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Do we see how they perceive risk? An integrated analysis of risk perception and its effect on workplace safety behavior

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ABSTRACT

While risk perception is a key factor influencing safety behavior, the academia lacks specific attention to the ways that workers perceive risk, and thus little is known about the mechanisms through which different risk perceptions influence safety behavior. Most previous research in the workplace safety domain argues that people tend to perceive risk based on rational formulations of risk criticality. However, individuals' emotions can be also useful in understanding their perceptions. Therefore, this research employs an integrated analysis concerning the rational and emotional perspectives. Specifically, it was expected that the identified three rational ways of perceiving risk, i.e., perceived probability, severity, and negative utility, would influence the direct emotional risk perception. Furthermore, these four risk perceptions were all expected to positively but differently influence safety behavior. The hypotheses were tested using a sample of 120 construction workers. It was found that all the three rational risk perceptions significantly influenced workers' direct perception of risk that is mainly based on emotions. Furthermore, safety behavior among workers relied mainly on emotional perception but not rational calculations of risk. This research contributes to workplace safety research by highlighting the importance of integrating the emotional assessment of risk, especially when workers' risk perception and behavior are concerned. Suggested avenues for improving safety behavior through improvement in risk perception include being aware of the possibility of different ways of perceiving risk, promoting experience sharing and accident simulation, and uncovering risk information.

1. Introduction

In high-risk industries, like construction, nuclear, transportation, aviation, and oil and gas, unsafe behavior among workers appears to be a critical factor in workplace accidents (Casey et al., 2015; Didla et al., 2009; Reason, 1990; Zou and Sunindijo, 2013). Accidents cause numerous direct costs such as injuries, and huge indirect damage such as psychological costs for the worker (Beus et al., 2015; Hofmann et al., 2003; Zou et al., 2014). Unsafe behavior can be motivated by internal and external factors, among which risk perception is a key internal one (Fung et al., 2012; Wang et al., 2016). Research has demonstrated the influence of risk perception on different kinds of safety behavior, such as using hearing protection devices (Arezes and Miguel, 2008), and involvement in safety management (Kouabenan et al., 2015). However, little research has clarified the key ways that workers perceive risk, and thus little is known about the mechanisms through which different risk perceptions influence safety behavior. It is important to understand how risk is perceived because interventions in unsafe or risky behavior heavily rely on a clear understanding of how people think about risk (Weber et al., 2002).

Risk means "uncertainty about and severity of the consequences (or outcomes) of an activity with respect to something that humans value," and risk perception refers to individuals' subjective judgment of the risk (Aven and Renn, 2009, p. 1). As risk perception is subjective and depends on a set of values, concerns, or knowledge (ISO, 2009), when workers perceive risk, they are likely to adopt different ways to judge risk. One possible way involves peoples' analytical, deliberative, verbal, and rational way of apprehending reality (Epstein, 1994). From a rational perspective, workers are likely to perceive risk through deliberate calculations of risk criticality. Frequently, formulations of this kind of risk perception include (a) the probability of risk occurrence, (b) the severity of risk impact, and (c) the expected utility of risk, i.e., the

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multiplication of the risk's probability and severity (Aven and Renn, 2009; Lehtiranta, 2014; Micic, 2016). This way of perceiving risk is termed as "rational risk perception" in this study, meaning that workers tend to perceive risk through the three rational risk formulations. These perceptions or judgment serve as a basis for everyday decision making (Epstein, 1994), and are also likely to influence decision making on safety behavior.

However, the rational risk perception can be problematic. Sociologists and psychologists have demonstrated that such a rational treatment of risk can be only possessed by experts in a particular field, while laypeople tend to perceive risk based on emotions, i.e., perceive risk through direct and intuitive judgment (Rundmo, 2002; Slovic, 2016). Such kind of risk perception can be irrational and influenced by diverse factors, such as characteristics of risk (Slovic et al., 1979), personal variables (Gyekye, 2006; Iversen and Rundmo, 2002), and cultural and socioeconomic background (Douglas and Wildavsky, 1983; Vaughan, 1995). Despite its complexity, emotional perception of risk can be assessed by asking about an individual's direct perception of risk; that is his or her direct and intuitive feeling of a specific risk (Lu and Yan, 2013; Rundmo, 1996). Researchers have further argued that real actions in risky situations are significantly affected by decision makers' emotional and intuitive judgment of risk (e.g., Slovic et al., 2004). To summarize, workers who cannot be considered as experts in terms of risk management tend to perceive risk in a direct and emotional way, and this direct risk perception will influence their actions and safety behavior.

