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AFFECT HEURISTIC AS A FUNCTION OF TRUST IN RISK COMMUNICATION

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We examined whether or not decision makers' level of trust in risk management institutions is an important determinant of their reliance on the affect heuristic for making evaluations and decisions. In Study 1 (N = 419), we examined how the delivery and context of warning information may influence individuals' marginal trust in risk management institutions. In Study 2 (N = 414), we combined marginal trust with message probability to explore (a) how marginal trust and message extremity probability influence public trust in warning information, and (b) how public trust in institutions moderates individuals' reliance on the affect heuristic in risk perceptions. In Study 3 (N = 45), we tested the generalizability of the moderating effect of public trust. Results showed that reliance on affect as a kind of heuristic was more marked among decision makers with a high, vs. low, level of trust in the relevant institutions.

Keywords: affect heuristic, decision making, trust, risk communication, risk perception, warning information.

Risk perception has long been considered a key element in social sciences research for its active role in facilitating the process of information exchange among interested parties regarding the nature, magnitude, significance, or control of a risk. According to Sjöberg, Moen, and Rundmo (2004), *risk perception* is one's subjective assessment of the probability of a specific type of disaster happening, and how concerned one is about the consequences of such an

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occurrence. Several major developments with regard to the prominent impact of affect on risk perception have been made in the last two decades. First, using experienced feelings as information has been characterized by Slovic, Peters, Finucane, and MacGregor (2005) as the *affect heuristic*; thus, many people turn to heuristics rather than the rules of probability theory when judging risks. Heuristics are used to "assess the frequency of a class or the probability of an event in terms of the ease with which instances or occurrences can be brought to mind" (Tversky & Kahneman, 1974, p. 1127). Second, Pachur, Hertwig, and Steinmann (2012) have identified perceived frequency, value of a statistical life (VSL), and perceived risk as three means of assessing people's evaluations of a given risk. According to Pachur et al., application of these three measures enables researchers to place risk judgments within a broader framework of both availability and affect heuristics.

Researchers (e.g., Bickerstaff, 2004; Castelfranchi & Falcone, 2000; Keller, Siegrist, & Gutscher, 2006; Xie, Wang, Zhang, Li, & Yu, 2011) have found that decisions are mostly based upon subjective responses to the options available, and that the affect heuristic is often a significant contributor to people's risk assessments. However, the majority of behavioral decision researchers (e.g., Böhm & Pfister, 2000; Visschers et al., 2012) have focused on subjective responses to risk issues, leaving the cognitive reasoning process a much less investigated area. McAllister's (1995) dual-mode model of affect-based and cognitive-based trust is based on the association between affect and trust. In addition, Podoynitsyna, Van der Bij, and Song (2012) put forward a dual-mechanism model for affect infusion functioning, which is based on the connection between affect priming and affect as information. We proposed that the affect heuristic might work through not only narratives, images, and metaphors, but also people's trust in the management institutions involved in disseminating risk information, thus further impacting on their risk judgment, perceptions, and decisions (Covello, 1992; Dawson & Johnson, 2014; Haynes, Barclay, & Pidgeon, 2008). Our primary hypothesis is that reliance on affect as a kind of heuristic will be more marked among decision makers with a high, vs. low, level of trust in the specified risk management institution. In Study 1, we investigated the factors that affect individuals' marginal trust (that is, marginal change in positive or negative trust) in risk management institutions. In Study 2, we focused on the effects that warning information, affect, and cognition exert on the interpretation of risk perceptions. In Study 3, we extended the previous two studies by including a range of contexts with more representative types of risks, in order to verify the generalizability of our findings.

Study 1

Scholars (e.g., Twyman, Harvey, & Harries, 2008) have shown that people's advice-taking behavior can be altered remarkably by changes to the amount of trust invested in the competence of information sources. That is, the more reliable a source is believed to be, the more it will be relied on when making judgments and decisions. In this study, we examined how the delivery and context of warning information may influence individuals' marginal trust in risk management institutions. We followed White and Eiser's (2006) method of examining trust using signal detection theory, by asking participants to respond to some hypothetical events involving risky conditions. A snowstorm was selected as the risky context for use in this study because they occur every winter in Changchun, in the northeast of China, which is where the participants lived. In this study, how participants' self-reported trust in management institutions is affected by the given information was the key dependent variable. Thus, the following three hypotheses were generated for testing in Study 1:

Hypothesis 1: A greater increase in trust by the public will be exhibited for institutions that have released warning information than for those that have failed to do so, resulting in communication bias.

