You have kept the money," "She/He has chosen to keep the money," or "She/has chosen to share the money." Before the experiment, participants were informed that one random trial would be selected at the end of the game, the outcome of this trial, i.e., obtaining 0, 5, or 7.5 yuan would as a reward for participants.

A total of 72 trials were included in the trust game, evenly distributed across twelve blocks. The first six blocks composed phase1 the other six blocks composed phase2. Thirty-six trials per partner condition were randomly administered across these blocks. The second trustworthiness rating was conducted after participants finished phase1. After participants finished the whole trust game, they rated the trustworthiness for the last time.

Unbeknownst to participants, trustees' decisions in the second step did not control by other participants. Trustees had preprogrammed reciprocity rate in which participants chose to invest: good-to-neutral partner had a high initial reciprocity rate (phase1; 70%), bad-to-neutral had a low initial reciprocity rate (phase1; 30%), and as time goes by, in the later period, these two partners changed to the same neutral in reciprocity rate (phase2; 50%). The trial procedure and the task schematic were shown in **Figure 1**.

Computational Modeling

Model Building

We employed computational models to test the possible link between internal cognitive mechanisms and trust behaviors. As an approach to the mechanism of learning, the reinforcement learning model applied to account for a wide range of learning behaviors including the social learning domain (King-Casas, 2005; Jones et al., 2011; Fareri et al., 2012, 2015; Kishida and Montague, 2012; Konovalov et al., 2018; Lockwood and Klein-Flügge, 2020). Based on the reinforcement learning frame and adapted for task context, we constructed three models, RW_P

model, RW_LG model, and RW_PLG model and focused on an important free parameter, the learning rate.

These models are all formalized by decision theory which states that people make decisions to maximize their expected value. Expected value (*EV*) of investment to encountered partner *i* on trial *t* can be expressed as the likelihood of obtaining reward (7.5 yuan; in our context is the occurrence of partner's reciprocation; Eq. 1).

The likelihood of receive reciprocation is learned information that needs to update in a trial-by-trial way. Computational models involving learning processing have their updating mechanism, that is, how to link between previous knowledge and novel knowledge or how new information integrates into prior knowledge to update the current stage. Reinforcement learning updates information through prediction error which refers to the difference between prediction and outcome. This difference facilitates the move from subjective belief to reality. We used a Rescorla–Wagner prediction error rule to update participants' expectations (Sutton and Barto, 2012). Given the trial *t*, if participants invested to partner *i*, their new expectation of *Pi* will update based on the feedback (γ = 1, *Pi* reciprocate; γ = 0, *Pi* defect). The degree of updating or the weight on current prediction error was also influenced by learning rate α, this free parameter was bounded between 0 and 1. With the same prediction error, the higher α indicated the higher degree of updating would be integrated into the $P(t+1)$ (see Eq. 3). This point varied in our three different models. In the RW_P model, we set different α for phase1 and phase2 separately for two partners on the basis of the hypothesis that given different volatility environments, different learning rates (α_{phase1}, α_{phase2}) can better represent the cognitive processing. Another consideration was the main different sense between loss (partners' betrayal) and gain (partners' reciprocation). In the RW_LG model, separate α was applied to loss and gain context (α_{loss}, α_{gain}) for these two partners, respectively, (Fareri et al., 2012, 2015). We also tested the possibility of combine influence with phase and loss/gain context in the RW_PLG model in which involved different learning rate both for phase and attribute of feedback ($\alpha_{\text{loss\_phase1}}$, $\alpha_{\text{loss\_phase2}}$, $\alpha_{\text{gain\_phase1}}$, $\alpha_{\text{gain\_phase2}}$).

The updated $P(t+1)$ would generate an updated $EV(t+1)$. It is transformed by the softmax function to calculate the probability of participants deciding to invest (*IPi*) the given partner *i* (see Eq. 2). The β in Eq. 2 was a free parameter that mirrored the extent of strategy changing. It bounded between 0 and 1, reflecting more explorative when it close to 1 whereas more exploitative when it close to 0. The probability of keep money equaled 1-*IPi*.

$$EVi(t) = Pi(t) * (7.5) \tag{1}$$

$$IPi = \frac{e^{\frac{EVi(t,1)}{\beta}}}{e^{\frac{EVi(t,1)}{\beta}} + e^{\frac{EVi(t,2)}{\beta}}} \tag{2}$$

$$Pi(t+1) = Pi(t) + \alpha * (\gamma i(t) - Pi(t)) \tag{3}$$

$$LLE = \sum_{t=1}^{n} \log(IPi,j(t)) \tag{4}$$

Model Estimation and Comparison

Log-likelihood estimation was calculated through maximizing function in Eq. 4 to estimate free parameters of each model for each participant, where *j* indexes the decision (share or keep), and *n* is the total number of trials.

For these three alternative models, we used the Akaike Information Criterion (AIC; Akaike, 1974), which applied a penalty scaled by the number of free parameters of a complicated model, to choose a more representative model. These estimations conducted using custom MATLAB scripts.

RESULTS

Reference Frame Effect in Reciprocity Updating

To examine the updating of reciprocity changes, we used one-sample t-tests on the share rate differences between phase1 and phase2 (i.e., the difference of percentage of the decision to share between phase1 and phase2) for two partners separately, by comparing the share rate differences with the neutral value zero in two age groups. The results showed that, in the adolescent group, to the good-to-neutral trustee, the value of the share rate of phase2 minus that of phase1 was not significantly different from zero (M = 0.03, SD = 0.23, $t_{(35)}$ = 0.69, p = 0.49, d = 0.11). As to the bad-to-neutral trustee, adolescents' share rate changed significantly (M = 0.16, SD = 0.17, $t_{(35)}$ = 5.53, p < 0.001, d = 0.94). In the adult group, to the good-to-neutral trustee, the value of the share rate differences between the two phases was not significantly different from zero (M = −0.02, SD = 0.26, $t_{(35)}$= −0.45, p = 0.65, d = 0.08). As to the bad-to-neutral trustee, adults changed their share rates significantly (M = 0.14, SD = 0.22, $t_{(35)}$ = 3.84, p < 0.001, d = 0.64). These results reflected that for the good-to-neutral partner, all participants' share rates did not change significantly in the two phases, while for the bad-to-neutral partner, all participants' investments in phase2 were significantly higher than in phase1 (**Figure 2**).

Age Difference in Trust Decisions

In order to explore the roles of age and partner's return rate in the time course of the experiment, with Partner

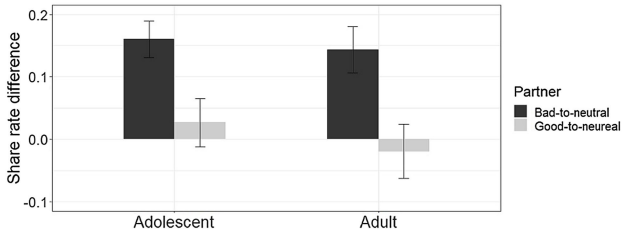

FIGURE 2 | The updating of share rates. The percentage difference of trials in which adolescents and adults shared on average between phase1 and phase2 separately to good-to-neutral and bad-to-neutral partner (error bars reflect SE).

(good-to-neutral vs. bad-to-neutral) and Block (block1-block12) as within-subject variables and Age (adult vs. adolescent) as a between-subjects variable, a three-way repeated ANOVA was conducted on the percentages of decisions to share. Results indicated a significant main effect of Partner, $F_{(1, 70)} = 39.68$, $p < 0.001$, $\eta_p^2 = 0.36$. Participants' share rates were significantly higher when they interacted with the good-to-neutral trustee ($M = 0.62$, SD = 0.02) than that of the bad-to-neutral trustee ($M = 0.49$, SD = 0.02). The main effect of Block was significant, $F_{(11, 770)} = 4.41$, $p < 0.001$, $\eta_p^2 = 0.06$, demonstrated that share rates changed with learning processing. Significant Partner × Block interaction was observed, $F_{(11,770)} = 4.86$, $p < 0.001$, $\eta_p^2 = 0.07$. As the trustees' return rates changed, participants' share rates also changed, and they learned different changes in return rates of two trustees during the experiment. We found a significant interaction of Age × Partner, $F_{(1, 70)} = 5.68$, $p = 0.02$, $\eta_p^2 = 0.08$. Next, simple effects were tested. We examined the differences of investment rates between two age groups to the good-to-neutral partner and the bad-to-neutral partner separately. No significant difference was found between two age groups (good-to-neutral partner: $p = 0.30$; bad-to-neutral partner: $p = 0.16$). On the other side, we tested the differences of investment rates between two partners in adolescent group (good-to-neutral partner: $M = 0.60$, SD = 0.03; bad-to-neutral partner: $M = 0.52$, SD = 0.03; $F_{(1, 70)} = 7.67$, $p = 0.01$, $\eta_p^2 = 0.10$) and adult group (good-to-neutral partner: M = 0.65, SD = 0.03; bad-to-neutral partner: $M = 0.47$, SD = 0.03; $F_{(1, 70)} = 37.69$, $p < 0.001$, $\eta_p^2 = 0.35$) separately. These two groups both showed significantly higher share rates to the good-to-neutral partner than the bad-to-neutral partner, indicated all participants learned the difference between two partners.

To search for the origin of the interaction between age and partner, we further compared two group participants' share rate differences between two partners by independent-sample t-test (**Figure 3**). Results showed that share rate difference of adult was significantly higher than that of the adolescent (adult: $M = 0.18$, SD = 0.19; adolescent: $M = 0.08$, SD = 0.15; $t_{(70)} = 2.46$, $p = 0.02$, $d = 0.58$). Combined with the above findings, it is found that adults and adolescents both invested higher to the good-to-neutral partner than the bad-to-neutral partner, while adolescents' share rate difference to these two partners was significantly smaller than that of adults which originated the significant interaction between age and partner.

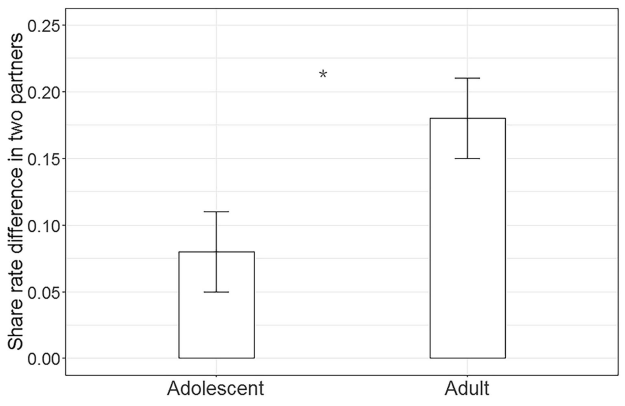

FIGURE 3 | Age effect on the share rate difference. Adolescents' percentage difference between trials in which shared with good-to-neutral and bad-to-neutral was significantly smaller than that of the adult group (error bars reflect SE, *$p < 0.05$).

As to reaction time, no significant main effect or interaction was found ($ps > 0.05$).

Trustworthiness Rating Difference in the Trust Game

The trustworthiness ratings for each partner served as a different condition manipulation check. The trustworthiness ratings were entered into a 2 (Age: adult vs. adolescent) × 2 (Partner: good-to-neutral vs. bad-to-neutral) × 3 (Phase: phase0, phase1, phase2) repeated-measures ANOVA ("phase0" referred to the first trustworthiness rating of trustees at the start of the experiment) to investigate the trustworthy changing processing based on the influence of age, partner and phase in subjective feeling. We found the significant interaction of Age × Partner, $F_{(1,70)} = 6.24$, $p = 0.02$, $\eta_p^2 = 0.08$. *Post hoc* tests showed that adults (good-to-neutral: $M = 5.05$, SD = 0.19; bad-to-neutral: $M = 4.02$, SD = 0.19; $F_{(1,70)} = 64.06$, $p < 0.001$, $\eta_p^2 = 0.48$) and adolescents (good-to-neutral: $M = 4.45$, SD = 0.19; bad-to-neutral: $M = 3.88$, SD = 0.19; $F_{(1,70)} = 19.99$, $p < 0.001$, $\eta_p^2 = 0.22$) both rated good-to-neutral partner more trustworthy than bad-to-neutral partner. Adults placed more trust in the good-to-neutral partner than adolescents, $F_{(1,70)} = 4.97$, $p = 0.03$, $\eta_p^2 = 0.07$. The interaction of Partner× Phase was significant, $F_{(2, 140)} = 50.17$, $p < 0.001$, $\eta_p^2 = 0.42$. Further analysis suggested that, both in phase1 ($F_{(1,70)} = 114.99$, $p < 0.001$, $\eta_p^2 = 0.62$) and phase2 ($F_{(1,70)} = 4.27$, $p = 0.04$, $\eta_p^2 = 0.06$), the trustworthiness ratings for good-to-neutral partner (phase 0: $M = 4.10$, SD = 0.19; phase1: $M = 5.81$, SD = 0.16; phase2: $M = 4.35$, SD = 0.20) were significantly higher than that of bad-to-neutral partner (phase0: $M = 4.25$, SD = 0.19; phase1: $M = 3.58$, SD = 0.16; phase2: $M = 4.01$, SD = 0.19). And as to good-to-neutral partner, trustworthy scores of phase1 was significantly higher than that of phase0 and phase2, $F_{(2,140)} = 41.42$, $p < 0.001$, $\eta_p^2 = 0.55$. As to the bad-to-neutral partner, the trust score of phase1 was significantly lower than that of phase0 and phase2, $F_{(2,140)} = 7.03$, $p < 0.001$, $\eta_p^2 = 0.17$. We also found significant main effects of Partner ($F_{(1, 70)} = 77.81$, $p < 0.001$, $\eta_p^2 = 0.53$) and of Phase ($F_{(2,140)} = 5.80$, $p = 0.004$, $\eta_p^2 = 0.076$). No other significant main effect or interaction was found ($ps > 0.05$).

Revelation in the Computational Model

Results of model estimation and comparison were shown in **Table 1**. Nonparametric Wilcoxon signed-rank tests were conducted on the value of AIC of three models. The AIC value of the RW_LG model was significantly smaller than the other two models, indicating its better fitness on participants' behaviors than the RW_P model ($z = -7.06$, $p < 0.001$, $dz = 1.07$) and RW_PLG model ($z = -7.20$, $p < 0.001$, $dz = 1.88$).

TABLE 1 | Model parameters.

Model	Partner	α loss (SE)	α gain (SE)	α phase1 (SE)	α phase2 (SE)	α loss_phase1 (SE)	α loss_phase2 (SE)	α gain_phase1 (SE)	α gain_phase2 (SE)	β (SE)	AIC (SE)
RW_LG	Good-to-neutral	0.47(0.03)	0.15(0.03)	–	–	–	–	–	–	0.96(0.02)	62.74(2.36)
	Bad-to-neutral	0.57(0.03)	0.18(0.03)	–	–	–	–	–	–		
RW_P	Good-to-neutral	–	–	0.12(0.03)	0.35(0.05)	–	–	–	–	0.99(0.001)	79.06(3.07)***
	Bad-to-neutral	–	–	0.56(0.04)	0.20(0.04)	–	–	–	–		
RW_PLG	Good-to-neutral	–	–	–	–	0.52(0.04)	0.36(0.04)	0.19(0.04)	0.28(0.04)	0.94(0.02)	68.07(2.31)***
	Bad-to-neutral	–	–	–	–	0.61(0.03)	0.37(0.04)	0.27(0.04)	0.20(0.03)		

***$p < 0.001$; *Comparison model: RW_LG.*

Further, in the framework of the RW_LG model, we tested whether different learning rates existed in different age groups. We conducted a repeated-measures ANOVA with Partner (good-to-neutral vs. bad-to-neutral) and Feedback (loss vs. gain) as within-subject variables and Age (adolescent vs. adult) as a between-subject variable on learning rates (**Figure 4**). It revealed that the main effect of Partner ($F_{(1,70)}$ = 7.07, p = 0.01, η_p^2 = 0.09), the learning rate of bad-to-neutral partner was significantly higher than that of the good-to-neutral partner. The main effect of Feedback was significant ($F_{(1,70)}$ = 113.10, $p < 0.001$, η_p^2 = 0.62), specifically the learning rate was higher when participants lost money than they gained. In addition, we also observed a significant main effect of Age ($F_{(1,70)}$ = 4.31, p = 0.04, η_p^2 = 0.06), adult participants had a higher learning rate than adolescents.

DISCUSSION

In the present study, we ran repeated rounds of the trust game to explore how adolescents and adults learn about changes in trustworthiness through interaction. We recorded the trajectories of the trust decisions of participants as well as their trustworthy ratings. Moreover, we used computational modeling to delve into the mechanisms underlying the behaviors of participants. We designed our study such that two trustees who interacted with participants had preprogrammed patterns in their rates of return. One trustee exhibited a higher initial return rate while the other exhibited a lower initial return rate. After a period of time trustees changed to the point where both had reached a neutral rate of return. When interacted with two changeable trustees, we found that adolescents and adults showed similarities as well as differences in their patterns of behavior: (1) In both groups, we observed asymmetric patterns of trust behavior as a function of the two learning reference frames. Participants showed similar rates of trust towards the good-to-neutral partner between phase1 and phase2, thus showing leniency to the partner who reduced their reciprocity from phase1 to phase2. Participants increased their trust behaviors upon observing an increase in reciprocity in the bad-to-good partner. (2) Compared with adults, adolescents showed a minor distinction in their rates of trust between good-to-neutral and bad-to-neutral partners. (3) In the reinforcement learning model, findings of differences in learning rates to two partners and between two age groups provided potential reasons separately for observed asymmetric patterns in trust behaviors and the age differences.

Asymmetrical Learning Patterns Produced by Two Changing Trends in Trustworthiness

One of the questions that we were most interested in was how participants respond to two partners with two distinct learning reference frames: one partner with a trustworthy to neutral frame and the other with an untrustworthy to neutral frame. To this aim, we implemented a two-phase task across

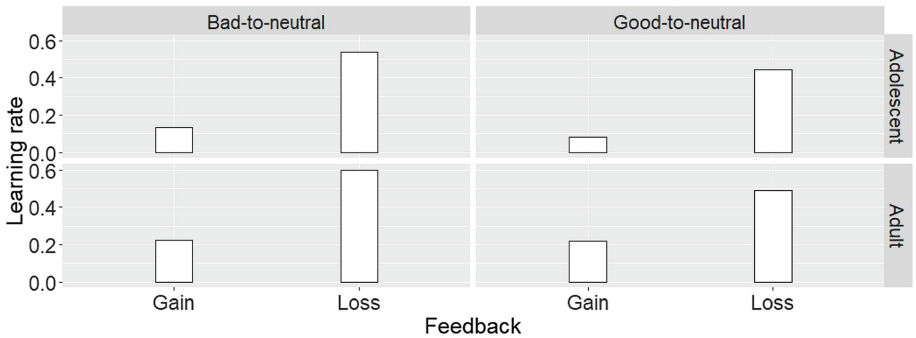

FIGURE 4 | Learning rates in the reinforcement learning model (RW_LG model). Participants had a higher learning rate when they received feedbacks representing loss money than that of gain money. Compared with the good-to-neutral partner, the learning rate to the bad-to-neutral partner was higher. Adults' learning rate was higher than adolescents'.

repeated rounds of the trust game. In phase1, participants formed a trustworthy impression of one partner by observing a high return rate and formed an untrustworthy impression of another partner by observing a low return rate. In phase2, behavioral patterns changed such that participants observed a medium return rate from both partners. We found that, for good-to-neutral partners, a change in reciprocity from high to neutral did not result in a decline in investment. In contrast, we found that, for bad-to-neutral partners, a change in reciprocity from low to neutral led to increases in investment. Such asymmetrical learning patterns brought about by these two changing trends in trustworthiness are indicative of the effect of reference frames. In this instance, we observed less updating when reciprocity trended in a negative direction (good-to-neutral) in a good frame while more updating occurred when reciprocity trended in a positive direction (bad-to-neutral) in a bad frame.

However, at first glance, this result seemed difficult to reconcile with the main findings in the domain of impression formation, much of which stressed that bad impressions are more powerful and more resistant to disconfirmation than good ones (Skowronski and Carlston, 1989; Baumeister et al., 2001; Reeder and Coovert, 1986). Employing narrative statements of extreme and rare behaviors (theft or violence) that many studies used can formulate unshakeable bad impressions (Baumeister et al., 2001; Ferguson et al., 2019). At least to a certain extent, the diagnostic characteristics of negative information are due to their relative perceived frequency, these less frequently observed behaviors are weighted more heavily during evaluation (Mende-Siedlecki et al., 2013). However, in the present study, participants learned only through rounds of interactions, thus allowing more space for participants to evaluate and adapt to changes in partners. Such an asymmetrical learning pattern found in this research, whereby bad-to-neutral reciprocity induced more updating in impression learning solely through interactions, suggests that unlike social prior obtained by diagnostic statements interaction-based information influences the learning process through a different mechanism. In line with our findings, another study, in which participants learned about the characters of others by observing their choices in a trial-by-trial way, found that beliefs about bad people are volatile compared with beliefs about good people which are more stable (Siegel et al., 2018). By modeled participants' choices with a Bayesian learning model, they observed a cognitive updating mechanism that was more flexible to bad information when the initial bad impression turns out to be inaccurate (Siegel et al., 2018). These findings of the framing effect imply different mechanisms that may be employed by interaction-based and prior-based cognitive updating processing. Based on previous studies, prior-based knowledge may be the main resource of "top-down processing" reflected in medial prefrontal cortex activity (Fouragnan et al., 2013; Krueger and Meyer-Lindenberg, 2019). In the communication between prior-based and interaction-based mechanisms, prior-based knowledge can diminish reliance on instant interaction-based information in the neural circuitry of trial-and-error reward learning (Delgado et al., 2005; Fouragnan et al., 2013; Krueger and Meyer-Lindenberg, 2019). The different behavioral expressions of framing effect in information updating based on social prior and interaction, for example, the current result and previous findings on diagnostic information, may originate from these two different cognitive mechanisms.

It is noteworthy that the results of subjective trust ratings did not show such an asymmetric pattern in these two frames. Specifically, participants correctly reported the changes in return rate produced by both partners, but chose not to change their trust rates to the good-to-neutral partner, and chose to forgive the bad-to-neutral partner. This particular pattern of results may be related to the type of task that we employed. In a cooperative background, like the trust game, choosing to cooperate is profitable. In another cooperative paradigm, the repeated prisoner's dilemmas, participants seemed to forgive their partners who betrayed them once and decided to cooperate with them again (Fudenberg et al., 2012). In these cases, or similar reality, although detecting negative changes and signs of the bad character of others has significant meaning for living while prematurely set boundaries between good and bad just relying on limited information may miss out much potential benefit of cooperation in the future (Molander, 1985; Johnson et al., 2013; Siegel et al., 2018). Evolutionary models

also found that these "forgive" strategy much better than end cooperation after a single betrayal (Wu and Axelrod, 1995; Fudenberg et al., 2012). This kind of strategic adaption is in line with our observations of how participants responded to good-to-neutral partners, in that they continued to cooperate with them even when they knew that they had become less trustworthy.

Taken together, we observed an asymmetrical pattern of behavioral updating whereby participants adapted their decisions regarding trustees who were either good-to-neutral or bad-to-neutral as a consequence of non-diagnostic interaction. Combined with previous studies, it implies that both the attribute of information (diagnostic and non-diagnostic) and the source of information (prior-based or interaction-based) play pivotal and distinct roles in the formation of impressions and the subsequent updating of behavior.

Age Difference in the Trust Game

Our study highlights the prominent role played by developmental factors in trust behavior. Compared with the adult group, adolescent participants showed smaller differences in their patterns of trust behavior for good-to-neutral and bad-to-neutral partners. In other words, although they treated the two partners in distinct ways, the degree of distinction, as indexed by the amount invested, was not as pronounced as that produced by the adult group.

The more ambiguous tendency of the adolescents towards the two partners suggests a wait-and-see attitude. During adolescence, the demands of individuals for interaction with others increase progressively (Blakemore, 2008; Fouragnan et al., 2013). Given this propensity for increased interaction, one explanation for such a wait-and-see attitude could be a strategy to ensure more social attachments in the future. Another possible explanation is that the more limited social experiences of adolescents led to less rapid discrimination of the changing trends between the two agents. In this way, their less developed social functions may hamper the processing of social learning (Blakemore, 2008; Steinberg, 2008; Crone and Dahl, 2012; Kilford et al., 2016). We tested this possible explanation using the following modeling analysis.

Explaining Underlying Trust Processes Using Reinforcement Learning Models

Next, we sought clues regarding the cognitive mechanisms underlying our observations of an asymmetrical updating pattern in trust behavior and the related age difference outlined above. We employed a computational modeling approach to further explore behavior within the context of a repeated trust game (Delgado et al., 2005; Fareri et al., 2012, 2015).

We formalized models using a reinforcement learning framework. Given the outcome that the RW_LG model fit the behaviors of participants significantly better than the other two candidates, we used it to explain our findings. In this model, based on the premise of benefit maximization, participants updated their predictions which then guided their behaviors and decisions. This assumption of decision rule originated in behavioral economics and assumes that humans select actions to maximize their projected utility (i.e., the expected value) (Fehr and Krajbich, 2014; Konovalov et al., 2018). This approach contributes to characterize how different motives and context factors influence behaviors by specifying the processing that individuals transfer relevant experimental variables into the expected value (Konovalov et al., 2018). Although the monetary reward is a goal that mankind pursues, their desire more than that. Humans are naturally social creatures, some social factors such as morality, equity, affect are valuable for them. Thus, decision theory was developed to suit human nature by taking abstract social value into expected value (Handgraaf et al., 2003; Hsu et al., 2008; Zhong et al., 2016). Though this decision rule is insufficient to explain all social behavior, its principle fits the current experiment well which can capture the effect of the changeable trustworthiness of trustees (Bellucci et al., 2017; Krueger and Meyer-Lindenberg, 2019). Another important mechanism in the computational model is the updating rule which is based on the prediction error in this study (O'Doherty et al., 2017). Prediction errors, which reflect the difference between a prediction about an outcome and reality (from feedbacks), play an integral role in learning processing and have been well established through numerous studies across domains and methods (Schultz, 2007, 2013; Behrens et al., 2009; Lockwood and Klein-Flügge, 2020). How much the degree of prediction error will be taken into internal computation is also restricted and scaled by another free parameter, named learning rate (Lockwood and Klein-Flügge, 2020). Learning rates vary among participants, reflecting the extent of learning through prediction error. In this study, we placed an emphasis on the learning rate and explored the function of learning rates in relation to decisions about trust.

We found significant differences in learning rates as a function of the two partners. Participants showed a higher learning rate when they interacted with bad-to-neutral trustees compared to that of good-to-neutral trustees. In addition, we observed significant differences in learning rates between adolescents and adults. Compared with adolescents, adults showed higher learning rates. These higher or lower learning rates do not necessarily have absolute links with worse or better performance, but rather depend on context. Learners with high learning rates are more likely to strongly update based on recent feedback (Lockwood and Klein-Flügge, 2020). This tendency may allow these learners to flexibly adapt to a changeable environment. Learners with low learning rates on the other hand are increasingly influenced by long-lasting previous feedbacks (Lockwood and Klein-Flügge, 2020).

The observed differences in the learning rate reconcile with our findings above. Firstly, the higher learning rate associated with bad-to-neutral partners prompted increasingly adaptive decisions compared with those for good-to-neutral partners. In other words, participants placed greater weight on initial information when updating behaviors in response to good-to-neutral trustees. Conversely, when these individuals interacted with bad-to-neutral partners, they adapted their decisions based more on current feedbacks. This implied close links between trustworthiness learning and asymmetrical patterns of two

trends of trustworthiness changing. Secondly, with higher learning rates, the adult group was found to flexibly adapt their decisions. Adults showing a more pronounced distinction in behavioral patterns in response to two changeable partners compared to the adolescent group. Differences in learning rates between adolescents and adults may be an underlying explanatory factor for our observed differences in trust behavior. A weakened distinction between good-to-neutral and bad-to-neutral partners in adolescents may be associated with their reduced cognitive updating. Our results of computational modeling provided evidence for an ambiguous tendency in adolescents. Their weak updating, which may be a manifestation of their incomplete social experiences, may hamper this group from rapidly discriminating between two agents.

CONCLUSION

These findings offer insights into how individuals update their representations of trust during instances of non-diagnostic interaction. They also serve to demonstrate the effect of age differences on trust behavior grounded in a more complicated and fluctuating social context. In addition, we provide a computational explanation as to how two changing trends in trustworthiness can produce the asymmetrical patterns in learning that were observed in this study. We were also able to reveal more insights as to why adult and adolescent groups showed different patterns of behavioral responses in the context of trust construction. We found that higher learning rates in relation to bad-to-neutral partners promoted rapid behavioral updating. When rates of learning were lower, participants kept investments high for good-to-neutral partners despite drops in trustworthiness. The relatively lower learning rates demonstrated in adolescents were associated with their weakened ability to distinguish between good-to-neutral partners and bad-to-neutral partners. Our study extends understanding of trust behavior to a fluctuating social context and explains behavioral differences brought by learning reference frames and developmental factors in a social learning perspective.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Human Research Ethics Committee of South China Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/ next of kin.

AUTHOR CONTRIBUTIONS

SL and CQ conceived and designed this study. SL programmed the experiments. XH, YM, and YC performed the experiments. SL and XH analyzed, interpreted the data, and wrote the manuscript. NS and CQ revised the manuscript. All authors contributed to the article and approved the submitted version.

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The Perceived Broad Group Emotional Climate Scale: Development and Validation With Chinese Community Residents and University Students

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Perceived broad group emotional climate (PBGEC) is a perceived meso-environment emotion, which refers to individuals' perceptions and experiences of the emotion climate when interacting with group members in daily life, and is not derived from individuals' own emotions. The purpose of this study was to develop and validate a PBGEC scale (PBGECS) for Chinese community residents and university students. A total of 1,408 residents from Chongqing completed the survey of PBGECS, the present social attitude scale, the future social expectations scale, and the social wellbeing scale, which constituted Sample 1; A total of 607 college students from Nanchang completed the survey of PBGECS and the Positive and Negative Affect Scale, which constituted Sample 2. Exploratory factor analysis revealed a two-factor structure, including positive PBGEC (PBGEC-P) and negative PBGEC (PBGEC-N). Internal consistency was strong for each factor and the full-scale ($\alpha \geq 0.83$). Confirmatory factor analysis showed that the correlated two-factor model of PBGEC and the four-factor model (including PBGEC-P, PBGEC-N, individual positive affect, and individual negative affect) demonstrated the best fit to the data, which supported the structural validity of the PBGECS. The interpretive validity, cultural validity, and population validity of the scale were also proved by examining the relationship between PBGEC and socioeconomic status, social attitude, and social wellbeing, respectively. The results show that the PBGECS demonstrated satisfactory reliability and validity, which can be used to assesses the perceived emotion climate of an individual's surrounding environment.

Keywords: perceived broad group emotional climate, scale development, validity, residents, university students, social well-being, social attitude

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INTRODUCTION

Groups are "the natural environment of the mind" (Caporael and Baron, 1997). In other words, individuals' emotional states and most aspects of their personality are fundamentally linked to group members who provide important information on how individuals can understand themselves and their environment. The perceived broad group emotional climate

(PBGEC) guides their social attitude and social wellbeing (Keyes, 1998; Wang, 2011; Liu and Wang, 2020). Over the last 30 years, research on group emotions has made remarkable progress, and people are increasingly aware of the existence of group emotions (George, 1990, 1996; Barsade and Gibson, 1998; Kelly and Barsade, 2001; Collins et al., 2013; Barsade and Knight, 2015; Knight and Eisenkraft, 2015). Indeed, group emotions are no longer at the periphery of group and team research; it has increasingly become the center of this field (Barsade and Knight, 2015). However, few studies have considered group emotions as the individual's meso-environment, or the external environment that connects individuals and groups—that is, the positive and negative forces that individuals experience in their interactions with others (Paquette and Ryan, 2001). Our focus in the present study is on this meso-environment emotion (De Rivera, 1977; De Rivera and Páez, 2007), which we refer to as PBGEC. The purpose of the current research was to develop and validate a theory-based and psychometrically sound measure that captures Chinese community residents and university students' experiences of PBGEC, and examine preliminary associations between PBGEC and social attitude, social wellbeing correlates.

Distinguishing Perceived Broad Group Emotional Climate From Related Concepts

General group emotions refer to emotions about group membership or belonging to the group (Kuppens and Yzerbyt, 2014). They have a "broader focus" (Smith et al., 2007). For example, people could feel proud to belong to a group if others view their group as prestigious (Kuppens and Yzerbyt, 2014). Group emotional climate refers to the predominant general group emotions generated through the social interaction of a group's members in a particular milieu (De Rivera and Páez, 2007). For example, when a group wins, the emotional climate of the group is filled with joy and excitement. Compared with general group emotion, group emotion climate has a more dynamic quality of emotional construction. It is based on and shared with individuals through social interactions (De Rivera and Páez, 2007).

In this research, PBGEC is conceptually similar to group emotional climate, which exists as independent from an individual's personal feelings (De Rivera, 1992; De Rivera and Páez, 2007; Páez et al., 2013) and reflects what individuals perceive regarding how most people feel about their ingroup's situation (Páez et al., 2013). However, PBGEC and group emotional climate are different in perceived emotional subjects. PBGEC is not related to their own feelings but to that of their group members, for example, a bystander who can feel the group emotional climate of joy and excitement when a team wins. In that sense, "group emotional climate" is the same as "individuals" perceptions of the emotional climate." According to the definition of PBGEC in this study, an individual perceives the emotional climate from the point of view of group members. This emotion is at the group level and has a broader focus, rather than being based on a particular event.

Currently, a question remains: What is the relationship between PBGEC and individual emotion? Can they both exist within a person at the same time? PBGEC and individual emotion appear to differ in both their theoretical underpinnings and in their experience. For example, people may perceive the broad group's emotion as positive, but their own emotion as negative (Mackie and Smith, 2017). This suggests that PBGEC and individual emotion are independent constructs. PBGEC and individual emotion also have different influence ranges. That is, PBGEC can be shared, while individual emotion is owned by the individual. Numerous studies have shown that sharing emotion with others can lead to emotional convergence—that is, the phenomenon of emotion becoming consistent among group members (Totterdell et al., 1998; Totterdell, 2000; Barsade, 2002; Ilies et al., 2007; Wang et al., 2017). This sharing can, however, amplify individuals' own emotional experiences. For example, watching a game with others may cause individuals to experience stronger emotions (e.g., excitement when one's team wins the game) than when watching the game alone. Again, this amplification effect suggests that PBGEC and individual emotion are distinct. Thus, the emotional climates in countries, broad groups, or organizations are the result of social construction processes that are situated at the meso-level of the social interactions among individuals (Pelletier, 2018).

However, the precise mechanisms that underpin the construction of emotional climate remain rather unclear. This research demonstrates the existing link between personal emotions [measured specifically with the Positive and Negative Affect Schedule (PANAS); Watson et al., 1988] and PBGEC. We therefore predict that PBGEC and individual emotion will be distinct but related concepts. For Hypothesis 1, we predict that PBGEC and individual emotion will be related; i.e., the positive PBGEC (PBGEC-P) and negative PBGEC (PBGEC-N) will positively correlate with individual positive affect (PA) and negative affect (NA), respectively. In that, they will share the dimension of valence, but will focus on different subjects, and thus will form four groups (see **Figure 1**). In other words, we presume that PBGEC and individual emotion will conform to a four-factor model (PBGEC-P, PBGEC-N, PA, and NA).

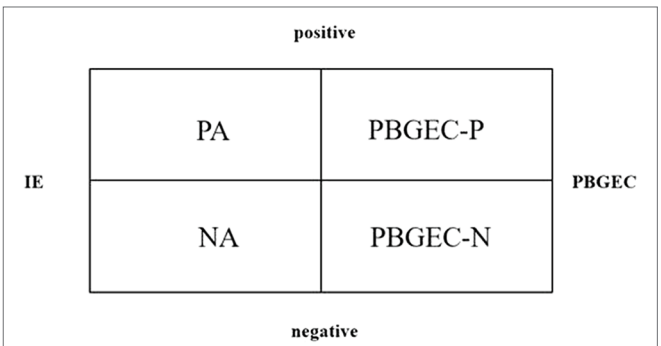

FIGURE 1 | Four-factor diagram.

Defining Perceived Broad Group Emotional Climate

Climate research can focus on both individual and group levels (Florin et al., 1990). Climate includes emotion (De Rivera, 1992) and exists within social interactions (Schneider and Reichers, 1983). Emotional climate adds a dynamic quality, as it is based on and shared with individuals through social interactions, and is often quite stable (Bar-Tal, 2007; De Rivera and Páez, 2007; Páez et al., 2013; Bobowik et al., 2017). It refers to the emotional states perceived and experienced by the majority of group members (De Rivera and Páez, 2007). The concept may be useful in linking macro- and micro-levels of analysis (De Rivera and Páez, 2007).

Group emotional climates typically include the emotion and mood aspects of groups. We adopted a broad perspective, using the term "emotion" as it is used in everyday language to refer to affectively charged cognitions, feelings, moods, affect, and wellbeing (Bakhtiar et al., 2018). Our study examines the influence of broad group emotional climate on individuals and is not concerned with specific emotional changes in the individual. Accordingly, we do not distinguish between emotions and moods (Forgas, 1995, 2002; Beedie et al., 2005) and use the term "emotion" to refer to both emotions and moods.

In summary, PBGEC is a perceived meso-environment emotion, which refers to individuals' perceptions and experiences of the emotion climate when interacting with group members in daily life, and is not derived from individuals' own emotions. Specifically, PBGEC is derived from the people around the individual and not from the individual's own emotions. It reflects individual perception of how most people feel about their ingroup's situation (Páez et al., 2013), i.e., meso-environment. Although this kind of PBGEC is created by groups, it is felt by the individual. For example, what emotional experiences do you think people around you (such as those in your community or your classmates) have experienced? Thus, PBGEC can be shared and influences how people interact with the group, either directly or indirectly. In this way, PBGEC helps individuals adapt their positions and viewpoints in accordance with the group or meso-environment, and individuals further adapt to their social lives in general (Lai, 2013).

Dimensionality of Perceived Broad Group Emotional Climate

An important dimension of subjective experience is valence; that is, something being pleasant or unpleasant (commonly referred to as positive or negative; Barrett and Russell, 1999). In their classification of emotion, Watson and Tellegen (1985) refined the valence concept using the terms positive emotion (PA) and negative emotion (NA). PA often reflects one's level of happiness, passion, activeness, alertness, and other pleasant emotional states. In contrast, NA generally entails various unpleasant emotional states, including anger, contempt, disgust, guilt, fear, and nervousness (Watson et al., 1988; Gaudreau et al., 2006). Watson et al. (1999) observed the PA–NA dichotomy across a variety of cultural contexts which demonstrated good cross-cultural applicability.

In the present study of the PBGEC, we also use the dimensions of valence (positive–negative) to define the emotional climate. We define PBGEC-P as individuals' perceptions and experiences of positive emotional climate, such as those of pleasure and enthusiasm, when interacting with group members in daily life. In contrast, PBGEC-N is defined as individuals' perceptions and experiences of negative emotional climate, such as those of anxiety and worry, when interacting with group members in daily life.

To provide a solid basis for investigating the distinction between PA and NA (e.g., through PANAS, Watson et al., 1988), most researchers have proposed two-factor models for their measurements (i.e., uncorrelated or correlated two-factor models). For instance, Watson et al. (1988) observed, based on an exploratory factor analysis (EFA), that the PANAS comprises two orthogonal factors. Other studies have reported that correlated two-factor models exhibit significantly improved fit compared to single-factor and uncorrelated two-factor models (Seib-Pfeifer et al., 2017). Based on the above-discussed classifications of emotion and emotional climate, we suggest that the valence (positive–negative) dimension can be used to jointly classify PBGEC. Accordingly, we speculate that the PBGEC scale (PBGECS) will have a similar structural model to the PANAS. Given this, our Hypothesis 2 is that the PBGECS will have both positive and negative dimensions, and will thus conform to a two-factor model.

The Effect of Socioeconomic Status on Perceived Broad Group Emotional Climate

Emotional climate depends on economic and educational factors and may change within the course of a single generation (De Rivera, 1992) due to socioeconomic status (SES), usually measured *via* education level and household income (Mahdavian and Safizadeh, 2015). In other words, people of different SES are likely to face different meso-environments and social mentalities (Liu and Wang, 2020). Thus, individuals with a higher SES, indicating greater wealth, tend to feel more positive emotional climates (De Rivera et al., 2007). For example, the underclass people report significantly less trust and security and more anger and fear than working-class and middle-class people (De Rivera et al., 2007). More specifically, with the development of online shopping, some educated online shoppers (from the middle-class) may perceive a PBGEC-P around them as most of their middle-class neighbors or colleagues enjoy the convenience of online shopping; other uneducated off-line shoppers (from the working-class) may feel a PBGEC-N around them as most of their working-class neighbors or colleagues feel abandoned in the era of online payments. It is valuable to understand the relationship between participants and their cultures (Altheide and Johnson, 1994). Previous studies have found that there was a significant negative correlation between SES and negative emotions (e.g., depression and anxiety; Salami and Walker, 2014), and a significant positive correlation between early-life SES and state positive affect (e.g., relaxed, cheerful, and pleased; Murdock et al., 2017). Therefore, PBGEC may be influenced by SES. The present study will examine associations

with PBGEC to test the external validity of the scale. For Hypothesis 3a, we hypothesize that SES will have a significant positive influence on PBGEC, with individuals who have a high SES scoring higher in PBGEC-P than those who have a low SES. For Hypothesis 3b, we propose that individuals who have a low SES will score higher on PBGEC-N than those who have a high SES.

The Function of Perceived Broad Group Emotional Climate

Individuals adjust their standpoints and viewpoints *via* direct or indirect interactions and experiences with group members, which in turn affect their emotions and attitudes toward events (Lai, 2013). In a similar way, PBGEC, by virtue of its existence in the meso-environment, leads to the formation of perceptions that affect individuals' attitudes, motivations, and behaviors (De Rivera and Páez, 2007).

Existing research shows that group emotions can influence the attitude of individuals (Frijda and Mesquita, 1994; Niedenthal and Brauer, 2012). For example, negative group emotions (such as anger and disgust) can reduce individual group members' contact with others outside of the group (Esses and Dovidio, 2002; Lu et al., 2016). In contrast, group positive emotion (e.g., gratitude) can reduce group members' bias against outgroup members (e.g., prejudice; Miller et al., 2004; Lu et al., 2016). Therefore, PBGEC may also influence individuals' attitudes.

Ma (2010) designed a social attitude questionnaire to assess present social attitudes and future social expectations. Present social attitudes refer to an individual's feelings regarding group members in the social environment (Ma, 2010) and the state in which they live, both of which can positively or negatively influence a person's social judgments (Cook and Bird, 2011). According to the value expectation theory of Atkinson and Cartwright (1964) and the future orientation theory of Nurmi (1991), the future social expectations refer to an individual's judgment of his or her social future development and living environment that is based on the individual's current situation. Individuals' perceptions of the social status quo are related to their expectations of the future of a society (Chen et al., 2018). To investigate the relationship between PBGEC and individuals' social attitudes and expectations, we propose a Hypothesis 4; that is, PBGEC will be related to individuals' present social attitudes and future social expectations. Specifically, the PBGEC-P will positively correlate with a positive present social attitude and positive future social expectations; the PBGEC-N will be associated with a negative present social attitude and negative future social expectations.

Group positive and negative emotions influence wellbeing (Smith et al., 2007; Gamero et al., 2008). In the present study, we also examined how PBGEC influences wellbeing. Social wellbeing (Keyes, 1998) focuses on the perceived quality of individuals' social relations and fulfillment of social tasks. This suggests that social wellbeing should be correlated with PBGEC. Therefore, we investigate this in Hypothesis 5.

Perceived Broad Group Emotional Climate Measurement

Perceived broad group emotional climate is considered to be a latent construct that cannot be directly observed and is therefore difficult to measure objectively (Marraccini et al., 2020). Studies have discussed how to measure the emotional climate of organizations (Ruiz, 2007). They either measure the role that emotions play in the organization or measure one aspect of emotional climate in the organization (Ruiz, 2007). In the present study, we regard accounting for individuals' subjective experiences as the most important aspect to consider when assessing PBGEC.

Overview of the Present Study

This study sought to develop a PBGECS and assess its validity and reliability. In addition to analyzing the structural validity of the scale, this study also examined the cultural, population, and interpretive validity of the scale based on the indicators of cultural understanding described by Washington and McLoyd (1982). Specifically, interpretive validity, which includes the voices of the participants, is assessed by SES (Mueller and Parcel, 1981). Cultural validity is represented by the use of the Social Attitude Scale (Ma, 2010). This scale assesses attitudes toward the present and the future of China. Population validity is assessed by the use of the Social Well-Being Scale (Zhao, 2010). In general, the hypotheses are summarized as follows: (1) PBGEC relates to, but differs from, individual emotion; PBGEC, individual emotion, and valence form a four-factor model (PBGEC-P, PBGEC-N, PA, and NA); (2) PBGEC has two dimensions: PBGEC-P and PBGEC-N; (3) SES significantly influences PBGEC: individuals with a high SES will score higher on the PBGEC-P (Hypothesis 3a) and individuals with a low SES will score higher on PBGEC-N (Hypothesis 3b); (4) PBGEC correlates with individual perceptions of present social attitudes and future social expectations; and (5) a correlative relationship exists between PBGEC and social wellbeing.

MATERIALS AND METHODS

Currently, there is a lack of a PBGEC measurement scale that enables us to assess how individuals evaluate the emotional climate of their groups. Thus, we compiled a questionnaire of adjectives most frequently used to describe broad group emotions perceived by individuals in daily life. By combining theoretical analysis with empirical investigation, we developed the PBGECS. Reliability and validity of PBGECS were subsequently tested in order to provide an effective, practical, and simple evaluation tool for measurement of PBGEC.

In general, group emotions are studied using one of two methods (Smith et al., 2007): The first method is to study people's emotional reactions to specific objects or events, and the second is to let people express their own emotional perceptions. We emphasized that PBGEC is derived from the people around them and not from the individual's own emotion. Thus, in the present study, we used the latter method; that

is, we asked participants to describe how they perceived the broad group emotions of the people in their immediate living environment. For example, "*To what extent do you feel these (given) descriptive (positive/negative) emotional words are experienced by people around you?*" Participants then rated the words on a 5-point Likert scale with answers ranging from 0 (*not at all*) to 4 (*very strongly*).

We used different instructions to test the participants' individual emotions. For example, "*This scale consists of a number of words that describe different feelings and emotion. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you have felt this way during the past week. Use the following scale to record your answers.*" Answers to the PANAS items range from "*not at all*" to "*very strongly*."

Item Generation

Based on the previous research, the present study surveyed PBGEC among community residents and university students in accordance with prior theoretical assumptions. At the same time, in considering the characteristics of Chinese people's emotional experience and expression, we did not use an arousal or activity dimension when structuring the PBGEC (Liu et al., 2014); rather, we directly used positive and negative dimensions.

In step 1, with reference to the PANAS (particularly its expanded list of positive and negative adjectives), phrases that did not duplicate PANAS items (but still reflected PA and NA concepts) were selected from the Circumplex Model of Affect (Russell, 1980; Watson and Tellegen, 1985; Barrett and Russell, 1999). This model found that the fundamental affect was the similarity between English- and Chinese-speaking respondents (Yik and Russell, 2003). Next, we selected certain words for the item pool. Examples include strong, excited, enthusiastic, proud, vibrant, afraid, uneasy, distressed, jittery, and anxious.

In step 2, we integrated this information with the 12 emotion adjectives that were investigated by Smith and colleagues (Smith et al., 2007; Moons et al., 2009). All words were divided into positive and negative PBGEC indicators. Examples include trust, afraid, indifferent, indignant, enthusiastic, afraid, enjoyable, safe, cheerful, happy, misery, and worried.

In step 3, frequently used phrases based on participant reports were extracted from a social emotional climate glossary published by Wang (2011, 2013a,b,c, 2018). In 2006, Wang and his colleagues completed the largest survey of social mentality in China and conducted a comprehensive study on the current social mentality of Chinese people (Wang et al., 2007). They identified the core set of Chinese group emotional climate, including anxiety, indifference, indignation, misery, cheer, blunder, and greed. The anxiety set includes words, such as uneasy, worried, afraid, and fearful. Indifference includes accidie, disregard, unconcerned, and unmoved emotions; indignant is caused by dissatisfaction, hostility, resentment, animosity, and other degrees of anger; misery is caused by life pressure, unemployment, family unhappiness, disasters, accidents, and other negative social emotions. Cheerful reflects the overall happiness of social members, including hopeful, enthusiastic, happy, excited, vibrant, inspiring, grateful, and satisfied. Blundering is a social irrationality caused by many complex reasons. Greed is the emotional expression of excessive social needs (Wang, 2013a).

These selected words were used as references during scale development. In addition, Chinese society advocates the creation of climates with such attributes as fair, coherent, free, delighted, and so on. After repeated rounds of discussion and expert reviews, a pilot PBGECS, which included 39 words describing positive and negative emotional experiences, was developed. Scale validity and reliability were tested to determine whether this scale would be an acceptable PBGEC measure.

Participants

Sample 1

We adopted a stratified random sampling strategy from 13 counties and 3 high schools from a municipality of Chongqing in Southwest China. From there, a unified testing method was implemented. The questionnaire was completed anonymously and was returned to the research team immediately following completion. In this process, participants first indicated that they understood our research purpose, process, matters needing attention, and confidentiality principle, and then filled in the informed consent. We then invited subjects to complete questionnaires. Finally, each participant received a reward of a small gift. A total of 1,519 questionnaires were distributed, and 1,408 valid questionnaires were returned (effective recovery rate = 92.7%). Participants' sociodemographic characteristics are summarized in **Table 1**.