As contended by Targoutzidis and Antonopoulou (2009), the workplace involves frequent interactions of human acts and materials and procedures, and thus different points of view from both engineering and social sciences can be useful in understanding workers' attitudes, perceptions, and behaviors. Given this, in order to understand how workers think about risk and behave under risk, both the rational risk perception derived from engineering and the emotional risk perception derived from social sciences can be useful. However, to date the literature on workers' risk perception has seldom examined these two perspectives in a systematic and empirical way. Rather, an emphasis has been put on the rational risk perception in the workplace safety domain (Arezes and Miguel, 2008). This may have biased our understanding of workers' risk perception and associated behavior. In the present study, by combining the two perspectives on risk perception, four ways of risk perception are identified: (a) perceived probability, (b) perceived severity, (c) perceived negative utility, and (d) direct risk perception. The present study first aims to clarify the individual influence the first three rational risk perceptions can exert on direct emotional risk perception. Second, this study aims to investigate whether these four different forms of risk perception influence safety compliance and safety participation. The fulfillment of these aims will contribute to workplace safety research by providing a more integrated analysis of workers' risk perceptions and subsequent behavioral outcomes. Also, the practical implications of this research will facilitate improving workers' risk perceptions to enhance safety behavior and ultimately to improve workplace safety performance.

2. Theoretical background and hypotheses

2.1. Perceived probability, severity, utility, and direct risk perception

According to social research on risk perception, an individual's perception on risk mainly depends on emotional, intuitive, direct judgment (Loewenstein et al., 2001; Slovic et al., 2004; Weber et al., 2002). Such a direct risk perception can be measured by soliciting people's opinions with questions such as "How risky do you think this factor is?" (e.g., Lu and Yan, 2013; p. 308). Thus, direct risk perception can be a good reflection of an individual's overall perceptions of risk, which will be influenced by different components of risk. Probability and severity have been widely acknowledged as two important components of risk (e.g., de Camprieu et al., 2007; ISO, 2009; Jani, 2011; Sjöberg, 2000). In reality, it is plausible that if a risk that leads to severe consequences or is one that frequently occurs, people are likely to perceive the risk as high. When encountering risky events in everyday life, most ordinary people deem that severity of outcome strongly influences their perceptions of risk (Sjöberg, 2000; Sjöberg and Drottz-Sjöberg, 1991). In the workplace context specifically, for example, it was found that construction site dumper drivers exhibited a pronounced dread dimension of potential negative consequences of risk (Bohm and Harris, 2010).

On the other hand, frequently occurring risks, regardless of how severe their consequences might be, are likely to leave people with an accumulated and negative impression of high risk levels. For example, some investigators have contended that individuals' general risk perception depends mainly on the likelihood of risk (Lam et al., 2007). However, based on the expected utility framework (Von Neumann and Morgenstern, 1974), people would perceive risk through the judgment concerning the utility of risk, i.e., the multiplication of the risk's probability and severity. Namely, the direct risk perception would be influenced by the negative utility of the risk. Based on these ideas we propose the following hypothesis.

Hypothesis 1. Perceived risk probability (Hypothesis 1a), perceived risk severity (Hypothesis 1b), and perceived negative utility (Hypothesis 1c) will be positively associated with direct risk perception.

2.2. Risk perception and safety behavior

Decision-makers become more concerned with losing assets (risk avoiding) when there are prior gains (a high risk perception) (Kahneman and Tversky, 1979; Sitkin and Pablo, 1992). The relationship between risk avoiding and risk perception indicates that if a person deems an event highly risky, he or she is likely to carry out protective behavior (Ji et al., 2011; Kouabenan et al., 2015; Lu and Yan, 2013; Wang and Yuan, 2011). One study on the link between two perceived food risks (contamination of chicken with salmonella or dioxin) and the behavioral reactions of 280 Dutch participants showed that people who perceived the risk as very high and saw themselves as vulnerable tended to avoid consuming contaminated chicken (Kuttschreuter, 2006). Similarly, Kouabenan et al. (2015) found that frontline managers would get actively involved in safety management if they perceived that their supervisees were likely to be subject to high levels of risk in the workplace. However, little research has focused on the influences of risk perception specifically on safety compliance and safety participation, which are two important distinct employee safety behaviors (Griffin and Hu, 2013).

To examine the influences of risk perception on safety behavior, the present study focuses on safety compliance and safety participation. Safety compliance, as a manifestation of prescribed safe behavior, is defined as "the core activities that individuals need to carry out to maintain workplace safety" (Griffin and Neal, 2000; p. 349). Safety participation, being discretionary and voluntary, refers to "behaviors that do not directly contribute to an individual's personal safety but that do help to develop an environment that supports safety" (Griffin and Neal, 2000; p. 349).

In the hazardous industries, frontline workers are directly exposed to danger and accidents in the workplace, thus it can be concluded that if workers perceive high risk, they are likely to undertake safety compliance to avoid or mitigate risks. Safety compliance aims to ensure that employees adhere to safety procedures and regulations within organizations. Such behaviors include adhering to standard work procedures, carrying out work in a safe manner, and so on. Obviously, these actions can be a direct and effective way to prevent workers themselves from accidents or fatalities. In addition to compliance to safety regulations, for the increasing complexity and uncertainty in the workplace, safety participation is also an effective and particularly proactive approach to