

Linking emotion to risk-taking behaviours of construction workers: appraisal-tendency framework

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Abstract. The reduction of construction accidents contributes to the sustainable development of the construction industry. Risk-taking behaviour of construction workers is an important cause of accidents. Also, discrete negative emotional states, as important psychological factors influencing the risk-taking behaviour, are determinants for controlling accident rate in the construction practice. But there are limited studies on construction safety risk from the appraisal tendencies of emotions. Therefore, this study conducted the classic Balloon Analogue Risk Task (BART) in two behavioural experiments to explore the correlation between emotions and risk behaviours of construction workers. The behavioural results suggested that construction workers in the positive emotion were more prone to take risks than those in the negative emotions, which was in accord with affective generalization hypothesis. Specially in the negative emotions, construction workers with anger and sadness were prone to take risks while workers with disgust and fear to risk aversion. This study made an in-depth analysis of the correlation between different emotions valence (positive and negative) and risk-taking behaviours, with a particular focus on the relationship between the discrete negative emotions (i.e., anger, disgust, fear and sadness) and risk-taking behaviours. Therefore, such findings give insights into appraisal-tendency framework (ATF) in the construction industry.

1 Introduction

The frequent accidents in the construction industry not only cause a large number of deaths, but also increase the social cost and hinder the sustainable development of construction[1]. Risk-taking behaviours were generally interchangeable with unsafe behaviours in previous researches[2]. Emotion, as one of determinants of risk-taking behaviours, has been widely investigated in the previous researches[3]. However, some contradictory results about the relationship between negative emotions and risk-taking behaviours were found from the previous studies in the construction field. Some researchers suggested that negative emotions could perceive more risk, which meant a negative-emotion person was more inclined to risk-aversion[4]. While others found that incidental emotional states exhibited no influence on the risky decision (include hazard identification and risk perception)[5]. Therefore, it is essential to explore how different valence (positive and negative) affect the risk-taking behaviours of construction worker. In addition, few studies have examined the role that the appraisal tendencies or themes of discrete negative emotions play in risk-taking behaviours in the construction field. Consequently, the study on risky behaviours of construction workers is lack of psychological basis on the emotional appraisal tendencies. Therefore, this paper explored the correlation between different emotional valence and the risk-taking behaviours of construction workers, and then

further investigated the correlation between different negative emotions and the risk-taking behaviours.

2 Literature review

Emotions are generally divided into two categories, including negative and positive valence. Different valence exhibited different influences on decision making. Affective generalization hypothesis (AGH)[6] and mood maintenance hypothesis (MMH)[7] both make claims about the effect of different valence (positive and negative) on risk-taking behaviours. However, the two hypotheses argue the opposite. AGH is proposed that positive emotions could make optimistic predictions about risk (underpriced risk), and negative emotions would make its pessimistic estimate of risk (overestimate risk). For example, Zolotoy et al. explored the behavioural consequences of stock option incentives from a mood perspective. The result shows that executives in positive affect would engage in strategic risk taking[8]. In contrast, MMH posits that individual in positive emotional states would avoid taking risks to maintain their positive emotions, while individual in negative emotions tend to take risks and try to change current situations or obtain benefits. Likewise, Loewenstein et al. proposed risk as feelings hypothesis on the relationship between emotional states and behaviours[9]. The hypothesis deems that individual in negative emotion is sensitive to dangerous state. In the construction industry, some researches showed that

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individual in the negative emotions perceive more risks or exhibited a relatively higher hazard identification level than those in the positive emotion[4,10]. Therefore, this research proposes the following hypothesis:

Hypothesis 1. Construction workers in positive states are likely to conduct risk-taking behaviours and those in the negative state are the opposite (risk-averse).

Negative emotions, as the most common emotional states among construction workers, are likely to cast an influence on either organizational environment or individual behaviours[11]. According to appraisal-tendency framework (ATF)[12], anger and fear exert different influence on judgement and decision-making, which attributes to the different appraisal dimensions including certainty and control. The dimension of high certainty can activity a tendency to taking risk. The dimension of control can be categorized as situational control and individual control. Situational control is associated with the tendency to situational factors whereas individual control activities the tendency to perceive less risk across new situations. Anger, including high certainty and individual control, is associated with the tendency to make optimistic judgments about perceived risk. Fear is related to uncertainty and situational control. Therefore, fearful individual tends to perceive more risk of negative events and is more prone to be risk-aversion. Yang et al. also revealed the different effects of anger and fear on risk-taking behaviours though the event-related potential (ERP) technique[13].