Sample 2

To determine whether PBGEC and individual emotion are different emotional constructs, the present study employed the convenient sampling strategy by recruiting students from five general elective classes at a university in Nanchang, Jiangxi Province, Central China. Participants were from different departments and in different years in university, and were approximated by random sampling. The investigation process was the same as for Sample 1. Each participant received a small gift in return for their participation. A total of 700 questionnaires were distributed, and 607 valid questionnaires were returned (effective recovery rate = 86.79%). Of the 607 participants, 21.9% were male, and 78.1% were female, which is consistent with the gender distribution of college students in this school. There was no significant difference in gender. The results of the *t*-test were −0.32 (p_{PA} = 0.75), 0.06 (p_{NA} = 0.95), −0.02 ($p_{PBGEC\text{-}p}$ = 0.99), and −1.80 ($p_{PBGEC\text{-}N}$ = 0.07), respectively. Age proportions were as follows: <20 years (75.3%), 20–25 (24.2%), and 26–35 (0.5%). There was no significant difference in age too. The results of ANOVA were 0.10 (p_{PA} = 0.91), 1.58 (p_{NA} = 0.21), 0.04 ($p_{PBGEC\text{-}p}$ = 0.96), and 1.57 ($p_{PBGEC\text{-}N}$ = 0.21), respectively.

Sample 3

After the PBGECS was developed, 102 participants (78 females; 7 residents and 95 college students, aged between 18 and 58 years, and recruited from three universities in Jiangxi Province and Yunnan Province in China) were followed up online for 1 month.

TABLE 1 | The sociodemographic characteristics of participants.

Topic	Sample	Topic	Sample
Gender		Not provided	1.0%
Male	46.6%	**Age**	
Female	45.3%	17–25	27.4%
Not provided	8.1%	26–35	29.9%
Marital status		36–45	25.1%
Unmarried	33.1%	46–55	13.6%
Married	60.3%	More than 56	2.3%
Divorced	4.8%	Not provided	1.8%
Widowed	0.6%	**Educational level**	
Not provided	1.1%	JH	9.9%
Occupational backgrounds		H/T	18.3%
Administrators	3.6%	C	22.8%
Business managers	4.9%	U	41.3%
Private entrepreneurs	3.7%	M & D	7.5%
Professional technicians	8.5%	Not provided	0.3%
Staff from party government offices/companies/ institutions	23.2%	**Household income**	
Individual industrial and commercial workers	8.1%	Less than 10	8.2%
Business services personnel	6.0%	10–20	10.7%
Manual workers	2.6%	20–40	22.9%
Farmers	6.4%	40–60	23.1%
Full-time students	19.5%	60–100	17.5%
Unemployed individuals	2.7%	100–150	7.9%
Emeritus and retired	0.4%	150–200	5.0%
Freelancers	5.0%	More than 200	4.2%
Others	4.5%	Not provided	0.5%

Nsample 1 = 1,408. Educational level: JH, Junior high school level or below; H/T, high school/technical secondary school level; C, college level; U, university level; M & D, Master's degree and doctor's degree level. Household income:1,000 RMB is the unit of measurement.

Measures

In the present study, we draw lessons from the Cronbach and Meehl's (1955) classic structural validation proposal to explore the internal structure of the scale, establish the test–retest reliability, and determine the criterion validity of the scale. For Sample 1, we developed a general information questionnaire to collect data pertaining to demographic characteristics, including gender, age, marital status, education level, household income, and occupation. For Sample 2, we only collected data pertaining to demographic characteristics, including gender and age.

Self-Generated PBGECS-39 Items Pilot Questionnaire

The perceived broad group emotional climate scale-39 (PBGECS-39) is comprised 39 emotional adjectives, of which 19 items are positive emotional adjectives (e.g., cheerful, hopeful, and enthusiasm) and 20 items are negative emotional adjectives (e.g., anxious, uneasy, and worried). Participants were instructed to answer the following question for each adjective: "*To what extent do you think the people around you (such as your community residents or your classmates) experience the emotions described by the following words?*" The participants responded based on a 5-point Likert scale with answers ranging from 0 (*not at all*) to 4 (*very strongly*).

Positive and Negative Affect Schedule

We adopted the Chinese version of the PANAS (Huang et al., 2003) to measure individual emotion. Huang et al. (2003) conducted a study on the applicability of PANAS in a Chinese population and found that Cronbach's α reliability coefficients for a Chinese population for positive and negative emotion was 0.88 and 0.85, respectively. This shows that the Chinese version, like the English version, has a high degree of homogeneity. In our study, the PANAS was also comprised two dimensions: PA (10 items) and NA (10 items). The participants responded based on a 5-point Likert scale with answers ranging from 0 (*not at all*) to 4 (*very strongly*). In the present study, Cronbach's α reliability coefficients were 0.94 and 0.93 for the PA and NA subscales, respectively.

Present Social Attitude Scale

For the present study, we employed the social attitude scale developed by Ma (2010). Using this scale, it is possible to only administer specific subscales. Thus, we employed the present social attitude subscale and the future social expectations subscale. The present social attitude scale consists of 10 items and was used to measure participants' present social attitudes. Responses were provided on a Likert-type scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). The scale consists of two subscales: a positive present social attitude subscale, which is comprised 5 items (e.g., "*China's current political and economic condition is good*"), and a negative present social attitude subscale, which is also comprised 5 items (e.g., "*overall, the general social conduct is not as good as before*"). In the present study, the Cronbach's α reliability coefficient for the positive subscale was 0.80 ($p < 0.001$) and 0.72 ($p < 0.001$) for the negative subscale.

Future Social Expectations Scale

A 4-item scale developed by Ma (2010) was implemented to investigate participants' future social expectations (Chen et al., 2018). A Likert-type response scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*), including two subscales, was used. The first is a positive future social expectations subscale that comprises two items (e.g., "*I have full confidence in the future of China*"). The two positive expectation items were significantly correlated ($r = 0.63$, $p < 0.001$) in the present study. The second subscale, negative future social expectations, also comprises two items (e.g., "*Most people are not optimistic about the future of China*"). The two negative expectation items were also significantly correlated ($r = 0.63$, $p < 0.001$) in the present study.

Social Well-Being Scale

Zhao (2010) developed the social wellbeing scale based on Keyes' (1998) five-dimensional structure model. The scale comprises 22 items and five dimensions: social integration (four items, e.g., "*I feel that I belong to the community and society*"), social acceptance (four items, e.g., "*I feel comfortable with others*"), social contribution (five items, e.g., "*I believe that I am a vital member of society, with something of value to give to the world*"), social actualization (four items, e.g., "*I can envision that we like our community, and there are potential beneficiaries for social growth*"), and social coherence (five items, e.g., "*I feel that my life is meaningful and coherent*"). A Likert-type response scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*) was used. The Cronbach's α reliability coefficients for each dimension were 0.77, 0.81, 0.76, 0.82, and 0.77, respectively. Internal consistency for the full-scale was 0.82 ($p < 0.05$).

Procedure

Before data collection began, the research team was uniformly trained. The study followed principles of confidentiality and voluntary participation. All participants provided informed consent and completed the questionnaire anonymously and independently. For community residents (Sample 1), the basic sampling unit was a household. For university students (Sample 2), cross-disciplinary and cross-grade general elective classes were the primary sampling units. We used a combination of centralized and distributed surveys, and the questionnaires were collected on the spot.

Sample 1 was examined using the PBGECS-39, the present social attitude scale, the future social expectations scale, the social wellbeing scale, and the general information questionnaire. Sample 2 was examined using the PBGECS-20 (the revision of PBGECS-39, **Supplementary Material**), PANAS, and general information questionnaire (only gender and age). Sample 3 was examined using the PBGECS-39 (including the PBGECS-20). The interval between the two surveys was about 1 month, and the test–retest reliability of these two scales was obtained.

Statistical Analyses

Statistical analyses were performed using SPSS 22.0 and Mplus7 (Muthén and Muthén, 1998–2012). SPSS 22.0 was used to analyze descriptive statistics and to perform correlation analyses. Mplus7 was used to perform a confirmatory factor analysis (CFA). According to the operating principle of factor analysis (Hu and Mo, 2002), Sample 1 (N_1 = 1,408) was randomly divided into two subsamples (Sample 1A and Sample 1B), both with a sample size of 704. Data from Samples 1A and 1B were used to conduct an EFA and CFA, respectively. Sample 1 data also underwent reliability testing and criterion validity analysis. The data from Sample 2 was used to assess relations between the PBGECS and PANAS, and was then subjected to a CFA to evaluate the models of the relations between PBGEC and individual emotion.

RESULTS

Item Analysis

The present study used a project differentiation analysis to check whether scale items were adequate. Total correlations and critical ratios (critical point at 27%) among items were used as analytical indices for item discrimination. Results from Sample 1 (**Table 2**) revealed that the correlation coefficients between the 39 PBGECS items ranged from 0.69 to 0.85, which indicates satisfactory item discrimination.

Factor Analysis

PBGECS-39 Factor Analysis

In Hypothesis 5, we predicted that the PBGEC would have two dimensions, positive and negative, and its structure would be a two-factor model. Therefore, our study used factor analysis to explore and verify the dimensions and structure of our scale, and to test whether the actual model was consistent with the theoretical model.

We randomly divided Sample 1 into two sections according to the operating principle of factor analysis (Hu and Mo, 2002). One section was used for the EFA, and another was used for the CFA. To verify if the data set was suitable for an EFA, the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were first performed on Sample 1A. Results revealed that $\chi^2 = 22348.07$, $p < 0.001$, KMO = 0.96, which indicated suitability for a factor analysis. Results from the Bartlett's test of sphericity ($p = 0.000$) indicated the existence of a common factor within the correlation matrix, also suggesting suitability for an EFA. By using principal components analysis for the EFA and performing a varimax rotation, the analysis revealed five factors with eigenvalues greater than 1. However, the number of one item loaded on more than one factor at the same time is too much. From the previous literature, we can see that PBGEC has two factors (positive and negative). Therefore, we use the method of fixed factor number, and the factor extraction number is set to 2. Thus, 58.27% of the total variance was explained (see **Table 3**). According to the scree plot, the point of inflexion was at the second factor. Hence, it was reasonable to delineate two factors. The first factor referenced positive emotion; hence, this factor was termed "positive of perceived broad group emotional climate" (PBGEC-P). This factor's eigenvalue (after rotation) was 11.42, with a contribution rate of 29.28%. The second factor referenced negative emotion; hence, this factor was termed "negative of perceived broad group emotional climate" (PBGEC-N). This factor's eigenvalue (after rotation) was 11.31, with a contribution rate of 28.99%. The correlation coefficient between PBGEC-P and PBGEC-N was −0.33 ($p < 0.001$). The factor loading matrix is shown in **Table 3**.

Sample 1B data were examined *via* a CFA to assess scale construct validity. The EFA revealed that the PBGECS has a two-dimensional structure, supporting our hypothesis that the PBGEC can be classified into two dimensions: PBGEC-P and PBGEC-N. However, the degree of fit between theoretical constructs and the actual collected data required confirmation.

TABLE 2 | Corrected item-total correlation and critical ratio for the PBGECS-39.

Item	Corrected item-total correlation (*r*)	Critical ratio (*t*)	Item	Corrected item-total correlation (*r*)	Critical ratio (*t*)	Item	Corrected item-total correlation (*r*)	Critical ratio (*t*)
愉悦 (Cheerful)	0.58	22.01	欣喜 (Joy)	0.56	20.63	漠然 (Accidie)	0.65	27.89
希望 (Hopeful)	0.55	22.12	和谐 (Harmonious)	0.60	23.05	不满 (Dissatisfied)	0.68	31.62
热情 (Enthusiastic)	0.60	23.93	满意 (Satisfied)	0.65	25.93	无奈 (Helpless)	0.64	26.71
开心 (Happy)	0.59	22.13	安全 (Safe)	0.61	24.73	失望 (Disappointed)	0.66	27.87
享受 (Enjoyable)	0.53	18.57	信任 (Trusting)	0.64	25.05	怨恨 (Resentment)	0.61	23.72
坚强 (Strong)	0.49	19.05	公平 (Fair)	0.67	26.79	愤恨 (Indignant)	0.57	21.56
兴奋 (Excited)	0.55	20.34	焦虑 (Anxious)	0.61	22.70	敌视 (Hostile)	0.54	20.23
活跃 (Vibrant)	0.55	19.54	不安 (Uneasy)	0.63	23.94	仇恨 (Animosity)	0.51	19.22
鼓舞 (Inspiring)	0.56	20.37	担忧 (Worried)	0.63	24.57	痛苦 (Misery)	0.59	23.87
感激 (Grateful)	0.59	21.77	害怕 (Afraid)	0.61	24.36	压力 (Stressful)	0.55	22.24
自豪 (Proud)	0.57	21.22	恐惧 (Fearful)	0.57	22.03	浮躁 (Blundering)	0.59	24.42
自由 (Free)	0.54	19.34	郁闷 (Distressed)	0.62	24.81	贪欲 (Greedy)	0.62	26.46
正义 (Justicial)	0.60	23.54	冷漠 (Indifferent)	0.67	29.23	战战兢兢 (Jittery)	0.52	19.09

Nsample 1 = 1,408. PBGECS-39, perceived broad group emotional climate scale-39 items.

TABLE 3 | Factor loading matrix for exploratory factor analysis of the PBGECS-39.

Item	Factor 1	Factor 2	Communalities	Item	Factor 1	Factor 2	Communalities
PBGEC-P Subscales				**PBGEC-N Subscales**			
愉悦 (Cheerful)	−0.14	**0.73**	0.55	焦虑 (Anxious)	**0.72**	−0.16	0.54
希望 (Hopeful)	−0.10	**0.72**	0.53	不安 (Uneasy)	**0.74**	−0.17	0.57
热情 (Enthusiastic)	−0.13	**0.78**	0.63	担忧 (Worried)	**0.70**	−0.20	0.53
开心 (Happy)	−0.09	**0.80**	0.65	害怕 (Afraid)	**0.77**	−0.10	0.60
享受 (Enjoyable)	−0.09	**0.74**	0.55	恐惧 (Fearful)	**0.76**	−0.06	0.57
坚强 (Strong)	−0.04	**0.67**	0.45	郁闷 (Distressed)	**0.75**	−0.14	0.59
兴奋 (Excited)	−0.05	**0.80**	0.64	冷漠 (Indifferent)	**0.77**	−0.16	0.61
活跃 (Vibrant)	−0.05	**0.78**	0.62	漠然 (Accidie)	**0.76**	−0.17	0.60
鼓舞 (Inspiring)	−0.09	**0.78**	0.62	不满 (Dissatisfied)	**0.77**	−0.22	0.64
感激 (Grateful)	−0.15	**0.77**	0.61	无奈 (Helpless)	**0.70**	−0.26	0.55
自豪 (Proud)	−0.13	**0.77**	0.61	失望 (Disappointed)	**0.79**	−0.20	0.66
自由 (Free)	−0.15	**0.71**	0.52	怨恨 (Resentment)	**0.79**	−0.11	0.63
正义 (Justical)	−0.18	**0.75**	0.59	愤恨 (Indignant)	**0.78**	−0.04	0.60
欣喜 (Delighted)	−0.03	**0.82**	0.67	敌视 (Hostile)	**0.76**	−0.01	0.59
和谐 (Coherence)	−0.14	**0.72**	0.54	仇恨 (Animosity)	**0.74**	0.01	0.54
满意 (Satisfied)	−0.18	**0.81**	0.69	痛苦 (Misery)	**0.78**	−0.05	0.60
安全 (Safe)	−0.20	**0.72**	0.56	压力 (Stressful)	**0.59**	−0.18	0.38
信任 (Trust)	−0.22	**0.76**	0.62	浮躁 (Blundering)	**0.71**	−0.17	0.53
公平 (Fair)	−0.28	**0.75**	0.64	贪欲 (Greedy)	**0.75**	−0.17	0.60
				战战兢兢 (Jittery)	**0.73**	−0.02	0.53

Nsample 1A = 704. PBGECS-39, perceived broad group emotional climate scale-39 items; PBGEC-P, positive perceived broad group emotional climate; PBGEC-N, negative perceived broad group emotional climate. Factor loadings >0.40 are in boldface. Extraction method: Principal Component Analysis. Rotation Method: Varimax. Rotation converged in 100 iterations.

CFA results (see **Table 4**) indicated that the uncorrelated two-factor model and the correlated two-factor model had a TLI and CFI over 0.80 (but lower 0.90) and a RMSEA under 0.08. Hence, these two-factor models indicated better fit than the one-factor model. Even though fit indices for both models reached a satisfactory level, these values were not ideal.

PBGECS-20 CFA

We observed that the fit of several items did not reach the ideal level. Thus, the items were eliminated through a stepwise method, using the following standard: If removal of an item significantly increased overall scale reliability, the item was permanently eliminated. This procedure led to the retention

TABLE 4 | Model fit indices for the PBGECS-39 and the PBGECS-20.

CFA model	$\chi 2$	*df*	SRMR	TLI	CFI	RMSEA	90% CI
Sample 1B ($N_{sample\ 1b}$ = 704) Original Scale (Items-39)							
Model 1: one-factor	13300.40***	702	0.23	0.39	0.42	0.16	0.157–0.162
Model 2: uncorrelated two-factor	3550.31***	702	0.11	0.80	0.81	0.08	0.073–0.078
Model 3: correlated two-factor	3521.09***	701	0.07	0.80	0.81	0.08	0.073–0.078
Shortened Scale (Items-20)							
Model 4: one-factor	4484.85***	170	0.21	0.49	0.55	0.19	0.185–0.195
Model 5: uncorrelated two-factor	988.16***	170	0.13	0.90	0.91	0.08	0.078–0.088
Model 6: correlated two-factor	930.28***	169	0.05	0.91	0.92	0.08	0.075–0.085
Sample 2 ($N_{sample\ 2}$ = 607) Shortened Scale (Items-20)							
Model 7: one-factor	3525.07***	170	0.19	0.51	0.56	0.18	0.175–0.186
Model 8: uncorrelated two-factor	1358.02***	170	0.10	0.83	0.85	0.11	0.102–0.113
Model 9: correlated two-factor	1334.68***	169	0.06	0.83	0.84	0.11	0.101–0.112

*PBGECS-39, perceived broad group emotional climate scale-39 items; PBGECS-20, perceived broad group emotional climate scale-20 items. ***p < 0.001.*

of 20 emotion words. The 10 PBGEC-P words were cheerful, enthusiastic, happy, enjoyable, excited, vibrant, inspiring, proud, joy, and satisfied, while the 10 PBGEC-N words were anxious, worried, afraid, fearful, dissatisfied, distressed, misery, indifferent, resentment, and greedy.

To verify the goodness of fit of the PBGECS-20, we tested the one-factor, uncorrelated two-factor, and correlated two-factor models for Sample 1B and Sample 2 (**Figure 2**). The CFA results suggested that the fit indices for the one-factor model were not ideal; in contrast, the correlated two-factor model had adequate fit (see **Table 4**). This indicated that the PBGECS-20 was more effective than the PBGECS-39 for measuring PBGEC.

In order to verify Hypothesis 1, we first investigated the relationship between PBGEC and individual emotion. Subsequently, we used CFA to explore whether PBGEC and individual emotion contain two factors (positive and negative) or four factors (PBGEC-P, PBGEC-N, PA, and NA).

We matched PBGEC and individual emotion data from Sample 2 to analyze the correlations between PBGEC and individual emotion. The results revealed that PA was positively associated with PBGEC-P ($r = 0.58$, $p < 0.001$), NA was positively associated with PBGEC-N ($r = 0.54$, $p < 0.001$), and PBGEC-P was negatively associated with PBGEC-N ($r = -0.20$, $p < 0.001$) and NA ($r = -0.14$, $p < 0.05$). The correlation coefficients r between PBGEC-N and PA and between PA and NA are not significant, which are 0.03 ($p = 0.403$) and −0.01 ($p = 0.911$), respectively.

CFA of the PBGEC and Individual Emotional Relationship Model

Using CFA, we assessed the fit of the one-factor model, two-factor model, and four-factor model. The results are shown in **Table 5**. The fit of the four-factor model was significantly better than the one-factor model and two-factor model (see **Figure 3**), suggesting that the PBGEC is different from individual emotion. The one-factor model was a pure measurement model, including all the measurement factors. The two-factor model included PBGEC and individual emotion, or positive and negative emotion. The four-factor model included PBGEC-P, PBGEC-N, PA, and NA.

Validity and Reliability for the PBGECS-20

Reliability

Internal consistency on the PBGECS-20 revealed that for Sample 1, Cronbach's α for the full-scale was 0.83 ($p < 0.001$). The PBGEC-P scale had a Cronbach's $\alpha = 0.94$ ($p < 0.001$), the composite reliabilities (CR) = 0.94 and average variance extracted (AVE) = 0.63, whereas the PBGEC-N had a Cronbach's $\alpha = 0.93$ ($p < 0.001$), CR = 0.94 and AVE = 0.61. In Sample 2, the full-scale Cronbach's α was 0.83 ($p < 0.001$); the PBGEC-P scale had a Cronbach's $\alpha = 0.94$ ($p < 0.001$), CR = 0.95 and AVE = 0.65, whereas the PBGEC-N scale had a Cronbach's $\alpha = 0.89$ ($p < 0.001$), CR = 0.91 and AVE = 0.50.

The test–retest reliability for the total scale of Item-39 and subscales was as follows: total PBGEC $r = 0.584$ ($p < 0.001$), positive PBGEC $r = 0.665$ ($p < 0.001$), and negative PBGEC $r = 0.649$ ($p < 0.001$); the total scale of Item-20 and subscales was as follows: total PBGEC $r = 0.600$ ($p < 0.001$), positive PBGEC $r = 0.676$ ($p < 0.001$), and negative PBGEC $r = 0.660$ ($p < 0.001$).

External Validity

Gender, age, and SES (i.e., education level and household income) were used as indicators of the external validity of

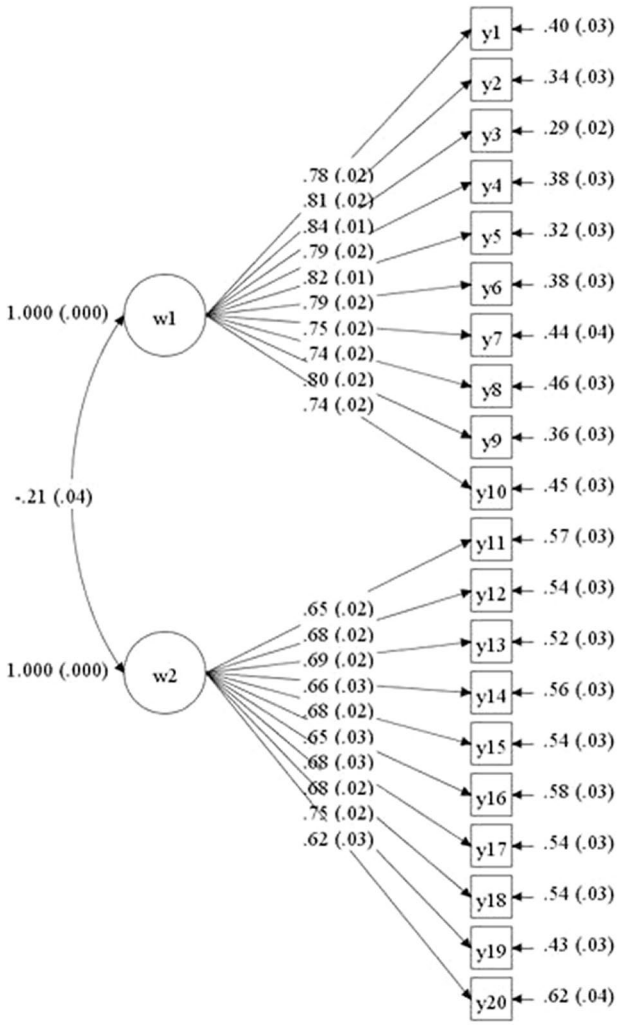

FIGURE 2 | Corrected two-factor model for the perceived broad group emotional climate (PBGEC).

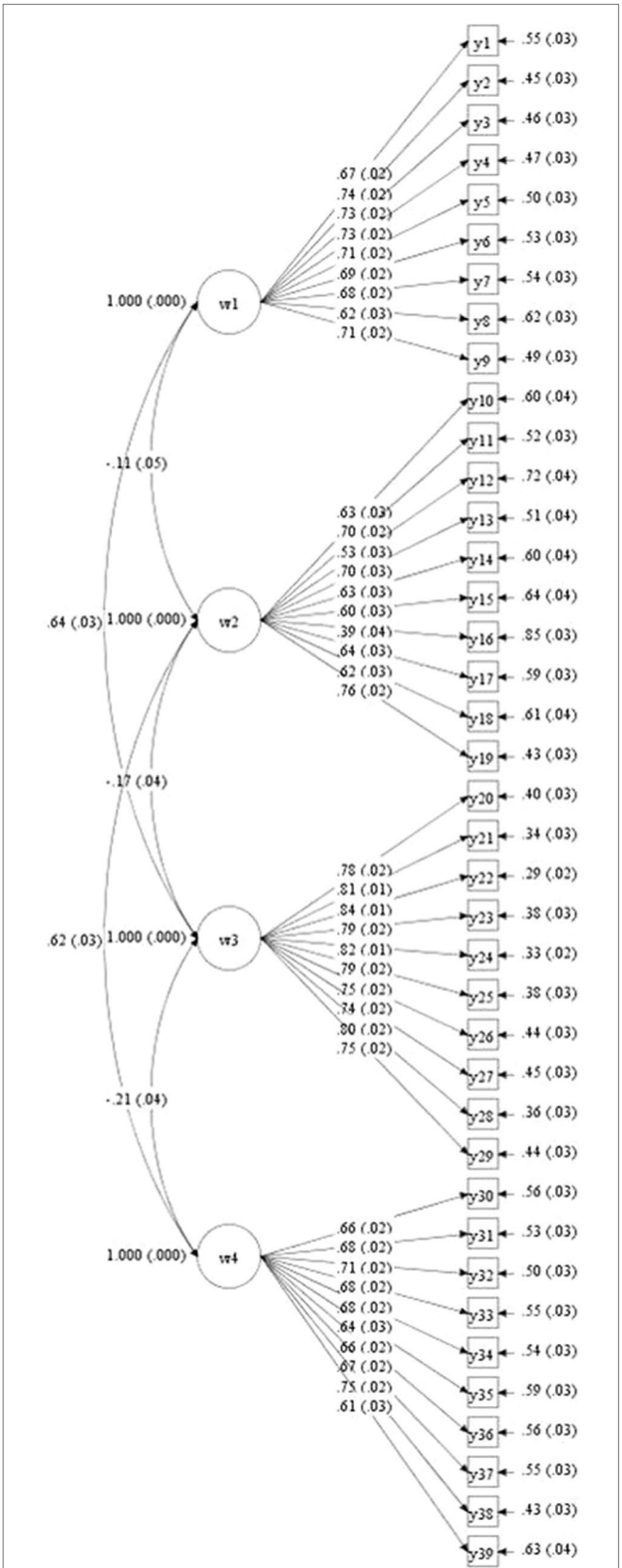

FIGURE 3 | Four-factor model for the PBGEC and individual affect.

the PBGECS-20. In order to support Hypothesis 2, we compared PBGEC-P and PBGEC-N scores according to gender, age, education level, and household income. The following results were obtained. There were no significant differences between men and women in either the PBGEC-P (t = 0.09, p = 0.93) or PBGEC-N scores (t = 0.61, p = 0.54). There was a significant difference in PBGEC-P scores between different age groups, F (4,1378) = 5.71, p < 0.001, η^2 = 0.02. *Post-hoc* tests (LSD) revealed that individuals under the age of 25 scored significantly higher than those over the age of 36–55, ps < 0.001. Furthermore, those aged 26–35 years also scored significantly higher than the age of 46–55, ps < 0.05. No significant age differences emerged for PBGEC-N scores, F (4,1378) = 0.86, p = 0.49, η^2 = 0.00, as shown in **Table 6**.

There were no significant differences in PBGEC-P scores based on education level [F (4,1399) = 1.23, p = 0.30, η^2 = 0.00],

TABLE 5 | Model fit indices for PBGEC and the individual affect model.

CFA model	$\chi 2$	*df*	SRMR	TLI	CFI	RMSEA	90% CI
One-factor model	8045.65***	702	0.17	0.41	0.44	0.13	0.129–0.134
Two-factor model (PBGEC and individual emotion)	6911.41***	701	0.17	0.50	0.53	0.12	0.118–0.123
Two-factor model (positive and negative emotion)	4641.35***	701	0.08	0.68	0.70	0.10	0.094–0.099
Four-factor model (PBGEC-P, PBGEC-N, PA, and NA)	2709.70***	696	0.06	0.84	0.85	0.07	0.066–0.072

*Nsample 2 = 607. PBGEC, perceived broad group emotional climate; PBGEC-P, positive perceived broad group emotional climate; PBGEC-N, negative perceived broad group emotional climate; PA, positive affect; NA, negative affect. ***$p < 0.001$.*

TABLE 6 | Sociodemographic characteristics on positive and negative PBGEC scores in different groups.

Topic	Sample size (*n*)	PBGEC-P (M ± SD)	*t*/*F*	*p*	PBGEC-N (M ± SD)	*t*/*F*	*p*
Gender							
Male	656	20.77 ± 7.68	0.09	0.93	15.33 ± 7.93	0.61	0.54
Female	638	20.73 ± 6.98			15.07 ± 7.45		
Not provided	114						
Aged							
17–25	386	21.95 ± 6.65	5.71***	0.000	15.51 ± 7.49	0.86	0.49
26–35	421	21.30 ± 7.61			15.47 ± 7.70		
36–45	353	19.94 ± 7.75			14.71 ± 7.87		
46–55	191	19.46 ± 7.55			14.90 ± 7.44		
More than 56	32	19.97 ± 6.09			16.19 ± 7.06		
Not provided	25						
Educational level							
JH	139	20.33 ± 8.57	1.23	0.30	13.86 ± 8.45	5.69***	0.000
H/T	257	21.04 ± 7.51			14.43 ± 7.93		
C	321	20.37 ± 7.92			14.42 ± 7.54		
U	581	20.99 ± 6.66			16.23 ± 7.30		
M & D	106	22.00 ± 7.99			16.21 ± 7.74		
Not provided	4						
Household income							
Less than 10	116	19.82 ± 8.26	5.25***	0.000	15.47 ± 8.82	1.71	0.10
10–20	151	20.43 ± 7.67			14.85 ± 7.84		
20–40	323	21.37 ± 7.22			15.57 ± 7.42		
40–60	325	19.54 ± 7.39			15.91 ± 7.31		
60–100	246	21.22 ± 7.17			15.00 ± 7.54		
100–150	111	22.19 ± 6.99			14.29 ± 7.42		
150–200	70	23.84 ± 6.65			12.97 ± 7.22		
More than 200	59	22.53 ± 7.24			14.75 ± 9.11		
Not provided	7						

*Nsample 1 = 1,408. PBGEC, perceived broad group emotional climate; Educational level: JH, Junior high school level or below; H/T, high school/technical secondary school level; C, college level; U, university level; M & D, Master's degree and doctor's degree level. Household income:1,000 RMB is the unit of measurement. ***$p < 0.001$.*

but there were significant differences in PBGEC-N scores, F (4,1399) = 5.69, $p < 0.000$, $\eta^2 = 0.02$. *Post-hoc* tests (LSD) revealed that those with an undergraduate and graduate education scored significantly higher than all other groups, ps < 0.05, as shown in **Table 6**.

The PBGEC-P scores differed as a function of household income, F (7,1393) = 5.25, $p < 0.000$, $\eta^2 = 0.03$. *Post-hoc* tests (LSD) revealed that individuals with household incomes of 20,000–40,000 RMB, 60,000–100,000 RMB, 100,000–150,000 RMB, or over 200,000 RMB scored significantly higher than individuals with household incomes under 10,000 RMB or 40,000–60,000 RMB, ps < 0.05. Individuals with a household income of 150,000–200,000 RMB scored higher than individuals with household incomes of 10,000–20,000 RMB, 20,000–40,000 RMB, 40,000–60,000 RMB, or 60,000–100,000 RMB, ps < 0.05. PBGEC-N scores did not differ based on

household income, F (7,1393) = 1.71, p = 0.10, η^2 = 0.00 (see **Table 6**).

Criterion Validity

We predicted that the positive and negative dimensions of the PBGEC would be related to present social attitude, future social expectations, and social wellbeing (Hypotheses 3 and 4). As shown in **Table 7**, the PBGEC-P was positively associated with all social wellbeing dimensions (rs = 0.24 to 0.37), while the PBGEC-N was negatively associated with all social wellbeing dimensions (rs = −0.39 to −0.27). The PBGEC-P was also positively associated with positive present social attitude and positive future social expectations (r = 0.33 and 0.22, respectively). The PBGEC-N was positively associated with negative present social attitude and negative future social expectations (r = 0.26 and 0.21, respectively), as well as negatively associated with positive present social attitude and positive future social expectations (r = −0.38 and −0.24, respectively).

DISCUSSION

This research developed a PBGECS for measuring how individuals evaluate the emotional climate of the people around them. Based on a literature review and a series of studies, this research shows that the scale of PBGEC-20 has strong reliability and validity. Our results suggest that our developed scale performs effectively.

First, we clarified that PBGEC and individual emotion can be considered separate constructs. Our delineation aligns with the existing presumption that although individual emotion and PBGEC are based on the same psychological system, the two are still conceptually independent (Rahn et al., 1996). Next, Samples 1 and 2 in the present study were also employed to determine whether PBGEC and individual emotion could together form four-factor model: PBGEC-P, PBGEC-N, PA, and NA. Notably, this four-factor model had a better fit than the two-factor model or one-factor model. Hence, Hypotheses 1 and 2 were also supported.

Second, PBGECS has strong validity. We examined the scale's construct validity, cultural validity, population validity, and interpretive validity (Washington and McLoyd, 1982). For construct validity, the PBGEC-20 can be divided into positive and negative dimensions along with its correlated two-factor model. It is consistent with the PANAS' dimensions and structures (Seib-Pfeifer et al., 2017). For cultural validity, PBGEC-P was positively associated with positive present social attitude and positive future social expectations, while PBGEC-N was negatively associated with positive present social attitude and positive future social expectations, as well as positively associated with negative present social attitude and negative future social expectations. For population validity, PBGEC-P was positively associated with all five social wellbeing dimensions, while PBGEC-N was negatively correlated with social wellbeing. For interpretive validity, PBGEC-P was highest among individuals under the age of 35 and those with higher household incomes, while PBGEC-N scores were highest among more educated participants. Our findings are consistent with the fact that SES best predicts familial emotional climate (Farrell et al., 2018). These results align with Hypothesis 3, Hypothesis 3A, Hypothesis 4, and Hypothesis 5.

The present study also revealed that there is an important dynamic quality to PBGEC that generates not group-based emotions, but general group emotions. Specifically, this study is similar to Kuppens and Yzerbyt's (2014) research indicating that PBGEC-P has a positive correlation with social identification; and PBGEC-N has a negative correlation with social identification. At the same time, the results of this research provided an empirical evidence for the study of Kuppens and Yzerbyt.

The scale can be used for research to determine how individuals perceive and experience of the emotion climate when interacting with group members in daily life. Future research may use this scale to determine the relationship between individuals' perceived emotional climate in their surroundings and other variables, including social adaptation behavior, interpersonal relationships, and relative deprivation.

Implications and Connections to Past Research

Perceived broad group emotional climate represents group emotions as perceived by individuals (Marraccini et al., 2020), which may in turn influence an individual's attitudes and societal functions (De Rivera and Páez, 2007). For example, a positive perception of broad group emotional climate, as opposed to a negative perception, has an orientation toward the future and is associated with greater wellbeing. According to the social verification and self-categorization theory, such affects are powerful psychological foundations upon which individuals come to understand reality (Shteynberg, 2009). While the PBGEC is important for an individual's daily life, it is relatively difficult to turn it into a precise concept that can be objectively measured (De Rivera, 1992). Through previous studies, we know that emotional climate is slightly different from PBGEC and that only emotional climate scales currently exist. Given this, it is necessary to develop a PBGECS to measure individuals' perceptions and experiences of broad group emotions.

This study advances our knowledge of emotional climate by offering a measure of PBGEC. Our scale was developed in response to Rousseau's (1988) appeal for the development of a scale that measures specific emotional climates (Liu et al., 2014). Our scale was based on general group emotions in China and enriches existing research sampled from Western cultural groups. We differentiated concepts related to group emotional climate and viewed individuals' subjective experience as the most important aspect that should be considered.

Each era has its own method for determining appropriate display rules for emotions and expressions. The present study

TABLE 7 | Correlations of the PBGECS with present social attitude, future social expectations, social well-being.

S. No.		M	SD	1	2	3	4	5	6	7	8	9	10	11
1.	PBGEC-P	20.88	7.43	1										
2.	PBGEC-N	15.23	7.68	−0.24***	1									
3.	Social acceptance	16.22	3.00	0.35***	−0.31***	1								
4.	Social integration	16.65	3.53	0.37***	−0.39***	0.69***	1							
5.	Social contribution	22.13	3.78	0.24***	−0.27***	0.64***	0.67***	1						
6.	Social actualization	17.66	3.30	0.31***	−0.35***	0.64***	0.76***	0.79***	1					
7.	Social coherence	21.39	3.95	0.29***	−0.28***	0.69***	0.66***	0.79***	0.73***	1				
8.	Social well-being	94.05	15.39	0.35***	−0.36***	0.83***	0.86***	0.90***	0.89***	0.89***	1			
9.	Positive present social attitude	20.62	3.78	0.33***	−0.37***	0.61***	0.66***	0.57***	0.67***	0.58***	0.70***	1		
10.	Negative present social attitude	19.64	3.90	−0.03	0.26***	0.06*	−0.08**	0.13**	0.01	0.11***	0.05*	−0.00	1	
11.	Positive future social expectation	8.89	1.79	0.22***	−0.24***	0.46***	0.56***	0.61***	0.69***	0.55***	0.66***	0.63***	0.07*	1
12.	Negative future social expectation	7.23	2.04	0.02	0.21***	0.07*	−0.11***	−0.03	−0.11***	0.02	−0.04	−0.03	0.56***	−0.10***

*Nsample 1 = 1,408. PBGEC, perceived broad group emotional climate; PBGEC-P, positive perceived broad group emotional climate; PBGEC-N, negative perceived broad group emotional climate. ***p < 0.001, **p < 0.01, *p < 0.05.*

investigated individual PBGEC by constructing an emotion lexicon suited for group emotions that was based on psychological emotion models. PBGEC plays an important role in influencing people's moral and social life (Zhou and Yu, 2015) and is ubiquitous in people's daily lives, not only for individual behavior, but also for intra-group relationships and social stability (Wang and Wang, 2009; Kuppens, 2011).

Previous emotional climate studies have divided this construct into positive and negative climate. Prior work predominantly focused on the domains of commerce, politics, economics, and communication. By studying PBGEC within individuals' daily lives, the present study suggests that individuals may engage in positive evaluations of the world when in a good emotional climate, and engage in negative evaluations when in a bad emotional climate (Rahn et al., 1996). Therefore, our study supports the conclusion that individuals' present social attitudes and future social expectations may be positive when in a PBGEC-P and vice versa. The resulting perceptions may affect people's attitudes, motivations, and behaviors (De Rivera, 1992). Specifically, a positive emotional climate influences a range of psychosocial phenomena, such as decision-making, tolerance toward diversity, willingness to build cooperation, and social unity. Conversely, a negative emotional climate tends to hobble interpersonal harmony and contribute to interpersonal conflicts and repressive decisions (see De Rivera, 1992; Conejero and Etxebarria, 2007; De Rivera et al., 2007; De Rivera and Páez, 2007; Pelletier, 2018).

In addition, individual social emotion (i.e., PBGEC of this study) is an important part of people's social mentality and an important reflection of a country's social governance (Wang et al., 2007; Wang, 2013a,b, 2018). The PBGECS assesses the perceived emotion climate of an individual's surrounding environment, which may also can help government personnel understand people's social mentality and serve as a public opinion barometer of the government's governance effect, so as to promote good governance and improve people's wellbeing.

Limitations and Future Directions

A few study limitations should be noted. First, the current PBGECS only applies to the Chinese context for Chinese community residents and university students. Due to constraints regarding research staff, available materials, and financial resources, we could only examine participants from the southwestern and central regions of China. Future research should include samples from other regions and other cultures to increase the representativeness of the sample and enhance the generalizability of the present findings. Second, we chose not to use the "arousal" dimension in the structure of PBGEC after taking the context of China, which is a collectivist culture into consideration. Some evidence in the scientific literature notes that the emotional display rules and expressions differ between those from Asia and those from Western cultures (Liu et al., 2014). For example, emotions of positive and negative valence tend to be associated with increased arousal in Western cultures, whereas valence and arousal tend to be experienced relatively independently from each other in East Asian cultures (Kuppens et al., 2013). In other words, high arousal positive affect is preferred in Western cultures and lower arousal positive affect is preferred in East Asian cultures (Tsai et al., 2006). Third, our study only explored PBGEC at the individual level. In the future, it would be necessary to explore PBGEC at the group level using the other types of group emotion. Finally, there are many other factors that may affect PBGEC, such as violence and apologies, among others (Bobowik et al., 2017). The present study only examined SES as the predicting variable. Future research should use other, more influence factors to study PBGEC. Certainly, according to the nomological validity, we can also consider those variables which are low relate or no relate to PBGEC, such as personality factors, in order to investigate the nomological validity of PBGEC.

Future research can consider the potential clinical application of PBGEC in the important work of general group emotion in clinical intervention. For example, during the COVID-19 pandemic, the influence of people around on the health of patients and whether remote psychotherapy can be adopted to effectively improve the individual's perception of the emotional environment (Poletti et al., 2020).

CONCLUSION

Perceived broad group emotional climate and individual emotion are two related but distinct concepts. The PBGECS scale devised from the present analyses revealed a two-dimensional structure, consisting of PBGEC-P and PBGEC-N. The correlated two-factor model demonstrated the best fit to the data. Together, the two (i.e., positive and negative) form four dimensions: PBGEC-P, PBGEC-N, PA, and NA. Our results indicate that SES affects PBGEC. The PBGEC was significantly correlated with present social attitudes, future social expectations, and social wellbeing. Finally, the PBGECS shows satisfactory reliability and validity in the Chinese context for Chinese community residents and university students. Thus, the PBGECS can be used as an effective and reliable tool for quantifying PBGEC. In the future research, this scale can provide as psychosocial context information that affect behavior. In turn, researchers can benefit from the PBGECS to predict and explain some behaviors (e.g., collective behavior and individual social adaptive behavior).

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at: https://osf.io/gh3az/.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of School of Psychology, Jiangxi Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

XY and XW: research framework design, data collation and analysis, and writing and revising the paper. XW: The development of PBGECS. JL, SL, ML, and BY: revising the paper. XY and XW contributed equally to this work and should be considered co-first authors. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at https://www.frontiersin.org/articles/10.3389/fpsyg.2021.686734/full#supplementary-material

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Prosocial Gains and Losses: Modulations of Human Social Decision-Making by Loss-Gain Context

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The role of the loss-gain context in human social decision-making remains heavily debated, with mixed evidence showing that losses (vs. gains) boost both selfish and prosocial motivations. Herein, we propose that the loss context, compared to the gain context, exacerbates intuitive reactions in response to the conflict between self-interest and prosocial preferences, regardless of whether those dominant responses are selfish or altruistic. We then synthesize evidence from three lines of research to support the account, which indicates that losses may either enhance or inhibit altruistic behaviors depending on the dominant responses in the employed interactive economic games, prosocial/proself traits, and the explicit engagement of deliberative processes. The current perspective contributes to the ongoing debate on the association between loss-gain context and human prosociality by putting forward a theoretical framework to integrate previous conflicting perspectives.

Keywords: loss aversion, social decision making, dual-process framework, prospect theory, do-no-harm principle

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INTRODUCTION

Human behaviors and cognitions are disproportionately influenced by negative events relative to positive or neutral events, demonstrating a "negativity bias" (Baumeister et al., 2001; Rozin and Royzman, 2001; Vaish et al., 2008). Negative events are more preferentially attended to (Hansen and Hansen, 1988; Cooper and Langton, 2006), difficultly disengaged from (Salemink et al., 2007), and heavily weighted (Skowronski and Carlston, 1989) compared to other events. For instance, task-irrelevant negative events often induce a larger interference on an individual's ongoing task performance than that induced by irrelevant neutral or positive events (Williams et al., 1996; Feng et al., 2018). Notably, the priority in the processing of negative information occurs at early processing stages (Huang and Luo, 2006; Olofsson et al., 2008; Kappenman et al., 2015), operates automatically, and is independent of the information load and awareness (Hansen and Hansen, 1988; Öhman, 2005). Negativity bias represents one of the most basic and overarching psychological principles (Baumeister et al., 2001; Rozin and Royzman, 2001) and might serve the

evolutionarily adaptive function of avoiding detrimental situations. Herein, we focus on how negativity bias manifests in human decision-making, especially in social contexts.

EFFECTS OF LOSS ON INDIVIDUAL DECISION-MAKING

In accord with the asymmetrical effects of the bad and the good in other domains, it has been proposed that losses exert a stronger effect on human judgments and decisions than comparable gains (Hilbig, 2009; Neumann and Böckenholt, 2014; Mrkva et al., 2020; Brown et al., 2021). For instance, many studies have identified that the behavioral avoidance of choices leads to potential losses, even when accompanied by equal-sized or substantially larger gains (Tversky and Kahneman, 1991; Novemsky and Kahneman, 2005; Kahneman and Tversky, 1979). In contrast, other studies have not found this effect, particularly for small to medium losses (see review in Yechiam and Hochman, 2013; Gal and Rucker, 2018). Notwithstanding, studies have shown that even small losses increase arousal, performance, and cortical processing (see review in Yechiam and Hochman, 2013). The asymmetric effects of losses on human behaviors have been historically attributed to higher subjective weighting of losses than gains in prospect theory, i.e., loss aversion (Kahneman and Tversky, 1979). However, more recent empirical evidence has indicated that losses might only induce global increases in sensitivity to task reinforcements, which do not necessarily give rise to loss aversion at the behavioral level (Hochman and Yechiam, 2011; Yechiam and Telpaz, 2011, 2013; Yechiam and Hochman, 2013).

The effect of the loss-gain context on human decision-making could be understood in the dual-process framework (Epstein, 1994; Kahneman, 2011; Feng et al., 2015; Loewenstein et al., 2015); the intuitive system (i.e., System 1) consists of affective processes that are fast and automatic, while the deliberative system (i.e., System 2) includes rational processes that are slower, more analytical and calculating in nature. In particular, it has been increasingly acknowledged that asymmetry in the impact of gains and losses reflects the essential role of intuitive emotional processes in human decision-making (e.g., Slovic et al., 2007; Loewenstein et al., 2015). For instance, the modulation of loss context on decision-making engages the involvement of the amygdala as a key node for emotional processing (De Martino et al., 2006; Roiser et al., 2009; Canessa et al., 2013), the activity of which predicts individual differences in the susceptibility to loss context (Roiser et al., 2009). Moreover, the loss-gain asymmetry in risky decisions is significantly attenuated among amygdala-lesioned patients compared with healthy controls, who typically exhibit higher sensitivity to losses than gains (De Martino et al., 2010). Last, experimental manipulations that facilitate deliberative processes, such as intentional emotional regulation strategy and presenting choices in a foreign language, effectively decrease the loss-elicited bias in decision-making (Sokol-Hessner et al., 2009, 2013; Keysar et al., 2012), as well as associated physiological arousal (Sokol-Hessner et al., 2009; Sheng et al., 2020) and amygdala activations (Sokol-Hessner et al., 2013) in response to losses. In contrast, experimental procedures that promote intuitive processes (e.g., incidental fear cues) enhance susceptibility to loss context as well as amygdala responses or skin conductance responses to losses (Stancak et al., 2015; Schulreich et al., 2016, 2020).

Together, previous findings have indicated that human decisions pertaining to losses and gains are quite different from each other, and loss-gain asymmetry is closely related to the intuitive emotional system. Although the past decades have witnessed a wealth of empirical evidence on the influence of loss context on human individual decision-making under risk and uncertainty (Neumann and Böckenholt, 2014), it remains controversial how loss-gain context modulates human social behaviors or preferences.

EVIDENCE THAT LOSSES (VS. GAINS) DECREASE PROSOCIALITY

A large body of evidence has indicated that individuals exhibit lower levels of prosocial behaviors in the loss context than in the gain context. In particular, some studies have indicated that proposers in the dictator or ultimatum game show a lower dislike for advantageous inequality when outcomes are framed as losses than when outcomes are framed as gains (Lusk and Hudson, 2010; Neumann et al., 2018; Fiedler and Hillenbrand, 2020). Moreover, across die-under-the-cup and coin-toss tasks, people are more motivated to cheat to avoid loss than to make gains of identical size (Van Yperen et al., 2011; Grolleau et al., 2014, 2016; Schindler and Pfattheicher, 2017; Sun et al., 2017; Markiewicz and Czupryna, 2020; Markiewicz and Gawryluk, 2020). Last, individuals are more likely to approve of obtaining "insider information" in response to hypothetical scenarios (Kern and Chugh, 2009) and more prone to making self-serving mistakes in a die-roll task (Leib et al., 2019) in the loss context than in the gain context.

These findings align with prospect theory, which holds that people dislike losses more than they like equivalent gains, that is, loss aversion (Kahneman and Tversky, 1979). In other words, it is psychologically more aversive to endure a loss than to give up an equivalent gain to enhance the net payoff of others (Reinders Folmer and De Cremer, 2012). According to this account, it is likely that the effect of the loss context on human prosociality is mediated by the intuitive emotional processes, given the critical role of emotional processing in loss aversion (Sokol-Hessner and Rutledge, 2019). Alternatively, these findings could be accounted for by a recent attention-allocation model positing that losses increase attention to the task, which in turn facilitates the reaction to the reinforcement structure (Yechiam and Hochman, 2013). That is, losses might enhance the motives to maximize self-interest, in line with previous findings that losses lead to greater maximization during individual decision-making (Bereby-Meyer and Erev, 1998; Yechiam and Ert, 2007).

