



Focusing on appraisals: How and why anger and fear influence driving risk perception

Jingyi Lu, Xiaofei Xie^{*}, Ruogu Zhang

Department of Psychology, Peking University, Beijing, China

ARTICLE INFO

Article history:

Received 16 October 2012

Received in revised form 28 December 2012

Accepted 28 January 2013

Available online 13 February 2013

Keywords:

Anger

Fear

Driving risk perception

Appraisal

Reappraisal

ABSTRACT

Introduction: The present research explores how and why anger and fear influence driving risk perception. **Methods:** Based on appraisal tendency framework, researchers hypothesized that anger and fear would influence driving risk perception in opposite directions due to their differences in appraisals. **Results:** Study 1 showed that anger reduced risk perception, whereas fear increased it. In Studies 2, 3, and 4, the researchers adopted the paradigm of reappraisal to investigate the causes of the opposite effects found in Study 1. Consistent with our hypothesis, appraisals accounted for these effects: After reappraisals along the dimensions of certainty (Study 2), control (Study 3), and responsibility (Study 4), the different effects between anger and fear on driving risk perception diminished or disappeared. In addition, fearful or angry experience mediated the effects of reappraisals on driving risk perception. **Impact on industry:** The findings highlight the necessity to differentiate anger and fear in road safety management. Additionally, the current research also provides feasible methods (e.g., certainty, control, or responsibility reappraisal) to intervene in driving risk perception, which is important for driving safety.

© 2013 National Safety Council and Elsevier Ltd. All rights reserved.

The increasing number of traffic accidents all over the world (Bureau of Traffic Management, PRC, 2011; United Nations Economic Commission for Europe, 2011) heightens the need for identifying the causes of driving risk. A large volume of studies describe the significant role of emotion and its effects on driving (e.g., Deffenbacher, Lynch, Oetting, & Yingling, 2001; Hu, Xie, & Li, 2013; Mesken, Hagenzieker, Rothengatter, & de Waard, 2007; Rhodes & Pivik, 2011; Taubman-Ben-Ari, 2012). In daily life, drivers inevitably experience various emotions, and anger and fear are among the most frequent ones (Mesken et al., 2007; Taylor, Alpass, Stephens, & Towers, 2011). Driving anger, also known as road rage, troubles drivers to a large extent (Dula & Geller, 2003). Fear, however, is prevalent among the less experienced or less skillful drivers (Taylor, Deane, & Podd, 2002, 2007). Thus, research focus should be put on the question that how anger and fear, the two common emotions in driving, influence driving risk perception.

Categorizing emotions into positive and negative ones is a traditional way to examine the impacts of emotions on driving risk perception (Hu et al., 2013; Taubman-Ben-Ari, 2012). The emotions that make people feel good are classified as positive, whereas those eliciting bad feelings are classified as negative (Watson, Clark, & Tellegen, 1988). Anger and fear, both categorized as negative emotions, are assumed to similarly affect driving risk perception. However, little empirical evidence exists to shed light on whether all negative emotions influence driving risk perception in the same way. Consider being involved in a quarrel with

a good friend before driving home. In such a situation, how likely would you think that you would be involved in a potential traffic accident? Additionally, suppose that you witness a traffic accident while driving and, from then on, are gripped by fear. In this case, how would you perceive driving risks? Therefore, we seek to address the questions: Do anger and fear affect driving risk perception similarly or oppositely? And why do such effects emerge?

1. How anger and fear influence risk perception

Risk perception, defined as intuitive risk judgment, plays a crucial factor in decision making (Slovic, 1987). Only if people are able to perceive risks is it possible for them to avoid risks and make sensible decisions. Slovic (1987) divided risk perception into two factors: The first is dread risk, which is uncontrollable, dread, catastrophic, and involuntary; and the second is unknown risk, which is unobservable, unknown, and new. The higher a hazard scores on both factors, the more risks people perceive.

Risk perception is also a focus of attention in the transportation field (e.g., Hu et al., 2013; Lund & Rundmo, 2009; Mesken et al., 2007; Nordfjærn, Jørgensen, & Rundmo, 2011; Nordfjærn & Rundmo, 2009), and it is a factor correlating with driving behaviors (Rundmo & Iverson, 2004). Previous studies showed that emotion was a key factor in determining risk perception in both the non-transportation (Loewenstein, Weber, Hsee, & Welch, 2001; Slovic, Finucane, Peters, & MacGregor, 2004) and transportation fields (Hu et al., 2013; Mesken et al., 2007; Taubman-Ben-Ari, 2012).

^{*} Corresponding author at: Department of Psychology, Peking University, Beijing, 100871, China. Tel.: +86 10 62759999; fax: +86 10 62761081.

E-mail address: xiaofei@pku.edu.cn (X. Xie).

There are two competing theories for the roles of anger and fear on risk perception. Scholars from a *valence-based perspective* advocated labeling emotions as either positive or negative, and examining these valence effects on risk perception. Key findings from this approach were that negative emotions elevated risk perception, whereas positive ones decreased it (Johnson & Tversky, 1983). Applying this perspective into driving research, researchers found similar results such that negative emotions increased risk perception compared with positive and neutral ones (Hu et al., 2013). From these results, however, it is difficult to draw a distinct line between anger and fear, as both are categorized as negative emotions. All we can do is to assume that because both anger and fear belong to negative emotions, they would similarly elevate driving risk perception.

By contrast, *appraisal tendency framework* (ATF; Han, Lerner, & Keltner, 2007; Lerner & Keltner, 2000, 2001), which contends that the research focus should be put on specific emotions beyond valence, makes the exactly opposite predictions. ATF presumes that though of the same valence, anger and fear differently affect risk perception. For instance, anger promoted more optimistic assessments for future events relative to fear (Lerner & Keltner, 2000). These findings were replicated in both laboratory and field studies (Fischhoff, Gonzalez, Lerner, & Small, 2012; Lerner, Gonzalez, Small, & Fischhoff, 2003; Lerner & Keltner, 2001). In line with ATF, fearful drivers should be prone to feel higher risk levels; angry drivers, however, may feel lower risk levels. Consistent with this prediction, anger was found to induce poor driving behaviors (e.g., Abdu, Shinar, & Meiran, 2012; Arnett, Offer, & Fine, 1997; Mesken et al., 2007) and cause accidents (Underwood, Chapman, Wright, & Crundall, 1999).

2. Why anger and fear influence risk perception

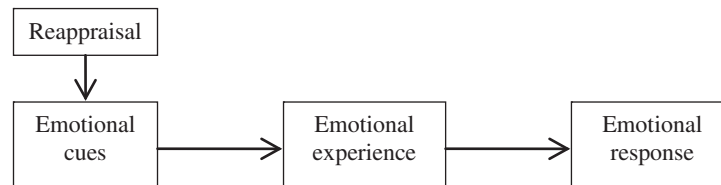
Why do the aforementioned opposite effects emerge such that anger reduces driving risk perception whereas fear increases it? According to ATF, an emotion is triggered by certain appraisals of an event (Han et al.,

2007; Lerner & Keltner, 2000, 2001). More exactly, each emotion differs on the appraisals of certainty, control, pleasantness, attentional activity, anticipated effort, and responsibility (Ellsworth & Smith, 1988; Smith & Ellsworth, 1985). Such appraisals, in turn, determine how people with a specific emotion make future judgment (Han et al., 2007; Lerner & Keltner, 2000, 2001). The differences between two emotions in appraisals contribute to their differential effects on subsequent perception (Han et al., 2007; see also Bonifield & Cole, 2007; Winterich, Han, & Lerner, 2010; see the central panel in Fig. 1 for a conceptual model).