Hypothesis 2: A greater increase in trust by the public will be exhibited for institutions that have launched emergency plans while showing acceptance of danger than for those that have failed to do so while showing a rejection of danger, resulting in response bias.

Hypothesis 3: A greater increase in trust by the public will be exhibited when no losses or injuries are suffered than when losses and injuries are suffered, resulting in consequence bias.

Method

Participants. We placed recruitment advertisement posters in classroom buildings and dormitories on the campus of Jilin University and 419 students applied to participate in this study. Among them, 162 (38.7%) were male and 257 (61.3%) were female, and their ages ranged from 17 to 23 years (M = 19.83, SD = 2.19). Each participant was paid RMB5 (US$1.00) as an incentive.

Procedure. Participants were first presented with hypothetical warning information about a snowstorm. Then, they were asked to read a scenario composed of three major cues, each with two different situations: the government had (had not) accurately released warning information about the snowstorm 1 month previously, the government had (had not) promptly launched an emergency plan, and people had eventually suffered (had not suffered) losses or injuries during the snowstorm.

Measures. Participants were randomly assigned to one of the eight different conditions (release and no release/launch and no launch/loss and no loss; see Appendix), giving us a between-subjects experimental design. We presented all materials in questionnaire format on a sheet of A4 paper, which participants completed in 4–5 minutes. After reading the material, participants rated how their level of trust toward the government would change under the conditions inducing perceived consequences bias, response bias, and communication bias, on a 7-point Likert scale ranging from -3 (*much less trust*) to +3 (*much more trust*).

Data analysis. To test the hypotheses, we applied a 2 × 2 × 2 (release and no release/launch and no launch/loss and no loss) multifactorial analysis of variance (ANOVA), with marginal trust in the institution as the dependent variable. All analyses were calculated using PASW Statistics 18.0. We adjusted the ANOVA model for testing the formulated hypotheses.

Results

In accordance with Hypotheses 1, 2, and 3, there were significant main effects of response bias, $F(1, 411) = 173.48$, $p < .001$, $\eta^2 = .297$, communication bias, $F(1, 411) = 59.78$, $p < .001$, $\eta^2 = .127$, and consequence bias, $F(1, 411) = 48.88$, $p < .001$, $\eta^2 = .106$. Individuals' marginal trust toward the government was greater in the condition where emergency plans were launched after the catastrophic events had taken place ($M = 0.07$) than in that the condition where no emergency plans were launched afterwards ($M = -1.27$). Compared to the condition of having suffered losses or injuries ($M = -1.01$), marginal trust was greater in the condition when no losses or injuries were caused by the event ($M = -0.28$). Marginal trust also appeared to be greater in the condition of events where some warning information was issued in advance by the government ($M = -0.23$) than when there was no advance warning ($M = -0.96$). This suggests that individuals' marginal trust in the government may be increased by offering warning information about the disaster in advance, implementing emergency plans afterward, and avoiding losses and injuries when facing a catastrophic event.

Marginal trust was most strongly correlated with the severity of the consequences in that there was a significant interaction between response bias and communication bias, $F(1, 411) = 19.73$, $p < .001$, $\eta^2 = .046$. This means that fluctuations in individuals' marginal trust are more strongly affected by the release of warning information than by the launch of emergency plans. Further, there was a significant interaction between communication bias and consequence bias, $F(1, 411) = 11.29$, $p < .001$, $\eta^2 = .027$, indicating that fluctuations in individuals' marginal trust are more strongly affected by whether or not losses or injuries were caused by the snowstorm than by the release of warning information. Finally, no significant interaction was shown to exist between

response bias and consequence bias, $F(1, 411) = 1.68$, $p = .196$, indicating that there was a significant three-way interaction among all three dimensions, $F(1, 411) = 11.29$, $p < .001$, $\eta^2 = .028$.

Discussion

In this study, we speculated that issuing warning information about a potential disaster, launching emergency plans after the disaster, and whether or not losses and injuries were suffered during the disaster may contribute to individuals' marginal trust in government. Our first finding was that individuals' marginal trust in government increased only when warning information and emergency plans were available and in the absence of losses and injuries. Otherwise, marginal trust in government declined. It appears that such trust can be easily lost, but is very difficult to gain. Further, the result of the main effect of consequence bias shows that the outcome of the risk event is of great importance to people who were affected by it. When other variables were kept constant, people tended to trust the government more when no damage was caused by a snowstorm, than when damage was caused.