EVIDENCE THAT LOSSES (VS. GAINS) INCREASE PROSOCIALITY

Many other studies have demonstrated that people exhibit enhanced concern for the welfare of others and for social norms in the loss domain than in the gain domain. Across several countries, ultimatum bargaining over losses induces higher demands from responders and higher offers from proposers than ultimatum bargaining over gains, which suggests that fairness is assigned a higher weight in the loss domain than in the gain domain (Buchan et al., 2005; Zhou and Wu, 2011; Baquero et al., 2013; Guo et al., 2013; Wu et al., 2014; Neumann et al., 2017). Likewise, fairness is more accessible, fairness norms are stronger, and resource allocation is more equal when bargaining over losses than over gains. Notably, the effect of the loss context on allocation behavior is mediated by enhanced fairness motivations and attenuated self-interest motives; that is, fairness concerns dominate over self-interest in the loss context (Leliveld et al., 2009). Moreover, people who act as dictators in the dictator game are intrinsically motivated to share more money with recipients in a loss domain than in a gain domain, thereby demonstrating a higher level of generosity in the loss context (Baquero et al., 2013; Yin et al., 2017; Thunström, 2019; Cochard et al., 2020). Last, people are less likely to harm others by exclusion (van Beest et al., 2003, 2005) and are more cooperative (De Dreu et al., 1992) in the loss context than in the gain context.

These findings are consistent with the "do-no-harm" principle asserting that people are unwilling to harm others to benefit themselves (Baron, 1995; Van Beest et al., 2003, 2005). Therefore, it is likely that losses are more readily appraised as a kind of harm to others than gains, which in turn enhance people's concern for others through aversion to imposing harm on them (Leliveld et al., 2009; Thunström, 2019). This account is consistent with the evidence showing that the enhancement of human altruism by the loss context is mediated by the relative importance between self-reported proself and prosocial concerns (Van Beest et al., 2005; Leliveld et al., 2009). Notably, the "do-no-harm" principle is implemented as more heuristics than analytics, such that people's decisions according to this principle are often different from their reasoning about available options (Ritov and Baron, 1992; Baron, 1995). Therefore, this account also emphasizes that the modulation of the loss context on human prosociality relies on the operation of intuitive heuristics rather than a deliberate, controlled reasoning process.

DISCUSSION

The current literature has provided seemingly contradictory evidence indicating that loss context (compared to gain context) could facilitate both self-interest concerns and prosocial motivations. A plausible account for the current mixed evidence is that the loss context promotes reflexive or automatic responses regardless of whether they are selfish or prosocial. In other words, self-interest concerns might dominate over prosocial concerns in some contexts or for some people, whereas altruistic reactions represent intuitive responses for others, and those intuitive reactions are further amplified by the loss context. This conjecture, which provides a potential reconciliation for the apparently discrepant relationship between losses and prosociality in the current literature, has been supported by several lines of research.

First, previous studies have revealed that loss contexts often enhance human generosity (Baquero et al., 2013; Yin et al., 2017; Thunström, 2019; Cochard et al., 2020) but usually reduce human honesty (Van Yperen et al., 2011; Grolleau et al., 2014, 2016; Schindler and Pfattheicher, 2017; Sun et al., 2017; Markiewicz and Czupryna, 2020; Markiewicz and Gawryluk, 2020). The opposite effects of losses on the two distinct social preferences could be attributed to the reason that human generosity mainly reflects intuitive responses, whereas human honesty often requires cognitive control. On the one hand, generous decisions, such as voluntary giving and charitable donations, consistently engage emotion-related regions (e.g., ventral striatum) rather than brain regions implicated in cognitive control [e.g., lateral prefrontal cortex (lPFC); Moll et al., 2006; Harbaugh et al., 2007; Zaki and Mitchell, 2011; Ty et al., 2017], which is thought to reflect the intrinsic value of generosity (Zaki and Mitchell, 2013). Moreover, excitatory stimulation of the lPFC decreases voluntary giving (Ruff et al., 2013), whereas inhibitory stimulation of the lPFC leads to increases in generosity (Ruff et al., 2013; Christov-Moore et al., 2017; Yin et al., 2017). Last, some studies have found that people might exhibit an enhanced level of generosity under cognitive load (Schulz et al., 2014) or time pressure (Cappelletti et al., 2011), which constrain cognitive control; however, it should be noted that recent meta-analyses indicate that the effects of cognitive manipulations are modulated by gender (Rand et al., 2016) or nonsignificant (Fromell et al., 2020). On the other hand, costly honest decisions involve cognitive control regions (Abe and Greene, 2014; Yin et al., 2016) as well as stronger functional coupling between these regions (Dogan et al., 2016). In addition, lesions to the lPFC significantly reduce honesty behaviors (Zhu et al., 2014), and excitatory stimulation of the lPFC leads to dramatic increases in honesty (Maréchal et al., 2017). Last, restraining people's deliberate thinking decreases costly honesty (Mead et al., 2009; Gino et al., 2011; Shalvi et al., 2012). In light of these findings, the opposite effects of loss context on human generosity and honesty are consistent with the account asserting that losses promote intuitive reactions during social decision-making.

Second, several studies have demonstrated that whether losses enhance selfish or altruistic behaviors depends on individual variations in social value orientations, such that loss contexts promote prosocial individuals' altruistic preferences but curtail individualists' altruistic concerns (De Dreu and McCusker, 1997; Reinders Folmer and De Cremer, 2012). For instance, prosocial individuals cooperate more in a loss domain than in a gain domain, whereas proself individuals cooperate less in a loss domain than in a gain domain (De Dreu and McCusker, 1997). In the same vein, females are generally more generous than males (My et al., 2018; Cochard et al., 2020); accordingly, it has been reported that females are more generous in the loss domain in than the gain domain, but males do not exhibit

significant differences in generosity between domains (Cochard et al., 2020). These findings agree with the idea that the effect of losses on human prosociality depends on distinct intuitive (selfish or prosocial) responses exhibited by different individuals.

Third, the effect of losses on human altruism is attenuated by the engagement of the deliberative system. For instance, providing participants with more time to consider the outcomes associated with different options decreased the effect of the loss context (Zhou and Wu, 2011). Moreover, the effect of the loss context on human generosity significantly decreases when individuals are encouraged to engage in rational behaviors by reminding them of the financial consequences of their decisions (Thunström, 2019). These findings complement two other lines of research showing that (i) a loss situation can accelerate the consumption of self-control resources (Liu et al., 2020) and that (ii) individuals are less rational in the loss domain (Baron, 1995), such that people are less likely to harm a group in a loss domain than in a gain domain to achieve a better overall outcome (Van Beest et al., 2005). These findings indicate that the modulation of losses on human prosociality depends on reflexive processes, whereas engagement in more deliberative mental processes can attenuate the effect of losses.

Taken together, there is a growing body of empirical evidence supporting the idea that the modulation of loss context on human prosociality might be achieved by magnifying intuitive responses in the task at hand, independent of whether these relatively automatic reactions are altruistic or selfish. This account provides a promising reconciliation for the apparently mixed evidence on the relationship between losses and human prosocial preferences.

LIMITATIONS AND FUTURE DIRECTIONS

Several limitations and corresponding future directions should be noted. First, it is important for future studies to reveal the nature of intuitive responses of the employed tasks. For instance, it has been revealed that honesty could be automatic or controlled depending on the types of tasks utilized (Köbis et al., 2019). Relatedly, future studies need to characterize participants in terms of their personality traits associated with prosociality and/or negativity (e.g., Brunell et al., 2014; Buelow and Brunell, 2020). On the one hand, some people are more altruistic than others, which in turn likely leads to different intuitive responses among individuals (Rand et al., 2016). On the other hand, personality traits such as neuroticism/narcissism modulate one's reactivity to negative events (Canli et al., 2001; Chan et al., 2007); it is plausible that the more individuals are sensitive to negativity, the more likely their prosocial behaviors are modulated by loss contexts. The heterogeneity in tasks and/or samples utilized in the literature might explain the null effects of the loss-gain context on human prosociality reported in several studies (e.g., Antinyan, 2014).

Second, although the evidence synthesized in the Discussion section aligns with the hypothesis proposed in the current perspective, these studies did not directly test the hypothesis. As mentioned above, future studies need to better control for intuitive responses of employed tasks and recruited samples to directly test the hypothesis.

Third, in light of the attention-allocation model, an alternative account of inconsistent findings on losses and prosociality could be that losses increase people's attention to the task, which in turn makes people act less noisily but instead more in line with the dominant prosocial or proself response (Hochman and Yechiam, 2011; Yechiam and Hochman, 2013). Although the attention-allocation model has considered attention as a component of the deliberative system (e.g., Yechiam and Hochman, 2013), many brain imaging studies has indicated that attention bias to negative events is automatic and thus associated with brain activity in the intuitive system (e.g., amygdala; Dolan and Vuilleumier, 2003; Albert et al., 2017) or occurs at early processing stages (Olofsson et al., 2008; Luo et al., 2010). Therefore, attention might mediate the promotion of losses on intuitive reactions, in line with the hypothesis proposed in the current perspective. This conjecture is consistent with several lines of research. First, the effects of losses on generosity could be significantly diminished by the engagement of the deliberative system (Thunström, 2019). Second, many studies have indicated that optimizing one's performance (or decreasing the randomness of behavior) does not necessarily rely on controlled processes but could be closely related to emotional intuitive processes (Bechara and Damasio, 2005; Poppa and Bechara, 2018). Nevertheless, future studies could directly test these alternative hypotheses by employing brain imaging techniques.

CONCLUSION

It has been well demonstrated that people treat losses and gains differently during individual decision-making, which is closely related to differential emotional responses to losses and gains (Ashraf et al., 2005; Camerer, 2005). However, it remains unclear how human social decision-making might be different across loss and gain domains, with mixed evidence showing that losses boost both selfish and prosocial motivations. From the current perspective, we aimed to propose a potential account to reconcile previous seemingly inconsistent findings, arguing that the modulation of losses on human social decision-making relies on intuitive emotional processes, similar to the role of losses in individual decision-making. We then synthesized evidence from three lines of research to support the account, revealing that losses may either increase or curtail selfish behaviors depending on dominant responses in the employed interactive economic games, prosocial/proself traits, and the explicit engagement of deliberative processes.

The current perspective contributes to the ongoing debate on the association between loss-gain context and human prosociality by enabling a theoretical framework to integrate contradictory perspectives in the literature. Moreover, the context- and person-dependent effect of losses may have

significant practical implications pertaining to the understanding of human altruism in the downturn as well as the design of institutions to facilitate social preferences, emphasizing that loss context might enhance social preferences in some contexts and for some people but may have unintended side effects for others.

DATA AVAILABILITY STATEMENT

All datasets generated for this study are included in the manuscript.

AUTHOR CONTRIBUTIONS

CF wrote the manuscript. YZ, ZZ, and JY provided important comments to improve the manuscript. All authors contributed to the article and approved the submitted version.

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Effects of Game Situation-Dependent Emotions on Sport Spectators' Food Craving

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This study sought to challenge prevalent accounts of emotional eating by exploring the effects of situation-dependent emotions on consumers' food craving. Four specific game situations in the context of spectator sports, each corresponding to the four types of emotional coping (outcome-desire conflict, avoidance, fulfillment, and pursuit), were identified as follows: decisive victories, decisive losses, close victories, and close losses. By employing laboratory-based virtual reality spectatorship, Study 1 tested the causal effects of happiness (fulfillment), anger (conflict), sadness (conflict), fear (avoidance), and hope (pursuit) on food craving. Study 2 further designed fans' previous association between emotions and eating as a moderating mechanism in the context of online sport viewership. The results of the two experiments supported the three theoretical principles of eating behavior, including the "food as fuel" principle of anger, the hedonic eating principle of happiness, and the self-regulation principle of hope. However, the results rejected the escape awareness principle of sadness and fear. The study concludes with a discussion of context-dependent emotional positioning and intervention strategies for marketers and policy makers.

Keywords: obesity, uncontrolled eating, affect, emotional coping, spectator sports

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INTRODUCTION

Obesity is becoming more and more prevalent in the United States (van Strien, 2018). Legislators and health professionals have repeatedly looked for possible means to combat obesity given the serious impact that obesity has on individuals' health (Vainik et al., 2019). In recent years, scholars have made significance advances in their attempt to better understand underlying elements that must be tackled to reduce the harmful consequences associated with obesity (Sharpe et al., 2008). Notably for the scope of this study, research in the field of consumer behavior and food studies has suggested that individuals' eating behavior is largely affected by their emotions (van Strien, 2018; Wiedemann et al., 2018; Low et al., 2021). That is, it has been increasingly suggested that emotional eating (caused in response to affective cues) contributes to uncontrolled eating, overeating, and obesity (Nicholls et al., 2015; van Strien, 2018; Vainik et al., 2019).

Emotional eating generally refers to the tendency to eat in response to affective states (Arnow et al., 1995; Ferrell et al., 2020; Barnhart et al., 2021). The evidence of affective states as an antecedent to emotional eating has been firmly established (Barnhart et al., 2020). Nonetheless, recent research (e.g., Altheimer and Urry, 2019; Barnhart et al., 2021) has called attention to

the suggestion that existing studies on emotional eating have excessively relied on the assumption that negative emotions (rather than positive ones) inherently induce food intake. This conventional belief is rooted in the escape awareness principle of eating.[1] As such, the general assumption is that emotional consumers are often involved in this habitual and compulsive consumption to deal with unfavorable emotions (Macht, 1999). This presumption, however, has been counter-argued by the notion that positive emotions have also the potential to trigger emotional eating (e.g., Bongers et al., 2013; van Strien, 2018; Altheimer and Urry, 2019).

For example, recent evidence indicates that food craving[2] can be understood as a learned behavior shaped through cumulative emotional coping experiences (Altheimer and Urry, 2019). That is, individuals often crave food intake under situations that evoke particular emotions because they have associated emotions with eating in the past as a means to address situation-dependent emotional responses (Nath et al., 2020; Low et al., 2021). To illustrate, sport fans often react emotionally to the performance of athletes/teams they support while also frequently conducting an emotional assessment of events as they watch a game (Cornil and Chandon, 2013). Specific game situations may then activate spectators' intensive emotional experiences, potentially contributing to and shaping their eating tendencies. For example, the game situation of close losses may cause fans to experience feelings of sadness or anger and to undoubtedly activate the coping process of outcome-desire conflict to deal with the loss of their favored team (Geniole et al., 2017). On the other hand, the game situation of decisive victories is likely to contribute to fans' feelings of happiness as well as activate their coping experiences of outcome-desire fulfillment given that, in this scenario, fans' goals are achieved, and the outcomes are pleasurable (Mehta et al., 2015).

Fans may then crave food intake to alleviate their negative feelings and shift attention away from disappointing situations (i.e., the escape awareness principle of sadness; Macht, 1999), to fuel their bodily and psychic energy (i.e., the "food as fuel" principle of anger; Cornil et al., 2020), or to augment their pleasurable feelings (i.e., the hedonic eating principle of happiness; Salerno et al., 2014). In the meantime, the nuanced game situation of close losses is likely to also concurrently evoke feelings of hope (in addition to negative feelings such as anger); that is, the fans of that team may remain hopeful and pursue positive outcomes in the future, presumably resulting in aversive effects on their eating habits (i.e., the self-regulation principle of hope; Reynolds and McCrea, 2017; Stautz et al., 2018).

As such, game situations-specific emotions are likely to interact with the way spectators have learned to associate particular emotions with eating in the past, affecting the dynamics that determine their food consumption. Based on this understanding, the current study aims to examine the effects of situation-dependent spectator emotions on food craving in conjunction with previously established associations between emotions and eating.

[1]Given that food intake functions to narrow down human's cognitive attention to immediate and pleasurable objectives (i.e., food), food craving under stressful circumstances is considered to be part of a fundamental aspect of human nature that seeks to reduce the consumer's psychophysiological burden (Okumus and Ozturk, 2021).

[2]Food craving is defined as "an intense desire to consume a specific food" (Rodriguez-Martin and Meule, 2015, p. 1).

THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

Emotional Coping and Food Craving

Emotion theorists have suggested that emotions are discrete, with each type of discrete emotions involving subjective experiences of psychophysiological changes that result in unique behavioral reaction patterns (Macht, 1999). For example, sadness is a type of negative affect that largely induces a sense of loss, helplessness, and disappointment (Salerno et al., 2014); therefore, an overreaching adaptive response of sadness is self-verification (such as seeking out social acceptance and self-promotion; Macht, 1999). On the other hand, happiness signals success and achievement (Bongers et al., 2013), which is why happy people tend to be perceived as being more socially attractive (Tanzer and Weyandt, 2019). As a result, happy people often seek to continue feeling the emotion of happiness and even desire to augment the pleasurable feelings they are currently experiencing in their happy state (Bongers et al., 2013).

The emotional coping account of eating (e.g., Okumus and Ozturk, 2021) asserts that emotions play a central role in regulating food intake because eating is a product of a series of coping processes that allow humans to control fluctuating mood states. According to the sequential processes of emotional coping (Cornil et al., 2020), individuals often appraise the outcomes of an event by comparing them to a desired state of emotional experiences. As a result of the outcome-desire appraisal process, these individuals experience either positively or negatively valenced affective states (Bagozzi, 1992). Certain behavioral actions, such as eating, are then adapted and implemented as coping responses corresponding to the aroused affective states (Salerno et al., 2014). For example, in response to outcome-desire conflicts/disparities or goal failures (i.e., situations that evoke negative emotions such as sadness and anger), individuals often crave sweet and savory foods to direct their temporal affective states toward a desired outcome. Moreover, research suggests that food intake is generally an accessible option to shift one's attention away from negative emotions-evoking events (Reynolds and McCrea, 2017; Barnhart et al., 2020).

Based on this background knowledge, emotion theorists (e.g., Bagozzi, 1992; Winterich and Haws, 2011) have further illustrated these sequential processes by identifying the four types of emotional coping: (1) outcome-desire conflict, (2) outcome-desire avoidance, (3) outcome-desire fulfillment, and (4) outcome-desire pursuit. In the context of spectator sports, the unscripted performance and outcomes of a sport event lend themselves to an evolving emotional experience (Campo et al., 2019). Fans' emotions are then arguably largely influenced by the final outcome of a game as well as the dynamics of a games' processes and various events that transpire throughout a game (Mehta et al., 2015). As such, fans' emotional coping

responses correspond to the specific game situations of the team/athlete fans support when they are in the role of spectators. In addition, appraisal theories in psychology suggest that emotions and emotional coping responses arise following individuals' evaluation and interpretation of certain events (Salerno et al., 2014; Cornil et al., 2020). The following sections delineate how the four types of emotional coping correspond to particular game situations in the context of spectator sports.

Outcome-Desire Conflict

Outcome-desire conflicts happen when people fail to accomplish objectives or experience unfavorable situations (Bagozzi, 1992); therefore, this type of appraisal is likely to induce negatively valenced emotions such as anger and sadness (Tiedens, 2001). The primary coping response to outcome-desire conflicts is seeking to reduce harm (Bagozzi, 1992). Studies on emotional coping (e.g., Mikulincer and Shaver, 2019) suggest that an increase in anger and sadness triggers emotional eating in an attempt to reduce negative emotions by providing a temporary distraction or sense of comfort (Overall et al., 2015).

In the context of spectator sports, the game situations of close and decisive losses are likely to induce spectators' appraisals of outcome-desire conflict. Research shows that, generally, both types of discrete emotions – anger and sadness – are similarly triggered by experiencing loss, failure, and defeat (Barnhart et al., 2020; Chang and Inoue, 2021); consequently, feelings of anger and sadness concurrently emerge in both game situations involving the team's loss simply because fans' favored team was defeated and unsuccessful. However, anger often arises when goals are thwarted but remain potentially attainable (e.g., a close loss), while sadness is likely to elicit a sense of loss when goals appear beyond reach (e.g., decisive loss; Weisberg et al., 2016). Regardless of the specific types of negative emotions, as the emotional coping account of eating (e.g., Salerno et al., 2014; Cornil et al., 2020) suggests, both anger and sadness are likely to induce spectators' food craving in an attempt to alleviate the negative feelings experienced by spectators.

> *Hypothesis 1A*: Sport spectators' outcome-desire conflict-induced anger positively influences their food craving.
> *Hypothesis 1B*: Sport spectators' outcome-desire conflict-induced *sadness positively* influences their food craving.

Outcome-Desire Avoidance

Both outcome-desire conflict and avoidance induce negatively valenced emotions on their own. Outcome-desire avoidances, however, differ from outcome-desire conflicts in regard to temporal focus (i.e., future- vs. past- or present-focused; Winterich and Haws, 2011). With respect to outcome-desire avoidances, the appraisal is largely based on the anticipation of an unpleasant future event (rather than after the event already took place as is the case for outcome-desire conflicts; Bagozzi, 1992). Fear, worry, and anxiety are emotions that primarily arise from outcome-desire avoidances, with the coping response aiming to avoid undesirable future outcomes (Bagozzi et al., 1999). Individuals experience fear and anxiety when their surrounding situations are uncertain, cautious, and seemingly threatening (Dunn and Hoegg, 2014). Fear promotes avoidant behaviors (Madrigal and Bee, 2005); thus, individuals tend to cope with the intent to avoid the unfavorable consequence or reinterpret the potential danger or risk with outcome-desire avoidance appraisals (Mikulincer and Shaver, 2019).

Individuals often increase food consumption in their attempt to regulate negative emotions that have an avoidance motivational component (Macht, 1999). The escape awareness principle included in the emotional coping account (Reynolds and McCrea, 2017; Barnhart et al., 2020) suggests that people overeat in response to negative emotions resulting from a desire to escape or stay away from an unpleasant stimulus. Thus, eating becomes a tool to avoid negative thoughts and emotions. In the context of spectator sports, fans may perceive the close victories of a favored team as a situation where the winning position is insecure, susceptible, and illegitimate because said victories were hardly attained (Mehta et al., 2015). Consequently, fear arises due to fans' concern over the close possibility of losing; thus, in order to obtain relief from this fear, a sport spectator witnessing a close victory outcome is likely to show an increase in food intake.

> *Hypothesis 2*: Sport spectators' outcome-desire avoidance-induced *fear positively* influences their food craving.

Outcome-Desire Fulfillment

In contrast to outcome-desire conflicts and avoidances, outcome-desire fulfillment and outcome-desire pursuits both induce positively valenced emotions (Bagozzi, 1992). Outcome-desire fulfillment occurs when an individual accomplishes objectives and experiences favorable situations (Bagozzi et al., 1999). The main emotion that arises with this appraisal type is happiness (Tanzer and Weyandt, 2019). Outcome-desire fulfillment transpires when an individual accomplishes objectives, experiences favorable situations, or escapes from unfavorable situations, thus invoking happiness (Bongers et al., 2013). When experiencing happiness, individuals cope with the intent to maintain, increase, or share the outcome (Bagozzi et al., 1999).

With close and decisive victory situations for a favored team in the context of spectator sports, fans are likely to experience happiness simply because their favored team won (Chang and Inoue, 2021). While the majority of research developed based on the emotional coping account of eating has highlighted food intake as a mechanism to relieve unfavorable emotions, research has shown that favorable affect can also result in increased emotional eating (Cardi et al., 2015). For example, studies on hedonic eating (e.g., Bongers et al., 2013; Salerno et al., 2014) suggest that happy consumers are likely to show a strong desire for food intake in an attempt to sustain and augment their positive feelings. Accordingly, it is expected that sport spectators experiencing outcome-desire fulfillments due to their favored team's victory will turn to eating as a means to celebrate their victory as well as further strengthen their current happiness.

Hypothesis 3: Sport spectators' outcome-desire fulfillment-induced happiness positively influences their food craving.

Outcome-Desire Pursuit

Outcome-desire pursuits arise in expectancy of a favorable goal or outcome, which then invokes hope or hopefulness (Bagozzi, 1992). Hope is a positive emotion that arises from thinking about a future desired outcome (Tong and Jia, 2017). Though outcome-desire pursuits are similar to outcome-desire fulfillment in that both types of pursuits induce a positively valenced emotion (i.e., happiness as hypothesized in *H3*), outcome-desire pursuits differ slightly from outcome-desire fulfillment in that the former has a future temporal focus (whereas the latter focuses on the past/present; Winterich and Haws, 2011). That is, outcome-desire pursuits center future positive emotions elicited in response to an anticipated favorable event (Bagozzi et al., 1999). Hopeful individuals often remain assured that their goals can be realized (Tong and Jia, 2017), thus allowing them to cope with the intent to facilitate outcome attainment and sustain commitment toward desired future states (Gao et al., 2016). Hope has also been found to be positively associated with self-control (Tong and Jia, 2017). Individuals with future-focused hopefulness have been found to have greater self-control than individuals who rely on past-focused positive emotions (e.g., happiness; Winterich and Haws, 2011). Taken together, research shows that individuals who feel hopeful (positive emotion accompanied by an emphasis on the future) display lower levels of food consumption than when experiencing happiness or enjoyment (positive emotions accompanied by an emphasis on the past/present; Godfrey et al., 2015; Stautz et al., 2018).

In the context of spectator sports, the game situation of close losses may also induce hope (in addition to anger and sadness experienced through the outcome-desire conflicts appraisal; *H1*). Fans' perception of close losses may lead them to feel hopeful for a future positive outcome given that, in fans' minds, such disappointing outcomes were nearly prevented, and the favored team's relatively lower position becomes perceived as tentative and illegitimate (Mehta et al., 2015). Furthermore, sport spectators' future-focused feelings of hopefulness are likely to help enhance positivity attributed to (i) past memories of victories and successes, (ii) finding more important meanings (e.g., team tradition) in unfavorable circumstances, and (iii) guarding against the arousal of negative emotions in the future. As such, it is predicted that hopeful sport spectators coping with the game outcomes of close losses may not necessarily need to cope through emotional eating mechanisms; rather, feelings of hope may optimistically affect fans' self-regulation capability by associating their current consumption choices with future goal attainment, resulting in aversive effects on food craving.

Hypothesis 4: Sport spectators' outcome-desire pursuit-induced hope negatively influences their food craving.

EXPERIMENT 1

Design and Procedure

Seventy undergraduate students were recruited at a large midwestern university; a majority of the participants was Caucasian ($n = 61$, 88%) and male ($n = 50$, 72%), with an average age of 21.97 years ($SD = 1.95$). Randomly intercepted samples at university buildings who agreed to participate in this study were led to the experimental laboratory. They were randomly assigned to a basketball game played in the 2019–2020 National Basketball Association (NBA) season and then were prompted to watch the game for approximately 15 min by using the Oculus Go virtual reality device[3] provided to them on site. Immediately following the viewing task, participants were asked to respond to a survey where they rated the extent to which they experienced the emotional states of hope ("*hopeful*," "*optimistic*," and "*positive*"), anger ("*angry*," "*annoyed*," and "*irritated*"), fear ("*fearful*," "*scared*," and "*anxious*"), sadness ("*sad*," "*gloomy*," and "*blue*"), and happiness (e.g., "*happy*," "*pleased*," and "*delighted*") while watching the game, ranging from 1 = not at all to 7 = extremely (Coleman and Williams, 2013; Chang et al., 2018).

They were also asked to respond to the measure of food craving ["Indicate the extent to which you feel an urge to eat (one or more specific foods)": 1 = I have no desire to eat, 7 = I have an overwhelming urge to eat; "I am craving (one or more specific foods)": 1 = strongly disagree, 7 = strongly agree; "If I had (one or more specific foods), I could not stop eating it": 1 = strongly disagree, 7 = strongly agree; Arnow et al., 1995]. The covariate measures included NBA fanship ("I am a fan of NBA games": 1 = strongly disagree, 7 = strongly agree) and Team identification ("I identify myself as part of the team": 1 = strongly disagree, 7 = strongly agree). The last item in the survey asked participants to respond to the measure of perceived decisiveness/closeness of a game ("Overall, the game was decisive/close": 1 = decisive game, 7 = close game). In addition, as part of the survey, participants were asked to provide a brief written report about the game they viewed, including the team they supported and the final game result; in this report, they were also asked to complete a categorization task about the game they viewed ("My team had a": 1 = decisive victory, 2 = decisive loss, 3 = close victory, 4 = close loss). Upon successful completion of the experiment, they were thanked and compensated with a $10 prepaid debit card.

Results

The participants' game situations categorization task was reviewed through their open-ended responses to check for manipulations of the game situations. Specifically, the section of the open-ended responses was inspected where participants identified the name of the team each of them supported, and the final score of the game the participant at hand was tasked with viewing; this information was then matched with each participant's response to the situation categorization task. The results showed no violated matches.

As a supplement, after controlling for the two covariates, the ANCOVA results revealed significant differences between

[3]https://www.oculus.com

the two conditions: close vs. decisive [$F(1, 66) = 6.83$, $p = 0.01$]; specifically, the two close games were perceived to be more competitive (i.e., closer) than the decisive ones ($M_{\text{close games}} = 4.56$ vs. $M_{\text{decisive games}} = 3.81$). The multiple items assessing hope ($\alpha = 0.92$), anger ($\alpha = 0.91$), fear ($\alpha = 0.82$), sadness ($\alpha = 0.92$), happiness ($\alpha = 0.95$), and food craving ($\alpha = 0.87$) were averaged to form a composite variable for each construct, respectively.

The ANCOVA results revealed a series of dynamics that have significant main effects on the five different types of discrete emotions. Specifically, an inspection of the least-squares adjusted means (LSM) for each discrete emotion indicated the four different game situations had significant main effects on happiness [$F(3, 64) = 3.93$, $p = 0.01$], anger [$F(3, 64) = 5.55$, $p = 0.002$], and hope [$F(3, 64) = 3.99$, $p = 0.01$]; on the other hand, sadness and fear were not significantly different across the four different game situations. In terms of the outcome-desire conflicts assumption, anger was the most blatant emotion category in the close loss condition. Furthermore, a regression analysis revealed that feelings of anger evoked in both game conditions, close loss ($\beta = 0.62$, $SE = 0.27$, $p = 0.002$) and decisive loss ($\beta = 0.47$, $SE = 0.18$, $p = 0.02$), significantly and positively influenced food craving. The results supported *H1A*.

In addition to anger, close losses condition led to the highest scores in levels of hope; feelings of hope in this condition significantly and negatively affected food craving ($\beta = -0.39$, $SE = 0.29$, $p = 0.04$). Accordingly, the results support the assumption that sport spectators' outcome-desire pursuit-induced hope negatively influences their food craving (*H4*). With respect to outcome-desire fulfillments, decisive victories resulted in the happiest state among spectators. Both decisive victories ($\beta = 0.84$, $SE = 0.28$, $p = 0.01$) and close victories ($\beta = 0.29$, SE = 0.20, $p = 0.04$) exerted significantly positive influences of happiness on food craving, thus supporting *H3*. Both feelings of sadness and fear revealed non-significant effects on food craving in all of the four game situations, rejecting *H1B* and *H2* (**Figure 1** and **Table 1**).

Discussion

Experiment 1 tested causal influences that game situation-dependent discrete emotions exert on sport spectators' food craving by applying the four types of emotional coping. In summary, the results supported the emotional coping processes of outcome-desire conflict (anger), fulfillment (happiness), and pursuit (hope) in the given context; however, the results did not support the emotional coping processes of outcome-desire conflict (sadness) and avoidance (fear). The present results, therefore, suggest that anger has a stronger influence on emotional eating and food craving than other types of negative emotions, such as sadness and fear. One compelling account of the positive association between negative emotions and emotional eating is the escape awareness theory of emotions. Quite simply, the escape awareness theory (e.g., Macht, 1999; Barnhart et al., 2020) asserts that under stressful situations eliciting unfavorable feelings, individuals often desire to eat as a means to shift their attention away from negative emotions-eliciting stimuli (i.e., cognitive narrowing; Barnhart et al., 2020). That is, food intake functions to mask individuals' immediate and negative feelings of irritation, anxiety, and sadness (Reynolds and McCrea, 2017). However, given the results, the escape awareness is not well supported in the context of spectator sports.

Alternatively, the "food as fuel" mechanism is supported by the results. Scholars in consumer psychology and behavioral science (e.g., Cornil et al., 2020) have recently suggested that consumers tend to perceive food as an energy source and fuel for the body as well as the mind. In spite of not knowing the specific nutritional and caloric information of a food product, food (even unhealthy and high-caloric food) is generally perceived to help boost bodily and psychic energy (Bongers et al., 2013). The "food craving as fuel" phenomenon is, thus, prominent, especially when performance-related goals are activated (Cornil et al., 2020). In this regard, the contextual aspect of spectatorship sports (i.e., athletic performance-related) and the feelings of anger (evoked though experiencing close and suspenseful defeat from others) are likely to largely activate the "food as fuel" mindset as well as emotional eating. In sum, the "food as fuel" mechanism better accounts for sport fans' emotional eating than the escape awareness account (i.e., shifting their attention away from negative emotions-eliciting stimuli; cognitive narrowing in the situations of sadness and fear).

While the majority of emotional eating research has largely focused on negative emotions, it has been increasingly suggested that positive emotions (such as joy and excitement) have the potential to trigger emotional eating (Barnhart et al., 2020). For example, research suggests that emotional eating triggered by positive emotions happens with the same frequency as emotional eating triggered by negative emotions (Bongers et al., 2013; Vainik et al., 2019). The reasoning behind this theory is that the feeling of heightened pleasantness caused by eating appetizing food is the same regardless of individuals' prior emotional valence (Salerno et al., 2014; Wiedemann et al., 2018). In brief, these studies all point to increased food consumption as a product of experiencing positive emotions. In line with these recent findings, the results of Experiment 1 revealed that happiness evoked through experiencing decisive victories induced food craving.

The results revealed that the feelings of hope are not associated with emotional eating; the close loss condition even resulted in hope having aversive effects on food craving. Although there is lack of theoretical knowledge behind this relationship, the functionalist perspective of emotions may account for the negative consequences of hope on emotional eating. Existing studies (e.g., Griskevicius and Kenrick, 2013; Luong et al., 2016) suggest that negative emotions (e.g., anger) often facilitate the active use of working memory, resulting in ego depletion and low self-control; on the other hand, certain types of positive emotions (e.g., hope) help preserve individuals' working memory capacity as well as their cognitive control. That is, working memory is a memory facility containing important information in a short term (Ferrell et al., 2020); when having to face a challenging situation (e.g., close loss in spectatorship sports), individuals with higher working memory capacity have been found to be more likely to effectively manage situations-evoking emotions (i.e., high self-control; Stautz et al., 2018). Furthermore, in their meta-analytic reviews, Moher et al. (2009) found that

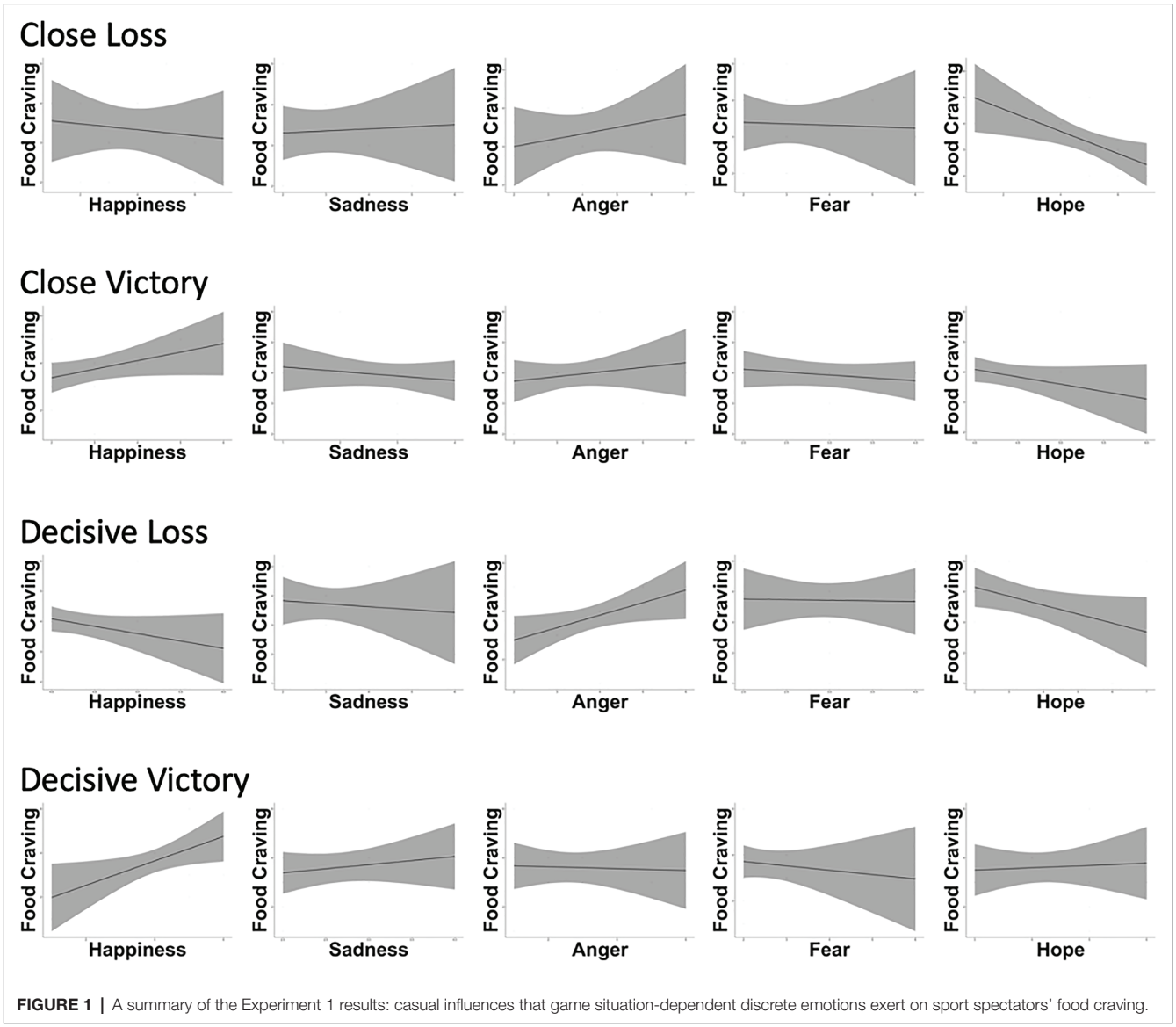

FIGURE 1 | A summary of the Experiment 1 results: casual influences that game situation-dependent discrete emotions exert on sport spectators' food craving.

low self-control often results in increased consumption of alcohol and tobacco as well as uncontrolled eating. Gheller et al. (2019) examined the causal influences of video game playing (VGP) on emotions, appetite, and food intake. They found that negative emotions evoked after VGP positively influenced food intake and subjective appetite; on the other hand, participants who felt positive emotions after VGP desired to eat less, demonstrating high self-control and the ability to resist palatable foods.

Despite such interesting and important implications, several limitations should be addressed. First, individual characteristics might have played a role on the relationships examined. In particular, recent research on food psychology (Altheimer and Urry, 2019) suggests the conjunctional role of previous association between emotion and eating; that is, eating triggered by emotions may require a condition in which individuals have associated emotions with food intake in the past in a given context. For example, in the context of spectator sports, past memories of food consumption while watching a game may largely influence fans' eating behaviors and food craving. Second, Experiment 1 utilized virtual reality technology as a means to mimic real-life spectating experiences by augmenting fans' emotional experiences and intensity. Although virtual reality spectatorship is becoming an emerging trend in sport consumption, a criticism of the study could be that the devices associated with VR technology might either have excessively intensified (e.g., sound and visual effects) or suppressed (e.g., dizziness and nausea) spectators' emotions (Cowan and Ketron, 2019). Experiment 2, then, addresses these potential issues to account for the confounding effects of VR in Experiment 1. Moreover, based on the results of Experiment 1, Experiment 2 was designed to give more attention to the focal discrete emotions of happiness, anger, and hope given the two game situations of decisive victory and close loss.

TABLE 1 | Correlation coefficients, F-statistics (Sig.), and raw means (least square adjusted means; LSMs).

	1	2	3	4	5	6	7	8
1. Happiness	1.00							
2. Sadness	0.08	1.00						
3. Anger	0.32**	0.19	1.00					
4. Fear	0.12	0.30**	0.34**	1.00				
5. Hope	0.33**	−0.05	−0.08	0.03	1.00			
6. Food craving	0.39***	0.15	0.46***	0.17	−0.26*	1.00		
7. Team ID	0.19	−0.04	0.32**	0.13	0.28*	0.19	1.00	
8. NBA Fanship	0.15	−0.01	0.36**	−0.02	−0.04	0.11	0.24*	1.00
	Happiness	Sadness	Anger	Fear	Hope	Food Craving		
Game situations	3.93* (0.01)	0.59 (0.63)	5.55** (0.002)	1.27 (0.29)	3.99* (0.01)	0.92 (0.44)		
NBA Fanship	0.91 (0.34)	0.04 (0.84)	4.66* (0.03)	1.44 (0.23)	1.48 (0.23)	1.09 (0.29)		
Team ID	1.03 (0.32)	0.05 (0.83)	8.58** (0.005)	0.72 (0.40)	4.32* (0.04)	2.39 (0.13)		
Decisive Victory	3.94 (4.11)[a]	2.67 (2.64)	2.67 (3.04)	2.56 (2.47)	4.17 (4.11)	4.11 (4.31)		
Decisive Loss	2.94 (2.99)	3.06 (3.05)	3.78 (3.91)	2.94 (2.97)	3.44 (3.53)	3.56 (3.63)		
Close Victory	4.29 (4.09)	2.71 (2.74)	3.41 (2.99)	2.94 (2.98)	4.29 (4.26)	4.06 (3.83)		
Close Loss	3.71 (3.66)	2.94 (2.95)	4.12 (4.01)[b]	3.12 (3.14)	4.82 (4.83)[c]	3.71 (3.65)		

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
[a]*Significantly greater than Decisive Loss.*
[b]*Significantly greater than Close Victory.*
[c]*Significantly greater than Decisive Loss.*

EXPERIMENT 2

The conditioning framework (Greenwald et al., 2009) accounts for the effects of previous association between emotion and eating. That is, food consumption as an unconditioned stimulus (UCS) is likely to induce an unconditioned response (UCR) such as mood recovery and emotional equilibrium (Hsu and Forestell, 2021); over time, particular discrete emotions (e.g., anger) may have systematically paired with food consumption, engendering emotions to become conditioned stimuli (CS), inducing such conditioned responses as eating (CR; Vainik et al., 2019). According to relevant scholarship in the field, many emotional eaters are unable to distinguish between food craving inflicted by emotions and food craving inflicted by physiological hunger due to their cumulative conditioning experiences (Altheimer and Urry, 2019). Similarly, in the context of spectator sports, past memories of food consumption while watching a game have been found to largely influence fans' eating behaviors (Cornil and Chandon, 2013). For example, angry fans may attempt to alleviate their feelings of stress with food and beverages while watching suspenseful or unsuccessful games; happy fans, on the other hand, may learn which behaviors induce a positive feeling, such as increased food intake, to celebrate victories or to sustain/augment positive feelings. The learning (or conditioning) processes of mood recovery (or augmentation) through food consumption are likely to have then reinforced fans' tendencies toward emotional eating. Accordingly, the following hypothesis was formulated.

> *Hypothesis 5*: Spectators' previous association between emotions and eating moderates the relationship between their game situations-evoked emotions and food craving; that is, spectators who have previous associations between emotions and eating are more likely to desire to cope with game situations-evoked emotions through food consumption.

Design and Procedure

One hundred and five undergraduate and graduate students were recruited from a large US university, 87 of which were male (83%). The average age of the participants was 23.14 years (SD = 2.45), and a majority of the participants was Caucasian ($n = 65$, 62%). The invitation for the online experiment was distributed through instructors at the university, and participants received course credits upon successful completion of the experiment. Pre-screening qualifications included fans' reported favorability toward the target NBA team to some degree (from mere awareness to fanatical). As proxy measures, this study utilized previous association between emotions and eating ("I often use food to cope with my emotions": 1 = no, 2 = yes; "I usually eat more when I'm happy": 1 = strongly disagree, 7 = strongly agree; "I tend to eat more when I am upset": 1 = strongly disagree, 7 = strongly agree). Then, they were randomly allocated to one of the two game situations, including decisive victory [Timberwolves (winner, 132 pts.) vs. Kings (loser, 105 pts.)] and close loss [Timberwolves (loser, 106 pts.) vs. Nuggets (winner, 107 pts.)] of the team. They were asked to watch a summary of the randomly allocated game extracted from YouTube.com for approximately 15–20 min through their own electronic viewing devices (such as laptops or smartphones). The remaining procedures were identical to those in Experiment 1.

Results

The participants were self-categorized into low vs. high (in relation to their previous association between emotions and eating) based on a binary measure (no vs. yes). The validity of the self-selected categorization was checked by using the two emotional eating scale items (i.e., happy and angry eating). The ANOVA results revealed significant differences between

the two conditions; participants placed in the high previous association category showed significantly greater levels of emotional eating [$F(1, 103) = 10.99$, $p = 0.001$. $M_{low} = 3.29$, $M_{high} = 4.16$ for happy eating; $F(1, 103) = 5.39$, $p = 0.02$. $M_{low} = 3.94$, $M_{high} = 4.46$ for angry eating]. Game situations manipulations were checked using the same methodology used in Experiment 1, with the results revealing no violated matches. The ANOVA results further revealed significant differences between the close vs. decisive conditions; the close game was perceived to be more competitive (i.e., closer) compared to the decisive game [$F(1, 103) = 8.29$, $p = 0.005$; $M_{close\ game} = 4.59$ vs. $M_{decisive\ game} = 3.92$].

The ANCOVA results revealed significant effects the interactions between game situations and previous association exerted on food craving [$F(1, 99) = 4.32$, $p = 0.04$]. Meanwhile, game situations had significant main effects on anger [$F(1, 101) = 16.47$, $p < 0.001$] and food craving [$F(1, 101) = 7.68$, $p = 0.007$]; specifically, the close loss condition exerted more intensive feelings of anger ($M_{close\ loss} = 4.14$ vs. $M_{decisive\ victory} = 3.32$, $p < 0.001$) as well as greater tendencies toward food craving ($M_{close\ loss} = 4.57$ vs. $M_{decisive\ victory} = 3.98$, $p < 0.001$) compared to the scores in the decisive victories condition. The results also revealed previous association's significant main effects on anger [$F(1, 101) = 17.73$, $p < 0.001$], hope ($F(1, 101) = 8.58$, $p = 0.004$), and food craving [$F(1, 101) = 10.18$, $p = 0.002$]. That is, the higher levels of sport fans' previous association, the greater the fans experience feeling anger ($M_{close\ loss} = 4.16$ vs. $M_{decisive\ victory} = 3.29$, $p < 0.001$) and hope ($M_{close\ loss} = 3.18$ vs. $M_{decisive\ victory} = 2.67$, $p = 0.001$) as well as the more they desire to eat ($M_{close\ loss} = 4.02$ vs. $M_{decisive\ victory} = 4.50$, $p = 0.03$). Furthermore, in individuals with high levels of previous associations between emotions and eating, both feelings of happiness ($\beta = 0.48$, $SE = 0.27$, $p = 0.03$) and anger ($\beta = 0.31$, $SE = 0.11$, $p = 0.003$) significantly and positively influenced food craving. On the other hand, for individuals with low levels of previous associations between emotions and eating, happiness ($\beta = 0.29$, $SE = 0.21$, $p = 0.001$) was a sole predictor of food craving. These results support the assumption that spectators who have previous associations are more likely to desire to cope with game situations-evoked emotions through food consumption (**Figure 2** and **Table 2**).

GENERAL DISCUSSION

Theoretical Implications

Past emotion research on eating behavior has revealed considerable inconsistencies across its key findings (Barnhart et al., 2020). As discussed in Introduction, such inconsistencies likely stem from the tendency in most emotional eating studies to predominantly focus on negative emotions, an approach based on the widespread assumption that, given individuals' inherent desire to avoid harm, negative emotions automatically induce eating (Macht, 1999). Recent studies (e.g., Altheimer and Urry, 2019; Nath et al., 2020), however, have suggested that individuals' emotional eating might be a behavioral tendency learned from their cumulative socialization process rather than being an inherent characteristic. These studies have further gone on to suggest that some positive emotions could ironically induce food craving and emotional eating behavior (e.g., hedonic and happy eating phenomena; Bongers et al., 2013; Salerno et al., 2014). In line with these keys, more up-to-date findings and in response to the call for more empirical examinations of such recent inquires (Altheimer and Urry, 2019), attempts were made to challenge the prevalent account of emotional eating by exploring the effects of situations-dependent emotions on food craving in the context of spectator sports.

Experiment 2 tested the moderating effects of spectators' previous association between emotions and eating behavior. The results revealed that spectators who have a previous association are more likely to desire to turn to emotional eating to cope with game situations-evoked feelings. In addition, for spectators who have a previous association, anger was significantly associated with food craving. Research suggests that individuals often desire to eat to help boost bodily and psychic energy as a result of activated performance-related goals (i.e., the "food as fuel" phenomena; Cornil et al., 2020). Research suggests that emotional eating is likely to be more prominent when individuals have associated specific affect with food intake in the past (Wiedemann et al., 2018); in particular, negative emotions, such as anger, are likely to trigger emotional eating as a means to satisfy individuals' psychological hunger (regardless of their physiological and nutritional emptiness; Vainik et al., 2019). For example, based on a meta-analysis exploring the influence of emotions on food consumption (Godfrey et al., 2015), anger was found to be a prominent antecedent of binge eating and obesity.