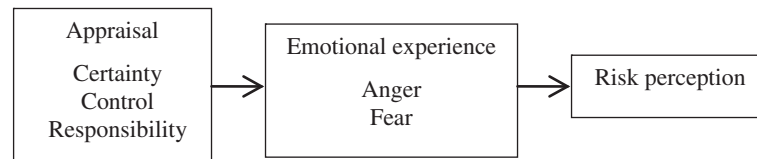
Regarding anger and fear, ATF assumes that they are located differently on the dimensions of certainty and control (Lerner & Keltner, 2000, 2001; Smith & Ellsworth, 1985). *Certainty* refers to the extent to which individuals perceive a situation as predictable or unpredictable. *Control* refers to the degree to which the cause of an outcome can be attributed to individual or situational factors (Lerner & Keltner, 2000; Smith & Ellsworth, 1985). Past research found that high certainty and individual control are associated with anger, whereas uncertainty and situational control are connected with fear (Lerner & Keltner, 2000; Smith & Ellsworth, 1985). In addition, one of the characteristics of uncertainty is unobservable, which is also a feature of high unknown risk in Slovic's (1987) "two-factor model". Situational control, however, contributes to high dread risk. Therefore, anger appears to reduce risk perception whereas fear increases the perception of risk.

Notably, ATF overlooks the difference between anger and fear in the appraisal of *responsibility*, which accounts for who (self vs. others) should be responsible for initiating an emotion-inductive event (Lerner & Keltner, 2000; Smith & Ellsworth, 1985). Although both responsibility and control identify the cause of an event, they are indeed different by definitions. In particular, control differentiates individual and situational factors, whereas responsibility focuses only on the individual factors and identifies self or other as the causes. Smith and Ellsworth (1985) showed that angry people were high in other-responsibility, whereas fearful ones were only moderately high. Notably, high other-responsibility means a

Emotion regulation model (Gross, 1998a)



Conceptual model of the present research



Main procedure of the present research

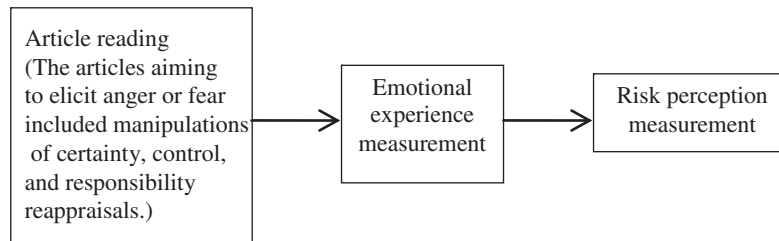


Fig. 1. Appraisal, reappraisal, emotional experience, and risk perception.

definite cause of an event, thus it is characterized by voluntary, which reduces dread risk. Therefore, we hypothesize that angry people would perceive less risk than fearful ones.

Based on the above reasoning, we assume that the opposite effects of anger and fear on risk perception are attributable to the differences between the two emotions in the appraisals of certainty, control, and responsibility. Lerner and Keltner (2001) evidenced the role of control but failed to verify the effects of certainty and responsibility. The current research aims to provide evidence for the roles of certainty, control, and responsibility in determining the ways that anger and fear influence driving risk perception.

3. The present research

The goals of the present research were twofold: to examine the opposing effects of anger and fear on driving risk perception and to explore the underlying causes for these effects. Specifically, we hypothesized that the differences between anger and fear in the appraisals of certainty, control, and responsibility led to the opposite effects. To this end, we experimentally manipulated certainty, control, and responsibility in order to diminish the differences between anger and fear in such appraisals. If the opposite effects were caused by appraisals, we predicted that the emotional experience of anger or fear would be weakened after manipulations on these appraisals, and that this would lead to lessening or complete elimination of difference in risk perception.

Inspired by the literature of emotion regulation, we adopted the reappraisal paradigm to manipulate appraisals. Reappraisal, by which individuals cognitively reevaluate an event so that they experience less emotional responses (Gross, 1998a), is one of the commonly used strategies in emotion regulation (e.g., Blechert, Sheppes, Di Tella, Williams, & Gross, 2012; Denson, Grisham, & Moulds, 2011; Gross, 1998a; Gross & John, 2003; McRae, Ciesielski, & Gross, 2012; Shiota & Levenson, 2012; Urry, 2009). It is noteworthy that reappraisal is characterized by its decreasing impacts on both emotional experience and behavioral expression (Gross, 1998a,b, 2001). Thus, when encountering an emotion-inductive event, the emotional response of people who reappraise an event is less strong than that of those who do not. The weakened experience of emotion then leads to less behavioral response (see the upper panel in Fig. 1 for emotion regulation model proposed by Gross, 1998a). Following this logic, we asked drivers to imagine an anger/fear-inductive event and then reappraise the situations along the dimensions of certainty, control, and responsibility. If appraisals accounted for the opposite effects of anger and fear on risk perception, the change in appraisals would bring about the change in emotional experience, and thus, risk perception.

To summarize, we aimed to examine the opposing effects of anger and fear on driving risk perception in Study 1. Specifically, drivers were primed with anger, fear, or neutral emotion, and their driving risk perception was assessed. In line with ATF, we hypothesized that anger would reduce risk perception, whereas fear would increase it. Study 2 (certainty), Study 3 (control), and Study 4 (responsibility) examined the roles of appraisals by employing the paradigm of reappraisal. Drivers were asked to read the articles aiming to elicit anger or fear, with or without reappraisal instructions. Both emotional experience and driving risk perception were measured (see the bottom panel in Fig. 1). We hypothesized that the difference between anger and fear on risk perception would no longer exist or at least be reduced after certain reappraisals, and that emotional experience mediated the relationship between reappraisal and risk perception.

4. Study 1: The opposite effects of anger and fear

We aimed to explore how anger and fear influence driving risk perception. Driver participants were randomly assigned to anger, fear, or neutral condition, and their risk perception including both cognitive and affective components (Rundmo & Sjöberg, 1998) was assessed.

We hypothesized that compared with neutral emotion, anger reduced risk perception but fear increased it.

4.1. Method

4.1.1. Participants and design

Ninety-seven drivers (55 men, 42 women, $M_{\text{age}} = 35.61$ years, $SD = 9.81$, $M_{\text{driving experience}} = 5.59$ years, $SD = 4.38$) participated. A one-factor between-participants design was employed, with primed emotion (anger/neutral/fear) serving as the independent variable and risk perception serving as the dependent variable. Control variables included age, gender, driving experience, type of profession, level of education, type of vehicles, average weekly driving miles, average weekly driving days, and the number of traffic accidents in the past year.

