Modeling of Public Risk Perception and Risk Communication Research: In A Social-Cognitive Direction

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Abstract

This study begins with a review of commonly discussed dimensions of public risk perception that may influence public opinion toward risks. Factors that have been revealed by the literature to have substantial impact on risk perception, such as demographic background, trust, and media environment, are also discussed. Meanwhile, we evaluate two well-known research models in the realm of risk analysis: 1) the psychometric paradigm, and 2) the social amplification of risk framework (SARF). Based on a literature review, this study suggests that, besides the psychological and social approach, models of risk perception and risk communication research should shift to a more comprehensive one by considering the interrelations between laypeople and the environment.

This study proposes a research model from the perspective of social cognitive theory (SCT) as a potential framework for future studies: 1) in the societal environment, individuals’ risk perception and information seeking behavior, which is determined by risk perception will be influenced by trust in regulators and interpersonal trust; 2) in the media environment, individuals’ risk perception and information seeking behavior will be influenced by individuals’ perceived information characteristics. Knowledge about risk accumulated through information seeking will change risk perception in a longitudinal process.

Keywords: Risk perception, risk communication, social-cognitive approach
Risk Perception Research

The Concept of Risk Perception

In the realm of risk analysis, the concept of risk perception has been a central topic for some time. Dissimilar from the experts who possess the expertise and skills to estimate and understand risks, the general public, does not have enough knowledge and perfect rationality to fully understand risks. When exposed to hazards, stimulated by external influencers such as the natural-social environment, or internal drivers such as psychological status, laypeople can only rely on their intuitions to interpret risk and make judgments on how risky the event will be (Slovic, 1987). This mental process of laypeople is typically called risk perception in academia. The concept indicates a knowledge gap between experts and laypeople, which has been seen as the fundamental motivation for conducting risk communication to prevent irrational chaos and guide efficient coping strategies (Frewer, 2004).

Psychometric Paradigm

In the nearly 50-year history of risk analysis, risk perception has been studied from various perspectives. No matter whether from the psychological perspectives such as affect heuristics (Finucane, Alhakami, Slovic, & Johnson, 2000), or from the sociological disciplines such as culture theories (Gierlach, Belsher, & Beutler, 2010), almost no research neglects the significance of psychometric paradigm which is defined as an approach that lets risk perception be quantifiable and predictable. It is claimed that laypeople form their judgment about risks out of their feelings towards risk information (Slovic, Finucane, Peters, & MacGregor, 2004). Multifarious signals that transmit emotions, affects, and stigma, risk information could arouse diverse feelings such as fear, familiarity and worry, that shape people’s risk perceptions. By adopting the psychometric paradigm, numerous feelings can be grouped into a limited number of components to serve as the characteristics of risk perception. The psychometric approach was first introduced by Fischhoff, Slovic, Lichtenstein, Read, and Combs (1978). In this pioneer study, they compiled nine key attributes that had been hypothesized as dimensions of risk perception. These attributes
include voluntariness, immediacy of effect, knowledge (to what extent the risk is known to people who are exposed to it), knowledge (to what extent the risk is known to science), controllability, newness, chronic-catastrophe, common-dread, and severity of consequences. Focusing on differences among hazards, they listed 30 hazards and created a “hazard × attribute rating matrix,” and asked people to rate the 30 hazards on each of the attributes. Then, using factor analysis, they obtained a two-factor structure, named dread and novelty, to explain laypeople’s risk perception.

After replication by a considerable number of studies, the psychometric paradigm became an iconic and formulaic model in risk perception research. Examples are not only found in studies using European and North American samples (Barnett & Breakwell, 2001; Binder, Scheufele, Brossard, & Gunther, 2011; Bubeck, Botzen, & Aerts, 2012; Coles & Hodgkinson, 2008; Kellens, Zaalberg, Neutens, Vanneuville, & De Maeyer, 2011; Lazo, Kinnell, & Fisher, 2000; Prati, Pietrantoni, & Zani, 2011; Slovic, 1987; Terpstra, 2011; Turner, Rimal, Morrison, & Kim, 2006; Verroen, Gutteling, & Vries, 2013), but also in those using Asian samples (Ho, Shaw, Lin, & Chiu, 2008; Hung & Wang, 2011; Kung & Chen, 2012; Lai & Tao, 2003; Li & Ito, 2012; Shi et al., 2003; Zhang, 1993). According to the results from a series of empirical studies, several feelings, which frequently occur when people face a hazard, have been commonly utilized in statistical analysis for predicting the characteristics of perceived risk among a certain population. These include perceived likelihood, asking how likely people think the hazard will happen and impact their life, is often used as one of the components to explain perceptions of natural hazards such as earthquakes (Kung & Chen, 2012), floods (Terpstra, 2011), and landslides (Ho et al., 2008). Perceived newness, asking how unfamiliar people think the hazard is, and perceived catastrophe, asking how harmful people think the hazard will be to the next generation and the future development of society, are often used when human-made and technological-related risks are under discussion, such as pollution (Zhang, 1993), disease (Shi et al., 2003), and genetically-modified food (Lai & Tao, 2003). Perceived dread, asking to what extent people feel scared about a hazard, perceived controllability, asking to what extent people think the influence of a hazard is controllable, and perceived severity, asking to what extent people think the consequences of a hazard are
severe, are generally applied, such as in studies examining public perceptions of nuclear radiation as well as many daily life hazardous activities (Fischhoff et al., 1978; Lai & Tao, 2003; Slovic, 1987).