It is worth noting that happiness was positively associated with both types of spectators, those who have and those who have not had a relationship between affect and food consumption in the past. The knowledge regarding associations between positive emotions and emotional eating in the existing literature presumably remains limited due to the continued neglect of positive emotions as a risk factor of emotional eating in both therapeutic and real-world settings. For example, Nicholls et al. (2015) suggested that binge eating as a product of positive emotions (e.g., happiness) seldom results in problematic consequences (such as night eating syndrome, severe obesity, and harmed life satisfaction). Barnhart et al. (2021) also argued that humans tend to overeat without emotional triggers because evolution encourages individuals to persist even in times of acute food shortages, leading people to inherently desire to overeat (when food is available) as an adaptive response. According to this line of reasoning, due to the presumed genetic pressure to overeat, it is probable to observe emotional eating even in the absence of individuals' previous association between affective states and eating behaviors.

Similarly, the functionalist perspectives of happiness are likely to account for the positive association of happiness with food craving (Bongers et al., 2013). The functionalist perspective is a theoretical framework of emotions developed based on the assumption that emotions facilitate the unconscious pursuit of certain desire (Angit et al., 2011). In particular, functionalists suggest that the emotions of happiness are productive to the pursuit of self-improvement, which, in turn, encourages impulsive,

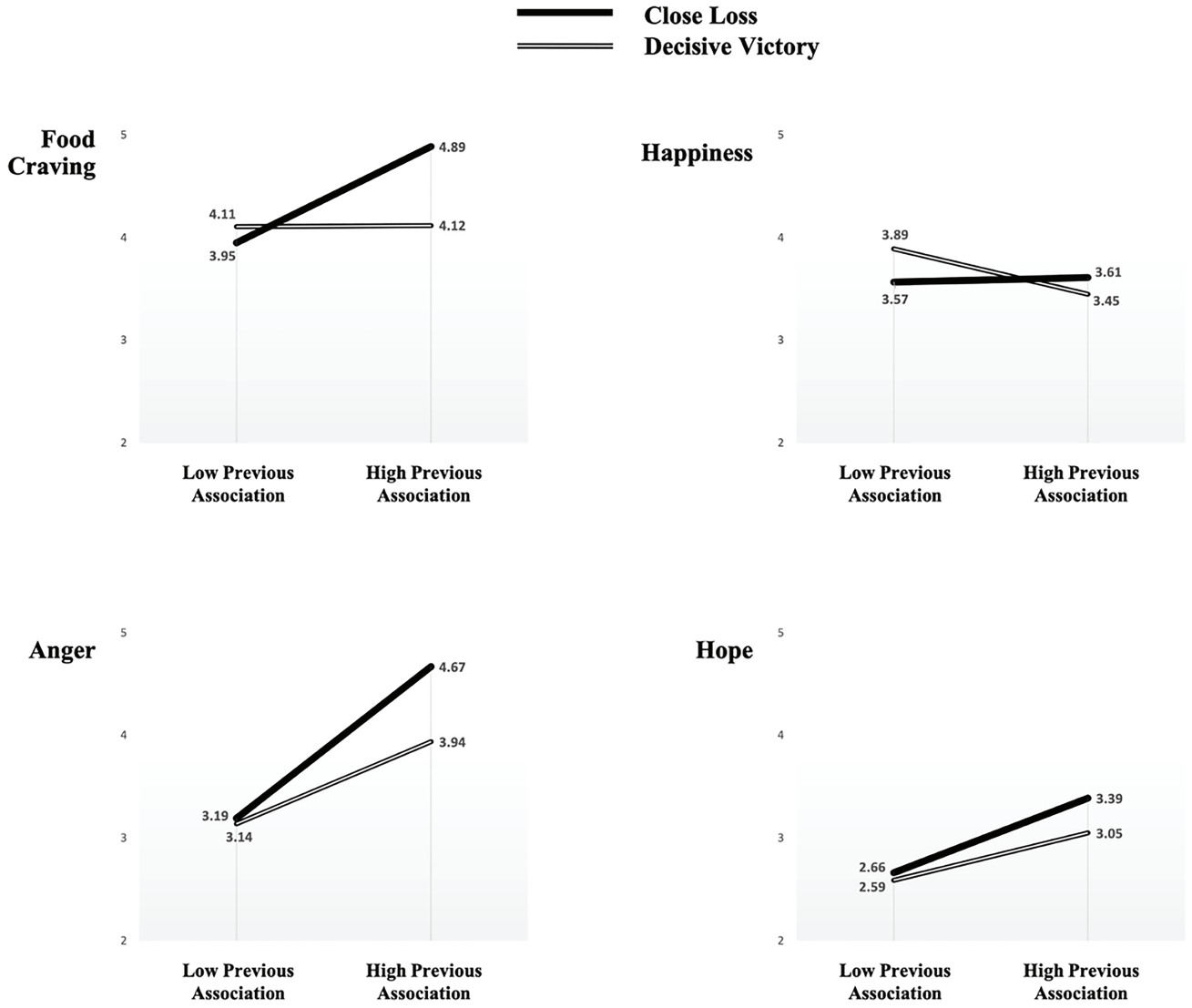

FIGURE 2 | A summary of the 2 (previous association between and eating: low vs. high) × (game situation: close loss vs. decisive victory) results in Experiment 2.

indulgent, and hedonic consumption (Tanzer and Weyandt, 2019). For example, research has shown that the tendency toward emotional eating in response to feelings of happiness was prominent for female adults seeking weight loss (Bongers et al., 2013); the authors of this particular study suggested that happiness facilitates short-term and unconscious craving for hedonistic experiences, and this affective hunger often overrides individuals' long-term goals (such as weight control, body fit, and disease prevention). The universal influences of happiness are then accounted by cultural, social, and contextual elements as eating is often associated with the celebration of events in spectator sports (i.e., the victorious and successful performances of supporting teams; Decrop and Derbaix, 2010).

The results of Experiment 2 are paralleled with the results of Experiment 1 given the non-significant associations between hope and food craving for both types of spectators (those who have had and those who have not had an association between emotions and eating behavior in the past). As aforementioned, the results support the functionalist perspective of emotions on regulatory behaviors (Godfrey et al., 2015); hope helps preserve individuals' cognitive control capacity, and, thus, even in the face of a challenging situation, hopeful individuals are more likely to effectively manage situations-evoking emotions (i.e., high self-control; Stautz et al., 2018).

Practical Implications

The results provide several important implications for marketers and media managers. First, from the perspective of marketing managers, the findings offer empirical and theoretical justification for managers' propensity to utilize emotions-eliciting cues in promoting their products. For example, the Coca-Cola brand's

TABLE 2 | Correlation coefficients (low/high previous association), F-statistics (Sig.), and LSMs.

	1	2	3	4	5	6
1. Happiness	1.00					
2. Anger	–0.04/0.47***	1.00				
3. Hope	–0.01/0.11	0.16/0.34**	1.00			
4. Food craving	0.62***64***	0.01/0.54***	–0.07/0.10	1.00		
5. Team ID	0.06/0.35**	0.19/0.73***	0.18/0.28*	0.02/0.57***	1.00	
6. NBA Fanship	–0.04/0.12	0.35**/0.57***	0.16/0.22	0.23*/0.29*	0.07/0.52***	1.00
		Happiness	Anger	Hope	Food Craving	
Game situations		0.003 (0.95)	16.47*** (<0.001)	3.41 (0.07)	7.68** (0.007)	
Previous association		1.54 (0.22)	17.73*** (<0.001)	8.58** (0.004)	10.18** (0.002)	
Team ID		6.25* (0.01)	39.98*** (<0.001)	5.14* (0.03)	12.37*** (<0.001)	
NBA Fanship		0.05 (0.82)	11.37** (0.001)	0.71 (0.41)	1.08 (0.31)	
Game Situations × Previous association		0.86 (0.36)	2.42 (0.12)	0.55 (0.46)	4.32* (0.04)	
High previous	Close loss	3.61	4.67[a]	3.39[b]	4.89[c]	
sssociation	Decisive victory	3.45	3.94	3.05	4.12	
Low previous	Close loss	3.57	3.19	2.66	3.95	
association	Decisive victory	3.89	3.14	2.59	4.11	

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

[a]*Significantly greater than Close Loss$_{\text{low Association}}$ and Decisive Victory$_{\text{low Association}}$.*

[b]*Significantly greater than Close Loss$_{\text{low Association}}$ and Decisive Victory$_{\text{low Association}}$.*

[c]*Significantly greater than Close Loss$_{\text{low Association}}$.*

signature slogans, such as "Open Happiness" and "Taste the Feeling" as well as its commercials highlighting customers' faces as they smile, and laugh are representative of strong, successful emotions-laden promotional strategies. Another example of a promotion built on similar high-quality strategies is the Google TV commercial that aired during the halftime segment of the Super Bowl game broadcast on February 2, 2020. Its broadcast during the middle of the show was meant to evoke feelings of sadness. In the commercial, the phrase "How to not forget" is being typed into a Google search bar; the rest of the commercial centers on an elderly man's nostalgic voice as he asks Google Assistant for help to remember details about his late wife. Whether it is the laughter and smiles of the Coca-Cola promotional material or the nostalgia and melancholy evoked by the Google commercial, these strategies effectively activate viewers' emotions to forge an emotional association with their product.

Given the results of the current study, marketing managers should proactively utilize their brand's packaging and aesthetic design, slogans, and commentaries in advertisements to strategically align the marketing with particular emotions corresponding to game situations (i.e., the feelings of happiness in decisive victories and feelings of anger in close losses). As such, the current study helps managers develop context-dependent emotional positioning strategies. For example, at the Super Bowl LIV game, the Kansas City Chiefs (Kansas City, Missouri) competed against San Francisco 49ers (Santa Clara, California), and the Kansas City Chiefs emerged victorious. In this scenario, brand managers should then promote differently designed products across the two cities to trigger and boost their target markets' emotional eating tendencies. Research in the field of design literature (e.g., Clark et al., 2021) suggests that yellowish color, decorative fonts, and curved shapes are more associated with feelings of happiness, while reddish color, hand script fonts, and angular shapes are more associated with feelings of anger.

Second, research suggests that individuals who have previous associations between emotions and eating are likely to show chronic tendencies of emotional eating (Altheimer and Urry, 2019), resulting in health risks such as severe obesity, diabetes, and heart disease (Nath et al., 2020). Media managers and legislators should then pay a closer attention to emotionally positioned advertising campaigns given that among the four types of discrete emotions examined, anger (experienced through close and decisive losses) has the greatest potential to evoke emotional eating. As an example of what this kind of campaign may look like in the real world, the "Like a Girl'" campaign initiated by the company Always was designed to evoke feelings of anger as a means to attract attention and proactively encourage women to share their stories; in fact, the expression of "Like a Girl" is often used in teasing, mocking, or insult. However, even in cases where the idea behind a marketing campaign is informative and well intentioned, if the message is accompanied by the two game situations, anger-evoking campaign messages may translate into consumers' emotional eating. Consequently, rather than becoming associated with the "Always" commercial, it would be more appropriate to be associated with Shopify's "Autonomy" campaign highlighting the emotion of hope (the ad features motivational phrases such as "Start your journey" and "Get more out of life"). This recommendation is, therefore, for broadcast and media managers to strategically program their advertising and campaign schedules so that they align with the values of public health.

Limitations and Future Suggestions

Caveats and recommendations should be addressed for future scholarship. First, and perhaps most importantly, the results of the current studies are limited given its exclusive reliance on self-reported measures of emotions, food consumption, and retrospective previous associations. For example, although the measure of previous association between emotions and eating might inherently rely on the retrospective nature of the behavior

at hand, participants' responses assessed *via* self-reported measures might have contained memory and recall bias, potentially compounding the results. Future studies then should extend the current experiments by employing alternative measures, such as the implicit association test (Greenwald et al., 2009; Chang et al., 2018), to explore individuals' unconscious association between affect and food consumption in addition to utilizing other types of discrete emotions than those centered in this study.

Second, the strength of both sadness and fear was relatively and reasonably weak in Experiment 1 (compared to other types of emotions), conceivably rendering the researcher unable to produce fans' food craving tendencies. Furthermore, for the sake of simplicity, Experiment 2 highlighted the three types of emotions (including happiness, anger, and hope) given the two game situations of decisive victories and close losses. The emotions of happiness and anger were designed in the current studies considering their significant explanatory power in accounting for food consumption evidenced in existing research (e.g., Macht, 1999); meanwhile, hope was selected because this emotion category is likely the most representative of regulatory and self-managed behaviors (Stautz et al., 2018). Nevertheless, there could be other types of emotions that would better explain individuals' food craving behavior in the given context. In fact, recent studies have started to suggest that pride (vs. shame) is highly associated with feelings of hope in the context of spectator sports (Decrop and Derbaix, 2010; Chang, 2019), potentially causing aversive effects on food craving and obesity. Last, given the confined scope of this research (i.e., sports consumers, spectators, and fans), it would be limited to generalize the results to other contexts. Taken together, future studies may replicate the current studies using different emotion types along with their dynamic degrees of emotion intensity in a variety of emotions-laden consumption contexts (e.g., video gaming, movie and television viewership, and tourism) to enhance the generalizability of the findings.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material; further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of Minnesota. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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frontiers in Psychology

BRIEF RESEARCH REPORT
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The Influence of Facial Asymmetry on Genuineness Judgment

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This study investigates how asymmetry, expressed emotion, and sex of the expresser impact the perception of emotional facial expressions (EFEs) in terms of perceived genuineness. Thirty-five undergraduate women completed a task using chimeric stimuli with artificial human faces. They were required to judge whether the expressed emotion was genuinely felt. The results revealed that (a) symmetrical faces are judged as more genuine than asymmetrical faces and (b) EFEs' decoding is modulated by complex interplays between emotion and sex of the expresser.

Keywords: facial asymmetry, facial expression, emotional facial expression, genuineness, decoding

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INTRODUCTION

The face and its various emotional expressions provide many information about the expresser's state and characteristics that are important for social interactions (Ross et al., 2007). Among other, facial expressions constitute a critical non-verbal component to judge whether an expressed emotion is genuinely felt or posed in the absence of the corresponding emotional state (Dawel et al., 2017). However, an event-elicited and genuinely expressed emotion does not guarantee that the Emotional Facial Expression (EFE) will be judged as genuine by the perceiver (Dawel et al., 2017). Zloteanu and Krumhuber (2021, p.4) referred to a "demeanor bias": although the emotion and intent are genuinely expressed, other factors can influence the perceiver's judgment in the sense of fakeness. The determinants of perceived genuineness, however, are still relatively unexplored in the literature.

Genuineness judgment would mostly rely on appearance-based cues rather than explicit knowledge about the expresser's behavior or personality (Rudoy and Paller, 2009). Some aspects of EFEs are thus directly relevant for genuineness processing. A likely candidate is the symmetry of the EFE. EFE asymmetry refers to one side of the face expressing a different emotion than the other side (Ekman and Friesen, 1975; Ekman et al., 1990). The most common example is the smirk. In contrast to the symmetrical smile suggesting a real enjoyment, the smirk suggests either the presence of a withheld and more genuine emotional state or an "experience of two competing primary emotions during a social situation" (Ross et al., 2013, p. 253). Facial asymmetry can also appear because the two sides of the face express the same emotion but at different intensities. For instance, electromyography studies showed that left hemiface muscles are more expressive than right muscles, whether the methodology used posed or spontaneous, positive or negative EFEs (for a review, see Powell and Schirillo, 2009). However, although EFEs in natural settings are predominantly asymmetrical (for a review, see Borod

et al., 1997), this issue has received poor empirical consideration and the research has mainly focused on facial asymmetry during emotional expression rather than visual perception. Previous research (e.g., Rhodes, 2006; Sofer et al., 2014) suggests that the distance from the subjective prototype of a specific social category is an indicator of fakeness. As prototypes are derived from the "mathematic average trait values" for a category, EFEs prototypes are likely to be symmetrical. Symmetrical EFEs would therefore have a genuineness advantage over asymmetric EFEs because of a subjective experience of prototypically.

The nature of the expressed emotion might also be an important source of information for genuineness judgment. Facial expressions can encompass multiple social emotions that are not systemically genuine (Ekman and Friesen, 1975). Indeed, social emotions are inherently characterized by display rules, resulting from an "intensification, a minimization, a neutralization, a simulation, a dissimulation, or a qualification (facial blends of emotion) of the primary emotion" (Ross et al., 2013, p.253). In this vein, some authors conceptualize the function of facial expressions as 2-fold: either reflecting a genuine emotional state or communicating signals of affect and intent (Zloteanu and Krumhuber, p.2). The "demeanor bias" (Zloteanu and Krumhuber, 2021) could therefore be fostered when the perceiver guesses the social function of the EFE. Based on the well-known expressions of smirk (i.e., an asymmetrical smile that only involves the left or right lips) or the "Non-Duchenne" smile (i.e., a false smile that only involves the lower face; Ekman et al., 1990), participants might judge a facial expression of happiness as less genuine by suspecting social desirability intent. Expression of anger or fear might rather be judged as an event-elicited facial leakage (Ekman, 1997), as they are less likely to be motivated by social desirability.

The current study investigates how asymmetry and emotional display of the expresser might affect genuineness judgment by the perceiver (operationally defined as "whether the emotional expression displayed by another person is a genuine reflection of its underlying affect"; Zloteanu and Krumhuber, 2021, p.2). We specifically predict that individuals will judge (a) symmetrical faces as more genuine than asymmetrical faces due to a subjective gap with EFEs prototypes and (b) happy faces as less genuine than angry and fearful faces due to their socially conditioned nature. Those hypotheses will be investigated using male and female artificial human faces, allowing for the assessment of potential gender influences during genuineness judgment. Moreover, hemispheric lateralization during EFEs visual processing have been widely documented, showing that asymmetrical EFEs occurring in natural settings might be more (or less) easily processed according to the hemiface on which they appear. The right-hemisphere hypothesis has received strong empirical support (Borod et al., 1986; Christman and Hackworth, 1993; Workman et al., 2000; Asthana and Mandal, 2001; Nicholls et al., 2004; Alves et al., 2009). It states a right brain hemisphere specialization for EFEs processing regardless of the emotional valence, so that individuals would visually perceive more accurately EFEs appearing in their left visual field (Levy et al., 1983; Workman et al., 2000; Alves et al., 2009; Bear et al., 2016). Although hemispheric specialization does not constitute the focus of this study, asymmetry will be considered as a binary variable to explore the perceptual bias towards the left visual field.

MATERIALS AND METHODS

Participants

Thirty-five undergraduate volunteers in psychology were recruited from the laboratory's participant pool. Only women volunteered to be part of the project. The sample size was determined by conducting an *a priori* power analysis with G*Power [statistical test = ANOVA: repeated measures, within factors; effect size $f = 0.20$; α error probability = 0.05; power ($1-\beta$ error probability) = 0.80; correlation among repeated measures = 0.7; Faul et al., 2007]. Participants ranged from 18 to 25 of age (mean = 21.06, SD = 1.999) and were native French speakers. Their participation was voluntary and paid 10 euros.

Visual Stimuli

Visual stimuli were Caucasian artificial human faces designed with the FaceGen software (version 3.5.3). Chimeric faces (350×350 pixels) were created by splitting EFE pictures down the vertical midline and by recombining each half-face with a neutral half-face of the same identity. Artwork was used to ascertain that hair arrangements look natural. Three EFEs were used: happiness, anger, and fear, based on FaceGen parameter. As a whole, 36 visual stimuli were created: 4 (two males and two females) × 3 (happiness, anger, and fear) × 3 (symmetry, right hemiface, and left hemiface) (see examples in **Figure 1**). Stimuli are available from the authors on a simple request.

Procedure

Emotion genuineness was conceptualized in this study as continuous rather than dichotomous (for evidence supporting genuineness being continuous, see Dawel et al., 2017). Participants had to judge the genuineness of the 36 visual stimuli on a five-point Likert scale (1 = "Not at all genuine"; 5 = "Totally genuine"), without time-limit and stimuli repetition. The scale included the clear meaning of each point (e.g., 3 = "slightly genuine"). All instructions were given explicitly by the experimenter and then displayed on the computer screen. Participants were seated at 50 centimeters of a 17″ computer screen.

Procedure of this study was approved by the Ethical Committee of the Psychological Science Research Institute of the UCLouvain, and performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Before testing, participants freely signed a written informed consent to participate in a study designed to explore the visual perception of emotional displays.

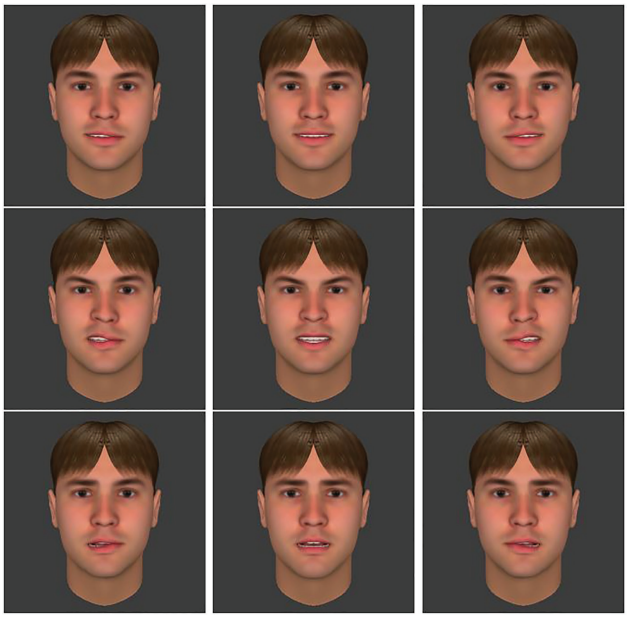

FIGURE 1 | Illustration of the three (a)symmetries (respectively left hemiface, symmetry, and right hemiface) of each emotion (respectively happiness, anger, and fear) for the young man.

RESULTS

The statistical analyses were performed using IBM SPSS Statistics software (version 25). Individual means of Likert judgments for each EFE score were submitted to repeated-measures ANOVA with (a)symmetry (symmetry, left asymmetry, and right asymmetry) × emotion (happiness, anger, and fear) × sex (male and female) of expressers as within-subject factors. In addition to the main effects, interactions between variables were also investigated to explore the potential moderating role of each variable, hence suggesting insights for future research. Significant F-tests were followed up with pairwise *t*-tests adjusted with Bonferroni correction.

As shown in **Table 1**, the analyses revealed a strong main effect of (a)symmetry, emotion, and sex. Consistent with the prototypicality hypothesis, the main effect of (a)symmetry on genuineness judgment indicated that symmetrical EFEs were judged as being more genuine than asymmetrical EFEs, $F(1.403,47.711) = 66.381$, $p < 0.001$, $\eta^2_p = 0.661$. The interaction (a)symmetry × emotion confirmed this pattern for all the three emotions, $F(4,136) = 2.455$, $p < 0.049$, $\eta^2_p = 0.67$. Moreover, *post hoc* comparisons revealed no significant differences between faces with an EFE on the right hemiface and faces with EFE on the left hemiface, except for fear. In this latter case, asymmetrical EFEs were judged as more genuine, followed by fear faces with an EFE on the left hemiface, and then by fear faces with an EFE on the right hemiface.

The main effect of emotion showed that EFEs expressing happiness and fear were perceived as more genuine than those expressing anger, $F(2,68) = 10.810$, $p < 0.001$, $\eta^2_p = 0.241$. This main effect was qualified by significant two-way interactions. The interaction (a)symmetry × emotion confirmed the main effect for symmetrical faces and faces with an EFE on the right hemiface. When the EFE is only on the left hemiface, fear did not differ significantly from happiness and anger, and happiness was the EFE judged to be the most genuine. Moreover, the interaction emotion × sex highlighted that female faces were indeed judged as more genuine when expressing fear, followed by happiness, with anger being judged the least genuine, $F(2,68) = 24.730$, $p < 0.001$, $\eta^2_p = 0.421$. In contrast, male faces were judged as the more genuine when expressing happiness. Fear and anger were judged equivalently as less genuine.

Surprisingly, the main effect of expresser's sex showed that male displays were judged as more genuine than female displays, $F(1,34) = 18.517$, $p < 0.001$, $\eta^2_p = 0.353$. However, the interaction (a)symmetry × sex showed that this judgment favoring male faces appeared only in their asymmetrical configuration as no significant differences were found when appearing with symmetrical configuration, $F(2,68) = 5.657$, $p = 0.005$, $\eta^2_p = 0.143$. Moreover, the interaction emotion × sex suggested that male faces were only judged as being more genuine than female faces for happy and angry faces. When expressing fear, female faces were significantly judged as more genuine than male faces.

DISCUSSION

In the present study, symmetrical EFEs were judged as more genuine than asymmetrical faces, with no perceptual differences between asymmetrical faces with an EFE in the left or the right visual field. Therefore, although the left visual field bias has not been demonstrated (Levy et al., 1983; Workman et al., 2000; Alves et al., 2009; Bear et al., 2016), the present study supports our hypothesis that the genuineness of a facial display is an inverse function of its subjective distance from the EFE prototype (Rhodes, 2006; Sofer et al., 2014). Indeed, prototypical facial expressions are always represented as symmetrical, although asymmetrical EFEs are more common than symmetrical expressions in everyday life (Rhodes, 2006; Alter and Oppenheimer, 2009; Sofer et al., 2014). Further, as prototypical EFEs are derived from the mathematic average of many EFE instances, their prototypes are likely to be symmetrical, lateral asymmetries compensating each other. Still, those results are preliminary and warrant future research to investigate whether symmetrical EFEs are indeed judged as more prototypical and whether prototypicality judgments correlate with genuineness judgments.

Results also showed that happy and fearful faces were judged as more genuine, which goes against the initial hypothesis opposing happiness to anger and fear. A possible explanation advocates a social advantage for EFEs encouraging prosocial intentions (Marsh et al., 2005; Dawel et al., 2017). Indeed, previous studies (e.g., Ekman and Friesen, 1975; Marsh et al., 2005, p.122) suggested that fearful EFEs promotes approach and helpful responses from the perceiver. In contrast to angry EFEs primarily perceived as aversive or threatening, fearful EFEs represent an "appeasement cue, intended to ameliorate conflict or elicit conciliatory or affiliative behavior by showing an affiliation desire or a submissive gesture"

TABLE 1 | Means and SDs for genuineness (1 = "Not at all genuine"; 5 = "Totally Genuine"), as a function of (A)Symmetry, Emotion, and Sex.

(A)Symmetry $F(1.403,47.711) = 66.381$, $p < 0.001$, $\eta^2p = 0.661$**

Symmetry	Right asymmetry	Left asymmetry
4.210 (0.541)[a]	3.183 (0.659)[b]	3.291 (0.600)[b]

Emotion $F(2,68) = 10.810$, $p < 0.001$, $\eta^2p = 0.241$**

Happiness	Anger	Fear
3.795 (0.602)[a]	3.217 (0.717)[b]	3.719 (0.699)[a]

Sex $F(1,34) = 18.517$, $p < 0.001$, $\eta^2p = 0.353$**

Female	Male
3.459 (0.502)[a]	3.695 (0.533)[b]

(A)Symmetry × Emotion $F(4,136) = 2.455$, $p < 0.049$, $\eta^2p = 0.067$*

	Happiness	Anger	Fear
Symmetry	4.343 (0.591)[a,i]	3.864 (1.044)[b,i]	4.457 (0.577)[a,i]
Right Asymmetry	3.464 (0.796)[a,ii]	2.979 (0.834)[b,ii]	3.214 (1.011)[a,ii]
Left Asymmetry	3.579 (0.740)[a,ii]	2.807 (0.868)[b,ii]	3.486 (0.874)[a,b,iii]

(A)Symmetry × Sex $F(2,68) = 5.657$, $p = 0.005$, $\eta^2p = 0.143$**

	Symmetry	Right Asymmetry	Left Asymmetry
Female	4.195 (0.567)[a,i]	3.091 (0.701)[b,i]	3.091 (0.646)[b,i]
Male	4.248 (0.604)[a,i]	3.348 (0.660)[b,ii]	3.491 (0.653)[b,ii]

Emotion × Sex $F(2,68) = 24.730$, $p < 0.001$, $\eta^2p = 0.421$**

	Happiness	Anger	Fear
Female	3.481 (0.727)[a,i]	2.991 (0.735)[b,i]	3.905 (0.715)[c,i]
Male	4.110 (0.634)[a,ii]	3.443 (0.789)[b,ii]	3.533 (0.827)[b,ii]

[a, b, c]*Indicate the (non) significant differences for horizontal lines.*
[i, ii, iii]*Indicate the (non) significant differences for vertical columns.*
**Indicates $p < 0.05$; **Indicate $p < 0.01$.*

(Marsh et al., 2005, p.122). In this perspective, happy and fearful EFEs would be presumed as more likely to be genuine because observers might be more inclined to respond to an affiliative (versus threatening) intention (Dawel et al., 2017).

Interestingly, results also revealed that male faces were perceived as more genuine by the female participants when expressing happiness and anger (but not fear). This is inconsistent with previous studies attesting to an own-gender bias (participants of the present study were only women). This bias leads individuals to better recognize EFEs when appearing in a face of their own gender (e.g., Lovén et al., 2011). In the present study, the task was not to identify the emotional nature of the EFE but its genuineness. Participants' judgment might have been influenced by the stereotype that males are more directly and less subtly expressive than females. Nevertheless, gender was investigated in this study in an exploratory way and in an all-women sample. Further evidence is required to draw strong conclusions on such a phenomenon. Especially, these stereotypes might be shared, different, or nonexistent among men.

This study also showed that female faces were judged as being more genuine when expressing fear while male faces were judged as more genuine when expressing happiness. These results are well accounted for by Becker et al. (2007) who asked participants to determine whether faces expressed anger, happiness, and fear, or no (neutral) expression. They showed that accuracy was higher when fear appeared on a female face rather than a male face. Again, these results suggest that gender stereotypes influence EFEs processing at least among women. Stereotypes would lead to cultural display rules (Ekman and Friesen, 1975) and reflect the personal and endorsed belief that men and women express emotions differently (Plant et al., 2000; Becker et al., 2007).

Limitations of the Present Study and Perspectives

Some limitations have to be acknowledged. First, the artificial stimuli used in this study prevented methodological issues due to the use of real human faces (e.g., contrasts, luminosity, face orientation, structural differences between the two hemifaces, etc.; Kowner, 1995). However, those stimuli may suffer from a lack of ecological validity. Their artificial nature prevents analysis according to the posed (i.e., generated without being necessarily experienced authentically) or event-elicited nature of EFEs. Moreover, analyses of the present study were conducted without considering structural asymmetries that are specific to the human facial anatomy (e.g., scalp shape, wrinkles, and malformations), and without varying levels of asymmetry and averageness.

Second, the generalizability of the results is limited by the use of an all-women sample. Future studies should explore the interplay of the expresser and perceiver genders in the judgment of the genuineness of facial expressions. Although it has not been demonstrated in this study, there is empirical evidence for an own-gender bias during face recognition (e.g., Lovén et al., 2011). Nevertheless, its manifestation needs further consideration. On the one hand, some studies showed that only women manifested an own-gender bias (e.g., Lewin and Herlitz, 2002; Rehnman and Herlitz, 2006, 2007). On the other hand, Palmer et al. (2013) showed that the magnitude of the own-gender bias

among women decreases when attentional resources are divided between two tasks.

CONCLUSION

The present study focused on EFEs as it is a critical cue shaping daily interactions and social judgment. Results revealed that asymmetrical EFEs were judged as less genuine than symmetrical EFEs, an observation that had not been reported yet in the literature. Moreover, an advantage for EFEs fostering social interactions and affiliation also emerged. Finally, results supported that gender stereotypes influence the EFEs processing at least among women, advantaging fearful faces for female faces, and happy faces for male faces.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethical Committee of the Psychological Science Research Institute of the UCLouvain. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

BD, FD, and PP contributed to conception and design of the study. BD organized the database, performed the statistical analysis, and wrote the first draft of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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The Effect of Malicious Envy on Schadenfreude When Schadenfreude Is Elicited Through Social Comparisons

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Previous studies have investigated whether envy, particularly malicious envy, increases feelings of schadenfreude and whether this effect is evident in both gain and loss frames. However, as a social-comparison-based emotion, schadenfreude was not investigated through social comparisons in these previous studies. Thus, the present study aimed to investigate whether malicious envy influences schadenfreude when schadenfreude is elicited in the context of precise and ambiguous social comparisons. To address this issue, participants in the present study were asked to play a monetary game with several other players. In the experimental condition, participants gained less or lost more than the other player; in the control condition, both the participants and the player gained little or lost much. Subsequently, the participants observed that the player encountered a misfortune, that is, gained less or lost more money than the participant. The results showed that when participants knew the exact amount of monetary gained and lost by themselves and the other player (i.e., precise social comparisons), malicious envy increased feelings of schadenfreude only in the loss frame rather than in the gain frame. More importantly, malicious envy turned out to reduce feelings of schadenfreude in both gain and loss frames, when participants did not know the exact amount (i.e., ambiguous social comparisons). The findings provide novel evidence that malicious envy does not always increase schadenfreude particularly when schadenfreude is elicited through social comparisons.

Keywords: malicious envy, schadenfreude, social comparisons, gain, loss

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INTRODUCTION

Envy is a social-comparison-based emotion that is elicited when "a person lacks another's superior quality, achievement, or possession and either desires it or wishes that the other lacked it" (Parrott and Smith, 1993). Envy is thought to be one of the most potent causes of unhappiness, and an envious person wishes to inflict misfortune on others (Russell, 1930). Therefore, when other individuals experience misfortune, it is often thought that the envious person will not sympathize with them and instead will feel malicious joy (i.e., schadenfreude;

Smith, 2000). Nevertheless, it is of interest to understand whether envy increases schadenfreude in different situations.

Previous studies have often utilized a scenario task to investigate whether envy influences envious persons' feelings of schadenfreude when misfortunes occur to enviable persons. Such tasks include two sequential parts (e.g., Feather and Sherman, 2002; Feather and Nairn, 2005; Van Dijk et al., 2006; Takahashi et al., 2009; Feather et al., 2013; Van de Ven et al., 2015; Baez et al., 2016, 2018; Santamaría-García et al., 2017; Lin and Liang, 2021). In the first part, participants encounter a person who is better than the participant in a specific domain (e.g., the person wins the lottery and the participant does not; that is, the experimental condition). In some cases, there is also a person who is similar to the participant in the related domain (e.g., both the person and the participant do not win the lottery). This manipulation is used as the control condition. In the second part, participants are told that the person they have just encountered experience an unfortunate event (e.g., the person does not win the subsequent lottery). The feelings of pleasure (schadenfreude) stimulated by others' misfortune are assessed. The effects of envy on the feelings of schadenfreude are measured as either the correlation between envy and schadenfreude (when the control condition is not manipulated) or the differential feelings of schadenfreude elicited by the envy and control conditions (when the control condition is manipulated).

Using such tasks, a number of studies have shown that envy increases feelings of schadenfreude (e.g., Van Dijk et al., 2006; Takahashi et al., 2009; Cikara and Fiske, 2013; Feather et al., 2013; Baez et al., 2016, 2018; Santamaría-García et al., 2017). Our recent study further revealed that this effect was evident in both gain and loss frames (Lin and Liang, 2021). On neural levels, schadenfreude has been found to recruit a fronto-temporo-subcortical network (Shamay-Tsoory et al., 2007; Takahashi et al., 2009; Santamaría-García et al., 2017; Baez et al., 2020; for a review: Jankowski and Takahashi, 2014), such as reward-related striatal regions (Takahashi et al., 2009; Dvash et al., 2010; Baez et al., 2016, 2018, 2020; Santamaría-García et al., 2017; for a review: Jankowski and Takahashi, 2014). Increased schadenfreude in the influence of envy was thus reflected by altered fronto-temporo-subcortical network, increased activations of striatum in particular (Takahashi et al., 2009; Baez et al., 2016, 2018).

The effect of envy on schadenfreude might be explained by the achievements of the motivational goal of envy and/or reduced psychological pain. The motivational goal of malicious envy is to prevent another person from being better off. If the other person encounters misfortune, his or her superiority is reduced. In this case, the motivational goal is achieved, thus triggering positive feelings (i.e., schadenfreude; Van de Ven et al., 2015). Regarding psychological pain, envy is thought to be a pain emotion (Lange et al., 2018). Increased schadenfreude in the influence of envy is because other's misfortune relieves individuals' feelings of pain (Takahashi et al., 2009).

However, other studies did not replicate this effect of envy on schadenfreude. The studies have observed that schadenfreude is not caused by envy but by other factors, such as negative emotions (e.g., resentment, anger, and dislike, Feather and Sherman, 2002; Hareli and Weiner, 2002; Feather and Nairn, 2005), painful feelings of inferiority (Leach and Spears, 2008), and beliefs about morality (Brambilla and Riva, 2017). These findings might suggest that envy does not always increase feelings of schadenfreude.

Whether the effect of envy on schadenfreude appears have been suggested to be associated with several factors. First, previous studies have proposed two categories of envy, malicious, and benign envy (e.g., Van de Ven et al., 2009; Crusius and Mussweiler, 2012; Crusius and Lange, 2014; Falcon, 2015; Lange et al., 2016; Van de Ven, 2016; Briki, 2018; Vrabel et al., 2018; Xiang et al., 2018). Both of these categories of envy are negative emotions caused by an individual lacking something another person has. Malicious envy is associated with deservedness and is reduced by pulling the other person down, while benign envy is associated with feelings of control and is reduced by improving one's own performance (Smith and Kim, 2007; Van de Ven et al., 2011a,b, 2012; Lange et al., 2016, 2018; Van de Ven, 2017). In studies that examined the two types of envy separately, schadenfreude was affected only by malicious envy and not by benign envy; more importantly, this effect was independent of other antecedents of schadenfreude (e.g., pain, inferiority, dislike, and anger; Van de Ven et al., 2015). Using a meta-analysis, Lange et al. (2018) also showed stronger and more positive connections between envy and schadenfreude when the relevant research operationalized malicious envy as distinct from pain or benign envy. In addition to different categories of envy, previous studies have also suggested that the effect of envy on schadenfreude is evident only when enviable persons are competitive out-group members (Cikara and Fiske, 2013) and when schadenfreude befalls an enviable person who is similar and might serve as a relevant social comparison (Van Dijk et al., 2006). Taken together, these findings might suggest that the effect of (malicious) envy on schadenfreude occurs only under certain circumstances.

Notably, social comparison theory suggests that a social-comparison-based emotion results from the implications of a comparison for the self (Smith, 2000). Both envy and schadenfreude are thought to be elicited by the process of social comparison (e.g., Smith, 2000; Ben-Ze'ev, 2001; Shamay-Tsoory et al., 2009). However, in previous studies, schadenfreude was not investigated in the context of social comparisons (i.e., the misfortune associated with schadenfreude was related only to others rather than to the differences between the participants and others; e.g., Feather and Sherman, 2002; Feather and Nairn, 2005; Van Dijk et al., 2006; Takahashi et al., 2009; Feather et al., 2013; Van de Ven et al., 2015; Baez et al., 2016, 2018; Santamaría-García et al., 2017; Lin and Liang, 2021). Importantly, if the misfortune involves social comparison, the assessment of schadenfreude can consider individuals' evaluation of the relative inferiority or superiority of their own and another person's attributes. This comparison may be integrated with preceding comparisons (e.g., those occurring during the elicitation of malicious envy), which might alter the effect of malicious envy on schadenfreude.

Furthermore, social comparisons are either precise (e.g., a person wins $100 more than someone else) or ambiguous (e.g., a person wins more than someone else, but the exact difference is unknown). During precise social comparisons, integrations between current and preceding outcomes for both individuals and others have individuals clearly affirm that their social status is not as inferior as it was used to be. This self-affirmation is thought to reduce schadenfreude (Van Dijk et al., 2011). Similarly, individuals during ambiguous social comparisons also know increased social status after outcome integrations, which might reduce feelings of schadenfreude. Moreover, due to ambiguous outcomes, individuals are uncertain about the extents social status increases (i.e., still inferior, similar, or superior). Previous studies have shown that uncertainty reduces pleasant feelings elicited by positive outcomes (Lin et al., 2012, 2015, 2020). The uncertainty about the variation of social status might also reduce schadenfreude.

Therefore, the present study aimed to investigate whether malicious envy influenced schadenfreude when both malicious envy and schadenfreude were elicited in the context of precise and ambiguous social comparisons. To address this issue, participants in the present study were required to play a monetary game similar to our previous study (Lin and Liang, 2021). The game included two rounds in each trial. The aim of the first round was to elicit a malicious envy emotion, and the aim of the second round was to assess schadenfreude. In the first round of the game, participants in the experimental (i.e., malicious envy) condition gained less money than the player in the win block and lost more in the loss block. For the control condition, both participants and players gained a little in the win block or lost a large amount in the loss block. In the second round, participants encountered a misfortune situation. As schadenfreude in this study was investigated through social comparisons, the situation was regarding the outcome was worse for the other players than for the participants (i.e., the players gained less money than the participants in the win block or lost more money in the loss block). The outcomes for participants and players and the outcome differences between them were precise in Experiment 1 but ambiguous in Experiment 2.

As mentioned above, malicious envy might not always increase schadenfreude when schadenfreude is elicited in the context of social comparisons (i.e., malicious envy might not influence schadenfreude in precise social comparisons and even reduce schadenfreude in ambiguous social comparisons), as individuals might affirm their increased social status after outcome integrations. Moreover, it has been shown that individuals in the gain frame are more sensitive to the differences between their own and the other's outcomes than do those in the loss frame (De Dreu et al., 1992, 1994; Poppe and Valkenberg, 2003). The sensitivity in the gain frame might have participants be more likely to integrate current and preceding outcomes (e.g., both Round 1 and 2) between themselves and others and to realize their increased social status, resulting in reducing schadenfreude to a larger extent. Nevertheless, it is notable that the modulation of frame might be only evident in precise social comparisons, as in ambiguous social comparisons, schadenfreude might have been largely reduced by outcome uncertainty irrespective of frame. Taken together, we predict that malicious envy will increase schadenfreude only in the loss-associated precise social comparisons, whereas this will not be the case in gain-associated precise social comparisons or in gain- and loss-associated ambiguous comparisons.

EXPERIMENT 1

Methods

Participants

Thirty-five undergraduate students (ranging from 18 to 22 years old, $M = 19.83$, $SD = 0.85$; 18 females) were recruited as participants. Because our previous study revealed an effect of malicious envy on schadenfreude in gain and loss frames by using 32 participants (Lin and Liang, 2021), the sample size in the present study was likely sufficient. Participants reported normal or corrected-to-normal vision and no history of neurological illness. All participants gave written informed consent in accordance with the standard ethical guidelines defined in the Declaration of Helsinki. The study was approved by the local ethics committee.

Procedure

After informed consent was obtained and handedness was determined, the participant was seated in a comfortable chair in a quiet room approximately 100 cm directly in front of a 22-inch computer monitor with a screen resolution of 640×480 pixels. Stimulus presentation and behavioral data collection were controlled by E-Prime 2.0 software (Psychology Software Tools, Inc., Sharpsburg, PA, United States). All stimuli were presented against a dark background.

Prior to the actual experiment, each participant was told that he/she would play a monetary game with three anonymous players. Previous studies have suggested that the effect of envy, particularly malicious envy, on schadenfreude is evident when enviable persons are competitive out-group members (Cikara and Fiske, 2013) and when schadenfreude befalls an enviable person who is similar and might serve as a relevant social comparison (e.g., the enviable person is of the same sex as the envious person; Van Dijk et al., 2006). Therefore, in the present study, it was emphasized to the participants that the players were undergraduate students from other universities and were of the same sex as the participants themselves. The participants were informed that the players would play the game in other rooms; therefore, the participants and players could not see each other. In fact, there were no other players, and all the players' choices in the experiment were predetermined by the experimental randomization. The participants were told that money could be won or lost based on 10% of the general tokens gained or lost across all trials with the addition or subtraction of a basic compensation of 10 RMB, respectively [e.g., if participants gained 10 tokens over all the trials in the game, then they would receive $(10 + 10 \times 10\%)$ RMB; if they lost 10 tokens overall in the game, then they would

receive (10–10 × 10%) RMB]. In fact, the general tokens gained or lost were randomized by a computer and ranged from −36 to +36.

As illustrated in **Figure 1**, the actual experiment consisted of 2 blocks: win and loss blocks. The presentation sequence of the blocks was counterbalanced across participants. For both of the blocks, each trial started with the label "player changing" for 1000 ms. The label signified that the computers would select one of the three players in a randomized order for the next trial of the game. However, participants did not know which player would be chosen. Each trial consisted of two rounds. The aim of the first round was to elicit malicious envy, and the aim of the second round was to assess feelings of schadenfreude. In the first round, participants were presented with two white boxes, one to the left of the center of the screen and the other to the right. Participants were told that there was either 1 or 10 token(s) in each box and that they would gain or lose that amount of money according to their selections. They were informed that this was a game of chance and that there was no correlation between the location of the box and the amount of money. They were told to choose one of the two boxes by pressing the "F" or "D" key for the left or right box using the index or middle finger, respectively, of their left hand. There was no time limit for the response. Subsequently, a blank screen was shown for 0 to 2000 ms ($M = 1000$ ms). Participants were told that the presentation of the blank screen indicated that they were waiting for the response from the player. This manipulation allowed the participants to believe they were playing with real persons. Then, the participant's and the player's outcomes were presented on the left and right sides of the center of the screen, respectively, for 1500 ms. The number presented signified the amount of money gained or lost. The symbols "+" and "−" to the left side of the number indicated monetary gain and loss, respectively. Participants were then asked to rate how much malicious envy they felt toward the player on a 9-point scale (1 = very low, 9 = very high) by pressing the number on the number keypad of the keyboard using the right hand. Notably, previous studies have shown that the effect of envy on schadenfreude is more evident when envy is malicious than benign (Van de Ven et al., 2015; Lange et al., 2018), we empathized to the participants that the ratings referred to malicious envy rather than benign envy. In addition, research has indicated that benign envy is more likely to occur when inferior persons perceive that they have control to improve their situation, while malicious envy is more likely to occur when inferior persons perceive that the outcome of superior persons is undeserved (e.g., Van de Ven et al., 2012; Lange et al., 2016). The outcomes of box selection were determined by chance, and it was easy for participants to consider the superior outcome of the player

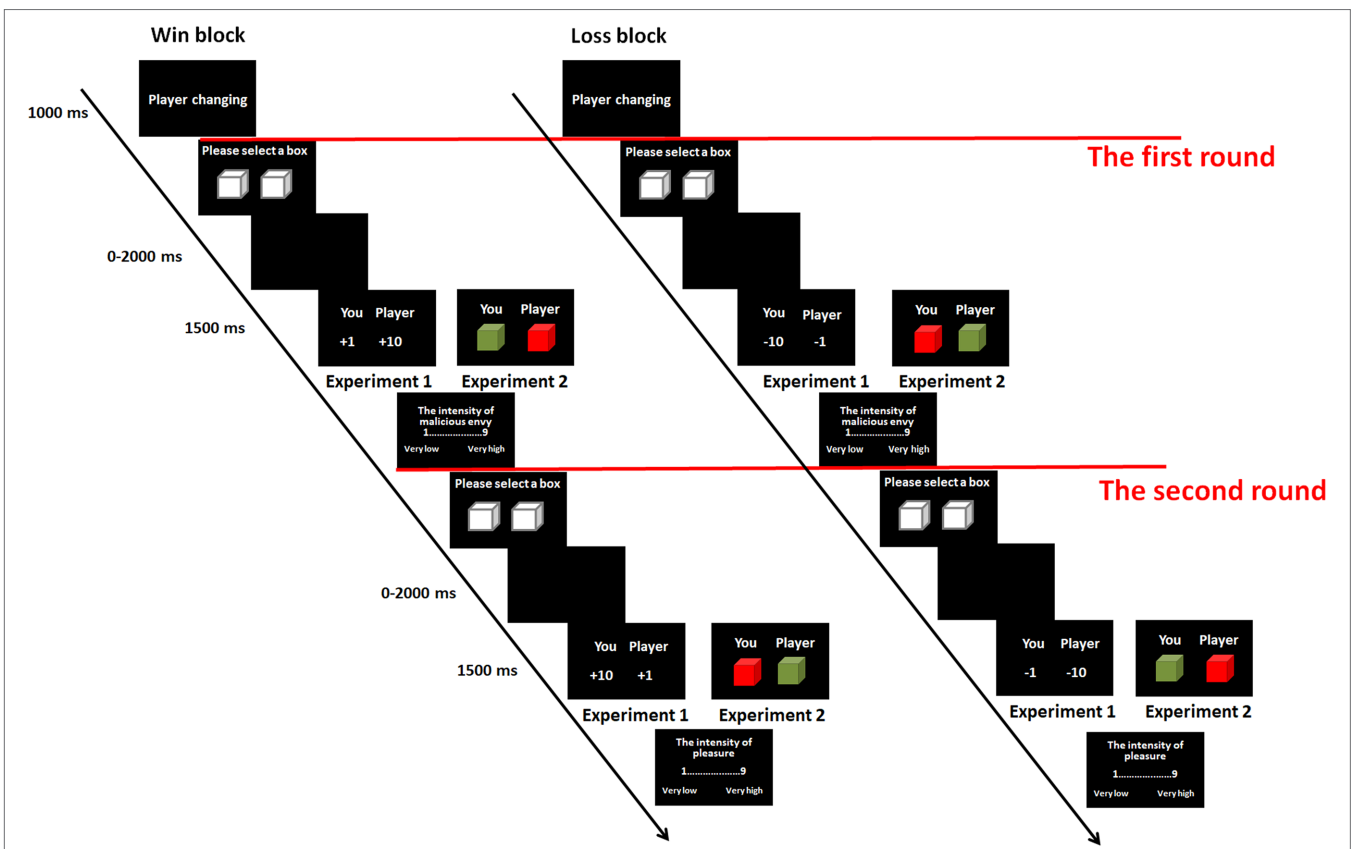

FIGURE 1 | Experimental procedure in Experiment 1 and 2. Each trial includes two rounds. The first round was to elicit malicious envy, and the second round was to assess schadenfreude.

as undeserved. Thus, participants were more likely to experience malicious envy than benign envy when they obtained a worse outcome than that of the player. The second round started immediately after the envy assessment. This round was similar to the first round; however, the rating reflected the intensity of pleasure participants felt upon seeing the outcome [ranging from 1 (very low) to 9 (very high)]. Notably, the rating of the degree of pleasure rather than the participant's feelings of schadenfreude was intended to decrease social desirability issues. The manipulation was in line with that used in previous studies (e.g., Takahashi et al., 2009; Steinbeis and Singer, 2013, 2014; Van de Ven et al., 2015; Baez et al., 2016; Santamaría-García et al., 2017). At the end of the experiment, the participants were asked whether they had participated in similar psychological experiments before and whether they actually believed in the existence of the other players. None of the participants reported that they had experience with similar experiments. All participants reported that they believed they had played with real persons.