4.1.2. Emotion induction

Short articles were used to elicit emotions (Hemenover & Zhang, 2004; Raghunathan & Pham, 1999). Participants were randomly assigned to one of the three following conditions: anger ($N = 34$), fear ($N = 34$), or neutral ($N = 29$). In the anger condition, the article was about conflict between another driver and "I". Participants were required to read as the following part:

I have been held in the traffic jam for more than half an hour on my way home. As soon as I finally get out of the traffic jam, a car from the lane next to me, which has been driving at a slower speed, all of a sudden forces its way in front of me and slows down after it gets its way. I have to brake urgently to avoid scraping against the car. It keeps driving on at a speed even lower than it should be in the smooth traffic. Finally, grasping a chance, I speed up and drive past the car. At the moment of passing the car, I glance at the driver, noticing that he is driving with a cell phone at one hand, without realizing that he has been influencing the traffic. His car does not seem to have a problem at all. There is another traffic jam soon and I have to slow down and manage my way forward. At this time, the car behind me begins to hoot its horn and flash incessantly. The car lights reflected in the rear windows are sharp and the loud noise of the horns bothers me greatly. I am reaching the limit of my patience. Despite the troubled mood, I could not speed up or make room for other cars because of the limited road conditions, so I have to endure the rude urges of the car behind me. When I get a chance to glance back at the car right behind me, I find out that it is the very car that I overpassed a while ago...and right at that moment, the driver of the car is looking right at me. With an aggressive and disdainful look, he even opens the window and curses at me...

In the fear condition, the article was about a traffic accident. Participants read about:

On the way back to the city from a day-trip, I am driving on a winding mountain road. Right at the moment of making a turn, all of a sudden, I hear a great sound "Bomb!" And then my friends start screaming. I feel that we've hit something severely and we begin to crash down the hill. Then I lose my consciousness and cannot recall anything else afterwards. After I revive, I feel sticky all over and then I realize that it is all my blood. I am covered and surrounded by pieces of broken glasses. The car doors are twisted. My legs are stuck in the car. I cannot move as it hurts so much. I feel the twists of pain all over and cannot see anything as well. I can only hear that my friends are moaning; some of them are breathing heavily. I try to talk to them, but I am only half conscious and it prevents me from doing so. It is completely dark inside the car. All I hear is the moans of pain and all I smell is the mixed air of blood and mud. I do not know where I am, how badly I am injured, or how my friends are doing. Suddenly, the car shakes with great force. I seem to hear the sound of branches breaking off. It seems that the car is hanging in the middle of the sky and will fall

off at any moment. In a car without even a slight beam of light, life or death seems to be a matter of fate...

In the neutral condition, participants read an introduction about the library of Peking University. Presented in Chinese, all the passages were approximately of the same length. In the conditions of anger and fear, participants were asked to imagine that they were the heroes in the story and to vividly experience the events of the story.

4.1.3. Procedure

Participants first took the emotion baseline test. Immediately after reading the articles and completing the manipulation checks, they took measures of risk perception and filled in a questionnaire about the control variables. At last, they were thanked and debriefed.

4.2. Measures

4.2.1. Emotion baseline

Participants rated their emotion on 11-point scales (*pleasant-unpleasant, tense-relaxed, vigorous-tired, and feeling bad-feeling good*; Hu et al., 2013; Cronbach's $\alpha = .80$). The average score of the 4 items was used as the index of emotion baseline.

4.2.2. Manipulation checks

Participants reported how much they felt angry and fearful respectively on an 11-point scale (0 = *do not feel the emotion at all*, 10 = *feel the emotion extreme strongly*) after reading the articles.

4.2.3. Risk perception

Participants were presented with three traffic accidents with different causes (i.e., alcohol, speeding, or jumping a red light). For each accident, they rated the probability to be involved in (0 = *extremely unlikely*, 10 = *extremely likely*) and the level of their worry about it (0 = *do not worry at all*, 10 = *extremely worry*) on 11-point scales. The average score of the 6 items was used as the index of risk perception (Cronbach's α s of the overall scale and two subscales were .84, .74, and .84). Higher scores indicated higher risk perception.

4.3. Results and discussion

A one-way analysis of variance (ANOVA) on emotion baseline revealed no significant difference among the anger ($M = .63$, $SD = 2.10$), fear ($M = 1.05$, $SD = 1.52$), and neutral ($M = 1.29$, $SD = 1.60$) conditions, $p > .30$, indicating that participants in three conditions did not differ in emotion baseline. Moreover, a one-way ANOVA was conducted on manipulation checks. Results revealed that participants in the three conditions differed in both anger and fear, $F(2, 94) = 87.28$, $p < .001$, $F(2, 94) = 120.15$, $p < .001$. Specifically, participants in the anger condition ($M = 6.50$, $SD = 1.73$) felt more angry than those in the fear ($M = 2.00$, $SD = 2.54$) and neutral ($M = .28$, $SD = 1.31$) conditions ($ps < .001$). In addition, participants in the fear condition ($M = 6.21$, $SD = 1.95$) felt more fearful than those in the anger ($M = 1.38$, $SD = 1.95$) and neutral ($M = .14$, $SD = .58$) conditions ($ps < .001$). Therefore, the results demonstrated a successful manipulation of emotion induction.

Next, Pearson correlation tests showed that risk perception was influenced by gender ($r = -.26$, $p < .05$) alone among all control variables: Men drivers perceived more risks than women drivers. Most importantly, after controlling for gender, $F(1, 93) = 8.43$, $p < .01$, $\eta^2 = .08$, risk perception was affected by emotion, $F(2, 93) = 31.16$, $p < .001$, $\eta^2 = .40$. Specifically, fearful participants ($M = 5.67$, $SD = 1.61$) had higher scores than neutral ones ($M = 4.42$, $SD = 1.40$), $MD = 1.25$, $p < .001$, whereas angry participants ($M = 3.03$, $SD = 1.15$) had lower scores than neutral ones, $MD = -1.34$, $p < .001$. As hypothesized, anger reduced driving risk perception, whereas fear increased it, highlighting the significance of distinguishing anger and fear in driving scenarios.

It should be noted that regarding the assessment of risk perception, participants rated the possibility that they were involved in the traffic accidents caused by factors such as alcohol. Nevertheless, some drivers never drink but others drink frequently. To ensure that different levels of risk perception were caused by the discrete emotions per se rather than other factors such as the frequency of drinking, three accidents described by severity of consequences were adopted in the subsequent studies. Moreover, Study 1 showed that risk perception was influenced by gender alone among the multiple control variables, making it reasonable to exclude all other control variables in the subsequent studies.

5. Study 2: The role of certainty

In Study 2, we focused on the role of certainty in the opposite effects found in Study 1. We attempted to verify that certainty was one of the causes that are responsible for such opposite effects. Drivers were instructed to read the emotion-inductive articles. Before the emotions had been fully generated, we adopted the reappraisal paradigm in order to reduce the difference in certainty between anger and fear. More specifically, participants reading the conflict article were asked to reappraise the situation in order to reduce their sense of certainty. To the opposite, those reading the accident article were asked to reevaluate the situation to increase their sense of certainty. According to our reasoning, the reappraisal task would reduce emotion experiential responding (i.e., people felt less angry or less fearful), which in turn diminished the difference between anger and fear on risk perception.