Potential External Predictors of Perceived Risk

Identified as personal feelings, risk perception has been frequently connected with individuals’ demographic backgrounds and socioeconomic status, such as: gender, age, income, educational attainment, occupation, and risk experience. Among these factors, direct risk experience has been proven to be the strongest predictor of perceived risk (Barnett & Breakwell, 2001; Kung & Chen, 2012). In most cases, people’s risk perception will be positively influenced by their direct risk experience, which means the more people are directly exposed to or have been impacted by a hazard, the higher risk level they will perceive the hazard to have. This phenomenon, being considered as a reinforcement of precautionary behavior, may be because risk experience can offer illustrations of a threat and generate imaginings about the potential consequences of a hazard (Wachinger, Renn, Begg, & Kuhlicke, 2013); therefore, it usually leads to a higher level of risk perception. The predicted effects of other factors are not powerful, even not significant in most cases, and their correlations with risk perception vary according to different types of hazards and individuals’ living context.

Trust, especially in authorities and regulators, has also been recognized as a significant predictor of perceived risk. Many previous studies have used trust in the examination of causal relationships. Stemming from people's judgments about an authority's propensity to be open and honest (White & Johnson, 2010), trust serves to reduce people's perception of the complexity and uncertainty of a situation, and allows people to adapt to various hazards they face in society and react in a rational way (Siegrist & Cvetkovich, 2000; Viklund, 2003; Welch et al., 2005). Results from early empirical studies show that trust is an important source of the variance of perceived risks and often leads to a lower level of risk perception.
Media, as an important information source, is another potential predictor that receives attention in risk perception research because of its central role in the social construction of risk (Miles & Morse, 2007). By transmitting risk information with various signals like affective elements, the media has a strong impact on laypeople’s cognitive responses (Dahlstrom, Dudo, & Brossard, 2012). It is worth noting that, compared with traditional media such as newspapers, television and radio, the emergence of new media, especially the Internet, has largely influenced risk information production and promoted a new and evolving method of risk communication. The Internet provides low-cost and easy access to the public, which helps to accelerate the intensity and speed of public attention to risk events (Chung, 2011). Particular features of information quality, such as amount, accuracy, and readability have also been assumed to affect risk perception (Kasperson et al., 1988; Kitzinger, 1999; Wahlberg & Sjöberg, 2000), although without sufficient empirical evidence at the present, their potential predictive power may be supported by future research.

**Development in Risk Communication**

**Early Stages: Scientific Approach to Risk**

Risk communication has been through a relatively short but rapid development since the phrase first appeared during the 1980s (Leiss, 1996). It has been acknowledged that, regarding risks, the cognitive disparities between experts and laypeople are the primary drivers of risk communication (Frewer, 2004). Because laypeople have limited knowledge about risks, they are assumed very likely to misunderstand situations they are involved in and behave irrationally when exposed to risk. For this reason, the experts and regulators have tried all means to transfer scientific information into easily understandable messages.

In the early stages, risk communication was interdependent with the scientific approach to risks, which contained three major steps including risk assessment, risk characterization, and risk management (Stern, 2007). Risk assessment is to rely on science
and statistics to calculate the probability of a hazard’s occurrence and the magnitude of its potential loss. A number or percentage is almost the only thing that can be shown to the public from risk assessment. The next step is risk characterization, in the process of which several characteristics of the risk have been identified, for example, how serious the impact will be on the current environment, and how harmful the consequences will be to future generations. Results from characterization can be used to give laypeople a descriptive explanation for establishing an image of risk. Based on the quantitative and qualitative analysis of risk, risk management begins to function. Experts and regulators have endeavored to improve informational and response systems for reducing the negative effects, controlling the potential loss, and avoiding a forthcoming threat.

All the efforts appear to be based on the precondition of seeing a hazardous event itself as the focal issue. However, it is the victims, including a large population of laypeople, who are exposed and react to real risks that produce ripple effects at different levels in human society.

**Follow-Up Stages: Audience-Oriented Risk Communication**

In the following phases of risk communication evolution, instead of seeing the public as ignorant and emotional, experts and regulators began to build a dialogue with them. The publication of *Seven Cardinal Rules of Risk Communication* is an important event in the transitional stage (Covello & Sandman, 2001). The central theme of risk communication became “what laypeople mean by risk.” From the perspective of social amplification of risk (Kasperson et al., 1988), individuals belong to the amplification station category, which decodes countless signals in risk information according to their subjective judgment about the risk. As a result, the actual risk event is likely to be amplified or attenuated by individuals through their intensifying, weakening, or filtering of the signals. Not limited to a vast social relationship network at the individual level, effects caused by people’s modification of information may also extend to a societal level, for instance, rumors and chaos leading to an institutional crisis. Laypeople, embedded in a socially mediated communication network,
had been taken as not only the target in communication, but also the partner in transmitting information (Covello & Sandman, 2001).