The outcomes of the participants and players were in fact predetermined *via* experimental randomization. According to the outcomes for the participants and players in the first and second rounds, there were 16 outcome combinations for each block (see **Figure 2** for more details). Based on previous studies (e.g., Dvash et al., 2010; Steinbeis and Singer, 2013, 2014; Lin and Liang, 2021), the outcome combinations written in red were used in the experimental and control conditions of the present study, and the other combinations were used in the filler trials. To elicit malicious envy, the experimental condition in the present study was manipulated such that the outcomes for the first round involved the participants gaining less money than the players in the win block (i.e., participants vs. players = +1 token vs. +10 tokens) or losing more money in the loss block (i.e., −10 tokens vs. −1 token). In the control condition, the outcomes involved both the participants and the players gaining a small amount of money (+1 token vs. +1 token) in the win block or losing a large amount of money (−10 tokens vs. −10 tokens) in the loss block. In the second round, participants in each experimental and control condition encountered two situations to assess schadenfreude. In the first situation (i.e., experimental-misfortune and control-misfortune), the participants gained more money than the players in the win block (i.e., participants vs. players = +10 tokens vs. +1 token) or lost less money in the loss block (i.e., −1 token vs. −10 tokens). In the second situation (i.e., experimental-fortune and control-fortune), both participants and players gained a large amount of money (+10 tokens vs. +10 tokens) in the win block or lost a small amount of money (−1 token vs. −1 token) in the loss block. The reason for using two experimental and control conditions for each block is explained in the "Behavioral Recordings and Analyses" section. Please refer to this section for details.

For each block, there were 20 trials for each experimental and control condition. Each filter trial was presented 4–12 times, for a total of 112 times. In each block, there were 4 breaks. The duration of the break was controlled by the participant. Prior to the actual experiment for each block, there were 16 practice trials to familiarize the participants with the experimental procedure. The experiment (including the practice sessions) lasted approximately 1.5 h.

Win block	The first round		The second round	
	Participant	Player	Participant	Player
	+10	+10	+10	+1
	+10	+10	+10	+10
	+10	+10	+1	+1
	+10	+10	+1	+10
	+10	+1	+10	+1
	+10	+1	+10	+10
	+10	+1	+1	+1
	+10	+1	+1	+10
Experimental-misfortune	+1	+10	+10	+1
Experimental-fortune	+1	+10	+10	+10
	+1	+10	+1	+1
	+1	+10	+1	+10
Control-misfortune	+1	+1	+10	+1
Control-fortune	+1	+1	+10	+10
	+1	+1	+1	+1
	+1	+1	+1	+10

Loss block	The first round		The second round	
	Participant	Player	Participant	Player
	-1	-1	-1	-10
	-1	-1	-1	-1
	-1	-1	-10	-10
	-1	-1	-10	-1
	-1	-10	-1	-10
	-1	-10	-1	-1
	-1	-10	-10	-10
	-1	-10	-10	-1
Experimental-misfortune	-10	-1	-1	-10
Experimental-fortune	-10	-1	-1	-1
	-10	-1	-10	-10
	-10	-1	-10	-1
Control-misfortune	-10	-10	-1	-10
Control-fortune	-10	-10	-1	-1
	-10	-10	-10	-10
	-10	-10	-10	-1

FIGURE 2 | The outcomes between the participants and players for the two rounds of the game in the win and loss block (on the left and right panel, respectively) in Experiment 1. The outcomes in red are those in the experimental and control conditions. The first round of the game is to elicit envy and non-envy emotions, and the second round is to assess the feelings of pleasure (schadenfreude).

TABLE 1 | Mean ratings of envy and schadenfreude and the SDs for all experimental conditions in Experiment 1.

	Loss		Win	
	M	*SD*	*M*	*SD*
Envy ratings				
Experimental	6.72	1.58	6.38	1.84
Control	3.57	1.58	2.75	1.28
Schadenfreude ratings				
Experimental (misfortune)	6.50	1.75	6.97	1.45
Experimental (fortune)	5.13	1.83	6.09	1.41
Experimental (misfortune – fortune)	1.37	1.35	0.87	1.58
Control (misfortune)	6.65	1.75	7.16	1.55
Control (fortune)	5.66	1.61	6.28	1.38
Control (misfortune – fortune)	0.99	1.52	0.88	1.59

Behavioral Recordings and Analyses

Malicious envy and schadenfreude ratings were recorded for each trial. The ratings were then averaged for all trials separately for each emotional category, emotion, and participant. To understand whether malicious envy was elicited successfully, we first averaged the ratings between the experiment-misfortune and experiment-fortune situations and between the control-misfortune and control-fortune situations and then used these averaged ratings to perform 2×2 ANOVA with block (win vs. loss) and emotion (experimental vs. control) as within-subject factors. The means and SDs of the ratings are shown in **Table 1**. Regarding the schadenfreude ratings, participants may feel pleasure when they have a beneficial outcome (e.g., gain 10 tokens rather than 1 token or lose 1 token rather than 10 tokens) irrespective of the outcome of the player. To exclude this effect, we calculated new schadenfreude ratings by subtracting the original schadenfreude ratings in the fortune condition from those in the misfortune condition separately for the experimental and control conditions. This calculation method was based on previous studies (Steinbeis and Singer, 2013, 2014). For these new schadenfreude ratings, we performed a 2×2 ANOVA with block (win vs. loss) and emotion (experimental vs. control) as within-subject factors. The means and *SD*s of the ratings are shown in **Table 1** and **Figure 3**.

Results

Envy Ratings

The analyses showed main effects of block [$F(1, 34) = 28.77$, $p < 0.001$, $\eta_p^2 = 0.46$] and emotion [$F(1, 34) = 142.40$, $p < 0.001$, $\eta_p^2 = 0.81$]. The envy ratings were generally higher in the loss condition ($M \pm SD = 5.14 \pm 1.31$) than in the win condition (4.57 ± 1.30) and in the experimental condition (6.56 ± 1.66) than in the control condition (3.16 ± 1.36).

The interaction between the two factors was also significant [$F(1, 34) = 4.68$, $p = 0.038$, $\eta_p^2 = 0.12$]. Bonferroni *post hoc* comparisons showed that the ratings were 3.63 points higher in the experimental condition than in the control condition for the win block ($p < 0.001$, 95% *CI* of the difference = 3.02 to 4.23) and 3.16 points higher for the loss block ($p < 0.001$, 95% *CI* of the difference = 2.57 to 3.74). The ratings in the control condition were 0.81 points higher for the loss block than for the win block ($p < 0.001$, 95% *CI* of the difference = 0.51 to 1.11), whereas the ratings of the win and loss blocks did not significantly differ in the experimental condition ($p = 0.207$).

Schadenfreude Ratings

The ANOVA did not show a main effect of block or emotion ($p \geq 0.126$). There was an interaction between these two factors [$F(1, 34) = 6.87$, $p = 0.013$, $\eta_p^2 = 0.17$]. Bonferroni *post hoc* comparisons showed that schadenfreude ratings were 0.38 points higher in the experimental condition than in the control condition for the loss block ($p = 0.038$, 95% *CI* of the difference = 0.13 to 0.64), whereas the ratings between the experimental and control condition were not significant for the win block ($p = 1.000$). The ratings of the win and loss blocks did not significantly differ in either the experimental or control condition ($p \geq 0.400$).

Discussion

In this experiment, we investigated the effect of malicious envy on the degree of schadenfreude separately for gain and loss frames when schadenfreude was explored through social comparisons. The results showed that malicious envy ratings were generally higher in the experimental condition than in the control condition, suggesting that envy was successfully evoked. More importantly, there was an effect of malicious envy on schadenfreude in the loss condition, whereas the effect was not significant in the win condition. The findings might indicate that the effect of malicious envy on schadenfreude occurs only in the context of loss-associated social comparisons.

It is notable that in this experiment, social comparisons associated with malicious envy and schadenfreude were investigated by presenting the exact value of the participants and the player in each round of the game. When participants integrated their outcomes with those of the player for all situations, they were able to compare the overall outcomes between themselves and the player precisely. However, social comparisons are not always precise but sometimes ambiguous. In this case, individuals might be uncertain about their position when all the situations are integrated. Such uncertainty might alter the effect of malicious envy on schadenfreude.

EXPERIMENT 2

In Experiment 2, we aimed to further investigate the effect of malicious envy on schadenfreude in gain and loss frames when social comparisons between the participants and the player were ambiguous. To address this issue, participants in this experiment were not informed about the exact values of the outcomes (e.g., the money gained or lost was +10 RMB or −10 RMB) and were instead given approximate values (e.g., the money gained or lost was more than or less than 5 RMB).

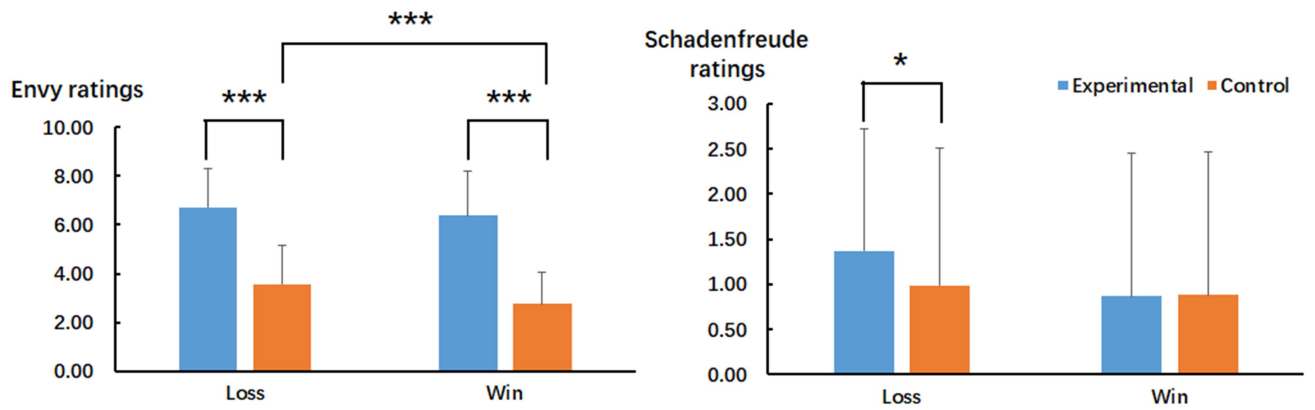

FIGURE 3 | Mean ratings of envy (the left panel) and schadenfreude (the right panel) for the interaction between emotion and block in Experiment 1. Vertical lines indicate the standard deviation of the means. The significance level of the emotional effect is marked by the number of the "*" symbol. $^{*}p < 0.05$ and $^{***}p < 0.001$, respectively.

In this case, the participants were uncertain about their position after two rounds (i.e., inferior, equal, or superior). As mentioned in the introduction section, we predict that malicious envy might not increase feelings of schadenfreude irrespective of frame in ambiguous social comparisons.

Methods

Participants

Thirty-four undergraduate students (ranging from 18 to 23 years old, $M = 20.51$, $SD = 1.01$; 23 females) were recruited as participants. The participants did not participate in Experiment 1. The requirements for participant recruitment were the same as those in Experiment 1.

Procedure

As illustrated in **Figure 1**, the experimental procedure was similar to the procedure in Experiment 1, except for the meaning of the white boxes and the presentation of the outcomes. With respect to the white boxes, participants were told that the amount of money in each white box ranged from 1 to 10 token(s). After the selection of the box, the outcomes for the participants and players were not presented as exact values but as red/green boxes. The color of the boxes indicated the approximate values for the participants and players. For half of the participants, the red box meant that the money gained or lost was more than 5 tokens, and the green box indicated that the money gained or lost was less than or equal to 5 tokens. For the other half, the meaning of the colored boxes was reversed. It was emphasized to the participants that they would not know whether their or the player's general outcomes were better for the two rounds in a trial. For example, suppose Players A and B choose the red box (representing a gain of more than 5 tokens) in the first round. In the second round, Player A chooses the red box, but Player B chooses the green box (representing no more than 5 tokens). The red boxes for Player A contain 6 tokens in the first and second rounds. For Player B, if the red box in the first round contains 6 tokens and the green box in the second round contains 1 token, then Player A will obtain more money than Player B. However, if the red and green boxes contain 9 tokens and 5 tokens, respectively, Player A will obtain less money than Player B. If the red and green boxes contain 7 tokens and 5 tokens, respectively, Players A and B will gain an equal amount of money. As illustrated, the participants were not told the exact values for themselves or the players in each round and therefore could not determine whose general outcomes were better for the two rounds in the experimental and control conditions. As shown in **Figure 4**, the outcome combinations written in red were used in the experimental and control trials. The other combinations were used in filler trials.

Behavioral Recordings and Analyses

The behavioral recordings and analyses were the same as those in Experiment 1. The means and SDs of the malicious envy ratings and schadenfreude ratings are shown in **Table 2**.

Results

Envy Ratings

The analyses showed main effects of emotion [$F(1, 33) = 84.80$, $p < 0.001$, $\eta_p^2 = 0.72$] and block [$F(1, 33) = 9.22$, $p = 0.005$, $\eta_p^2 = 0.22$]. The envy ratings were generally higher in the experimental condition (5.26 ± 2.11) than in the control condition (2.27 ± 1.05) and in the loss condition (3.96 ± 1.57) than in the win condition (3.57 ± 1.25).

Schadenfreude Ratings

The ANOVA showed a main effect only of emotion [$F(1, 33) = 5.11$, $p = 0.030$, $\eta_p^2 = 0.13$]. The schadenfreude ratings were generally lower in the experimental condition (0.42 ± 1.27) than in the control condition (0.67 ± 1.37). Other main effects or interactions were not significant ($p \geq 0.775$).

Win block	The first round		The second round	
	Participant	Player	Participant	Player
	> +5	> +5	> +5	≤ +5
	> +5	> +5	> +5	> +5
	> +5	> +5	≤ +5	≤ +5
	> +5	> +5	≤ +5	> +5
	> +5	≤ +5	> +5	≤ +5
	> +5	≤ +5	> +5	> +5
	> +5	≤ +5	≤ +5	≤ +5
	> +5	≤ +5	≤ +5	> +5
Experimental-misfortune	≤ +5	> +5	> +5	≤ +5
Experimental-fortune	≤ +5	> +5	> +5	> +5
	≤ +5	> +5	≤ +5	≤ +5
	≤ +5	> +5	≤ +5	> +5
Control-misfortune	≤ +5	≤ +5	> +5	≤ +5
Control-fortune	≤ +5	≤ +5	> +5	> +5
	≤ +5	≤ +5	≤ +5	≤ +5
	≤ +5	≤ +5	≤ +5	> +5

Loss block	The first round		The second round	
	Participant	Player	Participant	Player
	≥ -5	≥ -5	≥ -5	< -5
	≥ -5	≥ -5	≥ -5	≥ -5
	≥ -5	≥ -5	< -5	< -5
	≥ -5	≥ -5	< -5	≥ -5
	≥ -5	< -5	≥ -5	< -5
	≥ -5	< -5	≥ -5	≥ -5
	≥ -5	< -5	< -5	< -5
	≥ -5	< -5	< -5	≥ -5
Experimental-misfortune	< -5	≥ -5	≥ -5	< -5
Experimental-fortune	< -5	≥ -5	≥ -5	≥ -5
	< -5	≥ -5	< -5	< -5
	< -5	≥ -5	< -5	≥ -5
Control-misfortune	< -5	< -5	≥ -5	< -5
Control-fortune	< -5	< -5	≥ -5	≥ -5
	< -5	< -5	< -5	< -5
	< -5	< -5	< -5	≥ -5

FIGURE 4 | The approximate outcomes between the participants and players for the two rounds of the game in the win and loss block (on the left and right panel, respectively) in Experiment 2. The outcomes in red are those in the experimental and control conditions. The first round of the game is to elicit envy and non-envy emotions, and the second round is to assess the feelings of pleasure (schadenfreude).

TABLE 2 | Mean ratings of envy and schadenfreude and the SDs for all experimental conditions in Experiment 2.

	Loss		Win	
	M	*SD*	*M*	*SD*
Envy ratings				
Experimental	5.45	2.24	5.08	2.12
Control	2.48	1.26	2.06	0.93
Schadenfreude ratings				
Experimental (misfortune)	5.26	2.03	6.02	1.74
Experimental (fortune)	4.88	1.63	5.57	1.66
Experimental (misfortune – fortune)	0.38	1.15	0.45	1.75
Control (misfortune)	5.68	1.89	6.49	1.73
Control (fortune)	5.02	1.60	5.81	1.57
Control (misfortune – fortune)	0.66	1.26	0.68	1.86

Discussion

In the present study, we investigated the effect of malicious envy on schadenfreude separately in gain and loss frames when the comparisons between the participants and the player were ambiguous. Similar to the results in Experiment 1, the results in Experiment 2 showed that envy ratings were generally higher in the experimental condition than in the control condition, suggesting successful elicitation of malicious envy. Different from Experiment 1 and previous studies (e.g., Feather and Sherman, 2002; Feather and Nairn, 2005; Van Dijk et al., 2006; Takahashi et al., 2009; Feather et al., 2013; Van de Ven et al., 2015; Baez et al., 2016, 2018; Santamaría-García et al., 2017; Lin and Liang, 2021), however, we observed lower schadenfreude ratings in the experimental condition than in the control condition in both gain and loss frames. The findings suggest that malicious envy reduces the degree of schadenfreude irrespective of frame when social comparisons are ambiguous.

GENERAL DISCUSSION

The present study investigated whether malicious envy influenced schadenfreude in different frames when both malicious envy and schadenfreude were explored through social comparisons. The results showed that when the outcomes of the participant and the player were precise, malicious envy increased the degree of schadenfreude in the loss frame, whereas this was not the case in the gain frame. In the case of ambiguous outcomes, however, schadenfreude was reduced by malicious envy irrespective of frame. In general, the findings might suggest that malicious envy does not always increase schadenfreude particularly when malicious envy and schadenfreude are elicited by social comparisons.

When individuals know about the exact outcomes between themselves and others in the loss frame, increased schadenfreude by malicious envy might be explained by the achievement of the motivational goal of malicious envy and/or reduced psychological pain. The motivation goal of malicious envy is to damage the position of the superior other. When misfortune befalls the other, the superior position of the other might

be weakened. In this case, the motivational goal might be more or less achieved, resulting in positive feelings (i.e., schadenfreude; Van de Ven et al., 2015). Accordingly, in the present study, when participants lost more money than the player in the first round of the game, they may have experienced malicious envy and have been motivated to pull the player down. In the subsequent round, this motivation goal was achieved when a misfortune outcome occurred to the player, resulting in increased feelings of schadenfreude.

In terms of psychological pain, envy is thought to be an emotion related to pain (e.g., Lange et al., 2018). Other's misfortune that can relieve social pain is regarded as a reward and, thus, activates reward-related striatal regions. This increased activation leads to increased degree of schadenfreude (Takahashi et al., 2009). For the present study, participants might feel painful when they obtained a worse outcome than the player in the first round of the game. In the subsequent round, the player's misfortune might reduce the painful feeling elicited in the preceding round, leading to increased schadenfreude.

However, the effect of malicious envy on schadenfreude was not significant in the gain frame. After all the situations are presented (e.g., Round 1 and 2), individuals might calculate the general outcomes for themselves and others and to compare their general outcomes with those of the others. The comparison in the present study might have participants affirm that their position was no longer inferior but was similar to the position of the player, which might reduce schadenfreude (Van Dijk et al., 2011). More importantly, it has been shown that individuals in the gain frame focus more on the differences between their own and the other player's outcomes than for those in the loss frame (De Dreu et al., 1992, 1994; Poppe and Valkenberg, 2003). Therefore, general outcome comparisons and self-affirmation of the increased position might be more likely to occur in the gain frame, resulting that reduced feelings of schadenfreude are more probable to appear in this frame.

The differential effects of malicious envy on schadenfreude in gain and loss frames might also be explained by loss aversion. The prospect theory proposes that subjective experiences of monetary loss are more evaluable than the experiences of gains (Tversky and Kahneman, 1979). For the present study, participants in both gain and loss frames might realize their position was similar to the position of the player after calculating the general outcomes for all the situations (e.g., Round 1 and 2). Due to loss aversion, however, the evaluations to the similar position might be different in gain and loss frames. For example, participants in the loss frame might be likely to evaluate the similar position as an unfavorable outcome, whereas this might be not the case for participants in the gain frame. The specific evaluation pattern in the loss frame might lead to the maintenance of schadenfreude.

Surprisingly, when participants were told about ambiguous outcomes for themselves and the player, the present study showed a reversed effect of malicious envy on schadenfreude. Similar to precise social comparisons, participants might integrate their own outcomes and the outcomes of the player for all situations and affirm that the participants' position was not as inferior as it was used to be. This issue might have reduced the feelings of schadenfreude (Van Dijk et al., 2011) and, thus, the effect of malicious envy on schadenfreude (particularly in the gain frame). More importantly, due to ambiguous outcomes, participants were uncertain whether their position was still inferior or not, even though a misfortune occurred to the player. It has been reported that uncertainty reduces pleasantness feelings evoked by positive stimuli (Lin et al., 2012, 2015, 2020). Thus, in the present study, schadenfreude to the player's misfortune might be generally reduced by outcome uncertainty. Moreover, in the experimental condition, the outcomes between the participants and the player were reversed for the two rounds, and thus, the relative position between them might be considered to be quite uncertain. Even though the relative position was also uncertain in the control condition, the outcomes were similar between participants and the players in the first round but better for the participants than for the player in the second round, which looked that the overall outcomes were better for the participants. That is, participants might feel more uncertain in the experimental condition than in the control condition, as they in the control condition were more likely to think of obtaining a superior position, even though the exact probability of obtaining such a position in the present study was similar between the experimental and control conditions (48 and 49%, respectively). Therefore, schadenfreude might be reduced to a larger extent for the experimental condition than for the control condition, which leads to a reversed effect of malicious envy on schadenfreude irrespective of frame.

The current findings might be in line with previous studies, which indicated that envy increases feelings of schadenfreude only under certain circumstances. For instance, the effect occurs when envy is malicious but not when it is benign (Van de Ven et al., 2015; Lange et al., 2018), when enviable persons are competitive out-group but not when they are non-competitive or in-group members (Cikara and Fiske, 2013), and when enviable and envious persons have the same sex but not when they have different sexes (Van Dijk et al., 2006). The findings in the present study further revealed that the effect of malicious envy on schadenfreude was observed only when the scenarios involved loss-associated and precise social comparisons. Otherwise, the effect of malicious envy on schadenfreude was reduced or even reversed.

However, the findings in the present study (except when participants knew the exact outcomes for themselves and the players in the loss frame) are inconsistent with those of previous studies (e.g., Van Dijk et al., 2006; Takahashi et al., 2009; Cikara and Fiske, 2013; Feather et al., 2013; Baez et al., 2016, 2018; Santamaría-García et al., 2017; Lin and Liang, 2021), which showed that envy increased feelings of schadenfreude. Both our present study and previous studies used abovementioned approaches that enlarged the effect of envy on increased schadenfreude (i.e., eliciting malicious envy and presenting competitive out-group and similar enviable persons). Different from our present study, however, the scenarios regarding schadenfreude in previous studies did not involve social

comparisons (e.g., participants were told a story in which the person met with misfortune, were asked to imagine a misfortune befalling the person or saw a player whom they were playing with obtained a bad outcome). Individuals could not integrate the outcomes of social comparisons for all situations. In this case, individuals might be likely to believe that they are still in an inferior position even though social positions of others are pulled down by the misfortune. In the current study, however, not only malicious envy but also schadenfreude was investigated in the context of social comparisons, and outcomes for social comparisons could be integrated to some extents. When a misfortune occurred to the others, individuals know that their social position is not as inferior as the position that was used to be. This knowledge might alter the effect of malicious envy on schadenfreude particularly when social comparisons are ambiguous and/or gain-associated.

In general, the findings obtained in this study appear to be in line with theories regarding envy (e.g., the malicious envy theory, the dual envy theory, and the pain-driven dual envy theory), supporting the effect of envy, particularly malicious envy, on schadenfreude irrespective of frame (e.g., Van Dijk et al., 2006; Takahashi et al., 2009; Cikara and Fiske, 2013; Feather et al., 2013; Van de Ven et al., 2015; Baez et al., 2016, 2018; Santamaría-García et al., 2017; Lange et al., 2018; Lin and Liang, 2021). The findings in the present study extend previous theories by showing that the effect of malicious envy on schadenfreude occurs even when schadenfreude is assessed in the context of social comparisons. However, the findings provide new insights in that the mechanisms underlying the effect of malicious envy on schadenfreude might be more complicated than the mechanisms described by the theories. Specifically, when social comparisons associated with malicious envy and schadenfreude are precise, malicious envy increases schadenfreude in the loss frame but not in the gain frame. Moreover, the effect of malicious envy on schadenfreude is reversed irrespective of frame when social comparisons are ambiguous. The current study might contribute to further understanding of how malicious envy influences degree of schadenfreude.

In addition, recent evidence pointed out that malicious social-moral emotion resulted in the appearance and/or maintenance of pathological behaviors (e.g., dishonest, criminal, and antisocial behaviors; e.g., Panasiti and Ponsi, 2017; Franco-O'Byrne et al., 2021). Consistent with the evidence, our findings (at least at loss-associated precise social comparisons) and several other studies (e.g., Van Dijk et al., 2006; Takahashi et al., 2009; Cikara and Fiske, 2013; Feather et al., 2013; Baez et al., 2016, 2018; Santamaría-García et al., 2017) also showed that malicious social emotions (e.g., malicious envy) increased other pathological emotions (e.g., schadenfreude). It has been suggested that whether pathological behaviors and emotions are elicited involve a conflict between extrinsic (e.g., self-related benefits) and intrinsic goals (e.g., social norms; Mazar et al., 2008). Once extrinsic goals are more salient than intrinsic goals, pathological behaviors, and emotions might occur (Panasiti and Ponsi, 2017). For example, other's misfortune elicits either empathy or schadenfreude. The salient extrinsic goal of pulling others down (i.e., the motivational goal of malicious envy) increases schadenfreude and reduces empathy. Therefore, we speculate that social emotions involving extrinsic goals might be an important factor in eliciting pathological behaviors and emotions. This might also explain why individuals who have experiences in extremely pathological behaviors might have abnormal processes in social emotions and relationships (e.g., Jankowski and Takahashi, 2014), for example, offenders experienced reduced feelings of envy and schadenfreude (Franco-O'Byrne et al., 2021).

Finally, we would like to note some of the limitations of the present study and suggest future directions. First, to further understand the effect of malicious envy on schadenfreude, future studies could investigate the correlation/regression between malicious envy and schadenfreude ratings. In the present study, envy ratings were calculated by averaging the original ratings in the misfortune and fortune conditions, whereas schadenfreude ratings were calculated by subtracting the original ratings in the fortune condition from the ratings in the misfortune condition. The difference in the calculation approaches may affect the correlation/regression between these two ratings. Future studies might consider a single calculation approach that can be used for both ratings to further investigate their relation. Second, previous studies in which schadenfreude were not investigated in the context of social comparisons have suggested that schadenfreude is affected more by malicious envy than benign envy (e.g., Van de Ven et al., 2015; Lange et al., 2018). However, it remains unclear whether this is also the case when schadenfreude is investigated in the context of social comparisons. Future studies might investigate this issue for more details. Finally, the social comparison task in the present study required the participants to complete numerous trials, which may have led to carry-over effects or fatigue effects. Future studies should identify ways to reduce the number of trials while preserving high reliability and validity.

CONCLUSION

The present study showed that malicious envy increased feelings of schadenfreude occurred in the loss frame but not in the gain frame, when participants knew the exact outcomes of themselves and the players in each trial. Without this knowledge, however, there was a reversed effect of malicious envy on schadenfreude irrespective of frame. The findings of the present study highlight the effect of malicious envy on schadenfreude when both envy and schadenfreude were elicited through social comparisons.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the academic committee of School of Public

Administration, Guangdong University of Finance. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

HL contributed to conception and design of the study and wrote the first draft of the manuscript. HL and JL performed the data collection and statistical analysis. All authors contributed to manuscript revision, read, and approved the submitted version.

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Emotional Campaigning in Politics: Being Moved and Anger in Political Ads Motivate to Support Candidate and Party

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Political advertising to recruit the support of voters is an inherent part of politics. Today, ads are distributed via television and online, including social media. This type of advertisement attempts to recruit support by presenting convincing arguments and evoking various emotions about the candidate, opponents, and policy proposals. We discuss recent arguments and evidence that a specific social emotion, namely the concept kama muta, plays a role in political advertisements. In vernacular language, kama muta is typically labeled as being moved or touched. We compare kama muta and anger theoretically and discuss how they can influence voters' willingness to support a candidate. We then, for the first time, compare kama muta and anger empirically in the same study. Specifically, we showed American participants short political ads during the 2018 United States midterm election campaigns. All participants saw both kama muta- and anger-evoking ads from both Democratic or Republican candidates. In total, everybody watched eight ads. We assessed participants' degree of being moved and angered by the videos and their motivation for three types of political support: ideational, financial, and personal. The emotional impact of an ad depended on its perceived source: Participants felt especially angry after watching the anger-evoking ads and especially moved by moving ads if they identified with the political party that had produced the video. Both emotions mediated were associated with increased intentions to provide support. Importantly, if one of the two emotions was evoked, its effect on political support was enhanced if participants identified with the party that had produced the ad. We discuss limitations of the method and implications of the results for future research and practice.

Keywords: political advertisement, being moved, anger, emotion evocation, motivation, support

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INTRODUCTION

Political advertisement is an inherent part of politics today and has been so since ancient civilizations. In addition to rallies, canvassing, billboards and telephone calls, modern political advertisement heavily relies on campaign spots that are plaid on TV or on websites, including social media, hereafter political ads.

In the United States, the number of political ad airings on television, federal and gubernational, increased by 86 percent from 2014 to 2018 (Wesleyan Media Project, 2018a). In 2020, the Wesleyan Media Project recorded over 4.9 million ads having aired for federal races this year, more than

double the volume of ad airings in the 2012 and 2016 (Wesleyan Media Project, 2020a,b). It is evident that political advertisement has a wide reach that goes on to grow rapidly.

RESEARCH ON POLITICAL ADVERTISEMENT

In parallel to the spending on political advertisement, research on it has been growing. Besides structural topics – like ethics and policy (e.g., Banker, 1992; Shaw and Ragland, 2000; Gelb and Bush, 2011), branding (e.g., Guzmán and Sierra, 2009; French and Smith, 2010), and technological advancements (e.g., Kaid, 2002; Mylona, 2008), this research area also investigated psychological aspects of the strategies in political advertisement (e.g., Benoit, 2000; Airne and Benoit, 2005; Dardis et al., 2008), and compared them across cultures (e.g., Kaid and Holtz-Bacha, 1995; Griffin and Kagan, 1996; Tak et al., 2007; Harris and Lock, 2010).

Particular emphasis has been on affective and cognitive responses, such as resulting liking, beliefs, and intentions. Negative ads, so-called *attack-ads*, have been shown to effectively motivate viewers (e.g., Kern and Just, 1995; Bradley et al., 2007; Phillips et al., 2008). However, research (e.g., Yoon et al., 2005) also explored their boundary conditions, like, for example, viewer-involvement and source credibility. Additionally, attack-ads were shown to have potential for causing backlash (Phillips et al., 2008). Positive ads have increasingly come into focus. Recent work shows that positive ads also influence viewers' motivation to vote for a specific candidate or party (e.g., Seibt et al., 2019). While boundary conditions exist for the motivational effect of positive ads, too (e.g., Meirick et al., 2011), these results challenges the view that negative ads are more effective (Jasperson and Fan, 2002; Stevens, 2012). Research suggests that the most effective political campaigns make use of both types of political ads (Devlin, 1995).

Beyond mere cognitive responses, political ads also try to change preferences for specific politicians, create apprehension toward others, and influence actual turnout by fostering emotions (see e.g., Brader, 2005; Fridkin and Kenney, 2012; Seibt et al., 2019). The body of research on emotions in political ads, although gradually growing, is comparably small. Academic work on identifying the emotions' impact has been especially limited. In the current work, we focus on two specific emotions that differ in their valence, *being moved* and *anger*, and examine their role in creating political support.

EMOTIONS IN POLITICAL ADS

Brader (2005) researched 1,425 political ads from the years of 1999 and 2000, investigating what emotions were evoked in viewers. He found that 72% of the ads were rated to focus on emotion rather than logic. Brader assumed political advertising to significantly influence the decision making of voters, that is, besides other things also their voting behavior. Other scientists agree that emotions are important and decisive for political campaigns (e.g., Marcus et al., 2000). Politicians have realized the political utility of emotions in advertisement, too. Ridout and Searles (2011) showed when and how ads used emotional appeal and that they did this very strategically. Leading candidates were more likely to use positive emotions like enthusiasm and pride as appeals to foster support, while trailing candidates focused on negatives emotions like fear and anger to mobilize their followers.

Emotional ads can either just aim at evoking a general affect in the viewer or they serve the evocation of a specific emotion to guide voters' attitudes toward a candidate and party (Chang, 2001). Various different emotions can be targeted. They include negative emotions like *anger, contempt, disgust,* and *fear* (Fridkin and Kenney, 2012), as well as distinctly positive emotions like *awe* or what is called *being moved* in English vernacular (Seibt et al., 2019). In the following work, we focus on two emotions in particular: being moved, which we conceptualize using Kama Muta Theory (see e.g., Fiske, 2019; Fiske et al., 2019), and anger. Both are central components of the modern landscape of political advertisement. Being moved is especially evoked by somewhat longer ads that include narrative and praise a specific political candidate (see e.g., "Progress is on the ballot" from the United States presidential election of 2016; accessible via OSF[1]). Twenty one percent of Brader's (2005) 1,425 analyzed political ads were rated to evoke compassion, which shares relevant traits with *being moved,* and *moving* content was additionally explicitly found in viral political ads of the United States presidential election in 2016 (Seibt et al., 2019).

Anger plays a key role in the so-called attack ads. Ads can elicit anger toward a state of affairs against which the politician wants to act, but often the anger is directed at a political opponent. One half of Brader's 1,425 ads were identified as anger evoking, which makes anger the most frequently applied emotion in the array of analyzed ads. From 2014 to 2018 the number of attack ads in the United States midterm elections has gone up by 61 percent (Wesleyan Media Project, 2018b).

Kama Muta

Being moved – also *feeling moved* -was already recognized as an emotion by Darwin (1890) in his outline of emotion in human and animal (1890). However, being moved has been difficult to theorize properly, in large part due to the fact the English term is used very broadly and it has no clear facial expression, but rather shares shedding of tears with sadness. Recently, kama muta theory has been formulated to carve out a specific social emotion,[2] termed kama muta (Sanskrit for "moved by love"). Kama muta is conceptualized as a positive social-relational emotion that is felt when close (communal) relations intensify, and motivates to engage in strengthening of communal relation. It largely overlaps with what English speakers call being moved, but there are some instances that most English speakers would not call being moved (e.g., the emotion elicited by observing intense cuteness), and vice versa there are some experiences that could be labeled being moved that are not kama muta

[1] https://osf.io/v3ecg/

[2] We refer to the definition by Hareli and Parkinson (2008) that social appraisals have to be involved as causes or constituents for an emotion to be considered as social.

(e.g., sadness over loss) (Fiske et al., 2017a, 2019; Seibt et al., 2017).

While some research suggests that being moved is the result of evocations of solidarity, attachment, and generosity (Tan and Frijda, 1999) or witnessing moral acts (Haidt, 2003; Algoe and Haidt, 2009), Fiske et al. (2017a, 2019) have found that being moved is connected to the intensification of communal sharing. Communal sharing refers to a type of social relations where people feel a shared essence and therefore feeling unity with others (Fiske, 2004). As a result, they are motivated to share resources with these others largely without tracking reciprocity. Kama muta is proposed to be an emotion that is simultaneously biologically grounded in an evolved blueprint and culturally complemented. It thus depends on both biological and cultural evolution. The blueprint is recognizable in comparisons across cultures (Seibt et al., 2017; Schubert and Grüning, 2021). However, it is developed differently into culturally unique concept, and then evoked by different practices, is characterized by different experiences, and covers different meanings in different cultures (Fiske et al., 2017a, 2019). The folk concept *being moved* overlaps to a large degree with kama muta, but often includes emotional states that are not part of kama muta (e.g., sadness), and does not exclude others that would be kama muta (e.g., what is felt after seeing a really cute animal). Nevertheless, using the experience label "feeling moved/touched" is a useful component of any scale that measures kama muta (Zickfeld et al., 2019).

The emotion of kama muta is comprised of five components: appraisal, label/ing, physiology (=sensation and feeling), motivation, and valence (Zickfeld et al., 2019). Evidence on three of these characteristic elements dovetails with work on feeling moved (Cova and Deonna, 2014; Menninghaus et al., 2015; Fiske et al., 2017a). First, the emotion contains positive affect. Second, it comprises specific sensations, like, for instance, goosebumps, chills, and feelings of warmth in the chest. Third, the emotion motivates prosocial and altruistic behavior.

A stimulus (e.g., a political ad) should evoke *kama muta* if the stimulus includes the intensification of communal sharing, for instance a communal relation that is in danger, and a subsequent confirmation, renewal or triumph of this endangered communal sharing (Fiske et al., 2017b). It is also plausible that perceivers will *be moved* if a problem is introduced and communal relations are emphasized to tackle this problem, therefore perceivably intensifying communal sharing relations. To make this intensification of communal sharing happen, kama muta content emphasizes certain words and phrases (e.g., "we/our," "helping each other," and "together"). Displayed video images facilitate the same effect; sequentially showing pictures of several different people in the same context guides the viewer to conclude a notion of "we." Combining moving visualized actions (e.g., people helping each other), music sequences and titles (e.g., "Bridges"), videos have an optimal basis for intensifying the communal sharing relations between perceiver and the perceived person.

Anger

According to Carver and Harmon-Jones (2009), two fundamental features constitute the emotion of anger: first, its appraisal of a situation (Smith and Ellsworth, 1985; Ortony et al., 1988; Roseman, 1991; Scherer et al., 2001), and, second, the motivational processes behind anger (Arnold, 1960; Frijda, 1986; Roseman, 1991; Carver and Scheier, 1998; Davidson, 1998; Cacioppo et al., 1999). For the former feature, there exists the basic distinction of emotions being appraised as either positive (e.g., pleasant) or negative (e.g., aversive) in a situation (Lazarus, 1991). *Anger* is categorized as a negative emotion in general (Harmon-Jones, 2004). However, there are many different emotions which are generally categorized as negative. In the past, additional emotion components besides an emotion's appraisal were sought to distinguish anger from other negative emotions: for example, a violation of thought rules (e.g., Frijda, 1986; Mascolo et al., 2000), the experience of and focus on blameworthiness (Ortony et al., 1988) or the experience of being hurt by an intentional act of someone (Frijda, 1986). Carver and Harmon-Jones (2009) argued that all these additional aspects of an event besides valence do the same thing; they all motivate to remove (e.g., Depue and Iacono, 1989; Fox, 1991), the second fundamental feature characterizing anger. In more detail, Carver and Harmon-Jones (2009) argue that "anger often promotes the effort to remove the violation of what 'ought' to be." This can lead to the motivation to change someone's behavior (Fischer and Roseman, 2007) or, more generally, it leads to the motivation to reopen the closed path to a desired goal (Frijda, 1986). Building on this, Carver and Harmon-Jones lay out a range of evidence that anger is connected to an approach-oriented motivation rather than an avoidance-oriented one; like the majority of emotions described to have a negative valence (e.g., fear, disgust, or shame). The authors conclude that this makes anger an approach-related affect (Carver and Harmon-Jones, 2009). Additionally, Neumann (2000) showed that feelings of anger presuppose that the cause of the negatively experienced event is external. External attribution exerts feelings of anger in contrast to, for example, guilt, which is mainly related to internal attribution. This further supports the characterization of anger as approach oriented. An angry mind might, before all else, approach the problem because it is perceived as an external one.

Emotions From Political Ads Depend on Existing Social Relation

Seibt et al. (2019) showed, with the example of kama muta, that the elicitation of emotions from a political ad depends on the viewer's degree of prior preference for and identification with the candidate or party presented in the spot. The authors showed participants real political ads from the United States election in 2016, from Clinton and Trump, and asked them about their preference for one or the other candidate and party beforehand. Their studies showed that Clinton voters were much more moved to tears by Clinton ads than by Trump ads and vice versa. The authors subsequently showed that the elicitation of the emotion kama muta predicted how motivated a viewer was to support the shown candidate with her or his vote.

THE CURRENT RESEARCH

The present study serves as an extended replication and validation of the results of the study of Seibt et al. (2019) in the United States presidential election in 2016. We provide evidence on the robustness of the emotional and motivational effects but in a new setting of political advertisement in the United States, namely the mid-term instead of the presidential elections which differ in multiple aspects. Beyond providing evidence on the validity of these findings, the present study contributes two new insights to the literature on motivational effects of political advertisement. First, to our knowledge, we are the first to compare the evocation and the motivational effects of a social-relational emotion, kama muta, with the prominent emotion of anger in the context of political advertisement. Second, we use political ads that are substantially shorter than ads used in previous research so far (length of 35 s on average), investigating the spectrum of effect sizes of emotional and the subsequent motivational effects of political ads.

For both emotions, being moved and anger, we hypothesized two effects: (1) the enhanced evocation of the emotion by watching selected political ads that match a person's political preference and (2) an effect of this evocation on the participants' motivation to support the political candidate or party that commissioned the watched ad. We pre-registered all hypotheses[3].

Being Moved

An intensification of an interpersonal relation should especially be facilitated for peers considered as ingroup. Whether a political spot moves the viewer depends on the match between the ad's presented core values and the viewer's own worldview. As Seibt et al. (2019) already theorized, it also depends on the social relation between viewer and the candidate or party presenting the ad. That is, the prior identification with and preference for a candidate or party should influence the elicitation of kama muta, too, because communal relations are transitive (Fiske, 1992).

Hypothesis 1. Participants should be especially moved by an ad that has the party affiliation which the viewer identifies with most.

Additionally, with the extent to which a political ad is evoking the emotion of being moved, the participant's motivation should increase to support the shown candidate and the associated party. We reason this prediction through kama muta theory (Schubert et al., 2016; Fiske et al., 2017a; Seibt et al., 2017, 2018). The theory assumes that the intensification of communal sharing leads to the motivation to devote oneself to the communal sharing relationships which were intensified just then. Within the political context devoting oneself to this relationship might manifest in actively voting for the candidate and in supporting the candidate by ideational (e.g., acquiring other's votes) and financial means (e.g., donation). We test this hypothesis for the components of being moved, namely feeling, sensation, appraisal, and valence, separately.

[3]https://aspredicted.org/25598.pdf

Hypothesis 2. Being moved by the ad should have a significant effect on the viewers' motivation to support the candidate or party that commissioned the moving ad.

Anger

Anger analyses were explicitly planned and pre-registered as an exploratory approach. In this regard, we formulated hypotheses for effects on anger (hypothesis 3) and of anger (hypothesis 4) in political advertisement that matched the theoretically derived hypotheses for being moved.

Hypothesis 3. Participants should be especially upset by an ad that has the party affiliation which the viewer identifies with most.

Hypothesis 4. Being upset by the ad should have a significant effect on the viewers' motivation to support the candidate or party that commissioned the upsetting ad.

In summary, we predict that emotion evocation is increased when the videos party affiliation and the viewers' party preference match (H1 u. H3). We further predict that with the extent to which the two emotions, kama muta and anger, are evoked the participant's motivation increases to support the candidate and party responsible for the ad (H2 u. H4).

MATERIALS AND METHODS

The study was run from the 27th to the 30th of October in 2018, 1 week before the midterm elections in the United States, with participants from the United States. We selected eight political ads for eight different candidates to be shown. Note that we did not match participants' geographical location to the states or districts in which the candidates ran.

Participants

A total of 223 American participants were recruited and reimbursed via Mechanical Turk with the goal of reaching a sample size of 150 participants based on the recommendations of Schönbrodt and Perugini (2013). They were paid $3 each. We excluded participants who indicated to identify neither with Democrats nor with Republicans. As pre-registered, we also excluded participants who guessed the Democratic Party or an independent group as the ad-commissioners of only one specific ad, the "America is back"-ad (see Text Footnote 1). It was highly evident that this ad was commissioned by the Republican Party and served as an attention check. The final sample consisted of 146 participants. 76 indicated to be male (52.1%), 69 to be female (47.3%) and one preferred not to indicate a gender (0.7%). The average age was 39 years, ranging from 21 to 72. Of those who indicated a preference, 105 of the participants identified themselves more with the Democratic party (71.9%), while 41 identified themselves more with the Republican party (28.1%). Fifty-two participants reported to live in an urban neighborhood (35.6%), 70 to live in the suburbs (47.9%), and 23 to live in a rural neighborhood (15.8%, one missing value). Regarding ethnic background, 114 of the participants indicated to be White

(78,1%), 16 to be Black (11%), 9 to be Asian (6.2%), 4 to be Hispanic (2,7%), and 2 participants indicated *Other* writing they were "biracial" and "White/Native American" (1.4%). One preferred not to indicate (0,7%). In the present study, 36 out of the 50 states (+D.C.) in the United States were represented.

Design

The design varied experimentally within participants the source of the video (Democratic or Republican) and the emotion elicited by the video (kama muta or anger videos). For each combination we showed two videos, resulting in a total of eight videos. Videos were shown in random order. Participants' initially stated party preference was a quasi-experimental between-subjects factor (Republication vs. Democratic). In sum, the design was a 2 (video source, within) × 2 (video emotion, within) × 2 (party affiliation, between) mixed model.

Video Material

We used the 2018 United States midterm elections as source for the video material for several reasons. We chose the environment of American politics for two reasons. First, for the validity of replication, we wanted to stay in the same cultural and political realm as Seibt et al. (2019) and second, the two-party system in the United States offers an optimal starting point for researching the evocation and effects of emotions that rely on group-perceptions. The midterm elections were focused on for two reasons. First, from a practical perspective, they were the closest large election event in the United States at the time. Second, with our findings we aimed at expanding existing findings beyond the United States presidential elections and show that we find similar effects in the smaller but highly important midterm elective events in the United States, which typically have a lower turnout and mobilize more partisan voters.

We searched political ads online that according to our judgment elicited either kama muta or anger in a clear way. Note that we did not sample stimuli from a larger sample of ads randomly. Our results should thus be viewed as proof of existence of the hypothesized effects, but they cannot be generalized to the larger body of emotional ads.

In general, moving political ads are characterized by the introduction of a problem that can perceivably be tackled by working together. This intensifies people's feeling of communal sharing between the actors in the video, themselves, and other potential viewers. For the Democratic side two political ads stood out especially: (1) Bill Nelson for Senate and (2) Carper for Senate. The video titles "Stars" and "Bridges" already set the stage for the emotion of *being moved*. Adjectives like "together" and "helping each other" were predominant in the videos. This suits *being moved* very well. Additionally, both videos showed a wide reach across viewers side. These were the reasons why we chose these two ads for the Democratic side. On the Republican side we found two slightly shorter videos which show the same emotional direction trying to evoke a feeling of communal sharing, whose intensification is considered to be the main reason for *being moved* (Seibt et al., 2017). The one Republican video "More to Do/America is back" was especially interesting because it, at the time of selection, had over 4.5 million views on YouTube. While the second Republican video "Harvey" just had over 16.000 views at the time of selection, it exhaustively fulfilled criteria for a moving video and was therefore implemented in our study as the second political ad on the Republican side.

Because there were so many different *anger*-ads, our main criterion for choosing suitable videos was the intensity of the emotion evocation without taking the viewer-counts into account. The content of these political ads was characterized by the focus on one individual of the opposing political party that was accused of a specific wrongdoing that affects the whole community, state, or even country (i.e., money reputation). We chose two attack ads for the Democratic side, one against Barbara Comstock and the other against Mike Coffman, both politicians of the Republican party; and two attack ads for the Republican side, one against Joe Donnelly and the other against Joe Radinovich, both affiliated with the Democratic party. All four anger-ads were chosen because they showed the potential for a very intense anger evocation by an explicit and concrete accusation displayed in the videos.

In sum, we chose eight different videos. Each video is accessible on the corresponding OSF page (see Text Footnote 1).

Procedure

After the presentation of general information about the experiment, participants were asked to report their political identification (i.e., "What party do you identify with more?") choosing between identifying more with the Republican party, the Democratic party or neither of them. Subsequently, the respondents were shown the eight political ads in a randomized order.