5.1. Method

5.1.1. Participants and design

One-hundred and fourteen drivers (66 men, 45 women, 3 unreported, $M_{\text{age}} = 35.57$ years, $SD = 8.97$) were randomly assigned to conditions in a 2 (emotion: anger/fear) \times 2 (certainty regulation: reappraisal/non-reappraisal) between-participants design. Risk perception served as the dependent variable, emotional experience served as the potential mediator, and gender served as the control variable.

5.1.2. Manipulations of independent variables

Participants in the anger ($N = 54$) and fear ($N = 60$) conditions read the articles used in Study 1. Immediately after, participants in the anger-reappraisal condition ($N = 28$) read about:

At the moment, I curse back without hesitation. Quite contrary to my expectation that the driver would start quarreling with me, he does not give any more response. I am wondering: Is the conflict finished? Or is he looking for another chance to "revenge" me? In fact, I have no idea what he will do and I cannot predict what would happen afterwards.

However, participants in the fear-reappraisal condition ($N = 30$) read about:

At the moment, I am sure that I clearly hear the sirens of the ambulance and that the sirens are approaching where we are. Therefore, I know for sure that my friends and I will be rescued.

5.1.3. Procedure

Participants first took the emotion baseline test. Next, they were asked to read the articles. Afterwards, they took measures of emotional experience, risk perception and they completed manipulation checks. Finally, participants filled in a questionnaire about their demographic information and then they were thanked and debriefed. They were offered chances to win a cell phone card with a value of 50 RMB (renminbi).

5.2. Measures

5.2.1. Emotion baseline

Identical to Study 1 (Cronbach's $\alpha = .84$).

5.2.2. Emotional experience

Participants rated how much they felt angry and fearful after reading the materials on an 11-points scale (0 = do not feel the emotion at all, 10 = feel the emotion extreme strongly).

5.2.3. Risk perception

According to Hu et al. (2013), participants were presented with three traffic accidents of different levels, which were serious, moderate and slight. A brief description was provided for each level of accidents. Participants rated their risk perception, which was identical to Study 1 (Cronbach's α s of the overall scale and two subscales were .68, .56, and .69).

5.2.4. Manipulation checks

In the anger condition, participants rated the extent to which they could predict what would happen between the other driver and them. Likewise, in the fear condition, they indicated the extent to which they could predict that their friends and themselves would be finally rescued on an 11-point scale (0 = unable to predict, 10 = fully predict).

5.3. Results and discussion

Before emotion induction, participants in the anger and fear conditions did not differ in emotion baseline, $F < 1$. In addition, a 2 (emotion) \times 2 (certainty regulation) ANOVA was conducted on manipulation checks. Results revealed a main effect for emotion, $F(1, 110) = 19.01, p < .001, \eta^2 = .15$. Compared with fearful participants ($M = 3.30, SD = 2.88$), angry ones ($M = 5.41, SD = 2.79$) felt more certain. More importantly, we observed an interaction between emotion and certainty regulation, $F(1, 110) = 19.31, p < .001, \eta^2 = .15$. In the anger condition, people who reappraised the event ($M = 4.75, SD = 3.28$) perceived marginal less certainty than those who did not ($M = 6.12, SD = 1.95$), $F(1, 52) = 3.39, p = .071$. In the fear condition, conversely, people who reappraised the event ($M = 4.77, SD = 3.13$) felt certain more than those who did not ($M = 1.83, SD = 1.64$), $F(1, 58) = 20.71, p < .001$. Thus, the manipulation of certainty regulation was successful.

Next, we conducted a mediation analysis (Baron & Kenny, 1986) for angry drivers. Consequently, angry experience did not mediate the effect of certainty reappraisal on risk perception. Similarly, a mediation analysis was also conducted for fearful drivers. We found that fearful experience partially mediated the relationship between certainty reappraisal and risk perception (Sobel test, $Z = -1.45, p < .05$). We depict the mediation results in Fig. 2. Because certainty was more meaningful for fear than for anger (Smith & Ellsworth, 1985), the mediation effect of fear was significant whereas the mediation effect of anger did not reach a significant level.

Last, we examined whether certainty reappraisal could reduce the difference between anger and fear on risk perception. A Pearson correlation analysis revealed no significant effect between gender and risk perception, $p > .40$. Scores of risk perception were submitted to a 2 (emotion) \times 2

(certainty regulation) ANOVA. As a result, there was a marginal main effect for emotion, $F(1, 110) = 3.05, p = .083, \eta^2 = .03$. In general, fearful participants ($M = 4.69, SD = 1.70$) perceived more risks than angry ones ($M = 4.17, SD = 1.78$). Of our great interest, as illustrated in Fig. 3, a predicted interaction between emotion and certainty regulation emerged, $F(1, 110) = 17.64, p < .001, \eta^2 = .14$. Specifically, in the non-reappraisal group, angry participants ($M = 3.64, SD = 1.55$) perceived less risk than fearful ones ($M = 5.45, SD = 1.58$), $F(1, 54) = 18.55, p < .001$; in the reappraisal condition, however, the difference between anger and fear no longer existed, $p > .05$, indicating that it was certainty that triggered the opposite effects of anger and fear on risk perception.

6. Study 3: The role of control

We focused on the role of control in Study 3. The logic was similar to Study 2. Drivers were instructed to read the emotion-inductive articles and to reappraise the scenarios along the appraisal of control. Specifically, participants who read the conflict article were asked to reappraise the situation in order to reduce their sense of control. By contrast, those who read the accident article were asked to reappraise the situation to increase their sense of control. We assumed that the different effects between anger and fear on risk perception would diminish or even vanish because emotional experience was weakened after such reappraisal.

6.1. Method

6.1.1. Participants and design

Participants were 114 drivers (78 men, 31 women, 5 unreported, $M_{age} = 34.14$ years, $SD = 7.31$) and they were randomly assigned to conditions in a 2 (emotion: anger/fear) \times 2 (control regulation: reappraisal/non-reappraisal) between-participants design.

6.1.2. Manipulations of the independent variables

Participants in the anger ($N = 55$) and fear conditions ($N = 59$) read the same articles in Study 1. Afterwards, participants in the anger-reappraisal condition ($N = 30$) read about:

A moment ago, the driver has been in uncomfortable mood in the course of driving, and he experienced an extremely short consciousness disturbance. Therefore, his aggressive behavior was not controlled by anyone including himself.

Whereas participants in the fear-reappraisal condition ($N = 30$) read about:

Because I am a professional rescuer of an emergency rescue center and I have a lot of safety emergency knowledge and practical safety rescue experiences, I am fully capable of successfully getting my friends and me out of the danger.

6.1.3. Procedure

Identical to Study 2.