Sadness is characterized by the appraisal theme of experiencing the loss or absence of a reward[12]. When people feel sadness, they often interpret the feelings as a sense of something missing, showing work retardation or failure. Consequently, when people feel sad, they are more prone to be risk-seeking. While disgust, characterized by the appraisal theme of avoiding potentially contaminating object, would evoke a preference for expelling current objects. When individuals experience disgust, they tend to avoid situations and act negatively, without self-energy consumption or strong motivation to punish the starters. Based on the appraisal tendencies and themes of four negative emotions, this research proposes the following hypotheses:

Hypothesis 2. Construction workers in anger are prone to risk-taking behaviours.

Hypothesis 3. Construction workers in sadness are prone to risk-taking behaviours.

Hypothesis 4. Construction workers in disgust states are prone to risk-averse behaviours.

Hypothesis 5. Construction workers in fear states are prone to risk-averse behaviours.

3 Quations and mathematics

3.1 Participants and stimuli

43 construction workers (all males; $M=33.98$, $SD=2.55$; range 28-37 yrs.) from the Chongqing Construction Engineering Group Corporation were recruited via personal contact. They are all right-handed with normal vision and do not have any history of mental or neurological disorders.

60 pictures were selected from the Chinese Affective Picture System (CAPS) and Chinese Affective Face Picture System (CAFPS), which were employed to induce oriented emotion based on Chinese culture[14]. Of these pictures, 20 were neutral, 20 were negative, and 20 were positive. Meanwhile, 80 face pictures were collected from the CAFPS, such that each category (anger, disgust, fear and sadness) had 20 pictures. Size of each picture was $11*8$ cm² with a resolution of 100 pixels per inch.

3.2 Design and procedure

In experiment I , participants were randomly assigned into 3 groups: a control condition (neutral), positive condition, negative condition. In experiment II , participants were randomly divided to 4 groups (anger, disgust, fear and sadness). In addition to the experimental design and materials, participants and procedures of the experiment II were similar to that in experiment I .

Before the experimental session, participants received an emotion arousal. Firstly, a central fixation cross in red was presented for 500 ms, following by the targeted emotion induction. Secondly, 20 pictures were presented randomly at the centre of the screen (2500 ms each) with an interstimulus interval (ISI) of 500 ms. Finally, participants rated ten emotions from PANAS scale by inputting 1 to 5 on keypad[15]. The process is shown in Fig. 1(a).

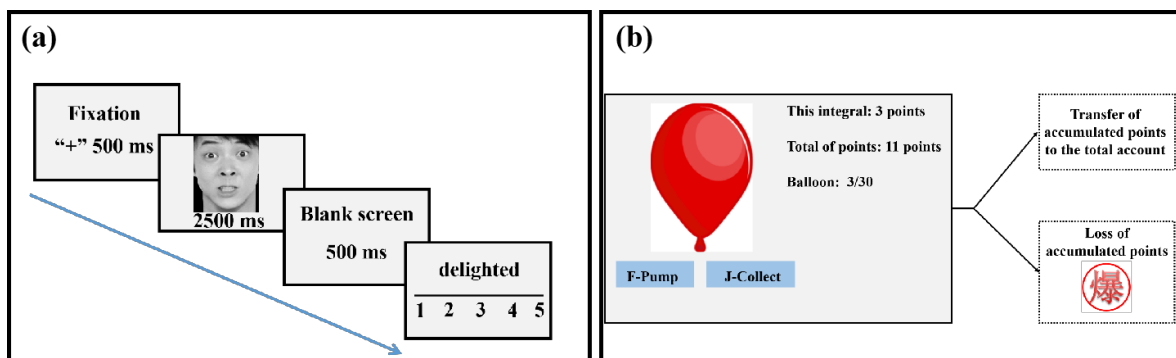


Fig. 1. The process of emotion arousal and Balloon Analogue Risk-Taking task.

Next, the Balloon Analogue Risk Task (BART) was conducted in this paper. The Balloon Analogue Risk Task (BART) consisted of 30 trials. Before the formal 30 trials, there were 3 additional trials for practicing. After a brief instruction, participants were presented with a red simulated balloon on a computer screen, including a “PUMP” button (i.e., the “F” key) and a “COLLECT” button (i.e., the “J” key). A J-click increase the size of the balloon and they earned 0.5 points collected in a temporary bank with each pump. Before the explosion, participants could cease at any moment to transfer all the points to the total account by pressing the “COLLECT” button. If the balloon exploded, a “pop” picture was produced and the participant would lose the points collected in the temporary bank. Then the following uninflated balloon would appear. Each trial ended up with feedback. The details about the process of the BART were showed in Figure.1(b).