After each ad viewers indicated what party affiliation they believed the video to have (i.e., "What do you think – was this an ad for a Republican, Democratic, or Independent candidate?"). Further, respondents reported (1) how *moving* and (2) how *upsetting* the content had been to them. The emotion kama muta (1) was assessed by asking questions about respondents' feeling (e.g., "The ad was touching."), sensation (e.g., "The ad was eye-moistening."), appraisal (e.g., "There were people in the ad who were welcoming or being welcomed.") and positive valence (i.e., "The ad had a positive tone."), whereas anger (2) was assessed by asking about participants' feeling toward the ad-commissioning candidate (e.g., "The person commissioning this ad annoyed me."), their feeling toward the featured candidate[4] (e.g., "The person being criticized in this ad annoyed me."), appraisal (i.e., "There were people in the ad who were criticized and rejected."), and negative valence (i.e., "The ad had a negative tone."). All items were presented with a 7-point Likert scale, anchored in 1 ("not at all") and 7 ("very much"), as is suggested for measuring kama muta by Zickfeld et al. (2019). Moreover, for every video participants indicated their motivation to support the candidate that had commissioned the seen ad, regarding voting support (i.e., "If I could vote in this election, I would be inclined to vote for the candidate or party that commissioned the ad."), financial backing (i.e., "I think it makes sense to give money to the

[4]We included this variable to cover the case that people get angry at a political ad they don't agree with.

candidate or party that commissioned the ad."), and ideational help (i.e., "If I knew somebody who can vote in this election, I would try to argue for the candidate or party that commissioned the ad."). Respondents indicated their (dis)agreement with the three statements on a 5-point Likert scale, ranging from 1 ("not at all true") to 5 ("completely true").

Finally, participants reported if they had seen any of the eight ads before and if they had had technical complications (e.g., sound or video playback). Subsequently, respondents indicated their gender, age, ethnicity, and the country, state, and neighborhood they were living in.

RESULTS

Pre-registration

We pre-registered our analyses (see Text Footnote 3). We had 146 participants in the final data set. Each participant watched 8 videos. This resulted in a sample of 1,168 observations. Our sample fell short on our pre-registered goal of 150 participants by four. We considered this number still satisfactory. We, further, pre-registered to remove every video for which its source (=commissioning party) was correctly identified in less than 66% of the cases. We didn't have to do so with any video. According to pre-registration, how we treated wrong guesses on the other videos was dependent on the wrong guesses' frequency in the specific cases. For the kama muta videos we found that in less than 25% of the cases participants wrongly guessed which party commissioned the ad. Therefore, we excluded all cases in which it was guessed wrong which party commissioned the specific ad and conducted all kama muta analyses with the variable *video party* (i.e., the videos' real party affiliation). For the anger videos, we found that in more than 25% of the cases participants guessed wrong which party commissioned the ad. Therefore, as pre-registered, we conducted anger analyses twice: (1) with the videos' real party affiliations as independent variable and all wrong guessing cases removed (as in the kama muta analysis), and (2) with the party affiliation a viewer guessed to be the video's affiliation, *party guess*. No playback problems with the videos or difficulties with sound were reported. Thus, no additional exclusions followed.

Aligning with our pre-registration, we also checked if the items for the two different components of feeling anger (six items in total) could be aggregated into one scale. The two sub facets were anger toward the candidate and party that were (1) featured in the ad (feeling toward protagonist) and toward those that (2) commissioned the ad (feeling toward commissioner). Both sub facets showed satisfactory reliabilities ($\alpha = 0.94$ and $\alpha = 0.95$). The correlation of these two components, however, was higher than $r = -0.60$ (i.e., it's absolute value was <0.60). Therefore, as pre-registered, we treat them as two independent facets measuring the feeling component of anger. The kama muta items' internal consistency was $\alpha = 0.88$ for the five sensation items, $\alpha = 0.86$ for the two appraisal items. We computed average scores for these emotion components. Valence was only represented by one item for being moved and anger each, appraisal of anger was only measured by one item and the present study included no sensation items for measuring anger. The measure of motivation to support a candidate had three items, which showed high internal consistency ($\alpha = 0.94$), and we thus averaged them.

Being Moved

The analyses were carried out in SPSS, focusing on two independent variables: (1) party preference of the participant (Republican vs. Democratic), and (2) the party affiliation of the ad (Republican vs. Democratic). The dependent variables we were interested in were the strength of emotion evocation (Hypothesis 1) and the motivation to support the ad-commissioning candidate (Hypothesis 2).

Manipulation Check

Kama muta-ads, as expected, moved viewers more than the anger-ads did; for feeling, $F(1,1166) = 388.45$, $p < 0.001$, $\eta_p^2 = 0.25$, sensation, $F(1,1166) = 119.07$, $p < 0.001$, $\eta_p^2 = 0.09$, appraisal, $F(1,1166) = 1780.82$, $p < 0.001$, $\eta_p^2 = 0.60$, and positive valence, $F(1,1159) = 2688.13$, $p < 0.001$, $\eta_p^2 = 0.70$.

Hypothesis 1

Subsequently, we ran four mixed models with the independent variables video's party affiliation (Republican vs. Democratic), the participant's party preference (Republican vs. Democratic), and video ID (1 to 4, nested within the video's party affiliation), and the evocation of the four kama muta emotion components as the dependent variables. Note that we treated video as a fixed instead of a random factor because it has to few levels. As shown in **Figure 1**, the four independent analyses showed that the two factors viewers' party preference and the ad's party affiliation interacted significantly for all four emotion components: for feeling, $F(1,362.0) = 48.49$, $p < 0.001$, $B = 2.14$, for sensation, $F(1,357.4) = 33.89$, $p < 0.001$, $B = -0.18$, for appraisal, $F(1,375.3) = 12.72$, $p < 0.001$, $B = 0.61$, and for valence, $F(1,364.6) = 33.62$, $p < 0.001$, $B = 1.74$, respectively. Viewers felt more moved by the ad content, felt greater physical sensation, appraised the content as more communally sharing and perceived it as more positive when their party preference was the same as the video's party affiliation (vs. not the same). The video party had a main effect on the evocation of all four components while the viewer's party preference had no effect in all four cases.

Hypothesis 2

We used four mixed models with the dependent variable being the motivation to support the candidate commissioning the ad and the independent variables being the video's party affiliation (Republican vs. Democratic), the participant's party preference (Republican vs. Democratic), and video ID (1–4, nested). The four emotion components of kama muta (i.e., feeling, sensation, appraisal, and valence) were used as separate predictors of viewers' motivation to support a candidate in the four models to see whether each of them predicted motivation on its own.

Before running these models, we ran one preliminary model without including the four emotion components explicitly as predictors. Here, the interaction effect of the participant's party preference and the ad's party affiliation on the motivation to support a candidate was significant, $F(1,378.5) = 377.47$,

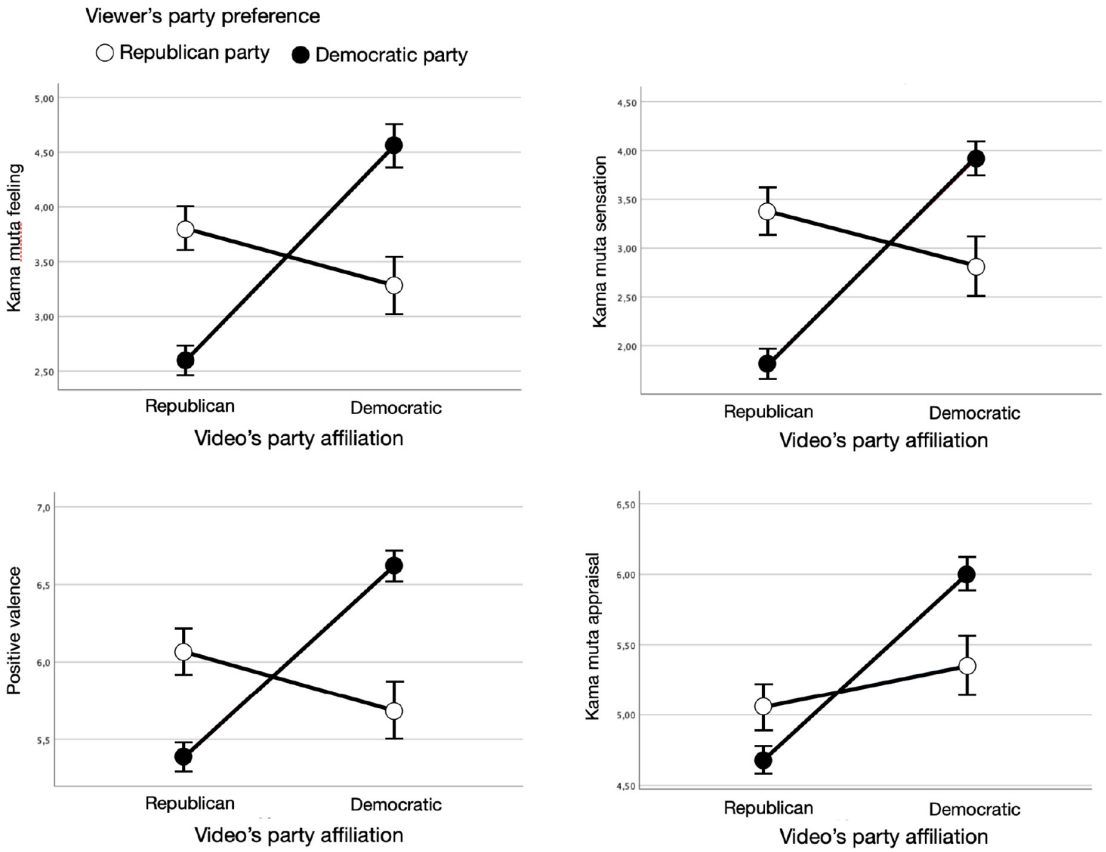

FIGURE 1 | Interaction effects of video's party affiliation and viewer's party preference on the four components of kama muta: feeling, sensation, positive valence, and appraisal.

$p < 0.001$, $B = 4.05$. That means, if the participant's party preference and the video's actual party affiliation matched, the motivation to support the candidate that commissioned the ad was higher. Further, the video's party affiliation had a main effect on the motivation to support, $F(1,378.6) = 19.65$, $p < 0.001$, $B = -2.54$. Specifically, Democratic ads were more motivating in general ($M = 3.49$) than Republican ones ($M = 2.07$). The viewer's party preference also had a significant main effect, $F(1,152.1) = 5.12$, $p = 0.025$, $B = -1.82$.

When adding the four emotion components of kama muta as predictors (in four separate models), all four predicted motivation significantly: feeling, $F(1,377.8) = 201.42$, $p < 0.001$, $B = 0.41$; sensation, $F(1,411.2) = 214.29$, $p < 0.001$, $B = 0.22$; appraisal, $F(1,476.6) = 44.88$, $p < 0.001$, $B = 0.44$; and valence, $F(1,461.1) = 15.89$, $p < 0.001$, $B = 0.40$. Viewers who felt more moved by the ad content, felt greater physical sensation, appraised the content as more communally sharing, and perceived it as more positive showed more post-ad motivation to support the candidate that commissioned the seen ad.

Additionally, kama muta appraisal and valence were such strong predictors that the interaction effect between viewers' party preference and the video's party affiliation became non-significant, $F(1,447.0) = 2.56$, $p = 0.110$ and $F(1,447.3) = 0.02$, $p = 0.889$, respectively. For kama muta feeling and sensation the interaction of party preference and video affiliation remained significant, $F(1,431.0) = 110.16$, $p < 0.001$, $B = 3.85$ and $F(1,444.6) = 211.24$, $p < 0.001$, $B = 4.11$, respectively.

Lastly, the mixed model analyses showed significance for the three-way interactions between the participant's party preference, the video's party affiliation and all four emotion components of kama muta, feeling, $F(1,464.1) = 4.04$, $p = 0.045$, $B = -0.18$, sensation, $F(1,482.9) = 15.37$, $p < 0.001$, $B = -0.30$, appraisal, $F(1,453.1) = 10.44$, $p = 0.001$, $p = 0.045$, $B = 0.46$, and valence, $F(1,446.0) = 13.23$, $p < 0.001$, $B = 0.63$, respectively. That means, if a participant's party preference matched the ad's party affiliation, the effect of this interaction on the respondent's motivation to support the candidate was further enhanced by the viewer feeling especially moved by the ad content, especially strong physical sensation, appraising the content as especially communally sharing and perceiving it as especially positive. These interactions were not predicted and contradict earlier findings by Seibt et al. (2019).

Anger

The analyses were carried out in SPSS with focus on the same two factors as for kama muta analyses: (1) party preference of the participant (Republican vs. Democratic), and (2) the party affiliation of the ad (Republican vs. Democratic). One new factor

we included in the analyses for anger, due to not meeting a pre-registered aspect of data quality as explicated above, was the party affiliation participants had guessed for the ad (instead of the video's actual party affiliation). Identical to kama muta analyses, the dependent variables we were interested in were the strength of emotion evocation (Hypothesis 3) and the motivation to support the ad-commissioning candidate (hypothesis 4).

Manipulation Check

First of all, the anger-ads, as expected, upset viewers more than the kama muta-ads did; for anger toward commissioner, $F(1,1166) = 250.39$, $p < 0.001$, $\eta_p^2 = 0.18$, and anger against protagonist, $F(1,1166) = 8.26$, $p = 0.004$, $\eta_p^2 = 0.07$, appraisal, $F(1,1166) = 930.49$, $p < 0.001$, $\eta_p^2 = 0.44$, and negative valence, $F(1,1166) = 2486.99$, $p < 0.001$, $\eta_p^2 = 0.68$.

Hypothesis 3

Analyses With Video's Guessed Party Affiliation. Here we used the same mixed model approach as for being moved but using the party affiliation participants guessed for an ad instead of the ad's actual affiliation. As shown in **Figure 2**, the four independent analyses showed that the interaction of viewers' party preference and the ad's guessed party affiliation had the expected significant effect on three of four emotion components of anger, that is, feeling against protagonist, $F(1,454.2) = 29.00$, $p < 0.001$, $B = 1.50$, feeling against commissioner, $F(1,450.6) = 28.03$, $p < 0.001$, $B = -2.18$, and negative valence, $F(1,414.8) = 9.75$, $p = 0.002$, $B = -1.27$, respectively. Concluding, viewers felt more upset by the featured candidate, less upset by the commissioning candidate, and perceived the ad content as more negative when their party preference was the same as the video's guessed party affiliation (vs. not the same). The interaction effect, however, was not significant for appraisal, $F < 1$, $p = 0.426$. The video party and the viewer's party preference only in few instances had a significant main effect on the evocation of all four components.

Analyses With Video's Actual Party Affiliation. Again, we used the same mixed model approach as for the kama muta analyses. For these analyses all cases were excluded in which the party affiliation of a shown ad was indicated incorrectly by a viewer. As shown in **Figure 3**, the four independent analyses showed that the interaction of viewers' party preference and the ad's actual party affiliation had the expected significant effect on three of four emotion components of anger, that is, feeling against protagonist, $F(1,264.1) = 87.72$, $p < 0.001$, $B = 4.30$, feeling against commissioner, $F(1,253.2) = 106.83$, $p < 0.001$, $B = -4.94$, and valence, $F(1,208.0) = 11.78$, $p = 0.001$, $B = -0.79$, respectively. Viewers felt more upset by the featured candidate, less upset by the commissioning candidate, and perceived the ad content as more negative when their party preference was the same as the video's party affiliation (vs. not the same). The interaction effect, however, was again not significant for appraisal, $F < 1$, $p = 0.347$. The video party had no significant main effect on the evocation of any of the four components and the viewer's party preference only had a significant main effect on the evocation of the anger feeling against the protagonist of an ad.

Hypothesis 4

We used a mixed model with the dependent variable being the motivation to support the candidate commissioning the ad and the independent variables being the video's guessed or actual party affiliation (Republican vs. Democratic), the participant's party preference (Republican vs. Democratic), and video ID (1–8). Additionally, the four emotion components of anger (i.e., feeling against protagonist, feeling against commissioner, appraisal, and valence) were used as predictors of viewers' motivation to support a candidate.

Analyses With Video's Guessed Party Affiliation. Without including the four emotion components explicitly as predictors, the interaction effect of the participant's party preference and the ad's guessed party affiliation on the motivation to support a candidate was significant, $F(1,471.7) = 39.68$, $p < 0.001$, $B = 1.62$. That means, if the participant's party preference and the video's guessed party affiliation were the same, the motivation to support the candidate that commissioned the ad was enhanced. The main effects of the video's guessed party affiliation and the viewer's party preference on the motivation to support showed as non-significant, $F < 1$, $p = 0.511$; and $F < 1$, $p = 0.482$. Specifically, ads which were guessed to be Democratic were not more motivating in general than ones that were guessed to be Republican and vice versa.

Importantly, three out of four emotion components of anger were significant predictors of the motivation outcome of participants: feeling against protagonist, $F(1,456.4) = 107.96$, $p < 0.001$, $B = 0.45$, feeling against commissioner, $F(1,475.2) = 9.41$, $p = 0.002$, $B = -0.31$, and valence, $F(1,461.1) = 10.10$, $p = 0.002$, $B = 0.02$. In short, viewers that felt more upset by the candidate featured in the ad, felt less upset by the ad-commissioning candidate, and perceived the ad as more negative showed enhanced post-ad motivation to support the candidate that commissioned the seen ad. Anger appraisal did not show a significant prediction of a participant's motivation to support, $F < 1$, $p = 0.377$.

Additionally, felt anger toward the candidate that was featured in the ad (feeling against protagonist) was such a strong predictor that the interaction effect between viewers' party preference and the video's guessed party affiliation became non-significant in the process, $F < 1$, $p = 0.736$. In other words, anger completely mediated the effect that a match between the ad's source and one's own prior preference had on motivation. Further, anger against the ad-featuring candidate came out as the superior predictor in comparison to anger against the ad-commissioning candidate. Including anger feeling against protagonist and feeling against commissioner in the same analysis lead to a non-significant effect of feeling against commissioner, $F(1,445.8) = 1.48$, $p = 0.224$, and a non-significant interaction of viewers' party preference and the video's guessed party affiliation, $F < 1$, $p = 0.428$. Feeling against protagonist held up as a significant predictor, $F(1,460.4) = 18.42$, $p < 0.001$, $B = 0.45$. That means to a viewer's motivation to support the ad-commissioning candidate it matters how upset a participant feels by the candidate featured in the ad. The side effect of participants getting angry because they don't agree

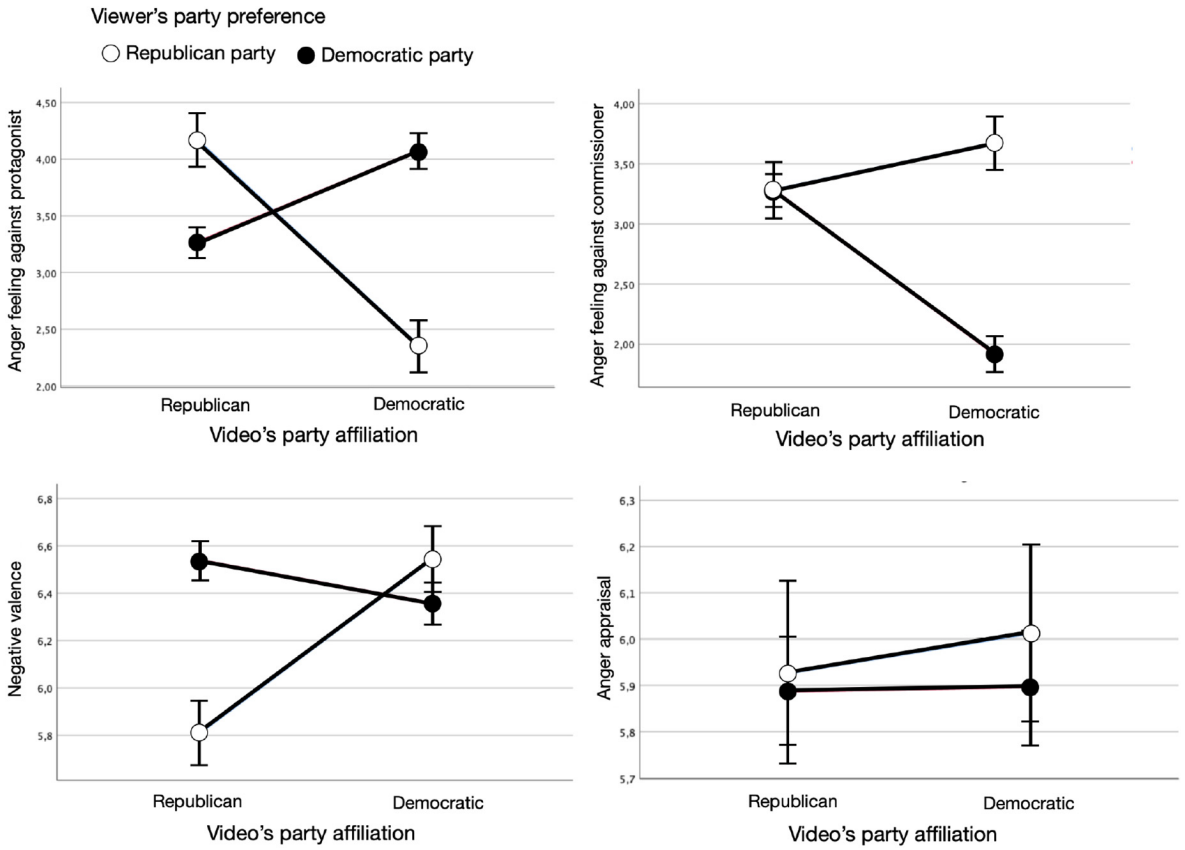

FIGURE 2 | Interaction effects of video's guessed party affiliation and viewer's party preference on the four components of anger: feeling against protagonist, feeling against commissioner, negative valence, and appraisal.

(with the ad-commissioning candidate or party) doesn't seem to matter in this case.

The mixed model analyses showed significance for the three-way interactions between the participant's party preference, the video's guessed party affiliation and two of four emotion components of anger, that is, appraisal, $F(1,426.3) = 6.12$, $p = 0.014$, $B = 0.42$, and negative valence, $F(1,482.3) = 9.36$, $p = 0.002$, $B = 0.89$, respectively [for anger against protagonist: $F(1,478.9) = 3.12$, $p = 0.078$; and against commissioner: $F < 1$, $p = 0.861$]. That means, if a participant's party preference matched the ad's party affiliation, the effect of this interaction on the respondent's motivation to support the candidate was further enhanced by appraising the ad-content as especially critical and perceiving it as especially negative.

Analyses With Video's Actual Party Affiliation. Without including the four emotion components explicitly as predictors, the interaction effect of the participant's party preference and the ad's actual party affiliation on the motivation to support a candidate was significant, $F(1,280.8) = 80.01$, $p < 0.001$, $B = 2.56$. That means, if the participant's party preference and the video's actual party affiliation matched, the motivation to support the candidate that commissioned the ad was enhanced. Further, the video's actual party affiliation had a main effect on the motivation to support, $F(1,280.8) = 7.57$, $p = 0.006$, $B = -1.67$. Specifically, Democratic ads were more motivating in general ($M = 2.77$) than Republican ones ($M = 1.80$). The main effect of viewer's party preference was non-significant, $F(1,111.7) = 1.05$, $p = 0.308$.

Importantly, three out of four emotion components of anger were significant predictors of the motivation outcome: feeling against protagonist, $F(1,313.5) = 73.60$, $p < 0.001$, $B = 0.49$; feeling against commissioner, $F(1,300.9) = 4.12$, $p = 0.043$, $B = -0.31$; and valence, $F(1,253.9) = 6.13$, $p = 0.014$, $B = 0.17$. Again, as for ads' guessed party affiliation, viewers that felt more upset by the candidate featured in the ad, felt less upset by the ad-commissioning candidate, and perceived the ad as more negative showed enhanced post-ad motivation to support the candidate that commissioned the seen ad. Anger appraisal did not show a significant prediction of the participant's motivation to support, $F(1,173.6) = 1.21$, $p = 0.273$.

Additionally, and similarly to analyses with a video's guessed party affiliation, anger feeling against protagonist was such a strong predictor that the interaction effect between viewers' party preference and the video's party affiliation showed as non-significant in the process, $F < 1$, $p = 0.858$. Further, feeling against protagonist came out as the superior predictor in comparison to feeling against commissioner. Including anger feeling against protagonist and feeling against commissioner in

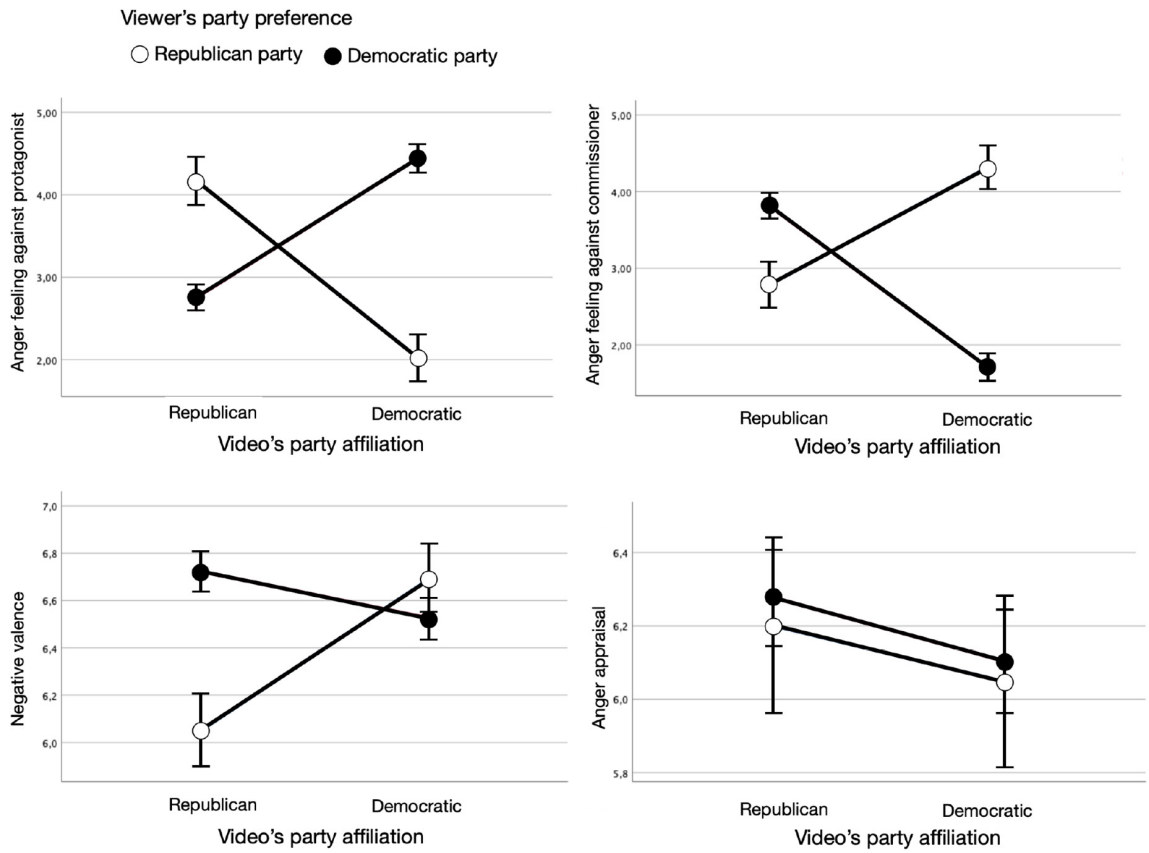

FIGURE 3 | Interaction effects of guessed party affiliation and viewer's party preference on the four components of anger: feeling against protagonist, feeling against commissioner, negative valence, and appraisal.

the same analysis lead to a non-significant effect of feeling against commissioner, $F(1,260.8) = 2.23$, $p = 0.136$, and a non-significant interaction of viewers' party preference and the video's actual party affiliation, $F(1,431.6) = 2.53$, $p = 0.113$. Feeling against protagonist held up as a significant predictor, $F(1,276.1) = 16.17$, $p < 0.001$, $B = 0.51$. That means, identical to the findings for ads' guessed party affiliation, to predict a viewer's motivation to support the ad-commissioning candidate it is irrelevant to know how upset this participant is with the candidate that commissioned the ad, if one knows how upset a participant feels with the candidate featured in the ad.

Lastly, the mixed model analyses showed significance for the three-way interactions between the participant's party preference, the video's actual party affiliation and three of four emotion components of anger, feeling against protagonist, $F(1,305.3) = 6.48$, $p = 0.011$, $B = 0.40$, appraisal, $F(1,279.3) = 4.932$, $p = 0.03$, $B = 0.42$, and negative valence, $F(1,304.7) = 7.85$, $p = 0.005$, $B = 0.89$, respectively (against commissioner: $F < 1$, $p = 0.933$). As in the analyses with an ad's guessed party affiliation, that means, if a participant's party preference matched the ad's party affiliation, the effect of this interaction on the respondent's motivation to support the candidate was further enhanced by feeling more anger toward the ad-featured candidate, appraising the ad-content as especially critical and perceiving it as especially negative.

DISCUSSION

The present study was conducted before the United States midterm elections of 2018. Participants were shown eight ads from real political campaigns of the midterm elections. We first tested if the ads evoked stronger emotions of *being moved* and *anger* in a viewer who watched ads that support the party she or he identifies with most. Second, we tested if these evoked emotions significantly increased the motivation to support a candidate.

The emotion *being* moved, that is all its four components, were significantly affected by the interaction effect of the party resembled by the video and the participant's party preference. If one's party affiliation matched the source of the video, participants experienced more kama muta. Further, for all emotion components (i.e., feeling, sensation, appraisal, and valence) their evocation significantly predicted the participant's motivation to support the focused candidate and party.

For *anger* we found the same effect pattern, except for a non-significant emotional effect on and motivational effect of anger's

constructed appraisal measure. The other emotion components (i.e., feelings and valence) were significantly evoked by the interaction effect of the party which commissioned the ad and the participant's party preference and these emotion evocations significantly predicted the motivation of participants to support the candidate and party that commissioned the ad.

For both emotions we find a three-way interaction effect of the video's party, the participant's party preference and the emotion evocation on the viewer's support motivation. That is, the present paper points at two moderation effects of video party and party preference. First, people are more moved and angered by videos of the party they identify with. Second, to the extent that one experiences kama muta, that experience motivates more strongly to support the party if it is one's own party.

What can we learn from the results? First, people get especially moved or angered by political ads that are commissioned by the party they identify with more. Second, these two evoked emotions, more specifically their different components, influence a participant's motivation to support the commissioning party and its candidate, in direct (i.e., voting for the candidate) as well as ideational (e.g., recommending the party to others) and financial terms (e.g., donating money to the party). The evoked emotions motivate a viewer more if they are evoked by a video from the party the viewer identifies with.

The present results are relevant in five ways. First, by replicating the results of Seibt et al. (2019) we support their reliability, solidifying our understanding of the theoretical concept of kama muta and its effects in political advertisement. Second, in our study we focused on ads that were much shorter than in previous research and chose the United States midterm instead of presidential elections that have been in prominent focus so far (see, e.g., Devlin, 1995; Benoit, 1999; Goldstein and Wilner, 2012). This focus expands the generalizability of the supported emotion effects, enhancing the theory's external validity. Third, the present study makes the point that an ad length substantially shorter than the common presidential campaign ads is already sufficient for a significant evocation of being moved or anger in viewers. On top of that, these political spots are able to facilitate a relevant influence on participants' motivation for different ways of political support. Finding these emotional effects advances existing insights on the impact of short attack-ads on cognitive responses (e.g., Kern and Just, 1995; Bradley et al., 2007). Note, however, that the comparison of effects in the present study with the effects Seibt et al. (2019) report is confounded by the ad-content, which was different. A direct comparison of these two is, hence, not informative.

Fourth, we also find a significant three-way interaction of the video party, viewer's party preference and the emotion evocation in their prediction of the participant's support motivation. This means that evoked kama muta only translated into support if the source of the emotion was an ad by one's already initially preferred party. This interaction was not observed by Seibt et al. (2019). There, the conclusion was that kama muta is able to overcome group boundaries [see also recent work by Blomster Lyshol et al. (in press)]. It is, however, in line with arguments that self-relevance is of importance (Mujani and Liddle, 2010; Chou and Lien, 2011). Methodological reasons might be that Seibt et al. (2019) used political ads that were longer than the videos used in the present study and that were material for the presidential election rather than the more partisan midterm election. Both factors might have enhanced the videos' emotional influence on viewers leaving less room for a three-way interaction effect to show as significant.

Lastly, while anger has long been recognized as an important emotion in the political context (Marcus, 2003; Brader, 2005), the present findings regarding anger effects of political ads are the first of their kind we are aware of. We enable the first parallel comparison of a positive social-relational emotion and anger in their evocation by political advertisement and their subsequent effects on the motivation for political support. By this comparison, we show that anger, like kama muta, can be represented and assessed from different emotion components and empirically support the notion in literature that anger is a motivator for political support.

Limitations and Future Research

The appraisal of anger, as the only component in the study's array of emotion components, was neither significantly affected by political ads nor did it have an effect on people's motivation to support a political campaign. A possible explanation might be that the wording of the appraisal item did not encode the correct kind of appraisal for anger. The item we chose to measure the appraisal of critique and rejection has measured exactly that. However, to correctly display an anger appraisal we argue that the item ought to not just capture critique and rejection but *unjust* critique and rejection instead. The appraisal item ought not to ask if there is critique on and rejection of a candidate, but if the critique or the rejection are unjust. To combat the measurement issue of the anger appraisal we propose to extend the measurement of appraisal to more than one item and to include items that do not encode the appraisal of critique and rejection (i.e., "There were people in the ad who were criticized and rejected.") but rather the appraisal of unjust critique and rejection (i.e., "There were people in the ad who were *unjustly* criticized and rejected."). Alternatively, or in addition, the appraisal item could tap into goal blocking and goal frustration in general, in line with prevalent notions of the anger appraisal (Kuppens et al., 2003, 2007).

While we found a significant interaction effect between the ad's party affiliation and the viewer's party preference on a viewer's feeling of being moved, on a more detailed level only Democratic sympathizers show a significant difference in being moved and angered by watching Democratic vs. Republican ads. Republican sympathizers are descriptively, but not significantly, more moved and angered by Republican than Democratic ads. This might have two reasons. First, the sample size of Republican sympathizers (N = 41) might have been too low to provide a reasonable power for an interaction analysis to hold significant results. However, the descriptives also do not point to the conclusion that Republican sympathizers, like Democratic ones, show more emotions when watching the ad their preferred party commissioned. Second and more aligning with descriptives, there could be a difference between Republican and Democratic sympathizers or the ads

themselves in being moved by political ads. However, answering such a question with satisfying certainty would need future research with higher statistical power to rule out the former shortcoming of the present study, and more control over the stimulus materials.

On the more detailed level of party sympathy we, further, find that while Republican sympathizers are more angered by attack ads against the Democratic than against the Republican party, this anger does not motivate them to support the Republican party instead of the Democratic Party. Again, two explanations can make sense of this phenomenon. The statistical power was too low[5] or there might be an actual difference in anger-motivated political support between Republican and Democratic sympathizers. Yet again, further research has to test both assumptions.

The present study did not include sensation measures for anger. Such measures should be implemented in future research to facilitate a more extensive view on the emotion concept of anger and enhance the resolution of anger's effect pattern in political advertisement.

We are aware of the weaknesses of motivation measures and the assessment of intentions (see for other cases Chou and Lien, 2010, 2011). Their validity as replacement of actual behavior is of course limited. We expect it to be difficult to completely break away from an artificial design and measure real voting behavior of participants in the election; first and foremost, this will be difficult because of confidentiality issues connected to recording people's votes. However, looking at the different ways political support was measured in the present study, other measures of voting-related behavior are certainly possible to implement. For example, future studies might measure how many other people a participant contacts to praise a candidate or how much a candidate donates to the ad-commissioning candidate after having seen a respective political spot (see for similar application, Erlandsson et al., 2018). Behavioral measures are central to understand the range of effects emotions have on people's voting behavior because they analyze the impactful step after an intention has formed. Note also that within-designs and measures on interval scales provide more statistical power.

Moreover, recent research has shown that the motivational effect of a single ad might be small on average (Coppock et al., 2020). We have presented participants with a conglomerate of political videos per emotion and political party. Future research may want to examine potential cascade effects of subsequently watching several political ads.

Lastly, a growing literature on examining the cognitive antecedents of evaluating leading vs. trailing political candidates (e.g., Alves and Mata, 2019; Grüning et al., 2021) raises the question of how this feature of an election may affect emotion evocation and motivational effects. Potentially, the evocation of being moved is especially pronounced for a political party that is behind in votes because this situation accentuates the problem that has to be overcome by working together. Future research might explore this and other elements that characterize political elections beyond the identification with a political side.

Practical Implications

The interaction effect of the participant's and the video's party affiliation held up even when participants guessed an ad's affiliation. That is, for a relevant emotional influence it did not matter if the party affiliation that matched the viewer's preference was an actual or a constructed one. This has several practical implications for advertisement for political campaigns. For instance, to just name one, campaign ads would do well to unambiguously communicate their political affiliation to prevent unwillingly feeding the support of political competitors.

On another practical note, in regard to policy making, the question arises how powerful and, consequently, how dangerous emotionalized political ads can be for the voter. If behavioral studies support the present findings of motivational effects on voter support, underpinning the manipulative potential of emotionalized political ads, multiple practical questions would urgently call for answers. For instance, should a political ad's emotionalizing potential be explicitly evaluated and communicated? We can not give answers from our current results, but any democratic process should be aware of the power of both heartwarming and attack ads to persuade through emotions.

Finally, the moderation of an ad's impact on emotions, and the subsequent moderation of that emotion's impact on motivation by the source of the video supports that ads in a modern political landscape actually have little effect in terms of winning over voters from the other side (but see, Phillips et al., 2008). Instead, they have impact on constituents who already identify to support through donations, and to turn out to the ballot box.

CONCLUSION

Our findings provide a glimpse into how the emotional side of political advertisement works. The present paper finds a double moderation of a video's party affiliation and the viewer's party preference. If the party that commissions the political ad fits the viewer's party preference the video evokes more kama muta and anger, depending on the video, in the viewer than if video party and party preference do not fit. Importantly, this same fit then also plays a role for the effect an evoked emotion has on the motivation of the viewer to support a candidate or party directly (i.e., voting for the candidate), ideationally (e.g., recommending the party to others) and financially (e.g., donating money to the party). That is, the fit between the video's party affiliation and the viewer's party preference matters for the emotional as well as, subsequently, the motivational influence of a political ad. In conclusion, the present findings show that political ads

[5]Note that in this case the descriptives, indeed, point in the direction of the hypothesized effect.

mainly influence voting turn out and alternative political support. However, they are less effective in changing people's minds and overtaking voters from the other political side.

DATA AVAILABILITY STATEMENT

The dataset presented in this study can be found in the following online repository: https://osf.io/v3ecg/.

ETHICS STATEMENT

The study involved human participants and was, therefore, reviewed and approved by the internal review board at the Department of Psychology, University of Oslo. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

DG created the materials, ran the study, analyzed the data, and wrote the first draft. DG and TS revised materials, checked analyses, and revised the manuscript. Both authors jointly planned the study and the analyses.

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Influences of Emotion on Driving Decisions at Different Risk Levels: An Eye Movement Study

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To explore the influences of traffic-related negative emotions on driving decisions, we induced drivers' three emotions (neutral emotion, traffic-related negative emotion, and traffic-unrelated negative emotion) by videos, then the drivers were shown traffic pictures at different risk levels and made decisions about whether to slow down, while their eye movements were recorded. We found that traffic-related negative emotion influenced driving decisions. Compared with neutral emotion, traffic-related negative emotion led to an increase in the number of decelerations, and the higher the risk, the more the number of decelerations. The visual processing time of the risk area was shorter in the traffic-related negative emotional state than that in the neutral emotional state. The less time drivers spend looking at the risk area, the faster they make their driving decisions. The results suggest that traffic-related negative emotions lead drivers to make more conservative decisions. This study supports the rationality of using traffic accident materials to conduct safety education for drivers. This article also discussed the significance of traffic-related negative emotions to social security.

Keywords: driving decision, negative emotion, eye movement, level of risk, visual process

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INTRODUCTION

The number of motor vehicles increases rapidly, which leads to an increase in traffic accidents. Traffic accidents have become one of the leading causes of death and disability. It poses a great threat to social security. Fatalities in a road traffic accident are caused by a series of factors including people, vehicles, roads, and the environment (Wang et al., 2019). Previous studies have indicated that drivers' characteristics and behaviors play an important role in predicting traffic accidents (Özkan et al., 2006), and improper driving behaviors are the main cause of accidents and violations (Mesken et al., 2002). Improper driving behavior not only relates to the driver's life and safety, but also increases a lot of hidden dangers, and even endangers the society. Driver's emotion, as one of the main psychological factors, is sometimes not controlled by cognition, and may spontaneously influence driving behaviors (Strongman, 2003; Šeibokaitė et al., 2017; Maldonado et al., 2020). Emotion is a short, easily affected, and rapidly changeable state of mind (Zimasa et al., 2016), which arises when something important to us is at stake and calls forth a coordinated set of behavioral, experiential, and physiological response tendencies that together influence how we respond to perceived challenges and opportunities (Gross, 2002).

In the process of driving, drivers are often affected by the events they experience, especially those related to negative emotion. The relationship between negative emotions and driving behavior has attracted the attention of researchers (Nesbit and Conger, 2012; Bogdan et al., 2016;

Sullman et al., 2017). Jallais et al. (2014) found that sadness increased the localization error rate, and anger made participants slower to locate road elements. Kovacsova et al. (2016) found that anger, hostility, nervousness, and being upset were associated with aggressive driving. Zimasa et al. (2016) found that negative emotions had a detrimental effect on cognitive processes in general and on driving safety in particular. In sum, previous studies often focused on the influence of a specific negative emotion such as sadness, anger, and hostility on driving behaviors, but when driving attentively in busy traffic, the driver could hardly tell what the exact emotion at the moment. However, the question of our study can be answered by examining the influence of negative emotions on driving decisions. Therefore, instead of distinguishing the specific types of negative emotions, this study only induced negative emotions to explore the influence of traffic-related negative emotions on driving decisions. Emotion arises with clear reasons. The duration of emotion is usually short and the whole process of emotion from arising to fading could be easily traced (Hu et al., 2013). Different studies have used different methods to induce emotions (Eherenfreund-Hager et al., 2017; Steinhauser et al., 2018). In the present study, we induced drivers' negative emotions by watching videos, which was a simple and effective emotion-induced method.

The relationship between eye movements and cognition had attracted researchers' attention for a long time (Posner, 1980). Some researchers have used eye-movement datasets over still images to evaluate visual attention models (Borji and Itti, 2013). Visual attention is controlled by top-down and bottom-up processing (Orquin and Loose, 2013). So risks on the road and drivers' emotions jointly act on drivers' visual processing speed of risk. Besides, studies have found that the driving decision is also affected by different situations. With the increase of risk rating, both the frequency of blinks and total duration decreased significantly (Charlton et al., 2014). We infer that the related events leading to negative emotions play a more dominant role and are easier to capture attention. Therefore, drivers with traffic-related negative emotions may be more sensitive to traffic-related risks and have shorter visual processing time for traffic risks.

Drivers' eye movements exhibit different fixation patterns for different driving tasks. Land and Lee (1994) found that when driving along a tortuous road, the driver paid more attention to the "tangent point" on the inside of each curve. Eye fixations may reflect the processing state of the driver. Lemonnier et al. (2014) asked participants to operate a driving simulator to a crossroad and decided to stop or not. They found different visual patterns in different decision-making phases: high visual exploration (larger saccade amplitudes and shorter fixation duration) for the differentiation phase (leading to a prior decision), and lower visual exploration (smaller saccades and longer fixations) for the consolidation phase (leading to a final decision). Markov models of eye movement behavior in simple situations could even be linearly combined to predict behavior in complex tasks (Liu et al., 1998). Different driving decision studies use different decision tasks (Calisir and Lehto, 2002; Alvaro et al., 2018). In Torres et al. (2017), participants were shown images of traffic situations and asked to make decisions on braking tasks. This kind of task was easier to understand and more related to real life. Referring to Torres, we used the decision task of whether to slow down in traffic scenarios at different risk levels to explore the influence of emotions on driving decisions. We infer that the shorter time for which drivers gaze at the risk area is related to the faster speed at which they make driving decisions.

In summary, we induced drivers' emotions by videos and recorded drivers' driving decisions, reaction time, and total fixation duration to investigate the driving-decision processing of whether to slow down when drivers watched traffic pictures at different risk levels. We proposed the following hypotheses: (1) Drivers with traffic-related negative emotional states make more deceleration decisions, namely, the higher the risk level, the more the number of deceleration decisions. (2) Drivers with traffic-related negative emotional states have faster visual processing on the risk scene. (3) The shorter time for which drivers gaze at the risk area is related to the faster speed at which they make driving decisions.

MATERIALS AND METHODS

We asked the participants to watch a video and fill in the emotional assessment scale. After a successful emotion induction, the participants were shown a group of pictures at three risk levels and asked to make driving decisions about whether to slow down according to the traffic risk in the picture. In our study, each participant must be induced three emotions and complete three decision-making procedures. The specific experimental methods are as follows.

Participants

G-power 3.1.9.7 is used to estimate the sample size ($\alpha = 0.05$, $1-\beta = 0.80$), with an effect size $f = 0.40$, and calculated minimum sample size $N = 24$ (Faul et al., 2009). Thirty-six college students with driving licenses were selected to participate in this experiment. One participant with unqualified eye movement calibration was deleted, and 35 participants remained (14 males, $\chi^2 = 1.4$, $p = 0.237$). The average age of participants was 25.17 years old, and the standard deviation (*SD*) was 3.07. Their average mileage driven was 5427.74 km and average time to obtain the driver's license was 41.66 months. All of the participants were right-handed, had the normal naked or corrected vision, and had no color blindness or color weakness. All of the participants have read and signed the Informed Consent Form and received appropriate remuneration after the experiment.

Experimental Apparatus and Materials

Eyelink 1000 Plus desktop eye tracker was used to collect eye movement data at a sampling frequency of 1,000 Hz. The stimulation was presented on a 19-inch LCD with a resolution of 1280 × 1024 and a refresh rate of 60 Hz. A chin-rest and forehead-rest minimized head movements. The eyes of the participant were about 60 cm from the center of the screen.

We prepared about 900 min of dashcam videos taken from the driver's perspective. During filming, vehicles were driving around

the city center, and the speed was about 40 km/h, the weather conditions were good. The vehicle ran on the road safely without traffic accidents. We asked a driver with more than 10 years of driving experience to take 180 pictures from the video, and each picture contained a traffic risk.

Then we asked 20 college students with driver's license to evaluate the risk in the picture on a scale of 1–7, 1 represented a very low risk, 4 represented a medium risk, and 7 represented a very high risk. The program for rating pictures was compiled and presented by E-prime 2.0. The average score of 20 students' ratings of a picture was the risk level score of this picture. We finally selected 60 low-risk pictures and 60 high-risk pictures from 180 pictures according to the risk level scores. The average risk level score of 60 low-risk pictures was 2.64 ± 0.62, significantly lower than 4 ($p < 0.001$). The average risk level score of 60 high-risk pictures was 5.47 ± 0.52, significantly higher than 4 ($p < 0.001$).

To avoid participants' fatigue or carelessness, we added the no-risk pictures. We captured 60 pictures without obstacles ahead of the road from the dashcam videos as no-risk pictures. Finally, we got a total of 180 experimental pictures, including 60 low-risk pictures, 60 high-risk pictures, and 60 no-risk pictures. The pictures were 1024×542 pixels.

We randomly divided high-risk pictures, low-risk pictures, and no-risk pictures into three groups, each group contained 20 high-risk pictures, 20 low-risk pictures, and 20 no-risk pictures. Variance analysis was performed on the risk level scores of the three groups of pictures, and the results showed that there was no significant difference in the three groups of pictures, $F(2,117) = 0.002$, $p = 0.998$. The risk description of the three groups of pictures was shown in **Table 1**.

Materials of Emotion Induction

There were three emotion induction videos in our study. The 4 min 40 s of the traffic accident scene and warning education clip video induced traffic-related negative emotion. The 6 min 20 s disaster film "Aftershock" induced traffic-unrelated negative emotion. And the 5 min scenery video induced neutral emotion.

The traffic accident scene and warning education clip video contained real traffic accident scenes and two traffic accidents caused by dangerous driving behaviors, which were performed by professional actors. Some earthquake scenes were taken and edited from the film named "Aftershock." Traffic accidents and earthquakes are both dangerous events that exist in real life, bringing loss of life and property. We used the two videos to induce traffic-related negative emotion and traffic-unrelated negative emotion.

Emotion Assessment

Three pairs of adjectives (unpleasant–pleasant, relaxed–tense, tired–vigorous) were used to measure emotion (Matthews et al., 1995). Referring to Hu et al. (2013), another dimension was added to rate overall feeling: feeling bad–feeling good. Scale endpoints

TABLE 1 | Description of risk scenarios in the three groups of pictures.

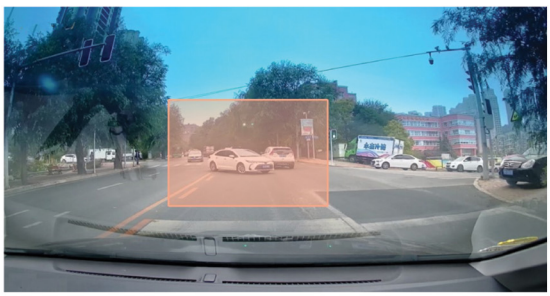
Picture group	Risk level	Risk type	Risk description	Number
1	Low-risk	Vehicle	Vehicles ahead turn or brake	2
			Vehicles on the left or right side turn or merge	7
		Pedestrian	Pedestrians ahead	2
			Pedestrians on the left or right side	9
	High-risk	Vehicle	Vehicles ahead turn or brake	2
			Vehicles on the left or right side turn or merge	8
		Pedestrian	Pedestrians ahead	6
			Pedestrians on the left or right side	4
2	Low-risk	Vehicle	Vehicles ahead turn or brake	5
			Vehicles on the left or right side turn or merge	5
		Pedestrian	Pedestrians ahead	2
			Pedestrians on the left or right side	8
	High-risk	Vehicle	Vehicles ahead turn or brake	8
			Vehicles on the left or right side turn or merge	2
		Pedestrian	Pedestrians ahead	8
			Pedestrians on the left or right side	2
3	Low-risk	Vehicle	Vehicles ahead turn or brake	5
			Vehicles on the left or right side turn or merge	5
		Pedestrian	Pedestrians ahead	3
			Pedestrians on the left or right side	7
	High-risk	Vehicle	Vehicles ahead turn or brake	6
			Vehicles on the left or right side turn or merge	4
		Pedestrian	Pedestrians ahead	7
			Pedestrians on the left or right side	3

1, 2, and 3, respectively, represent the first group of pictures, the second group of pictures, and the third group of pictures.