Study 2

On the basis of Study 1, the two extreme cases (the highest level and the lowest level) of people's marginal trust in the institution were retained in the second study so that we could further investigate how marginal trust and message extremity (probability) influence public trust in the warning information issued by the institutions concerned. Our two main aims in this study were as follows: to explore how marginal trust and message extremity jointly influence trust in warning information, and to investigate how trust in warning information, affect, and cognition affect the perception of risk. In particular, we examined whether trust in warning information moderates individuals' reliance on affect in regard to risk perception.

Method

Participants. We recruited 500 students in the same way as we did for Study 1. They were asked to complete a five-part questionnaire and received RMB5 (US$1.00) as an incentive. Among the 414 valid questionnaires we collected, 103 were from male participants ($M_{age} = 19.32$ years, $SD = 1.08$), and 311 were from female participants ($M_{age} = 19.32$ years, $SD = 1.97$).

Procedure. Participants were randomly assigned to one of two groups and then given details of either Scenario 2 (information released, emergency plan launched, no losses) or Scenario 7 (no information released, no plan launched, losses) from Study 1. After reading the scenario, participants were asked to

rate how their trust toward the government would change in terms of perceived communication bias, response bias, and consequence bias, on a 7-point Likert scale from -3 = *much more negative* to +3 = *much more positive*.

Measures. To assess marginal trust, participants were asked to imagine a scenario in which the government has issued a snowstorm warning, and the chance of it happening is 80% (group 1) or 20% (group 2). They were then asked to express their general trust in the government by answering the question "How trustworthy do you think the warning information released by the government tends to be?" on a 7-point Likert scale ranging from 1 = *not at all* to 7 = *very*. Finally, participants were asked to provide a risk evaluation reflecting their attitudes toward the specific event in terms of both affective and cognitive aspects. According to Pachur et al. (2012), assessing the level of dread evoked by a specific risk can be considered a convenient means for gauging affective responses in reaction to the risk. Therefore, we used the question "Please evaluate the level of dread that the disaster described in the given scenario may cause you if you were to experience it" to assess participants' affective state. Responses were made on a 7-point scale from 1 = *little to no dread* to 7 = *extreme dread*. We sources the concept of VSL from Pachur et al., choosing to use this because it is used in a wide range of fields, including economics, health care, worker safety, and environmental impact assessment. To obtain VSL judgments, we asked respondents to evaluate according to their knowledge and experience, how large a proportion of the total annual cost of snowstorm disasters should be covered by the government. Finally, participants were asked to evaluate their overall risk perception on a 7-point Likert scale ranging from 1 = *little to no risk* to 7 = *extremely high risk*.

Data analysis. We applied descriptive statistics to assess the relationship between marginal trust and probability in the two conditions. For data analysis, a two-way ANOVA was carried out with marginal trust and message probability as the independent variables and trust in warning information as the dependent variable. The main effects of marginal trust, $F(1, 322) = 18.58$, $p < .001$, and probability, $F(1, 322) = 20.44$, $p < .001$, were significant, which is in line with White, Pahl, Buehner, & Haye's (2003) finding about people being more willing to believe in those messages that accord with their prior attitudes, regardless of the valence of the content. The main effects of probability, $F(1, 322) = 20.44$, $p < .001$, were also significant.

According to the type of data and the purpose of the experiment, we used a random coefficient regression model to process the data. On the basis of their marginal trust levels, we divided the participants into two groups: increasing and decreasing. The dependent variable was the overall risk perception with

regard to the snowstorm, probability was considered as a dummy variable, and the predictor variables incorporated into the regression model were as follows: (a) score for dread of the risk (affect heuristic); (b) cognitive VSL with regard to the snowstorm risk (cognitive heuristic); (c) trust in the early warning information; (d) the interaction between (a) and (b); (e) the interaction between (a) and (c); and (f) the interaction between (b) and (c). All the data were centralized and, as we had expected, regardless of the marginal trust, the main effect of the emotion was significant. However, trust in warning information was the variable that moderated the emotion (see Table 1).