Finally, participants were asked to make emotion assessment after 30 trials. The BART value was used to measure the degree of risk-taking behaviour. The value was calculated by dividing the total number of inflatable balloons by the number of unexploded balloons. The higher the BART value, the higher level of risk-taking.

4 Results and discussion

4.1 Results

Emotion scores were as the independent variables, and the BART value (Eq. (1)) as the dependent variable to explore the relationships between emotion and risk-taking behaviour of construction workers.

$BART = \frac{\text{Total Number of Inflatable Balloons}}{\text{Number of Unexploded Balloons}}$ (1)

Analysis of variance (ANOVA) was used for statistical analysis by SPSS (22.0; SPSS, Inc., Chicago, IL, USA) and the results were shown in Table 1. In ANOVA models, 0.05 was set at the significance level. Descriptive data, including mean (M) and standard deviation (SD), were presented in this work. The main effect of emotion group was significant ($F=18.960$, $p<0.01$), indicating that different valence of emotion exhibited different behaviours in BART. Results of Correlation Analysis showed that there was a significant positive correlation between positive emotions and risk-taking behaviour ($r=0.859$, $p<0.01$), a significant negative correlation between negative emotions and risk-taking behaviours ($r=-0.879$, $p<0.01$), and a weak negative correlation between neutral emotions and risk-taking behaviours ($r=-0.282$, $p=0.374>0.05$). Hypothesis 1 was supported.

In the experiment II, the scores of specific negative emotions (i.e., anger, disgust, fear and sadness) were chosen as the independent variables (Table 1). The main effects of negative emotions were significant ($F=2.950$, $p<0.05$), which verified differences exist among the four affective states. The correlation between four negative emotions (anger, sadness, fear, disgust) and risk-taking behaviour was exhibited. It was observed that anger ($r=0.910$, $p<0.01$) and sadness ($r=0.889$, $p<0.01$) both were positively correlated with risk-taking behaviour, while disgust ($r=-0.967$, $p<0.01$) and fear ($r=-0.988$, $p<0.01$) were negatively correlated with risk-taking behaviour. Hypotheses 2,3,4,5 were supported.

Table 1. Analysis between emotion and risk-taking behaviour.

Variables	Experiment I			Experiment II				
	Positive	Negative	Neutral	Anger	Disgust	Fear	Sadness	
Risk-taking behavior	1	0.859** (0.000)	--	--	0.910** (0.000)	--	--	--
	2	--	-0.879** (0.000)	--	--	-0.967** (0.000)	--	--
	3	--	--	-0.282 (0.374)	--	--	-0.988** (0.000)	--
	4	--	--	--	--	--	--	0.889** (0.001)
M	7.295	13.877	10.876	14.516	10.922	15.205	13.836	
SD	1.303	2.985	3.481	3.335	2.761	3.376	4.164	
F		18.960			2.950			
p		0.000**			0.046**			

4.2 Discussion

The result supported hypothesis 1 coinciding with affective generalization hypothesis[6], which considered that construction workers in a positive

emotion might make risk-seeking behaviours due to underestimating risk, while those in a negative emotion do the opposite to make sure the judgments consistent with the current emotional states. This interpretation is observed in the previous studies on the construction worker[4,10]. This result testified the application of

affective generalization hypothesis in the construction safety.

The hypothesis 2 and 3 were verified, which could be due to the physiological impulse and rewarding seeking. Sadness is arisen from the loss or absence of reward. Therefore, the appraisal themes of sadness facilitate individuals prone to risk-seeking or unsafe behaviours. The risk-seeking tendency is like a psychological self-healing and self-relief for individuals[16]. Despite the existence of myopic misery, the individuals in sadness focus on the immediate feedback[17]. Therefore, workers in the anger and sad state were prone to conduct risk-seeking behaviours which might be due to the tendency of seeking reward.

The hypothesis 4 and 5 were also verified. In the state of disgust, individuals are in a strong sense of self-withdrawal and escape, and their behaviours are negative. In the face of risk decision-making, anything that may pose a threat will make them sensitive, even magnify risk perception or assessment, and thus they tend to make conservative non-risky behaviours. When construction workers are in fear, they will not take risks easily because they perceive more risks. Similar conclusions have been drawn in previous studies[18-19], Namely, the effect of disgust was similar with fear on the risk-taking behaviours.

5 Conclusion

This study contributes to a gradually deep debate on the relationship between emotions and the risk-taking behaviours of construction workers. The results of the experiment I supported affective generalization hypothesis. The results of the experiment II showed that construction workers in anger and sadness were prone to risk-taking behaviours while workers in disgust and fear emotions are prone to risk-averse behaviours. The findings demonstrated that the risk-taking behaviour of construction workers was accurately analysed from the specific emotional state perspective.

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