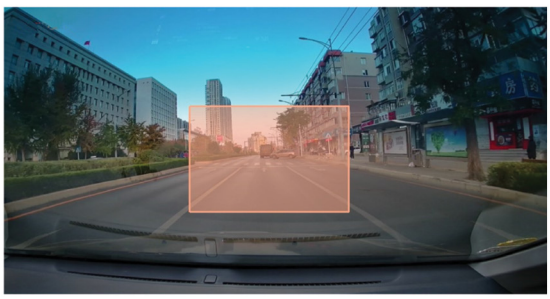
were 1 and 5. Cronbach's α of the scale is 0.89. The average score of the four items was used in the statistical analysis.

Area of Interest

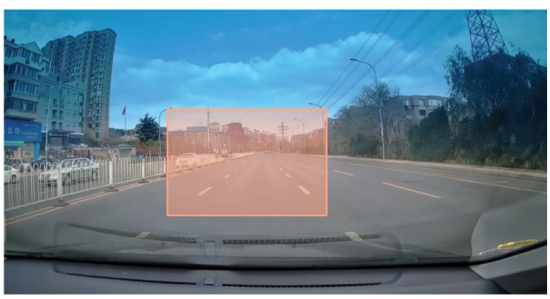
The eye movement data we analyzed were in the areas of interest. This study aimed to explore the influence of traffic-related negative emotion on deceleration driving decisions based on the risk level of the picture. Therefore, we took the risk area in the picture as the area of interest and focused on whether the driver's visual processing of the risk area was related to the driving decision. So, areas of interest for high-risk and low-risk pictures were drawn where the traffic risk appeared. There was one risk in every picture, and the area of interest covered the risk. As the baseline condition, the area of interest of the no-risk picture was close to the area of interest of the risky picture, and the size was the same. The area of interest of each picture was 300 × 200 pixels (see **Figure 1**).



A Area of interest in high-risk situation



B Area of interest in low-risk situation



C Area of interest in no-risk situation

FIGURE 1 | Areas of interest in different risk situations. **(A)** Area of interest in high-risk situation. **(B)** Area of interest in low-risk situation. **(C)** Area of interest in no-risk situation.

Experimental Design

The study adopted a two-factor within-participant design of 3 (emotion type: neutral emotion, traffic-related negative emotion, and traffic-unrelated negative emotion) × 3 (risk level: high-risk, low-risk, and no-risk). The emotion type and risk level were within-subject variables. The dependent variables were reaction time, decision making and total fixation duration. The total fixation duration refers to the total time of all fixation points in the area of interest. The total fixation duration represents the total processing time of the area of interest.

Experimental Sequence

Each participant was induced to experience three emotions (neutral emotion, traffic-related negative emotion, and traffic-unrelated negative emotion). To avoid the practice effect, we prepared three groups of pictures, each group contained 20 high-risk pictures, 20 low-risk pictures, and 20 no-risk pictures, which were presented in random order.

We used A, B, C to represent the three emotions and 1, 2, 3 to represent the three groups of pictures. We used permutation and combination to calculate the experimental sequences. The three emotion types form six sequences: A B C, A C B, B A C, B C A, C A B, and C B A. The three groups of pictures form six sequences: 1 2 3, 1 3 2, 2 1 3, 2 3 1, 3 1 2, and 3 2 1. We combined the sequences of emotion types with the sequences of three groups of pictures and then formed 36 experiment sequences. So, there were A_3^3 (three kinds of emotions) × A_3^3 (three groups of pictures) = 36 kinds of experiment sequences in **Table 2**. We randomly assigned participants to the experiment sequences.

Experimental Operation Steps

To make the effect of emotion induction undisturbed, a practice experiment was carried out before the first emotion induction. After reading the instruction, the participants practiced 10 trials, and the practice experimental procedure was the same as the formal experimental procedure. The practice experiment was compiled and presented by E-prime 2.0.

After the practice experiment, the participants were asked to fill in the emotional assessment scale before the emotion induction and then watch an emotion induction video. After that, they filled in the emotional assessment scale again and then completed an experimental procedure, the material of an experimental procedure consisting of a group of pictures. According to the previous studies that the effect of emotional induction could last for approximately 5–15 min (Bouhuys et al., 1995; Västfjäll, 2002; Green et al., 2003; Zimasa et al., 2016), we designed the experimental procedure that could be finished within 3 min in this study. After the experiment procedure, participants were asked to calculate simple math problems and then rested for 10 min to restore calm.

Then, the participants watched the second video and completed the second experiment procedure. Finally, the participants watched the third video and completed the third experiment procedure. Before each emotion induction, only the

TABLE 2 | Arrangement and combination of emotion types and picture groups.

Emotion type	Picture group					
	1 2 3	1 3 2	2 1 3	2 3 1	3 1 2	3 2 1
A B C	A1 B2 C3	A1 B3 C2	A2 B1 C3	A2 B3 C1	A3 B1 C2	A3 B2 C1
A C B	A1 C2 B3	A1 C3 B2	A2 C1 B3	A2 C3 B1	A3 C1 B2	A3 C2 B1
B A C	B1 A2 C3	B1 A3 C2	B2 A1 C3	B2 A3 C1	B3 A1 C2	B3 A2 C1
B C A	B1 C2 A3	B1 C3 A2	B2 C1 A3	B2 C3 A1	B3 C1 A2	B3 C2 A1
C A B	C1 A2 B3	C1 A3 B2	C2 A1 B3	C2 A3 B1	C3 A1 B2	C3 A2 B1
C B A	C1 B2 A3	C1 B3 A2	C2 B1 A3	C2 B3 A1	C3 B1 A2	C3 B2 A1

A represents neutral emotion, B represents traffic-related negative emotion, C represents traffic-unrelated negative emotion. 1, 2, and 3, respectively, represent the first group of pictures, the second group of pictures, and the third group of pictures.

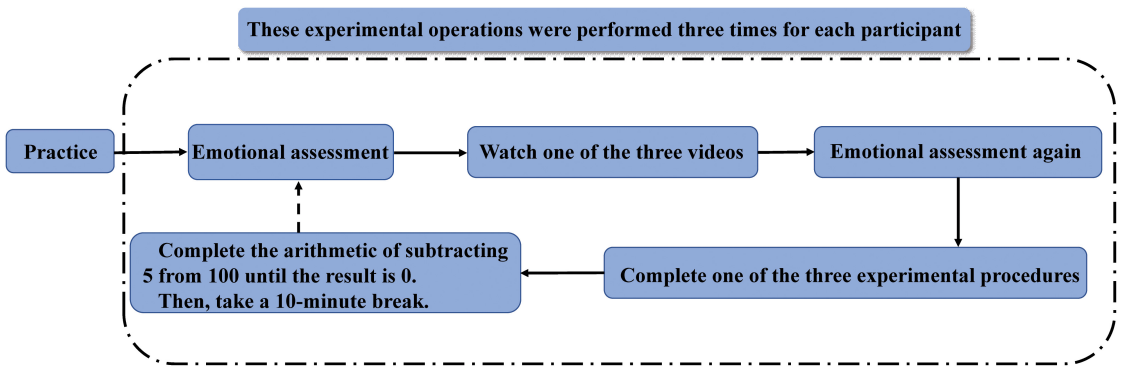


FIGURE 2 | Experimental operation steps.

participants whose scores on the emotion rating scale were 2.5–3.5 could continue the experiment. If the participants' emotional scores were not in this range, they were asked to continue to rest until their scores met the requirement. Each participant was randomly assigned to one of the 36 experiment sequences. The complete experimental operation steps are shown in **Figure 2**.

Experimental Procedure

The experiment procedure was programmed and run by Experiment Builder, and the 9-point calibration method was used for eye calibration. The experimental procedure began after the calibration was successful.

The participant was asked to imagine that he or she was driving on the road. When faced with the traffic condition presented in the picture, if he or she wanted to slow down, press the "F" key; Otherwise, press the "J" key. They should make a decision as soon as possible.

We proposed the experimental procedure referring to the previous researches on driving decisions (Pammer and Blink, 2013; Pammer et al., 2018). First, the fixation point " + " was presented at the center of the screen at a random time between 800 and 1,200 ms. Then, the picture was presented until the participant made a decision. Finally, an empty screen of about 500 ms appeared (see **Figure 3**). We prepared three experimental procedures, and each procedure presented one of the three groups of pictures.

Data Analysis

We used the Data Viewer of Eyelink 1000 Plus to export data. Trails with lost eye tracker data due to head movement, blinking, and other factors were eliminated. Data with a reaction time of more or less than 3 standard deviations were also eliminated. A total of 2.71% of the data was deleted.

The participants scored 1 point for choosing "F" and 0 point for choosing "J." The deceleration decision score was the percentage of deceleration decisions in all trials under the same experimental condition. Reaction time and total fixation duration were measured in milliseconds.

We used SPSS 22.0 (SPSS Inc, 2000) to perform repeated measurement analysis of variance to investigate the effects of emotion induction. Then we used repeated-measures analysis of variance to investigate the effects of independent variables (emotion type and risk level) and their impact on participants' deceleration decision score and reaction time. In addition, participants with different emotional states may have different driving decisions due to their visual processing patterns. Therefore, the next step was to use emotion type and risk level as independent variables and perform repeated measurement variance analysis using total fixation duration as a dependent variable to explore the differences in visual processing patterns for drivers in different emotional states when facing different risks levels. Finally, we conducted a correlation analysis of the deceleration decision score, reaction time, and total fixation duration of drivers in

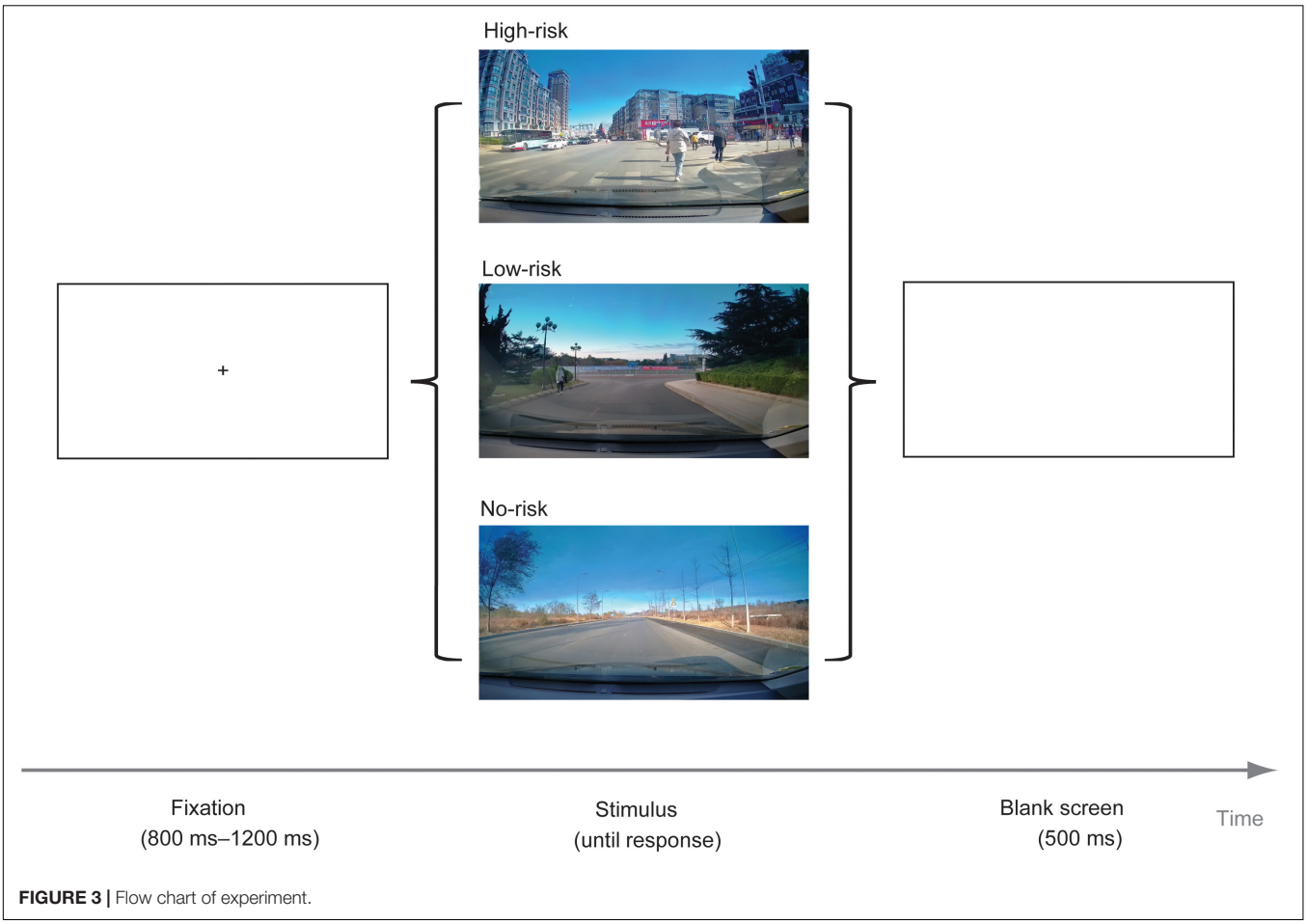


FIGURE 3 | Flow chart of experiment.

different emotional states when facing different risk levels to explore the relationship between driving decisions and visual processing patterns.

RESULTS

Emotion Induction

We used repeated-measures analysis of variance to verify the effectiveness of emotion induction in this study. Before the emotion induction, there was no significant difference in emotion rating scores among the three groups, $F(2,68) = 0.122$, $p = 0.885$. After the emotion induction, the difference of emotion rating scores among the three groups was significant, $F(2,68) = 154.387$, $p < 0.001$, $\eta^2 = 0.820$. The emotion rating score of the traffic-related negative emotion group was significantly lower than that of the neutral emotion group, $p < 0.001$, 95% CI = [−1.148, −0.909]. The emotion rating score of the traffic-unrelated negative emotion group was significantly lower than that of the neutral emotion group, $p < 0.001$, 95% CI = [−1.096, −0.847]. And there was no significant difference between the emotion rating scores of the two negative emotion groups, $p = 0.458$. These results indicated that emotion induction was effective (see **Figure 4**).

Descriptive Statistics

This study explored the impact of drivers' emotional states on driving decisions at different risk levels. Therefore, we proposed a 3 × 3 within-participant experimental design. To determine the effect of the independent variables on participants' behaviors,

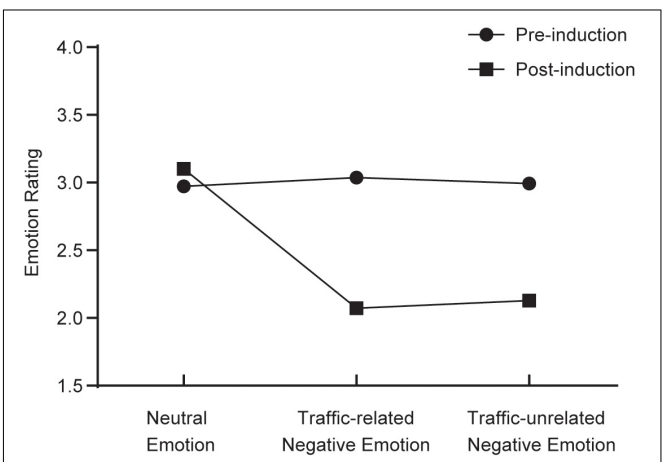


FIGURE 4 | Pre-test and post-test emotions of the three groups.

TABLE 3 | Means and standard errors of reaction time, decision scores, and total fixation duration (N = 35).

Emotion type	Risk level					
	No-risk		Low-risk		High-risk	
	M	*SE*	*M*	*SE*	*M*	*SE*
	Reaction time					
Neutral emotion	1002	63	1263	64	944	52
Traffic-related negative emotion	988	58	1143	71	821	43
Traffic-unrelated negative emotion	974	62	1180	75	916	58
	Decision score					
Neutral emotion	0.07	0.01	0.64	0.04	0.97	0.01
Traffic-related negative emotion	0.10	0.02	0.73	0.04	0.97	0.01
Traffic-unrelated negative emotion	0.09	0.02	0.69	0.04	0.98	0.01
	Total fixation duration					
Neutral emotion	834	46	907	52	694	35
Traffic-related negative emotion	814	41	796	48	617	33
Traffic-unrelated negative emotion	762	45	813	55	661	41

M, mean. SE, standard error.

we listed the descriptive statistics of the deceleration decision score and reaction time (see **Table 3**), which initially revealed that for different risk levels, participants' driving decisions may be differentiated by their emotional states. To further explore the visual processing of the influence of participants' emotional states on driving decisions, we listed the descriptive statistics of total fixation duration.

Variance Analysis

We used emotion type and risk level as independent variables, and the deceleration decision score as dependent variable to perform a two-factor repeated measurement analysis of variance. The results showed that the main effect of emotion type was significant, $F(2,68) = 3.91$, $p = 0.025$, $\eta^2 = 0.103$ (see **Figure 5**). The deceleration decision score in traffic-related negative emotional state was significantly higher than that in neutral emotional state, $p = 0.018$, 95% CI = [0.006, 0.078]. The main effect of risk level was significant, $F(2,68) = 536.49$, $p < 0.001$, $\eta^2 = 0.940$. The deceleration decision score at high-risk level was significantly higher than that at low-risk level, $p < 0.001$, 95% CI = [0.201, 0.364], and no-risk level, $p < 0.001$, 95% CI = [0.844, 0.929]. The deceleration decision score at low-risk level was significantly higher than that at no-risk level, $p < 0.001$, 95% CI = [0.526, 0.682]. The interaction between the emotion type and risk level was not significant, $F(4,136) = 2.202$, $p = 0.072$, $\eta^2 = 0.061$.

Emotion type and risk level were used as independent variables, and reaction time was used as a dependent variable to perform a repeated measurement analysis of variance. The results showed that the main effect of emotion type was significant, $F(2,68) = 3.86$, $p = 0.026$, $\eta^2 = 0.102$ (see **Figure 5**). The reaction time of driving decision in the traffic-related negative emotional state was significantly shorter than that in a neutral emotional state, $p = 0.021$, 95% CI = [−161.039, −10.507]. The main effect of risk level was significant, $F(2,68) = 35.10$, $p < 0.001$, $\eta^2 = 0.508$. The reaction time of driving decisions at the high-risk level was significantly shorter than that at the low-risk level, $p < 0.001$, 95% CI = [−379.346, −224.221]. The reaction time of driving decisions at the no-risk level was significantly shorter than that at the low-risk level, $p < 0.001$,

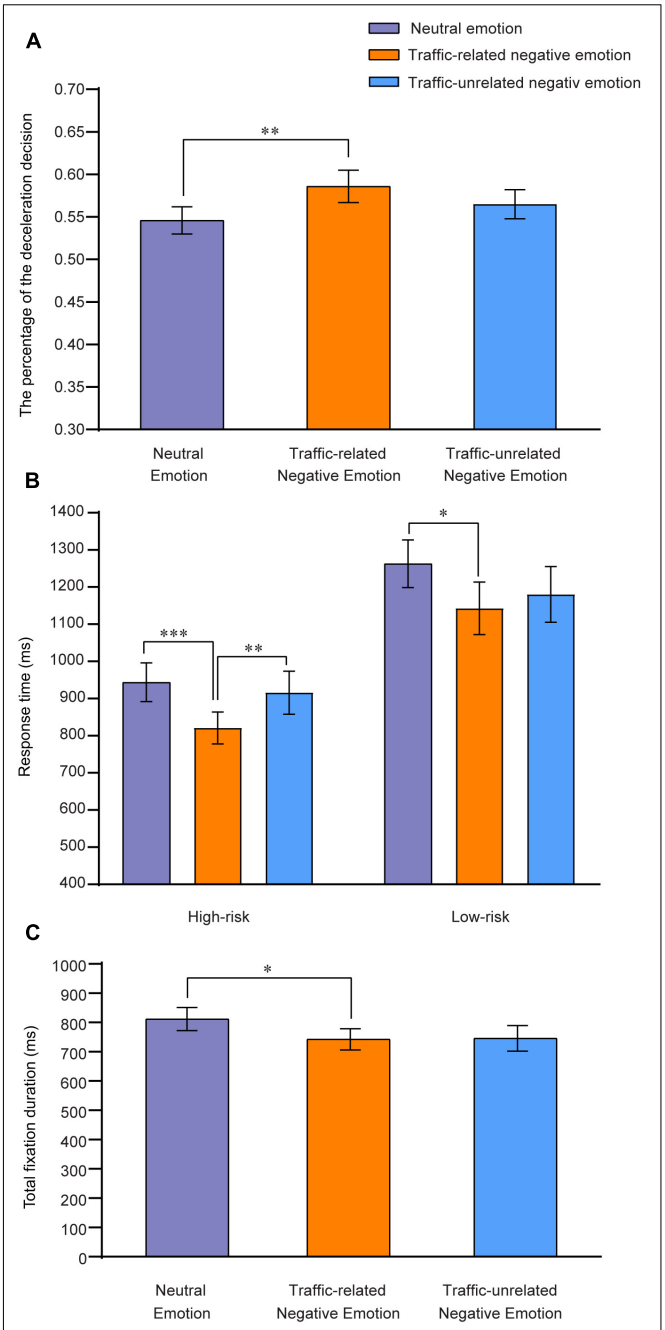


FIGURE 5 | (A) Under the three emotional states, the percentage of deceleration decision in the total number of the trials under the same condition. $^{**}p < 0.01$, Error bars represent the standard errors of the means. **(B)** At high-risk and low-risk levels, the reaction time of driving decision in three emotional states. $^{*}p < 0.05$, $^{***}p < 0.001$. **(C)** The total fixation duration of driving decision in three emotional states.

95% CI = [−308.667, −105.594]. The interaction between the emotion type and risk level was significant, $F(4,136) = 3.06$, $p = 0.019$, $\eta^2 = 0.082$. A further simple effect analysis showed that the reaction time of traffic-related negative emotional state was significantly shorter than that of neutral emotional state at the low-risk level, $p = 0.017$, 95% CI = [−217.331, −23.059]. At the high-risk level, the reaction time of traffic-related negative emotional state was significantly shorter than that of neutral emotional state, $p < 0.001$, 95% CI = [−169.322, −76.692], and traffic-unrelated negative emotional state, $p < 0.01$, 95% CI = [−149.193, −40.784].

A repeated measurement analysis of variance was performed using emotion type and risk level as independent variables, and total fixation duration as dependent variables. The results showed that the main effect of emotion type was significant, $F(2,68) = 3.54$, $p = 0.034$, $\eta^2 = 0.094$ (see **Figure 5**). The total fixation duration in traffic-related negative emotional state was significantly shorter than that in neutral emotional state, $p = 0.046$, 95% CI = [−137.815, −0.911]. The main effect of risk level was significant, $F(2,68) = 28.95$, $p < 0.001$, $\eta^2 = 0.460$. The total fixation duration at high-risk level was significantly shorter than that at low-risk level, $p < 0.001$, 95% CI = [−236.840, −125.390], and no-risk level, $p < 0.001$, 95% CI = [−214.303, −77.420]. The interaction between the emotion type and risk level was not significant, $F(4,136) = 2.262$, $p = 0.066$, $\eta^2 = 0.062$.

TABLE 4 | Correlation of reaction time, decision scores, and total fixation duration ($N = 35$).

Emotion type	Risk level		1	2	3
Neutral emotion	Low-risk	1. Total fixation duration	–		
		2. Reaction time	0.883**	–	
		3. Decision scores	0.210	0.124	–
	High-risk	1. Total fixation duration	–		
		2. Reaction time	0.826**	–	
		3. Decision scores	0.197	0.179	–
Traffic-related negative emotion	Low-risk	1. Total fixation duration	–		
		2. Reaction time	0.876**	–	
		3. Decision scores	0.121	0.017	–
	High-risk	1. Total fixation duration	–		
		2. Reaction time	0.785**	–	
		3. Decision scores	−0.045	0.079	–
Traffic-unrelated negative emotion	Low-risk	1. Total fixation duration	–		
		2. Reaction time	0.823**	–	
		3. Decision scores	0.100	0.065	–
	High-risk	1. Total fixation duration	–		
		2. Reaction time	0.846**	–	
		3. Decision scores	−0.076	−0.013	–

**$p < 0.01$.

Correlation Analysis of Variables

The above analysis explored the effect of drivers' emotional states on driving decisions and visual processes at different risk levels. Since there was no risk in the no-risk pictures, we analyzed the relationship between visual processing and driving decisions in risky situations based on the above analysis results (see **Table 4**). Pearson correlation analysis was performed on the reaction time, deceleration decision score, and total fixation duration of different emotion types and risk levels. The results showed that the total fixation duration was significantly positively correlated with the reaction time in all conditions. The amount of time the drivers spent on the risk was related to the speed at which they made decisions.

DISCUSSION

According to the results of the analysis of variance with deceleration decision score, we found that drivers with traffic-related negative emotional states made more deceleration decisions, which may have been because they were more cautious about the traffic condition. The deceleration decision in this study involved a rapid matching of a perceptual representation to the stored knowledge in memory, which allowed drivers to identify traffic risks on the screen and determine how they should respond to them (Ratcliff et al., 2016). Hu et al. (2013) used a video clip depicting some cases of the traffic accident and tragic scenes after accidents to induce participants' traffic-related negative emotion, and a video clip depicting cases of fire hazards and tragic scenes after accidents to induce traffic-unrelated negative emotion. They found that negative emotion significantly elevated drivers' risk perception. However, the participants in the traffic-related group thought they were more likely to get involved with traffic accidents than those in the traffic-unrelated group. This may explain why drivers made more deceleration decisions. When faced with the decision of whether to slow down, drivers tended to give up the pursuit of driving speed to ensure safety. Furthermore, Charlton and Starkey (2016) suggested that drivers' risk perception would affect their decision-making, especially in terms of speed. They found that when participants rated a higher risk level of road video from the driver's perspective, they operated the driving simulator at a lower speed. The decision to slow down meant reducing the speed of driving, so drivers in this study made more deceleration decisions to avoid traffic accidents.

The results of the analysis of variance with reaction time showed that the speed of driving decisions at different risk levels was a significant difference. Compared with low-risk pictures, drivers made faster-driving decisions when faced with high-risk pictures. Perhaps this was because high levels of risk lead to a greater possibility of accidents, which caused drivers to be alert and make decisions more quickly. Low levels of risk, however, were less likely to lead to traffic accidents, and drivers might hesitate to make decisions, resulting in slower reaction time, even slower than no-risk level. The results further showed that the reaction time of traffic-related negative emotional state was significantly shorter than that of neutral emotional state at the low-risk level. The reaction time of traffic-related negative emotional states was significantly shorter than that of neutral emotional state and traffic-unrelated negative emotional state at the high-risk level. This may have been because the higher

the risk level, the more likely drivers in the traffic-related negative emotional state were to involve themselves in traffic accidents. As a result, they made faster deceleration decisions to alleviate their own traffic-related negative emotional states and improve individual survival chances (Lang and Bradley, 2010). At the low-risk level, the driving decision under traffic-related negative emotional state was only significantly faster than that under neutral emotional state. With the increase of risk level, the driving decision under traffic-related negative emotional state was significantly faster than that under the other two emotional states.

According to the eye movements data results, we found that drivers in traffic-related negative emotional states had a shorter visual processing time of risk than that in a neutral emotional state. Previous studies have also shown that visual processing can distinguish the state and behavior of a driver. Underwood et al. (2003) found that experienced drivers and novice drivers have different visual attention patterns when driving on different types of roads (rural, suburban, and dual-carriageway). Walker and Trick (2019) found that emotional valence and arousal have different effects on drivers' attention and driving performance (speed, steering, and hazard response). Attention was a selective process, which was usually conceptualized as being related to limited cognitive and brain resources, and there were severe limits on our capacity to process visual information (Carrasco, 2011). Drivers in the traffic-related negative emotional state were more worried about their involvement in the risk and more alert to risks. Therefore, they must consume the least cognitive resources as much as possible to make decisions as soon as possible to avoid possible traffic accidents.

Previous studies found that a driver's intended actions can be inferred from their visual scanning behavior. Recognition performance could probably be significantly improved by improving the resolution of the gaze data so that features of the external visual scene could be identified (Liu and Salvucci, 2001). Results of the correlation showed that The shorter time for which drivers gazed at the risk area is related to the faster speed at which they made driving decisions. A dynamic driving simulator experiment found that the shorter the take-over time of drivers, the faster decision making and reactions, but generally worse in quality (Gold et al., 2013). In our study, there was no significant correlation between reaction time and deceleration decision score, we didn't find the relationship between driving decision and reaction time.

In daily life, traffic management departments often organized examinees who were about to obtain driving licenses to watch traffic accident scenes and warning education videos, which immersed drivers in traffic-related negative emotional states. The result of this study showed that in this emotional state, drivers would have more conservative and safer driving behaviors, indicating that this kind of education and training method was effective, can promote drivers to drive carefully, and improve the level of traffic safety. The results of this study provide a scientific method and basis for drivers' safety training: organizing drivers to watch the traffic accident scene and warning education clip video is an effective means of training. Correct and appropriate driving behavior of drivers is the premise to maintain driving safety, and road traffic safety is an important aspect of social security.

This study also has the following limitations. Firstly, previous studies showed that driving experience has an impact on different driving behaviors of drivers (Wallis and Horswill, 2007; Hills et al., 2018), this study did not consider this factor, so future research can explore the impact of negative emotions on experienced drivers and novices driving decisions. Secondly, this study focused on whether drivers' deceleration decisions were affected by negative emotions at the moment when they faced the risk situations. Future research can explore whether drivers' behavioral decisions are affected by negative emotions in the dynamic driving process, in order to improve the ecological validity of the experiment.

CONCLUSION

This study confirmed that drivers with different emotional states had different driving decisions and visual processing when facing traffic conditions with different risk levels. Compared with neutral emotion, drivers in traffic-related negative emotional states made more deceleration decisions, and the higher the risk, the more deceleration decisions. The visual processing time of the risk area was shorter in the traffic-related negative emotional state than that in the neutral emotional state. The shorter time for which drivers gazed at the risk area is related to the faster speed at which they made driving decisions. The results of this study provide a scientific method and basis for driver safety training: organizing drivers to watch the traffic accident scene and warning education clip video is an effective means of training.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of Liaoning Normal University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

YL and XZ conceived and designed the experiments. XZ and XS were involved in the data collection and analysis. XZ wrote the manuscript. YL and RC made critical comments and revised the manuscript. All authors contributed to the article and approved the submitted version.

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Moved by Social Justice: The Role of Kama Muta in Collective Action Toward Racial Equality

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Participation in collective action is known to be driven by two appraisals of a social situation: Beliefs that the situation is unfair (injustice appraisal) and beliefs that a group can change the situation (collective efficacy appraisal). Anger has been repeatedly found to mediate the relationship between injustice appraisals and collective action. Recent work suggests that the emotion of being moved mediates the relationship between efficacy appraisals and collective action. Building on this prior work, the present research applies kama muta theory to further investigate the relationship between efficacy appraisals and collective action. Kama muta is a positive emotion that is evoked by a sudden intensification of communal sharing, and largely overlaps with the English concept being moved. We investigated its relationship with collective action in both advantaged and disadvantaged racial groups in the context of the Black Lives Matter Movement (BLM) in Spring of 2020. In one pilot study (N = 78) and one main study (N = 215), we confirmed that anger toward the system of racial inequalities mediated between injustice and collective action intentions, and that kama muta toward the movement mediated between collective efficacy and collective action intentions. Both mediations were found for both Black and White participants. We also observed additional unpredicted paths from anger to kama muta and from efficacy to anger. Together, this provides evidence for the pivotal role of emotions in collective action intentions, but also points out that appraisals need to be better understood.

Keywords: kama muta, anger, sadness, collective action, racial equality, collective efficacy, social emotions, intergroup relations

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INTRODUCTION

The Black Lives Matter movement (BLM) has become the largest social movement in the history of the United States (Buchanan and Patel, 2020). In 2020, the unfortunate events of racial discrimination against Black people had a massive impact worldwide. Black people and other racial-ethnic minorities have raised their voices to condemn the systematic racism that affects them on a daily basis. Meanwhile, many White people have stood up in solidarity in the fight for racial justice. This social movement is an example of how members of advantaged and disadvantaged groups can join efforts to act for social change.

Emotions play a pivotal role to motivate or undermining collective action efforts because they sit at the intersection of multiple determining processes: They influence decision-making and action (Montada and Schneider, 1989; Jasper, 2011). When shared, emotions can coordinate social interactions and cooperative behavior (Thomas et al., 2009b) and they may influence social

identification, for instance by strengthening existing or promoting new group memberships (Peters and Kashima, 2007; Thomas et al., 2009a). This perspective of the role of emotions suggests that emotions experienced by both advantaged and disadvantaged group members could influence cooperation and foster intergroup equality (Thomas et al., 2009b) in contexts of collective action. Past work has described how several distinct emotions play a role in such processes (Fritsche et al., 2018). One emotion in particular has been focused on: anger. Research has studied anger (or resentment) as a mediator between injustice appraisals and participation in collective action (e.g., van Zomeren, 2019). Recent work in the context of environmental collective action has suggested that a second emotional experience, labeled being moved, can play a similar role, mediating between collective efficacy appraisals and collective movement participation (Landmann and Rohmann, 2020).

Building on these contributions, in the current research, we study intentions to participate in collective action toward racial equality of both Black and White US Americans. To follow up on the role of being moved in collective action, we use kama muta theory (Fiske, 2019; Zickfeld et al., 2019a). Kama muta theory theorizes the emotion underlying feelings of being moved based on social relations. We propose that this emotion can be experienced by both advantaged and disadvantaged groups and influence their intentions to participate in collective action. We thus extend general notions that positive social emotions can foster intergroup relations and promote social change by applying kama muta theory to collective action (Fiske et al., 2017; Pierre, 2019; Pizarro et al., 2021).

COLLECTIVE ACTION, POLITICIZED IDENTITIES, AND SOCIAL MOVEMENTS

Collective action is defined as an action taken by a group of individuals to achieve a common goal (Wright et al., 1990b). Different behaviors such as participation in demonstrations, signing petitions or donating can be categorized as collective actions (van Zomeren and Iyer, 2009). They can also include unlawful non-violent or even violent actions.

Theoretical and empirical work has clarified that collective action often involves a change in social identification and the content of identity (van Zomeren et al., 2008, 2018). Politicized Collective Identity Theory (Simon and Klandermans, 2001) has been influential for this line of argument. Unlike broader group identities, politicized identities such as social movements include clear norms, beliefs and behaviors. Individuals acting on their basis understand themselves as acting on behalf of their group and with reference to a more inclusive societal context (Simon and Klandermans, 2001, p. 319). The theory suggests that an awareness of shared grievances (identifying illegitimate inequality and violation of principles as part of a group) and adversarial attributions (recognizing a common opponent to blame for the group predicament) are essential to acquire a politicized collective identity. Social movements such as the feminist movement or the BLM are examples of such politicized collective identities. It is important to clarify that politicized identity should not be confused with political identity or ideology (e.g., in the US American context, identification with Democrats or Republicans).

Collective action typically plays out among groups (here we use the terms advantaged and disadvantaged groups). Members of disadvantaged groups are usually more inclined than advantaged groups to challenge injustice through collective action (van Zomeren and Iyer, 2009). Consequently, most research has focused on how people directly affected by injustice take action to overcome it. However, some perspectives indicate that members of advantaged groups can also get involved in collective action in favor of the disadvantaged (Subašić et al., 2008; Craig et al., 2020). This can follow several processes. For instance, if members of advantaged groups focus on the other group and perceive their disadvantages as illegitimate, they can feel sympathy and reduce their ingroup favoritism (Harth et al., 2008). Another possibility is that members of advantaged groups start to identify with the disadvantaged group, for instance after perceiving violations of their moral convictions (van Zomeren et al., 2011).

Actions by members of advantaged groups may result from them adopting the aforementioned politicized identities as new social identities that cross the original group boundaries. As a result of shared beliefs and emotions, it is possible to create connections among people and to create new groups (Peters and Kashima, 2007). These shared cognitions are determinants of social identity (Swaab et al., 2007) influencing social interactions and action between groups (Tiedens et al., 2004). In sum, identification with a social movement that clearly defines shared beliefs, violation of principles, and a shared opponent provides a foundation for a common identification for different sub-groups and thus, could allow a shared emotional experience among them.

DRIVERS OF COLLECTIVE ACTION

Collective actions depend on at least three different variables: identity, perceived unfairness, and perceived efficacy. Theorizing of such processes is grounded in classic theories of social identity and relative deprivation (Mummendey et al., 1999). According to the Social Identity Model of Collective Action (SIMCA), social identity predicts collective action directly and also indirectly through unfairness perceptions and efficacy beliefs (van Zomeren et al., 2008). Similarly, the Encapsulated Model of Collective Action (EMSICA) considers injustice and efficacy as predictors of collective action and points out social identification as a mediator in these associations (Thomas et al., 2009a).

A later model distinguishes two different paths for collective action and includes an emotional component explicitly. The dynamic dual-path model (van Zomeren et al., 2012) suggests that collective action is a strategy disadvantaged groups under certain circumstances use to cope with their disadvantage through two approaches. The first one is described as an emotion-focused path and places anger as a critical element. The second

path relates to a problem-focused approach characterized by efficacy beliefs. Likewise, a recent extension of SIMCA (van Zomeren et al., 2018) considers the violation of moral beliefs and politicized identity as essential motivation to engage in collective action mediated through group-based anger and group efficacy beliefs, respectively. All these models have in common that they distinguish between an emotional path mediated by anger and a non-emotional path mediated by efficacy.

Recent contributions elaborate this approach by suggesting that emotions can be mediators in both paths. For instance, the Social Identity Model of Pro-Environmental Action (SIMPEA) acknowledges that various emotions may determine goals and actions (Fritsche et al., 2018). Further, some research proposes that similar to the mediating role of anger in the path of injustice to collective action, the relationship between collective efficacy and collective action may be mediated through emotions, suggesting hope (Wlodarczyk et al., 2017) and the feeling of being moved (Landmann and Rohmann, 2020) as mediators. We will expand on these recent contributions in the following sections.

Appraisals as Predictors of Collective Action: Injustice and Collective Efficacy

Whether the aim is to change or defend the *status quo*, identity and perception of justice are important predictors of collective action (Thomas et al., 2020). Relative Deprivation Theory (RDT; Walker and Pettigrew, 1984) is widely used to explain the involvement of disadvantaged groups in collective action. RDT proposes that comparison with other groups and the subsequent perception of injustice could result in feelings of group deprivation that motivate collective action (Mummendey et al., 1999). New approaches extend the relevance of perception of injustice into a broader category of violation of moral beliefs (van Zomeren et al., 2018).

Advantaged groups would participate in supporting the disadvantaged group based on moral beliefs. For example, violation of a moral belief about justice would evoke emotional reactions such as moral outrage that motivate advantaged group members to act on behalf of the disadvantaged group (Radke et al., 2020). Since morality motivation could overlap with politicized identity (van Zomeren et al., 2018) it can lead to identification with the disadvantaged group (Craig et al., 2020) or with the social movement that represents those beliefs. Consequently, it can influence the collective action of both advantaged and disadvantaged groups toward the same goal.

Initially, efficacy was considered a subjective expectation regarding the effectiveness of the collective action (Klandermans, 1984). Subsequently, the role of the group in this process was widely acknowledged. Under the collective lens, group efficacy gives members of a group a sense of agency and empowerment necessary to believe that together they can change their reality (Drury and Reicher, 2005). Consequently, in disadvantaged groups, perception of instrumental social support increases the efficacy beliefs necessary to undertake actions to change their circumstances (van Zomeren et al., 2012). Similarly, for advantaged groups, perceived resources that include psychological, social, and political assets also predict their participation in collective action (Beaton and Deveau, 2005). Therefore, independently of the group's status, collective efficacy beliefs are necessary to support a cause.

Furthermore, collective efficacy has a vital role in social identification. Some evidence suggests that collective efficacy could increase group identification by affirming and strengthening it (van Zomeren et al., 2010). If members of different groups come together for the same purpose, their beliefs about their group efficacy could increase and, thus, their sense of shared identity. The joint participation of advantaged and disadvantaged groups under the same cause could also influence hope that a change is possible. When hope is high, it can influence efficacy beliefs and motivate collective action (Cohen-Chen and van Zomeren, 2018). This approach suggests that participation of both advantaged and disadvantaged groups under the same cause would enhance collective efficacy beliefs and therefore, also reinforce a shared identity as part of the movement.

Emotions: Linking Appraisals to Collective Action

Research has demonstrated the role of emotions in collective action (Montada and Schneider, 1989; Wright et al., 1990a; Mallett et al., 2008; Thomas et al., 2009b; Jasper, 2011; Tausch and Becker, 2013; Wlodarczyk et al., 2017; Cohen-Chen and van Zomeren, 2018). We focus on two emotions in the current research: Anger because it has been the one most consistently tied to collective action, and being moved because it has only recently been added as a potential predictor.

From Injustice and Norm Violation to Anger and Moral Outrage

Members of disadvantaged groups experience anger after perceiving injustice, which motivates collective action (van Zomeren et al., 2004, 2008). This perception of injustice elicits anger when the unfair situation targets oneself or others for whom one feels empathic concern (Batson et al., 2007). Therefore, advantaged groups can also experience this emotion on behalf of the disadvantaged (Mallett et al., 2008; Iyer and Ryan, 2009). Accordingly, identification with the disadvantaged group is associated with high reported levels of injustice and anger (Gordijn et al., 2006). However, anger can be experienced toward the advantaged group (Zhou and Wang, 2012). Alternatively, moral outrage blames a third party or system of inequality for moral transgressions (Montada and Schneider, 1989). As mentioned previously, blaming a common enemy is a key element of a politicized collective identity (Simon and Klandermans, 2001). Like anger, moral outrage is also provoked by the perception of injustice but is mainly elicited under violations of moral values such as justice and fairness, or other values derived from social relations (Rai and Fiske, 2011).

From Collective Efficacy to Being Moved and Kama Muta

Recent research investigated for the first time the role of being moved in collective action. Landmann and Rohmann (2020, p. 2) argued that "people may be moved and positively overwhelmed by the idea that they can collectively change something, and

these feelings of being moved may, in turn, motivate collective action." Thus, in their research, Landmann and Rohmann (2020) challenged the notion that anger (or the more general moral outrage) would be the only emotion involved in collective action. They suggest that experience collective efficacy causes being moved through a combination of moral, closeness, and achievement appraisals, referencing various theoretical perspectives of being moved (for an overview of theories on being moved, see Zickfeld et al. (2019b)). Consider a typical measurement item for collective efficacy: "I think that together we can change [the group-related problem]." While previous conceptualizations put the focus on "can change," Landmann and Rohmann's proposal emphasizes the "together" part and the emotional impact experiencing togetherness can have.

Landmann and Rohmann (2020) found support for their model in two studies. The first study investigated members and sympathizers of a specific local but widely known ecological movement in Germany; the outgroup for this group was a coal mining company. The second study investigated psychology students from a German university regarding views of the same movement. The second study also manipulated injustice and efficacy appraisal and focused on authorities as the outgroup. The results are comprehensive because all variables were measured both on a situation-specific and a general level, and there is both correlational and experimental evidence. As predicted by the modified model, feelings of being moved influenced collective action behavior *via* the path of collective efficacy. This path works in parallel to the path from injustice appraisals to anger to collective action. In addition, there was some crossover between the paths: feelings of being moved influenced collective action also *via* injustice appraisals. Being moved was measured with the German terms "bewegt" ("moved"), "überwältigt" ("overwhelmed"), and "ergriffen" ("stirred"). Being moved was distinguishable from sadness, which was measured separately.

Being moved has received increased attention in recent years. The literature is not without its controversies (Zickfeld et al., 2019b). Some authors have considered being moved as mixed emotion that incorporates both positive and negative affect, or that comes in two variants, one associated with positive affect and one associated with negative affect (Bartsch et al., 2014; Menninghaus et al., 2015; Landmann and Rohmann, 2020). Others have argued that it is a positive experience that can or cannot co-occur simultaneously with negative feelings (Menninghaus et al., 2015). The exact appraisal is debated as well. Proposals vary from broader notions such as surpassed internal standards in either relationships, achievement, willpower (Landmann et al., 2019), fit with core positive values (Cova and Deonna, 2014), and compatibility with prosocial norms and self-ideals (Menninghaus et al., 2015) to more circumscribed ideas such as salience of affiliative attachments (Cullhed, 2020).

Some of this debate may arise because the English vernacular term "being moved" can be used both for a very specific emotional experience, but also for a broader category of emotions with fuzzy boundaries, even including emotions like sadness (Zickfeld et al., 2019b). As an alternative to studying this emotional phenomenon, kama muta theory proposes to start with a theoretical definition rather than with emotion labels, following a tradition in social psychology of introducing separate terms for theoretically defined emotions (e.g., dissonance and elevation). Kama muta theory conceptualizes the experience denoted by the more narrow usage of "being moved" under the artificial (originally Sanskrit) term *kama muta* (*being moved by love*) (Fiske et al., 2017, 2019). It proposes that kama muta is elicited by appraisals of sudden increases in communal sharing relations (i.e., social closeness around perceived shared essence; Fiske, 1992); that it is positive; that it goes along with physical manifestations such as weeping and goosebumps when intense; and that it can lead to a sense of collective identification and motivate affective devotion and moral commitment. These hypotheses have been supported by cross-cultural studies (Zickfeld et al., 2019a).

Note that there are a few differences between kama muta theory and how Landmann and Rohmann use their concept *being moved*. Kama muta theory proposes intensifications of communal sharing as the primary appraisal, and argues that appraisals of exceeded morality or achievement should only lead to kama muta if they themselves affirm a communal sharing relation. For instance, athletes might be crying after victory because they see the victory as an affirmation of the communal relation to their family that sacrificed a lot for enabling them to train, or as an affirmation of the inclusion of the disadvantaged group they are a member of. However, this claim of kama muta theory has never been thoroughly tested. Also, neither Landmann and Rohmann (2020) nor the current work actually include specialized measures of these mediating variables. These differentiations between the theoretical approaches thus remain theoretical for the current work.

We nevertheless prefer to use the concept of kama muta over the term being moved in the current paper for two reasons: (1) We want to avoid using a vernacular concept from one specific language that may or may not be the language that is actually used in the measure (Fiske, 2020). (2) We want to emphasize that we are not referring to the broad meaning of the English vernacular "being moved." Nevertheless, we use the vernacular term "being moved" in our measure as an operationalization of the feeling component of kama muta, because English speakers typically label their kama muta experiences "being moved or touched."

Kama Muta and Collective Action by Disadvantaged and Advantaged Groups

Landmann and Rohmann formulated and tested their being-moved explanation of collective efficacy with groups that presumably consider themselves as the disadvantaged groups opposing powerful others (a mining company and the authorities). If correct, the model should generalize to other situations of social movements, including the BLM movement. However, does it also hold for advantaged groups?

We argue here that the model should apply to members of both advantaged and disadvantaged groups. As explained above, members of an advantaged group who perceive the situation to be unjust or as violating moral standards and are thereby motivated to change the situation, can identify with the disadvantaged group and/or adopt a politicized identity with a movement, which can cross the original intergroup divide. In both cases, perceiving that

the group one identifies with is unified and has the potential to change the situation through joint action (i.e., collective efficacy) should lead to kama muta.

Regarding social movements, our assumption is that they are understood as relationships on a foundation of a perceived shared essence of having the same beliefs, values and goals. Such relations are conceptualized as communal sharing relations by relational models theory (Often they add hierarchical structure and coordinate some tasks according to equality matching) (Fiske, 1992). Some evidence suggests that appraisals of increased interpersonal closeness in communal sharing relations and communal sharing-based morality predict feelings of being moved (Seibt et al., 2017). For instance, the perception of a sudden intensification of communal sharing by observing or participating in a demonstration or hearing a meaningful speech related to shared values of fairness would evoke kama muta (Fiske, 2019).

Social movements and social activists seem to successfully evoke kama muta to motivate people to participate and act through messages of communal identity and justice (Pierre, 2019). In political movements, using kama muta increases the motivation to support and commit to a political cause when there is partisan communal sharing (Seibt et al., 2019). These findings suggest that kama muta may have the potential to foster support for a social cause and engagement for the goals linked to a politicized identity.

The process is nicely illustrated by a the following quote from the (White) host of a widely distributed podcast published in June 2020, days after the murder of George Floyd:

> "My kids really wanted to protest. [. . .] I live in an overwhelmingly White town. [. . .] It was important to them, [. . .] it was important to me. [. . .] We went as a family down to the town hall [. . .] and stood on a corner [. . .] with signs saying: "Enough is enough," "Black Lives Matter." [. . .] I had one of the four or five most moving [. . .] experiences of my life. [. . .] I went down there thinking that we would have trouble. [. . .] I would say the positive response to our protest on this busy intersection ran about six, seven or eight to one from the most unexpected places. [. . .] We had guys on [. . .] Harleys [. . .] putting their thumbs up, [. . .] guys in [. . .] huge pickup trucks [. . .] cheering us on, [. . .] two sheriff's cars . . . give us this very subtle thumbs up. [. . .] So my plea to you [listeners] is: . . . Get on the right side of history. [. . .] Make a sign and protest." Metcalf et al. (2020) on the Slate Culture Gabfest Podcast, June 10, 2020).