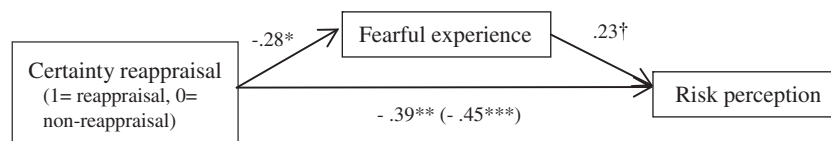


Fig. 2. Mediation analysis for fear condition (Study 2). Standardized regression coefficients and their significance are reported. The total effect of certainty reappraisal on risk perception is reported in parentheses, and the coefficient when the fearful experience is included in the regression is reported below the arrow. *** $p < .001$. ** $p < .01$. * $p < .05$. † $p < .10$.

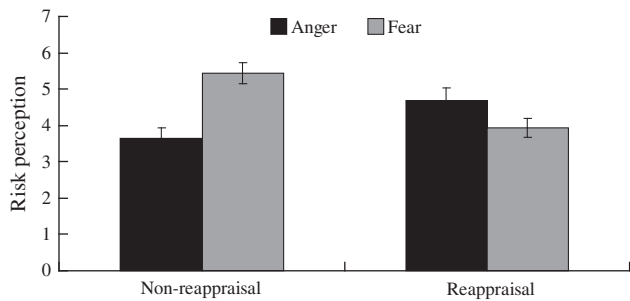


Fig. 3. The effect of emotion and certainty regulation on risk perception (Study 2).

6.2. Measures

6.2.1. Emotion baseline

Identical to Study 1 (Cronbach's $\alpha = .84$).

6.2.2. Emotional experience

Identical to Study 2.

6.2.3. Risk perception

Identical to Study 2 (Cronbach's α s of the overall scale and two subscales were .71, .54, and .69).

6.2.4. Manipulation checks

In the anger condition, participants rated the extent to which the driver's aggressive behavior was controlled by individual. Likewise, in the fear condition, participants indicated the degree to which the life of their friends and theirs could be controlled by individual on an 11-point scale (0 = situational control, 10 = individual control).

6.3. Results and discussion

Participants in the anger and fear conditions did not differ in emotion baseline, $p > .10$. Furthermore, a 2 (emotion) \times 2 (control regulation) ANOVA on manipulation checks revealed a main effect for emotion, $F(1, 110) = 9.36, p < .01, \eta^2 = .08$. In general, angry drivers ($M = 5.11, SD = 3.04$) were more apt to feel individual control compared with fearful ones ($M = 3.68, SD = 2.86$). More importantly, an interaction between emotion and control regulation was obtained, $F(1, 110) = 42.13, p < .001, \eta^2 = .28$. Specifically, in the anger condition, people who reappraised the situation ($M = 3.85, SD = 3.09$) perceived less individual control than those who did not ($M = 6.32, SD = 2.50$), $F(1, 53) = 10.70, p < .01$. However, in the fear condition, people who reappraised the situation ($M = 5.47, SD = 2.65$) perceived more individual control than those who did not ($M = 1.83, SD = 1.63$), $F(1, 57) = 40.10, p < .001$. The results revealed a successful control manipulation.

Next, a mediation analysis was conducted for angry drivers and we did not find a mediation effect of angry experience between control reappraisal and risk perception. A similar mediation analysis was conducted for fearful drivers. As a result, fearful experience partially mediated the relationship between control reappraisal and risk perception (Sobel test, $Z = -1.64, p < .05$). We depict the mediation results in Fig. 4. The results suggested that control appraisal was more crucial to fear than anger.

Last, we examined whether control reappraisal could reduce the difference between anger and fear on risk perception. A Pearson correlation analysis revealed that gender did not correlate to risk perception, $p > .40$. A 2 (emotion) \times 2 (control regulation) ANOVA on risk perception yielded a main effect for emotion, $F(1, 110) = 8.34, p < .01, \eta^2 = .07$. Compared with angry participants ($M = 3.95, SD = 1.90$), fearful ones ($M = 4.88, SD = 1.65$) generally perceived more risks. Importantly, as illustrated in Fig. 5, emotion and control regulation interacted on risk perception, $F(1, 110) = 8.72, p < .01, \eta^2 = .07$. In the non-reappraisal

condition, anger ($M = 3.60, SD = 1.65$) reduced risk perception whereas fear ($M = 5.48, SD = 1.33$) increased it, $F(1, 55) = 22.45, p < .001$; in the reappraisal condition, these two emotions had similar effects, $F < 1$. Therefore, the appraisal of control was one of the reasons that caused the opposite effects of anger and fear on driving risk perception.

7. Study 4: The role of responsibility

We focused on the role of responsibility in Study 4. Participants who read the conflict article were led to believe that they themselves were responsible for the event. To the opposite, those who read the accident article were made to believe that it was someone else's responsibility. We hypothesized that the difference on risk perception between anger and fear would diminish or even vanish because emotional experience was weakened after responsibility reappraisal.

7.1. Method

7.1.1. Participants and design

Eighty-eight drivers (59 men, 29 women, $M_{\text{age}} = 34.64$ years, $SD = 10.78$) were randomly assigned to conditions in a 2 (emotion: anger/fear) \times 2 (responsibility regulation: reappraisal/non-reappraisal) between-participants design.

7.1.2. Manipulations of the independent variables

Participants in the anger ($N = 45$) and fear conditions ($N = 43$) read the articles used in Study 1. Immediately after, participants in the anger-reappraisal condition ($N = 25$) read about:

The reason why the driver behaves aggressively to you is that you have hindered his normal and smooth driving.

However, those in the fear-reappraisal condition ($N = 23$) read about:

It is the other cars that have caused the occurrence of the accident.

7.1.3. Procedure

Identical to Study 2.

7.2. Measures

7.2.1. Emotion baseline

Identical to Study 1 (Cronbach's $\alpha = .80$).

7.2.2. Emotional experience

Identical to Study 2.

7.2.3. Risk perception

Identical to Study 2 (Cronbach's α s of the overall scale and two subscales were .84, .80, and .68).

7.2.4. Manipulation checks

Participants were asked to choose between "I" and "the other driver," as who should take the major responsibility for the described event.

7.3. Results and discussion

Participants in the anger and fear conditions did not differ in emotion baseline, $F < 1$. Next, Chi-square tests were conducted to examine whether manipulation of responsibility changed participants' sense of responsibility. In the anger condition, individuals who did not reappraise the event (100%) were more likely to perceive other's responsibility than those who did (36%), $\chi^2(1, N = 45) = 19.86, p < .001$. In the fear condition, drivers who reappraised the event (82.6%) were more inclined to perceive other's responsibility than those who did

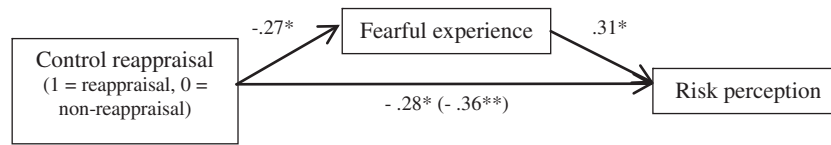


Fig. 4. Mediation analysis for fear condition (Study 3). Standardized regression coefficients and their significance are reported. The total effect of control reappraisal on risk perception is reported in parentheses, and the coefficient when the fearful experience is included in the regression is reported below the arrow. ** $p < .01$. * $p < .05$.

not (55%), $\chi^2(1, N = 43) = 3.87, p < .05$. These results indicated that the responsibility regulation was effective.