Table 1. *Overall Risk Regressed on Dread, Cognitive Value of a Statistical Life, Trust in Warning Information, and Disaster Occurrence Probability*

	Decreasing marginal trust		Increasing marginal trust	
	β Step 1	β Step 2	β Step 1	β Step 2
Step 1				
Dread	.460***		.446***	
Cognitive VSL	.288***		.110	
Trust	.189*		.141	
Probability	.032		-.158	
Step 2				
Dread		.487***		.515***
Cognitive VSL		.296***		.115
Trust		.173*		.178
Probability		.082		-.194
Dread × Cognitive VSL		-.184*		-.147
Dread × Trust		.212**		-.162
Cognitive VSL × Trust		.123		.034
R	.523	.579	.398	.432
R^2	.274	.336	.158	.186
Adj. R^2	.257	.308	.135	.147

Note. VSL = value of a statistical life

Discussion

In Study 2, we focused on how early warning information, affect, and cognition affect individuals' overall risk perception. The main effects of probability and marginal trust were significant—that is, the higher the marginal trust and probability, the greater was the level of trust in the warning information. In addition, the overall risk perception toward a specific risky event was established primarily through either affect heuristics or cognitive heuristics, which were moderated by the trust in warning information. These results fully verified Hypotheses 1, 2, and 3.

Study 3

A moderate effect of participants' trust in risk evaluations was observed in Study 2. Thus, we carried out Study 3 to examine whether or not the same moderate effect exists in relation to the warning information given for other types of risks. To test the generalizability of the potential moderate effect, five natural hazards (flood, typhoon, drought, earthquake, and snowstorm) and three technological hazards (haze, nuclear leak, and water pollution) were selected for assessing participants' perception of the risk and the institution involved. We expected that people's trust in the early warning information about an impending risk would moderate their emotion toward that risk (Smith, 2005; Trettin & Musham, 2000; van Bergeijk & Lazzaroni, 2015).

Method

Participants. We recruited 45 students (29 female, 16 male; M_{age} = 20.75 years, SD = 1.272) by the same method used for Study 1, and participants received RMB5 (US$1.00) as an incentive. We adopted a within-subjects design, and believe that the results will still be valid despite the small sample size because of the nature of the experimental design.

Procedure. Participants were asked to evaluate their overall risk perception of the disaster event on a 7-point Likert scale ranging from 1 = *not at all risky* to 7 = *very risky*. Next, they were asked to imagine that the government had issued a warning about each type of risk and to then answer the question "How trustworthy do you think the warning information released by the government tends to be?" on a 7-point scale ranging from 1 = *extremely untrustworthy* to 7 = *extremely trustworthy*.

Measures. Participants' relative trust level was assessed by subtracting the score of their trust in the warning information about the natural risks from that of their trust in the warnings about the technological risks. This allowed us to clarify the proportion of both affective and cognitive input in the overall evaluations. Participants were asked to report the level of dread that a given risk may evoke, on a 7-point Likert rating scale ranging from 1 = *definitely no* to 7 = *definitely yes*, with the responses reflecting their affective input. To measure cognitive input, we adopted a fill-in-the-blank response model and obtained rating scores. To obtain the VSL judgments, participants were asked "Based on your own knowledge and experience, how much (as a percentage) should the government allocate to funds for snowstorm rescue efforts?"

Data analysis. We gained 405 observations for the analyses. In view of the mixed nature of the data, we ran a random coefficient regression model using participant-specific intercepts to control for the effect of the target. According to the analysis, both affective, $\beta = .34$, $t = 9.11$, $p < .001$, and cognitive, $\beta = .03$, $t = 2.56$, $p < .05$, inputs were found to be relevant. Moreover, there were significant

main effects of both affective and cognitive assessments, suggesting that these exerted a positive impact on participants' opinions of the risks. In addition, the analysis also revealed a two-way interaction, indicating that the level of trust in a specific warning may moderate the influence of affective assessments on overall risk evaluations. The positive interaction between affective assessments and trust in the warning information, $\beta = .10$, $t = 2.23$, $p < .05$, indicates that these responses were more prominent among participants with a relatively higher level of trust in the warning information provided about technological risks than among those with a relatively lower level of trust in the warning information provided about natural risks.