Here, protest for the cause of a disadvantaged group after a moral norm violation resulted in an experience of support by other members of the advantaged group labeled as moving, and included the belief that there is large support (efficacy), and further support (plea for others to join). As noted above, kama muta theory specifically predicts that intensifications of communal sharing relations lead to the emotion. The theory has yet to spell out in detail what such intensifications can be, but common examples include reunions, altruistic help, selfless acts of compassion, expressions of love and closeness, and manifestations or affirmations of social inclusion. Subjectively, such events appear to be experienced as increases in social closeness. Affirmation of moral values of the communal relation seems to be an additional route (Seibt et al., 2017). Experiences of collective efficacy may embody intensifications of communal sharing for various reasons: the realizations that one is a member of a large social category, that one's membership is valued positively by others, and that one's values are shared. Also, the experience of collaboration and coordination toward a shared goal based on the shared membership in a social group, or manifestations of communal bonds through various non-verbal channels such as synchrony and physical closeness (Fiske, 2004).

It is also possible that when perceiving injustice and moral norm violations, members of advantaged groups identify with the disadvantaged group. The same processes of experiencing collective efficacy should apply, possible through vicarious or third-person kama muta, and perhaps enhanced by compassion and empathic concern (Zickfeld et al., 2017).

Communal sharing relations largely neglect to keep track of contributions, but rather follow the principle of distributing resources according to need and ability. Once experienced, kama muta is theorized to result in increased motivation to affirm and engage in the same relation and to relate based on communal sharing principles. Extant studies on kama muta have found support for these ideas using self-reported general motivations (e.g., "I wanted to do something extra-nice for someone" in Zickfeld et al. (2019a), self-reported intentions to support a political candidate ("more inclined to vote for" and "motivated to work to help elect [the candidate]," Seibt et al., 2019). Other studies that measured self-reported being moved have also found supporting evidence. For instance, showing moving videos not only leads to self-reports of feeling moved and warm feelings in the chest, but also more actual helping behavior for an unrelated experimenter (Schnall et al., 2010) and more actual donations to charities (Sparks et al., 2019).

In sum, we propose that kama muta theory is consistent with the idea that collective efficacy experiences and beliefs give rise to experiences of being moved, and in turn strengthen devotion to and motivation to participate in collective action.

THE CURRENT RESEARCH

Following these arguments, the present research investigates the link between injustice and collective efficacy appraisals on collective action. We specifically investigate the role of kama muta along with sadness and anger as positive correlates of collective action. Given that the United States has been the epicenter of massive mobilizations supporting racial equality in 2020/2021, we investigated participation in the BLM in this geographical context. We replicate and extend prior research on emotions and collective actions in several ways:

At the center of our study is a replication of Landmann and Rohmann (2020), where we test the hypothesis that two emotional pathways mediate between common appraisals and collective action: Anger is hypothesized to mediate between injustice appraisals and collective action, while being moved/kama muta is hypothesized to mediate between collective efficacy appraisals and collective action. We extend the contribution of this research by replicating the model in a

non-environmental context that involves the interaction of advantaged and disadvantaged groups.

Secondly, given that understanding the emotional process involved in advantaged and disadvantaged groups is necessary to develop strategies to achieve social change, we collected data from both Black and White Americans; insights in this area are particularly relevant for cross-group helping and intergroup relations research.

Third, we exchange Landmann and Rohmann's being moved measure (consisting of three feeling labels) for a measure designed based on kama muta theory that also includes feeling labels, and references to appraisals, physiological reactions, valence, and motivation (Coppin and Sander, 2021).

Fourth, we collected data on multiple targets of those emotions, both concrete in- and outgroups and more politically defined social entities (the BLM, and the system of racial inequality). In line with the findings by Landmann and Rohmann (2020), we hypothesized that kama muta toward the BLM movement mediates the relationship between collective efficacy and collective action intentions. Additional hypotheses, including the role of anger and sadness, were also included (see **Figure 1**).

As a fifth goal, we use measures of identification with various groups and identities to understand the nature of the kama muta experiences that we observe. Landmann and Rohmann found the higher politicized identification (i.e., identifying with the environmental activist group) was, the more participants reported participating in effortful and non-normative collective actions. Here, we use the identification measures in exploratory analyses to understand how politicized identity relates to kama muta in disadvantaged and advantaged groups.

PILOT STUDY

In the pilot study, we piloted a comprehensive measure of emotions and obtained the first exploratory data of the emotions and their association to collective action in the BLM movement. We targeted the measure of emotions toward the BLM movement, the system of racial inequalities, and Black and White people. We selected these targets because they represented the involved ethnic categories, the most active social movement, and the antagonist that this movement identified. We explored the associations between the emotions toward each target and their relationship with collective action.

Method

Participants

We recruited N = 100 participants from Academic Prolific[1] requesting US Americans. Participants were compensated with 1.25 GBP for approximately 10 min of their time. We excluded participants who failed 1 or both of the included attention checks and those who did not complete the survey (n = 22). The remaining 78 participants were 19–69 years old (M = 34.74, SD = 11.78); 32 reported being female, 45 male, and one third gender. Regarding ethnicity, 64.1% reported being White and the 35.9% remaining mentioned being members of ethnic minorities (Black n = 7, Asian n = 13, Hispanic n = 5, Other n = 3). Participants indicated their political ideology on a scale from 1 ("left") to 10 ("right"); the average value was M = 4.60, SD = 2.73, 64.1% reported values between 1 and 5. Thus, the sample was skewed toward leaning politically left, and there were few Black participants.

[1]https://prolific.co/

Procedure

Each participant was presented with a survey delivered online through Qualtrics.com. First, participants read an information sheet and signed a consent form. Then, participants were asked to respond to the measures in the same order described below. Data analysis was performed using SPSS statistics version 26.

Materials

Emotions

The emotional experience in the past year was assessed through a new measure designed for this research. We presented participants with the descriptions of three emotions: sadness, anger, and kama muta. Descriptions contained detailed information about the valence, appraisals, physical reactions, and labels that characterize each one of those emotions. Here is an example of the description that was used to measure kama muta. Note that it starts off without naming any label. Because it is only our theoretical term, the term kama muta was never mentioned:

> "This emotion gives you a positive feeling, and it makes you feel connected to others. Perhaps you have felt this emotion after experiencing a sudden sense of closeness to somebody else or an incredibly strong bond with another person or a group of people. When this emotion is mild, it feels a little warm and fuzzy. When it is more intense, you may notice warmth or a stirring in the center of the chest; your eyes may tear up, or you actually weep. Some people experience chills or goosebumps. You would probably call this as being touched or moved, and you would perhaps call the situation heart-warming."

After each description, participants indicated their emotional experiences on four items measuring the frequency ["How often did you feel this emotion toward the (target) during the past year?"], intensity ["During the past year, how strongly did you typically experience this emotion toward the (target)?"], salience ["During the last year, how present was this emotion in your life, toward the (target)?"], and ease of retrieval ["How easily do situations from the last year come to your mind where you felt this emotion toward the (target)?"] of the respective emotion experienced.

The above items were used to measure each emotion (i.e., kama muta, sadness, and anger) toward each of the four targets: the system of racial inequalities, the BLM, and White and Black people. Items were answered on 5-point Likert scales ranging from 1 = *not at all/never* to 5 = *very much/always*. In total, we assessed each target with four items for each one of the three emotions in a 4 (targets) × 3 (emotions) design (see **Supplementary Material** for an overview of the full measure).

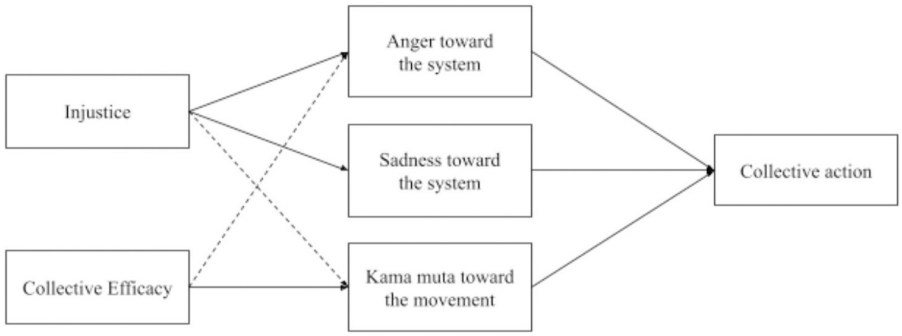

FIGURE 1 | The mediation model with paths to collective action. Solid lines were hypothesized and confirmed. Dashed lines were found to be significant in exploratory tests.

Collective Action

Participants reported their intentions to participate in collective action toward racial equality on a 5-point Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. The seven items were adapted from Landmann and Rohmann (2020) and included: "I would/participate in a demonstration against racism, participate in a protest for racial equality, volunteer in an organization to fight racism, convince others to engage in racial equality discussions, sign petitions to stop racism, donate to a charity which supports Black people, join a campaign online to share information supporting racial equality."

Results

Internal Consistency of the Measures

We calculated Chronbach's alpha for the four items for each emotion and target separately. Analyses demonstrated high internal consistency for all 12 scales. Subsequently, we averaged all items for each emotion and target and created composite variables. Reliability values and descriptive information for the scales are presented in **Table 1**. A correlation table with all variables can be found in the **Supplementary Material**.

Emotions Toward Different Targets

To investigate the differences between emotional reactions to different targets, we conducted an ANOVA with the target (system vs. movement vs. Black people vs. White people) and emotion (anger vs. kama muta vs. sadness) as within-participant factors. Mauchly's test indicated a violation of sphericity assumption χ^2 (20) = 117.92, $p < 0.001$. Since sphericity was violated ($\varepsilon = 0.660$), Greenhouse–Geisser-corrected results are reported. Results indicate that there was no overall difference between emotions $F(1.88,144.66) = 2.367$, $p = 0.101$, $\eta^2 = 0.03$. However, there were differences between targets irrespective of the emotions $F(2.53,194.80) = 6.500$, $p = 0.001$, $\eta^2 = 0.07$. Finally, the emotions and target factors interacted significantly $F(3.96,304.92) = 29.79$, $p < 0.001$, $\eta^2 = 0.28$. The system of racial inequalities elicited the highest levels of anger and sadness, while Black and White people elicited the highest levels of kama muta (see **Table 1**).

Exploratory Analysis on the Relationship of Collective Action and Emotions

In order to explore the association between the emotions, kama muta, sadness, anger, and collective action, we calculated a multiple linear regression. The model was run as a stepwise regression with the default settings in SPSS, which includes predictors with $p < 0.05$ and excludes them with $p > 0.10$ iteratively. We included the 12 composite variables as potential predictors. Additionally, we examined whether ethnicity could have an impact on the model and split the sample into White and non-White participants based on their reported ethnic identity. **Table 2** summarizes the variables that significantly predicted collective action. Kama muta toward the BLM movement was a consistent and strong predictor, as was sadness about racial inequality.

Discussion

This study aimed to pilot a new measure of emotions and carry out exploratory analysis of the association of those emotions

TABLE 1 | Reliability values and average levels of the emotions toward the four targets in the pilot study.

Scale	α	*M*	*SD*	*CI*
Anger toward System	0.91	3.08	1.09	[2.84; 3.33]
Anger toward BLM	0.95	2.31	1.24	[2.03; 2.59]
Anger toward Black	0.95	1.87	1.03	[1.63; 2.10]
Anger toward White	0.92	2.60	1.07	[2.36; 2.84]
Kama muta toward System	0.96	1.75	1.03	[1.51; 1.98]
Kama muta toward BLM	0.95	2.48	1.21	[2.21; 2.75]
Kama muta toward Black	0.93	2.91	1.01	[2.68; 3.14]
Kama muta toward White	0.93	2.60	1.06	[2.37; 2.83]
Sadness toward System	0.96	3.27	1.25	[2.99; 3.55]
Sadness toward BLM	0.93	2.31	1.09	[2.07; 2.56]
Sadness toward Black	0.93	2.32	1.07	[2.08; 2.56]
Sadness toward White	0.94	2.57	1.12	[2.31; 2.82]
Collective action	0.94	3.54	1.18	–

Means and 95% confidence intervals; System refers to system of racial inequality, BLM refers to Black Lives Matter Movement, Black refers to Black people, White refers to White people.

TABLE 2 | Summary stepwise regressions pilot study.

	Total sample			White participants (n = 50)			Non-white participants (n = 28)		
	R^2	p	F	R^2	P	F	R^2	p	F
	62.3	**<0.001**	**40.70**	**67.2**	**<0.001**	**31.48**	**54.1**	**<0.001**	**14.72**
Predictor	**B**	**CI**	p	**B**	**CI**	p	**B**	**CI**	p
Kama muta to BLM	0.67	[0.51,83]	<0.001	0.66	[0.46, 87]	<0.001	0.57	[0.33, 80]	<0.001
Sadness to System	0.34	[0.20,48]	<0.001	0.32	[0.13, 51]	<0.001	0.29	[0.05, 53]	0.020
Kama muta to Black	–0.20	[–0.40,00]	<0.001						
Kama muta to White				–0.26	[–0.46,–0.05]	0.016			

95% confidence intervals. Blank cells indicate that the stepwise regression removed this predictor from the equation. System refers to system of racial inequality, BLM refers to Black Lives Matter Movement, Black refers to Black people, White refers to White people.

and collective action intentions. These findings indicate that the measure designed for the current research context satisfactorily differentiated the emotions for each target. The results of exploratory regression analysis revealed that kama muta toward the movement was positively associated with collective actions toward racial equity, followed by sadness toward the system of racial inequalities in the total sample and for each sub-group. Neither anger toward the movement nor anger toward the system of racial inequalities was significantly associated with collective action. Notably, while kama muta toward Black people was high overall, it correlated much less with collective action than kama muta toward the BLM movement did. In the stepwise regression, it even ended up with a negative sign (likely the outcome of a suppression effect).

These initial findings mainly supported our initial theorizing on the positive relationship between kama muta and collective action and sadness and collective action. Different from our theorizing, the relationship between anger and collective action was not statistically significant in the present sample. However, the pattern of results points to the expected direction. Notably, the sample size was small. Given the partial preliminary support for the hypothesized association of emotions and collective action, we set up the main study as a confirmatory test of our full theoretical model (see **Figure 1**).

MAIN STUDY

The main study tested a mediation model to explain the relations between appraisals and collective action intention toward racial equity through the three emotions. To test this model, we surveyed only White and Black Americans. Specifically, we hypothesized that (H1) Kama muta toward the BLM movement mediates the relationship between collective efficacy and collective action; (H2) Anger toward the system of racial inequalities mediates the relationship between injustice appraisals and collective action intentions and (H3) Sadness toward the system of racial inequalities mediates the relationship between unfairness appraisal and collective action (see **Figure 1**). In addition, we explored whether the hypothesized model holds true for both the disadvantaged and advantaged group members that are Black and White people in the present context, and we also explored correlations with identification with the activist group (as in Landmann and Rohmann (2020)), the most the most relevant social movement (Black Lives Matter), the superordinate group (US Americans), and the advantaged and the disadvantaged group (White people and Black people). Preregistration of this study can be found here: *https://aspredicted.org/pd2w3.pdf*.

Methods

Participants

We recruited N = 306 participants from Academic Prolific with an equal sampling of US Black and White Americans. We aimed to collect data for 300 participants, 150 participants in each group, given that correlations are more stable around this sample size (Schönbrodt and Perugini, 2013). Participants were compensated with 1.25 GBP for approximately 10 min of their time completing the survey. Based on our pre-registered exclusion criteria, we excluded participants if their response time exceeded 3 SD (n = 7) and if they failed any of the included attention checks (n = 83). The analyzed sample included N = 215 participants.

White participants (n = 107) were 18–70 years old (M = 34.57, SD = 12.69); 41 reported being male, 62 female and 4 third gender. Participants indicated their political ideology on a scale from 1 ("left") to 10 ("right"); the average value was M = 3.40 (SD = 2.60). 84.1% reported at least some college education. Black participants (N = 108) reported age varying from 18 to 68 (M = 35.40, SD = 11.71), 57 reported being male and 51 female. The average value of ideology was 4.31 (SD = 2.49), and 84.3% reported some college education.

Procedure

Each participant had to answer a survey delivered online through Qualtrics.com. All participants completed the same questionnaire and answered the measures in the order described below. Participants indicated to what extent they agreed with a set of statements on collective efficacy and injustice, their emotional ratings toward two targets: the system of racial inequalities and the BLM movement, and their intentions to participate in collective action. The questionnaire ended with some exploratory variables (group attitudes, contact, and social

identification, see **Supplementary Material** for a full list of included items).

Measures

Collective Efficacy and Injustice Appraisals

Appraisals were adapted from Landmann and Rohmann (2020). Collective efficacy appraisals were assessed with three items on a 5-point Likert scale from 1 = *not at all t*o 5 = *completely;* "I feel that together people can reduce racial inequality; I believe that together people can stop unfairness toward Black people; People can together, through joint effort, achieve racial equality." Injustice appraisals were also measured with three items: "Racial inequality is unethical; Racial inequality violates moral rules; Discrimination toward Black people is unfair."

Emotions: Kama Muta, Sadness, and Anger, and Collective Action

We assessed emotions as in the pilot study. The only difference was that we only collected data of the three emotions targeting the system of racial inequalities and the BLM Movement. Collective action was assessed as in the preliminary study, except that the items were on a 7-point Likert scale rather than a 5-point Likert scale.

Identification

Identifications were measured through the single-item social identification measure (SISI, Postmes et al., 2013). Participants had to indicate the level of agreement with "I identify with (BLM /US Americans/Racial Justice activists/White people/Black people)" on 7-point Likert scales from 1 *fully disagree* to 7 *fully agree*.

Results

Internal Consistencies

The items for the appraisals, emotions, and collective action were analyzed for reliability. The scales were found to be highly reliable. Subsequently, we created composite variables by averaging the items for each appraisal, for each emotion and target, and for collective action. Descriptive statistics and reliability for each measure can be seen in **Table 3**. Correlations between all variables for the total sample and each group separately can be found in the **Supplementary Material**.

TABLE 3 | Reliability values and descriptive for each scale and each group in the main study.

Scale	α	*M*	*SD*
Collective efficacy	0.95	4.05	0.90
Injustice	0.85	4.63	0.69
Anger to System	0.91	3.52	1.05
Anger to BLM	0.96	2.46	1.36
Kama muta to System	0.96	1.83	1.19
Kama muta to BLM	0.94	2.93	1.16
Sadness to System	0.94	3.52	1.11
Sadness to BLM	0.96	2.48	1.23
Collective action	0.93	5.24	1.52

All items are 5-point Likert scales from 1 to 5, except collective action, which is in a 7-point Likert scale from 1 to 7. System refers to system of racial inequality, BLM refers to Black Lives Matter Movement, Black refers to Black people, White refers to White people.

Emotions Toward the Targets

In order to provide some context for the emotion levels, we compared the levels of the three emotional reactions to the system of racial inequalities and the BLM movement. We conducted a GLM analysis with emotions and targets as within-participants factors and ethnicity as a between-group factor. For the interaction between emotion and target, sphericity was not met as indicated by Mauchly's test, $\chi^2(2) = 134.64$, $p < 0.001$. Since sphericity was violated ($\varepsilon = 0.69$), Huynh-Feldt results are reported. We found main effects of emotion, ethnicity, and targets. More importantly, emotions differed depending on the target, as indexed by an emotion by target interaction, $F(1.37,292.36) = 153.33$, $p < 0.001$, $\eta_p^2 = 0.42$. However, there was no three-way interaction between emotion, target and ethnicity, $F(1,37,292.36) = 1.726$, $p = 0.189$, $\eta_p^2 = 0.01$. Finally, the test of between-subjects effects indicated that across emotions both groups differed in their overall emotion levels, $F(1,213) = 12.73$ $p < 0.001$, $\eta_p^2 = 0.06$. Black participants reported higher levels of emotional reactions across targets. The system of racial inequalities elicited a higher level of anger and sadness. The BLM movement elicited higher levels of kama muta, especially in Black participants (see **Table 4**).

Hypothesis Testing

We conducted first regression analyses and then structural equation modeling to test our hypotheses. The regressions are to some extent redundant with the structural models. However, we report here both because the regressions isolate the differences between the groups better.

Collective Action Regressed on Appraisals

We hypothesized that (H1.a) Collective efficacy appraisals are positively associated with collective action intentions and (H2.a) Injustice appraisals are positively associated with collective action. We ran a multiple regression on the complete sample while including ethnicity as a moderator. As pre-registered, we regressed collective action on ethnicity (contrast-coded as −1/2 for White participants and +1/2 for Black participants), injustice appraisal (centered), collective efficacy (centered), and the interaction terms of both injustice and efficacy

TABLE 4 | Mean values for the emotional reactions for each target and each group in the main study.

	White participants		Black participants	
	System	Movement	System	Movement
Anger	3.39 [3.18; 3.60]	2.13 [1.89; 2.38]	3.65 [3.46; 3.84]	2.80 [2.54; 3.07]
Kama muta	1.56 [1.37; 1.75]	2.93 [2.77; 3.08]	2.09 [1.84; 2.34]	3.13 [2.90; 3.37]
Sadness	3.48 [3.28; 3.68]	2.37 [2.15; 2.59]	3.56 [3.34; 3.78]	2.59 [2.35; 2.84]

Means and 95% confidence intervals.

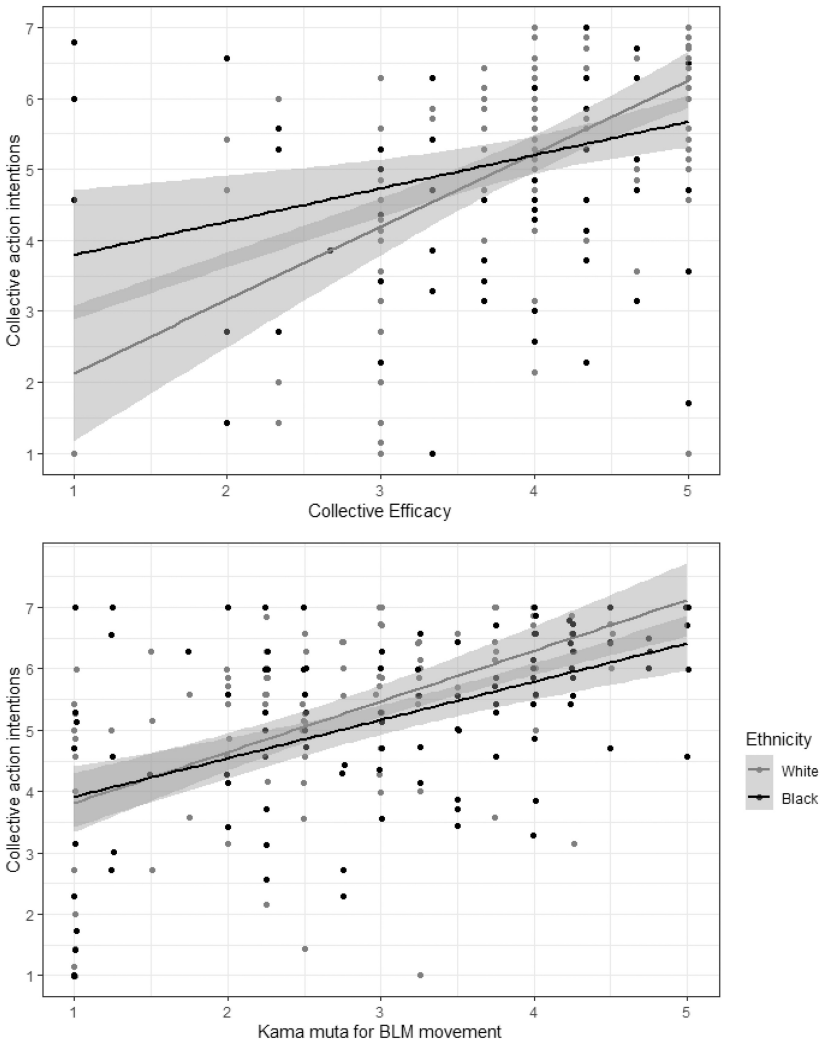

FIGURE 2 | Scatterplots of the relationship between collective efficacy and collective action and Kama muta for BLM and Collective action intentions for both Black and White people. Gray areas show 95% Confidence Intervals.

with ethnicity. Note that we did not include the three-way interaction. Also, note that centering was done on the complete sample.

The model explained 27.4% of variance of collective action, R^2 = 0.27, $F(5,209)$ = 15.80, $p < 0.001$. The intercept was B = 5.25, and represents the average of collective action scores. The main effect of ethnicity was not significant, B = –0.03, p = 0.885. Both appraisals explained a significant amount of variance. Injustice appraisals were positively associated with collective action, B = 0.57 [0.30,0.84], β = 0.26, $p < 0.001$. Collective efficacy appraisals were also positively associated with collective action, B = 0.63 [0.42,0.84], β = 0.37, $p < 0.001$. Ethnicity did not moderate the effect of injustice, B = –0.34 [–0.89,0.20], β = –0.08, p = 0.212 and neither the effect of collective efficacy, B = –0.29 [–0.71,0.13], β = –0.09, p = 0.171. Analysis run separately in each group can be found in the **Supplementary Material**.

Collective Action Regressed on Emotions

The model explained 54.5% of the variance of collective action $F(7,207)$ = 35.36, $p < 0.001$. The intercept was B = 5.23. The main effect of ethnicity was marginally significant, indicating slightly higher values for white B = –0.32 [–0.61, –0.03] compared to black participants, B = –0.11, p = 0.030. In line with hypotheses, the three emotions were positively associated with collective action intentions: Anger, B = 0.67 [0.49,0.85], β = 0.46, $p < 0.001$, kama muta, B = 0.32 [0.18,0.47], β = 0.25, $p < 0.001$, and sadness B = 0.10 [0.02,0.38], β = 0.15, p = 0.023. Ethnicity did not moderate the effect of anger, B = 0.12 [–0.24,0.48], β = 0.52, p = 0.523, and neither kama muta, B = 0.17, β = 0.07, p = 0.245 [–0.12,0.47] (see **Figure 2**). However, ethnicity moderated the effect of sadness, B = –0.55 [–0.90, –0.20], β = –0.20, p = 0.002.

We proceeded to analyze the model in each group separately without centering variables. The model explained 61.4% of the variance of collective action for White participants

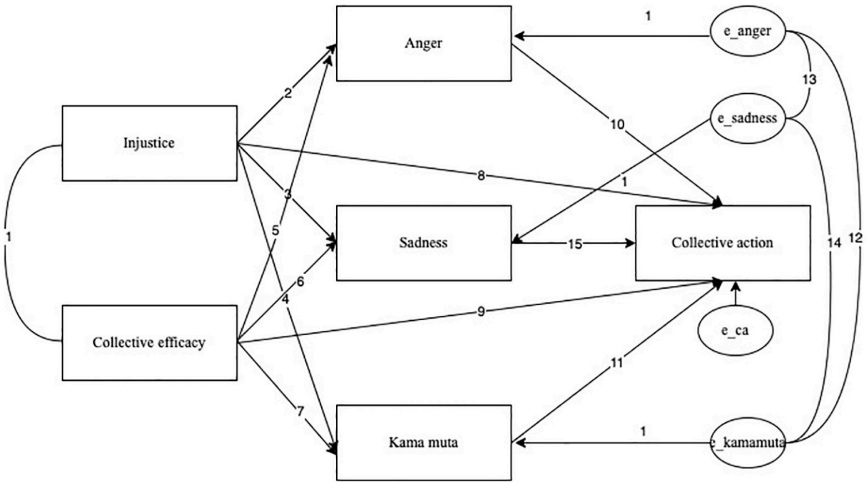

FIGURE 3 | Path model with all the interactions and parameters.

$F(3,103) = 54.50$, $p < 0.001$ and 46.2% of the variance for Black participants, $F(3,104) = 29.82$, $p < 0.001$. For White participants, anger, $B = 0.61$ [0.35,0.88], $\beta = 0.41$, $p < 0.001$, sadness $B = 0.48$ [0.19,0.76], $\beta = 0.32$, $p = 0.001$, and kama muta, $B = 0.24$ [0.01, 46], $\beta = 0.16$, $p < 0.001$, were positively associated to collective action. For Black participants, anger $B = 0.73$ [0.49,0.97], $\beta = 0.50$, $p < 0.001$ and kama muta $B = 0.41$ [0.22,0.60], $\beta = 0.34$, $p < 0.001$, but not sadness, $B = -0.07$ [0.19,0.76], $\beta = -0.74$, $p = 0.460$, were positively associated to collective action intentions. For both groups anger explained most of the variance of collective action. Kama muta descriptively explained more variance in the Black participants than in White participants, but this was not statistically significant, as noted above. Sadness significantly explained variance in White participants but not in Black participants.

Structural Equation Modeling

We performed a Structural equation modeling (SEM) to test the mediation model, using SPSS Amos version 27. The model combined the analyses above. It featured two independent variables (injustice and collective efficacy appraisals), the three emotions as mediators, and collective action as the dependent variable. The complete model is depicted in **Figure 3**. The independent variables were allowed to correlate, as well the residuals of the three emotions. Direct effects of the appraisals on collective action were also included. The overall fit was examined using the chi-square test and the root mean square error of approximation (RMSEA). A bootstrapping method (5000 iterations) was used to test the statistical significance of mediation with all mediators in the model. A multigroup analysis was performed to examine whether the mediation model was moderated by ethnicity. To do that, all regression weights and covariances were labeled in the model. There were in total 15 of them.

A preliminary model (1) tested whether the covariances among the residuals of the emotion terms (12, 13, 14) could be set to zero while allowing all other parameters to differ between the groups. This model did not fit the data well, RMSEA = 0.286 [0.24,0.33], $\chi^2(6) = 110.29$, $p < 0.001$. These parameters were thus allowed to differ from 0 in all following models. This indicates that, unsurprisingly, the correlations among the three emotions cannot be fully explained by the two appraisals.

In a second model, we set all parameters to be equal in the two groups (i.e., b1 = w1, b2 = w2, b15 = w15). This tested the hypothesis that the two groups do not differ regarding the relationship between the variables. Overall fit was not good, RMSEA = 0.104 [0.07,0.14], $\chi^2(15) = 49{,}51$ $p = 0.003$. We inspected all modification indices > 2 (see **Supplementary Material**). The modification indices indicated that relaxing the following parameters would substantially improve the fit of the model: (1) Covariance between unfairness and collective efficacy, (2) Regression path between collective efficacy and sadness, and (3) Regression path between sadness and collective action (which is in line with the regression analyses). In addition, the modification indices suggested adding a regression between kama muta and sadness in this model, which we did not follow, given that the residuals of the two emotions are allowed to correlate. In sum, the second model showed that Black and White participants differed regarding the covariance of the two appraisals and the influence of collective efficacy on collective action *via* sadness.

Consequently, in model 3, we allowed parameters 1, 6, and 15 to differ between the groups, while all other parameters were set to be equal. The overall fit is good, RMSEA = 0.044 [0.00,0.09], $\chi^2(12) = 16.86$, $p = 0.540$ (MacCallum et al., 1996). All parameters reported are from this model. **Table 5** shows the summary of the coefficients for both groups separately.

Injustice and collective efficacy appraisals covaried for White participants ($r = 0.39$, $p < 0.001$), but not for Black participants ($r = -0.06$, $p = 0.588$). The standardized total effect of collective efficacy on collective action, which includes both mediated and direct effects, was significant, for both White, $\beta = 0.38$, $p < 0.001$,

TABLE 5 | Summary of multigroup path analysis.

Path	White participants				Black participants			
	B	***SE***	**CR**	β	***B***	***SE***	**CR**	β
Injustice→anger	0.57	0.09	6.24***	0.41	0.57	0.09	6.24***	0.34
Collective efficacy →kama muta	0.30	0.08	3.58***	0.24	0.30	0.08	3.58***	0.23
Injustice→sadness	0.26	0.10	2.60 **	0.19	0.26	0.10	2.60†	0.14
Injustice→kama muta	0.36	0.11	3.40***	0.25	0.36	0.11	3.40***	0.19
Collective efficacy → sadness	0.51	0.09	5.51***	0.43	−0.08	0.11	−0.65†	−0.06
Collective efficacy → anger	0.30	0.07	4.16***	0.24	0.30	0.07	4.15***	0.26
Injustice→ collective action	0.14	0.11	1.23†	0.41	0.14	0.11	1.23†	0.06
Collective efficacy → collective action	0.30	0.09	3.48***	0.16	0.30	0.09	3.48***	0.19
Kama muta → collective action	0.31	0.07	4.36***	0.21	0.31	0.07	4.36***	0.26
Anger → collective action	0.61	0.09	6.79***	0.40	0.61	0.09	6.79***	0.44
Sadness → Collective action	0.28	0.11	2.46†	0.18	0.01	0.09	0.06†	0.01

****$p < 0.001$, **$p < 0.05$, †$p < 0.1$.*

Anger refers for anger toward the system of racial inequality, kama muta refers to kama muta toward the Black Lives Matter movement, and sadness refers to sadness over the system of racial inequality. CR refers to critical ratio.

and Black, β = 0.37, $p < 0.001$, participants. The standardized total effect of injustice on collective action, which includes both mediated and direct effects, was significant for both White, β = 0.31, $p < 0.001$, and Black participants, β = 0.26, $p < 0.001$. The standardized indirect effect of collective efficacy through emotions on collective action is β = 0.22 for White and β = 0.18 for Black participants. The mediated effect of injustice through emotions on collective action is β = 0.25 for White and β = 0.20 for Black participants. This indicates that more than half of the total effect of collective efficacy and two-thirds of the effect of injustice on collective action is mediated through emotions.

After adjusting the model, the SEM findings reveal that the direct path from injustice to collective action was not significant anymore. Collective efficacy, however, retained a significant direct path to collective action. It was also found that collective efficacy was significantly related to kama muta, sadness, and anger. Kama muta and anger, but not sadness were significantly associated with collective action (see summary of multigroup path analysis in **Table 5**).

A bootstrapping method was used to judge the significance of specific indirect effects of injustice and collective efficacy through each emotion on collective action. The mediation hypotheses were tested by requesting an additional estimate from Amos. The predicted meditations were tested with an alpha level of 0.05 each. In addition, we defined a new alpha level for the six unpredicted mediation tests as these were exploratory (in the lower half of **Table 6**). Bonferroni correction equals a new alpha level of 0.05/6 = 0.008. All mediation estimates are depicted in **Table 6**.

The results revealed that as hypothesized, kama muta mediated the relationship between collective efficacy and collective action, and anger mediated the relationship between injustice and collective action. In addition, sadness mediated the relationship between injustice and collective action, but only for White participants.

Finally, in the exploratory part, anger also mediated the relationship between collective efficacy and collective action, and kama muta mediated the relationship between injustice and collective action even after Bonferroni correction. In sum, both anger and kama muta mediated the relationship between both appraisals and collective action, while sadness only mediated the association between injustice and collective action for white participants.

TABLE 6 | Main indirect effects in the structural equation model.

Mediation	***B***	***p***	***CI***
Injustice via anger	0.344	< 0.001	[0.22; 52]
Collective efficacy via Kama muta	0.091	0.001	[0.04;0.17]
Injustice via Sadness (Black)	0.001	0.896	[–0.04;0.05]
Injustice via Sadness (White)	0.071	0.030	[0.01;0.18]
Collective efficacy via anger	0.179	< 0.001	[0.09,0.30]
Injustice via kama muta	0.110	0.001	[0.05,0.19]
Collective efficacy via Sadness (Black)	0.000	0.779	[–0.02,0.02]
Collective efficacy via Sadness (White)	0.142	0.033	[0.03,0.28]

All paths lead to Collective action. 95% confidence intervals.

Exploratory Analyses: Correlations With Identification

We assessed the association between the main variables of the study (kama muta toward the movement and collective action) and the social identification options for each group separately (see **Supplementary Material**). For Black participants, collective action motivation was most strongly associated with identification with Racial Justice activists ($r = 0.77$), the BLM ($r = 0.59$), and Black people in general ($r = 0.48$). The other possible identifications play no role. Kama muta toward the movement was associated most with identification with the movement ($r = 0.60$), somewhat less with identification with racial justice activists ($r = 0.53$), and still less with identification with Black people ($r = 0.27$). Collective efficacy is linked to identification with racial justice activists ($r = 0.37$) and BLM ($r = 0.32$), and surprisingly also somewhat with identification with White

people (r = 0.23). (All numerically listed correlations were statistically significant, but note that we did not correct for multiple comparisons).

For White participants, collective action motivation was most strongly associated with identification with both Racial Justice activists (r = 0.73) and the BLM (r = 0.72), and less but still significantly with Black people in general (r = 0.32). The other possible identifications played no role. Kama muta toward the movement in White participants was associated with identification with both racial justice activists specifically (r = 0.43) and the BLM in general (r = 0.41), and less but still significantly with identification with Black people (r = 0.21). Collective efficacy is again linked to identification with racial justice activists (r = 0.45) and BLM (r = 0.41), and this time also with identification with Black people (r = 0.32). (Again, all numerically listed correlations were statistically significant).

Discussion

The main study tested how the effects of appraisals of injustice and appraisals of collective efficacy on collective action were mediated by emotions of anger, kama muta, and sadness. The regression analysis confirmed that both collective efficacy and injustice appraisals were positively associated with collective action intentions in the full sample. Additionally, the three emotions were predictors of collective action intentions toward racial equity in the full sample, yet, after additional analyses by group, sadness was a predictor only for White participants. The structural equation modeling allowed a multigroup comparison of the mediation models between White and Black participants. As predicted, the effects of injustice and collective efficacy appraisals on collective action were mediated by anger and kama muta, respectively, in both White and Black participants. In addition, we found the respective other mediations in exploratory analyses. Exploration also showed that Black and White participants differ in the covariance of the two appraisals and in sadness *via* collective efficacy path. Collective efficacy and injustice were associated with sadness, but these associations and the mediation role of sadness for injustice were significant only for White participants.

The exploratory correlation analyses of the identification measures showed that for Black participants, collective action, identification with both the BLM movement and racial justice activists, and kama muta toward the BLM movement are all closely associated. Collective efficacy is also tied to identification with both BLM and activists, but less strongly. For White participants, the picture looks similar but more differentiated. On the one hand, collective action is correlated even more strongly with identification with the BLM movement and also identification with racial justice activists. Kama muta with BLM is clearly correlated with identification with BLM and activists, but somewhat less than for Black participants. Collective efficacy is also tied to identification with both BLM and activists for White participants.

GENERAL DISCUSSION

The current research investigated the role of kama muta for collective action intentions toward racial equity in the context of the BLM. We hypothesized that kama muta toward the BLM movement would mediate the path of collective efficacy appraisals to collective action intentions. In addition, we included hypotheses about the role of anger and sadness toward the system of racial inequalities as mediators between injustice appraisals and collective action intentions.

Findings

In the pilot study, we found that kama muta toward the movement and sadness toward the system were the main predictors of collective action intentions toward racial equity. In the main study, we found that kama muta toward the movement mediated the relationship between collective efficacy and collective action for both Black and White participants. Anger toward the system of racial inequalities fully mediated the relationship between injustice and collective action. Unexpectedly, we found that anger also partially mediated the association between collective efficacy and collective action, and kama muta partially mediated the association between injustice and collective action. In addition, we discovered that sadness toward the system of racial inequalities mediated the relationship between unfairness and collective action intentions; however, this effect was only significant for White participants. Finally, identification with both BLM movement and racial justice activists was correlated (a) strongly with collective action, (b) solidly with kama muta with the BLM movement, and (c) also solidly with collective efficacy in both Black and White participants. Kama muta with the movement was correlated more clearly with identification with the movement in Black participants than in White participants.

Thus, the results confirmed the mediating role of kama muta on the relationship between collective efficacy and collective action. Nonetheless, it also indicates a mediator role of kama muta for the effect of injustice. In addition, the model held for both White and Black participants, meaning that there was no difference between both groups in the pathways to collective action. It is notable that injustice appraisals and collective efficacy were correlated for White but not Black participants.

The findings on kama muta conceptually replicate and extend the findings that Landmann and Rohmann (2020) reported for activists who opposed a mining company and their sympathizers. The current findings show that these predictions hold when (1) a different measure is used (based on kama muta theory and including references to appraisals, feeling labels, bodily sensations, and motivation, rather than based on an approach focusing on being moved in general, and using feeling labels only), (2) when conducted in English rather than German, and (3) when tested in a different context than environmental actions, (4) and perhaps most importantly, for both the disadvantaged and the advantaged group in a struggle that aims at reduction of social inequalities. The results also demonstrate that kama muta is clearly different from sadness, which showed a separate path that was only present for the advantaged group.

Limitations and Future Directions

Measures and Sample

Any research on emotions, especially when it uses self-report on longer periods of time, is limited by participants' ability to remember, and verbally report the emotions. Discussing these measures critically is thus crucial. The current work based the design of the emotions measure and the general theoretical argument on the kama muta construct rather than on Landmann and Rohmann's *being moved* construct, but we reiterate here that this distinction is largely theoretical for the present results. The two theories differ mainly in an area that was included in neither study, namely their conjectures about *why* situations that cause the constellation of kama muta or being moved do that. While there is an overlap in the causes assumed by both theories (e.g., exceeded expectations of prosociality), there are also diverging ideas (see section "Introduction" and also below). This would clearly be a fruitful area for further work.

The kama muta measure designed and used in the current studies was piloted but otherwise not validated. It includes a more complete description of emotional experiences that can be directed to different targets. We are confident that is an appropriate measure because (a) it was based on a well-researched theoretical background, and (b) because the equivalent (and also new) measure of anger replicated the classic mediation between injustice and collective action. Nevertheless, future research should validate this measure of kama muta and adapt it to other intergroup contexts. Note that the design of the measure presented a conundrum. We opted for giving a rich description of the kama muta prototype that included an abstract description of the appraisal and the resulting motivation. The prompt was written in a way that asked participants to compare emotional experiences in the last year to this abstract description. Nevertheless, there is a potential downside to this richness, namely that the kama muta measure captures variance that actually belongs to predictor (collective efficacy) and outcome (motivation). We acknowledge this as a shortcoming of the study, but are confident that it does not compromise the results given that many other studies with separate measures of the kama muta components typically find parallel predictions by all components (with physical symptoms and motivation typically performing least well). The fact that our results closely parallel those of Landmann and Rohmann (2020), who relied on feeling labels alone, support this.

It is important to mention that the sample in this study is not representative. Larger and more representative samples could provide further evidence of the stability of these results. In addition, the results surely capture a transient moment in the life of a social movement. The items asked participants to reflect on their last year, which included massive protests, a polarizing presidential election with campaigns that often referenced the movement, and a pandemic that highlighted tragic vulnerabilities caused by the same social inequalities.

Test of Theoretical Model

In general, more evidence is needed to test the causality of the association between emotions and appraisals, therefore experimental research could provide insights in this direction. Note, however, that the kama muta model to some extent predicts reciprocal effects, especially over time in a dynamic social relation. If people experience kama muta from seeing joint demonstrations of advantaged and disadvantaged groups for values that they support and then join a demonstration themselves, this will give them another boost of experiencing collective efficacy and encourage further kama muta experiences.

The current data do not yet identify what elements of experiencing collective action lead to kama muta experiences and what role morality plays. Qualitative data could add more depth to understanding the context in which this emotion arises in a movement like Black Lives Matter. The idea that experiencing collective efficacy is equivalent to a communal sharing intensification and thus leads to kama muta experiences may be surprising at first. However, imagine situations like joining together to help a child that got lost, pushing a car out of mud, or defeating an opposing team in a tug-of-war. The experience of jointly having the potential and indeed power to enact collective action might act as a manifestation and confirmation of the communal sharing relation and thereby cause an experience of oneness and togetherness (Fiske et al., 2019), which can, in turn, become the source of kama muta.

In addition to the mediator role of kama muta through the path of collective efficacy, the results showed that kama muta also mediated the association between injustice and collective action. This relation was not predicted, but strong enough to survive the correction for multiple comparisons for the unpredicted mediations, and it deserves to be taken seriously while being interpreted with caution. Similar to our results, Landmann and Rohmann (2020) found that the feeling of being moved mediated the association between injustice appraisals and collective action. These authors suggest that people were "negatively moved" by unfair practices. Our results indicate that sadness does not account for the collective action of the disadvantaged group. It could be possible that appraisals of injustice could elicit kama muta toward the movement because the movement represents positive core values such as fairness and equality (Cova and Deonna, 2014) that are experienced as shared and may be necessary to contrarest the unfairness. Likewise, the observation that anger mediates the relationship between collective efficacy and collective action makes sense when considering that anger arises when one appraises a potential to change the situation (Roseman, 2013). In light of such speculations, it becomes clear that better measures of experienced or observed intensification of communal sharing are needed to test kama muta theory comprehensively.

Nevertheless, these results contrast with most collective action models that emphasize the tight association between injustice appraisal and anger, indicating only *one* emotional path to collective action. There might in fact be other emotions that play a role. Landmann and Rohmann (2020) pointed out collective guilt as a potential contributor (Ferguson and Branscombe, 2014), and we agree that collective guilt can shape not just engagement in, but also the specific goals of collective action (Masson and Fritsche, 2021). However, guilt is experienced mainly by the advantaged group (Thomas et al., 2009b). Therefore, guilt might indeed be involved in the effect of sadness in White participants

in the current study. Finally, another interesting avenue for future work might be emotions coming out of the intensification of other relational models, such as authority ranking – which might indeed be a part of what is commonly labeled as awe.

Kama Muta and Politicized Identities

Being moved and kama muta are conceptualized as social-relational emotions that are influenced by, and themselves result in, relational processes. The current work focused on the larger picture, from judgments of the social situation (injustice, collective efficacy) to collective action. Disentangling the more minute details, including tracing how social identification with the various identities involved change throughout these emotional experiences, remains a task for future work. However, the current research offers some insights in how kama muta (and also anger) and different social identities interact in the context of collective action.

We started our exploration in the pilot study by focusing on both politicized identities (BLM movement, "system of racial inequality") and ethnically defined identities (Black and White people). The former outperformed in the prediction of collective action, and thus, we focused on politicized entities. This is in line with longstanding arguments and findings that politicized identities play a major role in social change (van Zomeren et al., 2018). In the main study, the correlations between kama muta and the various social identification measures show that kama muta for the movement is indeed associated with politicized identities (BLM and racial justice activists) for both White and Black participants. One way to interpret this is to say that by fostering politicized identities, kama muta and other relationship processes could allow the creation of communal sharing relationships that would enable advantaged and disadvantaged group members to work together toward a common cause. But two caveats are necessary. First, reciprocal relations between identification, collective efficacy, and kama muta are likely. Such reciprocal relations with identification have been pointed out before (Kessler and Hollbach, 2005; van Zomeren et al., 2008), and experimental and longitudinal work is necessary to chart them.

Second, the correlations that we observe tentatively suggest a more central, or perhaps more uniform, role for kama muta toward the movement for Black participants than for White participants. It is possible that there is more diversity in what moved White participants about the BLM movement, and what identifications are at play. Some may see BLM as a movement that bridges the disadvantaged and advantaged group and be moved by the collective efficacy of this new joint social group that they identify with. A politicized collective identity based on shared values and beliefs about fairness and equity seems promising to integrate advantaged and disadvantaged groups (Subašić et al., 2008; Thomas et al., 2009a). Others may be moved by experiences of collective efficacy in their own in-group when protesting moral violations, but not identify with a movement that bridges the groups (and instead identify with a subgroup of their advantaged in-group). This is in line with arguments by Craig et al. (2020), who suggest that advantaged groups take actions based on values and norms rather than shared identification, and that perception of privileges is essential to encourage action. These possibilities reveal a weakness of the collective efficacy measures, which simply referred to "people," rather than specifying any exact group. The measures of collective efficacy, kama muta, and identification did thus not perfectly align. This has the advantage of making comparison to earlier studies easier, but the disadvantage of obscuring the actual identities involved. Future work could use more targeted measures. Due to the likely reciprocal processes and this ambiguity, we only presented correlational analyses rather than placing identification in the causal model.

It is noteworthy that we found no association between US American identity to kama muta toward the movement or to intentions to participate in collective action. Previous work has shown that kama muta can reduce affective polarization and increase the salience of a common in-group in the context of US politics (Blomster Lyshol et al., 2022). Common in-group identity can promote the reduction of stereotypes, prejudice, and discrimination toward the out-group (Dovidio et al., 2000, 2010). However, it can undermine collective action intentions (Ufkes et al., 2016). Banfield and Dovidio (2013) found that emphasizing a common "American" identity in White participants reduces the recognition of discrimination against Black people and consequently also their willingness to support them. In consequence, the authors suggested that awareness of racial injustice is essential to encourage collective action (see also Uluğ and Tropp (2021)).

Based on the context of the BLM, we have mainly focused on collective action that is aimed at increasing equality and intergroup relations. Note, however, that the exact same emotional processes should propel collective movements aimed at other goals. Fiske (2019) argued that it is likely that participants of fascist rallies in Nazi Germany fostered a sense of commonality and kama muta among its participants. Seibt et al. (2019) found that both Republicans and Democrats experienced kama muta when watching heartwarming political ads by their own party and that this motivated them to contribute to their party's efforts. Kama muta is a positive affective experience, but that does not imply that it is inherently connected to equality or social harmony between groups. Instead, it should strengthen any moral conviction of the group that it is experienced with. However, Although it is not inherently connected to social equality, kama muta may have the potential to "move" the members of different groups that share similar values and beliefs about justice motivating them to join efforts to achieve positive social change.

CONCLUSION

The present research extends the role of being moved for collective action, suggesting an application of kama muta theory to intergroup relations that can lead to collective actions aimed to foster equality among groups. We replicate earlier work showing that the impact of collective efficacy on collective action is partly mediated by the emotional experience of the togetherness, which is typically labeled being moved, and what we conceptualize as kama muta. Simply put, this emphasizes the *collective* in collective efficacy.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: https://osf.io/aqmxh.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the internal review board at the Department of Psychology, University of Oslo. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

DLP conceptualized the research, created the materials, carried out the investigation, and wrote the first draft of the manuscript. DLP and TS conducted the all statistical analyses. TS and JR edited and reviewed the manuscript. All authors planned the research.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.780615/full#supplementary-material

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