Next, we conducted a mediation analysis for angry drivers. It was found that angry experience partially mediated the relationship between responsibility reappraisal and risk perception (Sobel test, $Z = 2.33, p < .05$). We depict the mediation results in Fig. 6. Next, a similar mediation analysis was performed for fearful drivers and we found that fearful experience did not play a mediation role. The reason for the results was that responsibility was a central appraisal for anger rather than fear (Lerner & Keltner, 2000; Smith & Ellsworth, 1985).

Last, we examined whether responsibility reappraisal reduced the difference between anger and fear on risk perception. A Pearson correlation test revealed no significant correlation between gender and risk perception, $p > .60$. A 2 (emotion) \times 2 (responsibility regulation) ANOVA on risk perception revealed main effects for both emotion and responsibility regulation, $F(1, 84) = 80.13, p < .001, \eta^2 = .49, F(1, 84) = 8.94, p < .01, \eta^2 = .10$, demonstrating that fearful people ($M = 4.88, SD = 1.09$) were higher in risk perception than angry ones ($M = 3.17, SD = 1.15$), and that participants in the reappraisal condition ($M = 4.27, SD = 1.06$) were higher in risk perception than those in the non-reappraisal condition ($M = 3.68, SD = 1.69$). Of our particular interest, there was an interaction between emotion and responsibility regulation, $F(1, 84) = 26.74, p < .001, \eta^2 = .24$ (see Fig. 7). Specifically, in the non-reappraisal condition, angry people perceived less risk ($M = 2.25, SD = 0.76$) compared with fearful ones ($M = 5.12, SD = 0.10$), $F(1, 38) = 104.95, p < .001$. In the reappraisal condition, however, the difference between anger ($M = 3.91, SD = 0.85$) and fear ($M = 4.67, SD = 1.14$) diminished, $F(1, 46) = 7.10, p < .05$. Therefore, responsibility partially accounted for the opposite effects found in Study 1.

8. After test: Certainty, control, and responsibility

Although the scenarios were successful in changing the target appraisals in Studies 2, 3, and 4, it was difficult to find out whether other appraisals changed as well. Because an emotion can be experienced instantly and attenuates very quickly (Beedie, Terry, & Lane, 2005), to ensure the induced emotion could last until the experiments were completed, it was better not to include too many measures in one study. Here, an after test was conducted to ensure other appraisals were held constant during certain reappraisals.

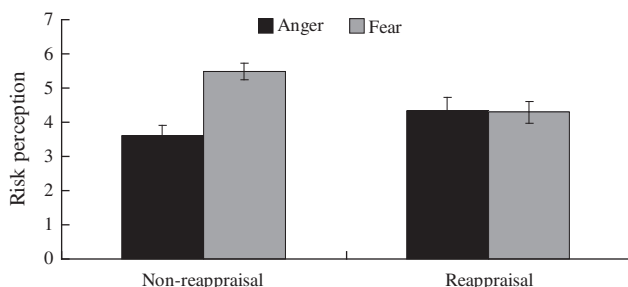


Fig. 5. The effect of emotion and control regulation on risk perception (Study 3).

8.1. Method

8.1.1. Participants and design

Seventy-seven students were randomly assigned to one of six conditions: anger-certainty, anger-control, anger-responsibility, fear-certainty, fear-control, or fear-responsibility.

8.1.2. Measures and procedure

Participants first read the emotion-inductive articles (identical to Study 1) and completed the measures of certainty, control, and responsibility (used in Studies 2, 3, and 4, respectively). After reappraising certain dimensions (identical to Studies 2, 3, and 4), they received the same measures of certainty, control, and responsibility again.

8.2. Results and discussion

Paired-sample t tests showed that for anger-certainty, anger-control, anger-responsibility, fear-certainty, and fear-responsibility groups, the target appraisals changed ($ps < .01$) whereas other appraisals were held constant ($ps > .05$) as predicted. The only exception was the fear-control group. The target appraisal of control changed as predicted, $t(15) = -5.26, p < .001$, and responsibility was held constant, $p > .30$. However, certainty changed as well, $t(15) = -2.67, p < .05$. Generally, the results indicated a success in changing the target appraisals and holding others constant. It was somewhat surprising at first glance that the sense of certainty changed accordingly when fearful participants reappraised the events along the dimension of control. However, the results were acceptable on the grounds that both certainty and control are central appraisals for fear (Lerner & Keltner, 2000), and that they overlap in some cases (Averill, 1973).

9. General discussion

People experience emotions all the time. Regarding driving, emotions cast particular effects (Hu et al., 2013; Mesken et al., 2007). Past research evidenced the negative effect of anger on driving safety (Dahlen, Martin, Ragan, & Kuhlman, 2005; Dahlen & White, 2006) in that it promoted speeding (Arnett et al., 1997; Mesken et al., 2007). Nevertheless, little evidence exists to shed light on the relationship between fear and driving, making it hard to determine whether anger and fear influence driving risk perception in the same way.

Applying ATF into transportation field, the current research examined how and why anger and fear, the two common negative emotions in driving, influenced drivers' risk perception. In Study 1, we found that anger reduced risk perception whereas fear increased it. The results are consistent with the predictions of ATF, as anger is associated with a sense of high certainty, individual control, and high other-responsibility whereas fear is associated with a sense of low certainty, situational control, and moderate other-responsibility. In Studies 2, 3, and 4, we reduced the differences between anger and fear in certainty, control, and responsibility by adopting the reappraisal paradigm. Results showed that the opposite effects of anger and fear on risk perception was reduced or disappeared accordingly, and that fearful or angry experience played a mediation role. Therefore, it was the appraisals of certainty, control, and responsibility that accounted for the different effects.

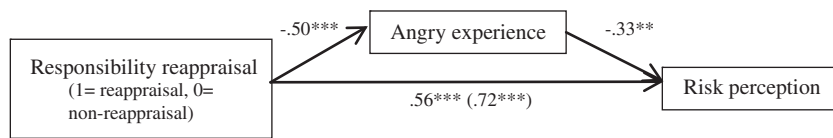


Fig. 6. Mediation analysis for anger condition (Study 4). Standardized regression coefficients and their significance are reported. The total effect of responsibility reappraisal on risk perception is reported in parentheses, and the coefficient when the angry experience is included in the regression is reported below the arrow. *** $p < .001$. ** $p < .01$.

We demonstrated that driving risk perception was influenced by appraisals. In other words, people used their senses of certainty, control, and responsibility as information to appraise risk. This logic corresponds with feelings as information hypothesis (Schwarz, 2004) and risk as feelings hypothesis (Loewenstein et al., 2001), which assume that people judge risks based on their present feelings. In current studies, we found that people attended to their emotions (anger or fear) and senses of appraisals (certainty, control, and responsibility) underlying the emotions to judge driving risks.