Discussion

As predicted, the influence of affective assessments of a particular risk was determined by participants' trust in the warning information of that risk. Compared with those whose level of trust was low, participants who had greater levels of trust in the warning information tended to be more susceptible to the influence of their affective assessments. These results are partly consistent with Hypothesis 1 and are also consistent with previous research findings that technological hazards are perceived as being riskier than natural hazards are, partly because of higher emotional arousal (Poortinga & Pidgeon, 2003; Reynolds & Seeger, 2005; Slovic, 2000a, 2000b; Slovic, Finucane, Peters, & MacGregor, 2002).

General Discussion

Risk management institutions are the major information source about potentially large-scale disasters; thus, they must earn public trust in their smooth operation and further implementation of necessary measures in risk situations. However, despite the intensive research attention focused on how affective processes function in risk decisions and judgments (e.g., Keller et al., 2006; Lachlan & Spence, 2010), much less effort has been devoted to investigating the determinants of reliance on affect in risk judgments among the public. Among the few researchers who have looked into those determinants, Pham and Avnet (2009) observed that "the reliance on affect as a heuristic of judgment and decision making is more pronounced under a promotion focus than under a prevention focus" (p. 267). With that in mind, we aimed to show that reliance on affect as a heuristic for risk judgments is determined by the level of trust in the risk management institutions involved. We found that reliance on affect as heuristic is more marked among decision makers with a high, vs. low, level of trust, and that in the marginal trust decreasing group both affect and cognitive heuristics exist, both of which are moderated by public trust in the warning information. From an applied perspective, our findings suggest that trust may be fundamental to

the effectiveness of risk communication efforts. Trust reduces people's cognitive and other functional complexities as well as their energy, which may explain the general tendency to rely on others, especially the government, to identify and control hazards (Henwood, Pidgeon, Sarre, Simmons, & Smith, 2008; McComas, 2006; Parker, Priest, & Tapsell, 2009; Peters, Covello, & McCallum, 1997).

Although we have contributed to understanding how trust elicits affect heuristics for risk judgments, certain limitations are inherent in our research. First, our correlational results do not reveal the direction of causality between trust and the affect heuristic. Second, the interpretation of people's reactions toward the warning information in relation to marginal trust judgments was only tested using hypothetical scenarios, which means that the results lack practicability in real-world situations. Third, we were not able to take sociocultural factors into consideration, even though these play a crucial role in shaping the public's institutional trust. Future researchers should more deeply consider which values help to form institutional trust, in order to further confirm that trust can elicit the affect heuristic and, with this, effective risk communication.

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Appendix

Participants were presented with details about the specific hypothetical warning information about a snowstorm and asked to read a scenario describing one of the following:

Group 1 (12 male, 29 female): For the experimental task, the participants in this group read a scenario in which the government had issued accurate warning information about the snowstorm one month ago, and promptly launched the emergency plan. However, people still suffered losses or injuries resulting from the severity of the snowstorm.

Group 2 (14 male, 36 female): The participants read a scenario in which the government had issued accurate warning information about the snowstorm one month ago, and promptly launched the emergency plan. Fortunately, people suffered no losses or injuries during the snowstorm.

Group 3 (22 male, 28 female): The participants read a scenario in which the government had issued accurate warning information about the snowstorm one month ago, but failed to launch any emergency plan. People suffered losses or injuries during the snowstorm.

Group 4 (31 male, 30 female): The participants read a scenario in which the government had accurately issued warning information about the snowstorm one month ago, but failed to launch any emergency plan. Fortunately, people suffered no losses or injuries during the snowstorm.

Group 5 (30 male, 20 female): The participants read a scenario stating that the government had launched the emergency plan for the snowstorm one month ago, but failed to issue any warning information about the snowstorm to the public. People suffered losses or injuries during the snowstorm.

Group 6 (25 male, 42 female): The participants read a scenario in which the government had launched the emergency plan for the snowstorm one month ago, but failed to issue any warning information about the snowstorm to the public. Fortunately, people suffered no losses or injuries.

Group 7 (13 male, 37 female): The participants read a scenario in which there was a snowstorm one month ago somewhere. The government had neither issued any accurate warning information about the snowstorm nor launched any emergency plan. People suffered losses or injuries during the snowstorm.

Group 8 (14 male, 35 female): The participants read a scenario in which the government had neither issued any accurate warning information about the snowstorm, nor launched any emergency plan for the snowstorm one month ago. Fortunately, people did not suffer losses or injuries during the snowstorm.