Here is another question: Are there any key appraisals for anger and fear, respectively? On the one hand, we found that fearful experience mediated the effects of certainty and control reappraisals on risk perception, whereas angry experience mediated the relationship between responsibility reappraisal and risk perception. On the other hand, reappraisals of certainty and control changed risk perception more for fearful drivers than angry ones, whereas the reappraisal of responsibility changed risk perception more for angry drivers than fearful ones. Taken together, we suggest that responsibility is a central appraisal for anger; however, certainty and control are key appraisals for fear.

One major limitation of this research was that anger and fear were elicited by different materials. The same held true for the texts in reappraisals. However, using different materials to induce different emotions is a common way in emotion research. For example, participants were instructed to recall an experience in which they feel a specific emotion (Lerner & Keltner, 2001) or watch a video clip to induce positive or negative emotions (Hu et al., 2013). It is difficult to use a same story to elicit different emotions. As for the texts in reappraisals, it also seems to be impossible to use the same reappraisal instructions that should be coherent with emotion-inductive stories. Concerning about this, future research should adopt a stricter manipulation of emotions and reappraisals.

A further problem was that different risk perception in the anger and fear conditions might be caused by priming stories rather than emotions per se. The priming article for fear included a traffic accident whereas the article for anger did not. The conceptual accessibility to accident for fearful drivers may result in higher risk perception. However, the results of Studies 2, 3, and 4 supported that emotions themselves did influence risk perception. For participants in the anger condition, they read almost identical materials no matter whether they reappraised the event or not. Nevertheless, people in the reappraisal and non-reappraisal conditions reported different risk perception. The reason for such results was that emotional experience reduced by reappraisals affected risk perception. It was same

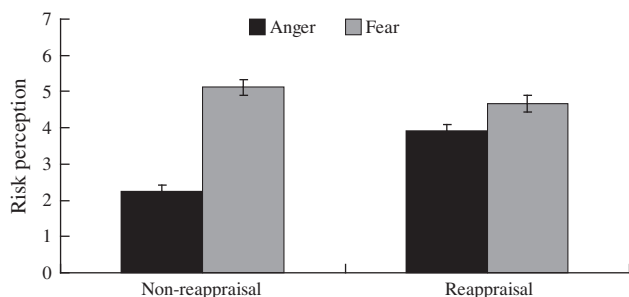


Fig. 7. The effect of emotion and responsibility regulation on risk perception (Study 4).

for the fearful participants. Thus, the above results showed that the specific emotions themselves did influence driving risk perception.

Furthermore, some may wonder whether the changes of risk perception in Studies 2, 3, and 4 were actually caused by reappraisal or by another emotion regulation strategy named suppression. Reappraisal and suppression cast different effects on cognitive appraisals and behavioral responses (Gross, 1998a,b). Reappraisal changes both cognitive appraisals and responses, whereas suppression only influences affective responses. The results of manipulation checks demonstrated changes of certainty, control, and responsibility, indicating participants used the strategy of reappraisal rather than suppression.

We contribute to the research in how emotions color judgment in several ways. First, we introduced ATF into driving behavior and found that the opposite effects of anger and fear on driving risk perception. Thus, the current findings demonstrate the importance to differentiate fear and anger rather than treat them equally. Second, we focused on the antecedent of emotions, that is, appraisals and then explored the reasons of the opposite effects. To this end, experimental manipulations of appraisals are badly needed. Unfortunately, rarely had researchers used this kind of methods. However, paradigm of reappraisal enabled us to do so. Our findings derived from new methods supplied ATF with further support. Finally, we shed light on the appraisal of responsibility in distinguishing anger and fear. Certainty and control are two appraisals used to distinguish anger and fear (Fischhoff et al., 2012; Lerner & Keltner, 2000, 2001). However, responsibility is also an important dimension based on the fact that angry people perceive other-responsibility but such tendency is not strong for fearful ones (Smith & Ellsworth, 1985). Our research clarified the role of responsibility in determining how anger and fear influence driving risk perception.

Practically, drivers, as well as mass media and transportation administration departments, should bear in mind the opposite effects of anger and fear on driving risk perception. Reappraisal is one of the feasible methods to intervene in risk perception, which in turn could decrease risky driving (Brown, 2010). For instance, drivers high in both trait and state anger could be trained to reappraise the anger-inductive event to reduce their senses of certainty, control, and other-responsibility, and thus it may help establish road safety. The methods correspond with the cognition therapy that was proved to be effective for driving anger (Del Vecchio & O'Leary, 2004).

Acknowledgements

This research was financed by the General Program of National Natural Science Foundation of China (70522202) and the Key Program of National Natural Science Foundation of China (91224002). We would like to thank Huiyuan Jia, Phillip Blue, and Ellen Wan Heung Yeung for their help in proofreading. And we would extend our sincere gratitude to Professor Ralf Schwarzer and Ms. Chenying Tang for their insightful comments on the manuscript.

References

- Abdu, R., Shinar, D., & Meiran, N. (2012). Situational (state) anger and driving. *Transportation Research Part F*, 15, 575–580.
- Arnett, J. J., Offer, D., & Fine, M. A. (1997). Reckless driving in adolescence: 'State' and 'trait' factors. *Accident Analysis and Prevention*, 29, 57–63.

- Averill, J. R. (1973). Personal control over aversive stimuli and its relationship to stress. *Psychological Bulletin*, 80, 286–303.
- Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173–1182.
- Beedie, C. J., Terry, P. C., & Lane, A. M. (2005). Distinction between emotion and mood. *Cognition and Emotion*, 19, 847–878.
- Blechert, J., Sheppes, G., Di Tella, C., Williams, H., & Gross, J. J. (2012). See what you think: Reappraisal modulates behavioral and neural responses to social stimuli. *Psychological Science*, 23, 346–353.
- Bonifield, C., & Cole, C. (2007). Affective responses to service failure: Anger, regret, and retaliatory versus conciliatory responses. *Marketing Letters*, 18, 85–99.
- Brown, S. L. (2010). Changes in risk perceptions prospectively predict changes in self-reported speeding. *Risk Analysis*, 30, 1092–1098.
- Bureau of Traffic Management, PRC (PRC, 2011). Report of road traffic accidents in the first half of 2011 in China. Retrieved September 23, 2012, from <http://www.mps.gov.cn/n16/n85753/n85870/2857811.html>
- Dahlen, E. R., Martin, R. C., Ragan, K., & Kuhlman, M. M. (2005). Driving anger, sensation seeking, impulsiveness, and boredom proneness in the prediction of unsafe driving. *Accident Analysis and Prevention*, 37, 341–348.
- Dahlen, E. R., & White, R. P. (2006). The Big Five factors, sensation seeking, and driving anger in the prediction of unsafe driving. *Personality and Individual Differences*, 41, 903–915.
- Deffenbacher, J. L., Lynch, R. S., Oetting, E. R., & Yingling, D. A. (2001). Driving anger: Correlates and a test of state-trait theory. *Personality and Individual Differences*, 31, 1321–1331.
- Denson, T. F., Grisham, J. R., & Moulds, M. L. (2011). Cognitive reappraisal increases heart rate variability in response to an anger provocation. *Motivation and Emotion*, 35, 14–22.
- Dula, C. S., & Geller, E. S. (2003). Risky, aggressive, or emotional driving: Addressing the need for consistent communication in research. *Journal of Safety Research*, 34, 559–566.
- Ellsworth, P. C., & Smith, C. A. (1988). From appraisal to emotion: Differences among unpleasant feelings. *Motivation and Emotion*, 12, 271–302.
- Fischhoff, B., Gonzalez, R. M., Lerner, J. S., & Small, D. A. (2012). Evolving judgments of terror risks: Foresight, hindsight, and emotion: A reanalysis. *Journal of Experimental Psychology: Applied*, 18, e1–e16.
- Gross, J. J. (1998a). Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology*, 74, 224–237.
- Gross, J. J. (1998b). Emotion regulation: Past, present, future. *Cognition and Emotion*, 13, 551–573.
- Gross, J. J. (2001). Emotion regulation in adulthood: Timing is everything. *Current Directions in Psychological Science*, 10, 214–219.
- Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology*, 85, 348–362.
- Han, S., Lerner, J. S., & Keltner, D. (2007). Feelings and consumer decision making: The appraisal-tendency framework. *Journal of Consumer Psychology*, 17, 158–168.
- Hemenover, S. H., & Zhang, S. (2004). Anger, personality, and optimistic stress appraisals. *Cognition and Emotion*, 18, 363–382.
- Hu, T.-Y., Xie, X., & Li, J. (2013). Negative or positive? The effect of emotion and mood on risky driving. *Transportation Research Part F*, 16, 29–40.
- Johnson, E. J., & Tversky, A. (1983). Affect, generalization, and the perception of risk. *Journal of Personality and Social Psychology*, 45, 20–31.
- Lerner, J. S., Gonzalez, R. M., Small, D. A., & Fischhoff, B. (2003). Effects of fear and anger on perceived risks of terrorism: A national field experiment. *Psychological Science*, 14, 144–150.
- Lerner, J. S., & Keltner, D. (2000). Beyond valence: Toward a model of emotion-specific influences on judgement and choice. *Cognition and Emotion*, 14, 473–493.
- Lerner, J. S., & Keltner, D. (2001). Fear, anger, and risk. *Journal of Personality and Social Psychology*, 81, 146–159.
- Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin*, 127, 267–286.
- Lund, I. O., & Rundmo, T. (2009). Cross-cultural comparisons of traffic safety, risk perception, attitudes and behaviour. *Safety Science*, 47, 547–553.
- McRae, K., Ciesielski, B., & Gross, J. J. (2012). Unpacking cognitive reappraisal: Goals, tactics, and outcomes. *Emotion*, 12, 250–255.
- Mesken, J., Hagenzieker, M. P., Rothengatter, T., & de Waard, D. (2007). Frequency, determinants, and consequences of different drivers' emotions: An on-the-road study using self-reports, (observed) behaviour, and physiology. *Transportation Research Part F*, 10, 458–475.
- Nordfjærn, T., Jørgensen, S. H., & Rundmo, T. (2011). A cross-cultural comparison of road traffic risk perceptions, attitudes towards traffic safety and driver behaviour. *Journal of Risk Research*, 14, 657–684.
- Nordfjærn, T., & Rundmo, T. (2009). Perceptions of traffic risk in an industrialized and a developing country. *Transportation Research Part F*, 12, 91–98.
- Raghunathan, R., & Pham, M. T. (1999). All negative moods are not equal: Motivational influences of anxiety and sadness on decision making. *Organizational Behavior and Human Decision Processes*, 79, 56–77.
- Rhodes, N., & Pivik, K. (2011). Age and gender differences in risky driving: The roles of positive affect and risk perception. *Accident Analysis and Prevention*, 43, 923–931.
- Rundmo, T., & Iverson, H. (2004). Risk perception and driving behaviour among adolescents in two Norwegian counties before and after a traffic safety campaign. *Safety Science*, 42, 1–21.
- Rundmo, T., & Sjöberg, L. (1998). Risk perception by offshore oil personnel during bad weather conditions. *Risk Analysis*, 18, 111–118.
- Schwarz, N. (2004). Metacognitive experiences in consumer judgment and decision making. *Journal of Consumer Psychology*, 14, 332–348.
- Shiota, M. N., & Levenson, R. W. (2012). Turn down the volume or change the channel? Emotional effects of detached versus positive reappraisal. *Journal of Personality and Social Psychology*, 103, 416–429.
- Slovic, P. (1987). Perception of risk. *Science*, 236, 280–285.
- Slovic, P., Finucane, M. L., Peters, E., & MacGregor, D. G. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis*, 24, 311–322.
- Smith, C. A., & Ellsworth, P. C. (1985). Patterns of cognitive appraisal in emotion. *Journal of Personality and Social Psychology*, 48, 813–838.
- Taubman-Ben-Ari, O. (2012). The effects of positive emotion priming on self-reported reckless driving. *Accident Analysis and Prevention*, 45, 718–725.
- Taylor, J. E., Alpass, F., Stephens, C., & Towers, A. (2011). Driving anxiety and fear in young older adults in New Zealand. *Age and Ageing*, 40, 62–66.
- Taylor, J., Deane, F., & Podd, J. (2002). Driving-related fear: A review. *Clinical Psychology Review*, 22, 631–645.
- Taylor, J., Deane, F., & Podd, J. (2007). Driving fear and driving skills: Comparisons between fearful and control samples using standardized on-road assessment. *Behaviour Research and Therapy*, 45, 805–818.
- Underwood, G., Chapman, P., Wright, S., & Crundall, D. (1999). Anger while driving. *Transportation Research Part F*, 2, 55–68.
- United Nations Economic Commission for Europe (2011). Number of fatalities in road traffic accidents, year 2010. Retrieved September 23, 2012, from http://w3.unece.org/pwweb/quickstatistics/readtable.asp?qs_id=40
- Urry, H. L. (2009). Using reappraisal to regulate unpleasant emotional episodes: Goals and timing matter. *Emotion*, 9, 782–797.
- Del Vecchio, T., & O'Leary, K. D. (2004). Effectiveness of anger treatments for specific anger problems: A meta-analytic review. *Clinical Psychology Review*, 24, 15–34.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS Scales. *Journal of Personality and Social Psychology*, 54, 1063–1070.
- Winterich, K. P., Han, S., & Lerner, J. S. (2010). Now that I'm sad, it's hard to be mad: The role of cognitive appraisals in emotional blunting. *Personality and Social Psychology Bulletin*, 36, 1467–1483.

Jingyi Lu is currently a Ph.D. candidate in the Department of Psychology at Peking University, Beijing, China. Her research interests include risk perception and self-other decision making.

Xiaofei Xie, Ph.D., is a professor in the Department of Psychology at Peking University, Beijing, China. Her area of specialty involves risk perception, risk communication, risky behavior, and decision making.

Ruogu Zhang, M.S., received her diploma from Department of Psychology at Peking University, Beijing, China. Her research interests include risk factors in driving and risk communication in crisis.