With the purpose of guiding rational interpretations of risk and coping actions, experts started to explore factors that influence laypeople’s thoughts and behavior in a response to risk. Combined with risk perception research, it found that the media, also as one major amplification station, can play a persuasive role in people’s cognition building (Kasperson et al., 1988). Information with positive mood, alerts, and elements alleviating worries is likely to decrease people’s risk perception; however, information with negative mood, stigma, and elements diminishing personal beliefs is likely to increase people’s risk perception (Slovic, Finucane, Peters, & MacGregor, 2010). Additionally, information from sources with high credibility is likely to decrease the levels of laypeople’s perceived risk, and vice versa (Renn & Levine, 1991). Since previous studies show that risk perception can significantly predict behavioral intentions that will engender actual actions taken to prepare for risks (Terpstra, 2011), the effectiveness of risk communication is derived from the audience feedback, cognitive and behavioral.

**Modeling from a Social-Cognitive Perspective**

**The Social Cognitive Theory and Efficacy Beliefs**

The social cognitive theory (SCT) was introduced as a possible theoretical framework for modeling human-centric risk communication. SCT is said to connect cognitivists and behaviorist together to explore the mechanisms of human development from a perspective that emphasizes the interrelationships among humans’ cognition, action, and the environment they are embedded in (Bandura, 1986). Unlike other human functioning theories suggesting humans’ behavioral change is either manipulated by external stimuli or driven by internal forces, SCT negates the one-side determinism. It focuses on the individual level of human functioning and asserts that humans are developing within a triadic reciprocal interplay among their personal characteristics (cognitive and psychological
variables), behavioral idiosyncrasies (given actions), and environmental influencers (natural-social environment) (see Figure 1). In evolution, humans are endowed with capabilities that enable them to be plastic for an enduring development, which indicates that humans are self-controlled, self-regulated, and proactive through an observational learning from the environment (Bandura, 2001). As a functioning agent, humans also reinforce the surroundings by changing their cognitive and behavioral pathways (Bandura, 1986). In the triangle-shaped structure, the three bidirectional causations may not happen simultaneously or share the equal strength of effect (Wood & Bandura, 1989). Instead, the three sets of determinants are operating in a longitudinal process and interacting with each other dynamically.

Figure 1

The Triadic Reciprocal Relationship among Environmental, Personal, and Behavioral Determinants

SCT claims that, among a large number of psychological and cognitive factors that affect human actions, none is more influential than people’s belief in their capabilities of controlling over events that impact their daily life and exercising actions to manage prospective situations (Bandura, 1989). Coming from mastery experience, vicarious learning, social persuasion, and personal psychological state, efficacy beliefs regarding execution of a course of actions will activate four major processes operating in concert in the ongoing regulation of human functioning (Bandura, 1995). The four processes include
cognitive process that visualizes anticipatory outcomes for goal setting, motivational process that facilitates self-regulation for efforts exerting, affective process that produces psychological stress affecting individuals’ perception of the environment, and selection process that backs up individuals’ choice of suitable environment for further development. Previous studies have invited self-efficacy to predict behavior, and supported that self-efficacy has the closest association with behavioral variables and is a significant predictor of behavior change (Schwarzer & Fuchs, 1995).

The Hypothesized Structure

The social-cognitive approach can be used to demonstrate a possible theoretical direction for future phases of risk communication evolution. The hypothesized model presented here takes the public as coordinator in the communication network. They are affected due to their exposure to social environment and they affect the communication path through their active information seeking and feedback to information sources. First, people’s psychological and cognitive status will be determined by environmental factors through observational learning. Individuals are supposed to obtain vicarious experiences from risk regulators, other people around, and the media. Whether they trust or distrust those agencies and how they evaluate their performances and contributions will influence their risk perceptions as well as their information seeking behavior. Then, the increased or decreased risk perceptions and results of continuous information seeking behavior will act on the societal and media environment as a feedback to the effectiveness of risk communication. At the individual level, people’s risk perception will predict their actual information seeking behavior through the acting of their outcome expectations and self-efficacy regarding exertion of the behavior. In a longitudinal process, knowledge about risk will be enriched and modified by information seeking and dynamically changes individuals’ risk perception. The hypothesized structure is shown in Figure 2.
Figure 2

The Hypothesized Structure from a Social-Cognitive Perspective

Conclusion

Risk communication has undergone an evolution for over 30 years. Although it has made considerable progress to obtain new findings and skills, an ongoing discovery of more complicated problems to solve is impossible to avoid (Fischhoff, 1995). Facing the impact of new media technologies, risk communication needs to shift its focus and paradigm for overcoming the challenges from changes in information production and transmission, and plan well-functioning communication schemes for better effectiveness. The fundamental impulse of communication is to bolster humans’ adaptation and reinforcement to the environment (Lang, 2013). By acknowledging communication as a natural aspect of human development, human-centric variables should be the central point in discussion. The general public is the partner rather than the target in information circulation since laypeople’s reactions to risk are likely to cause ripple effects at different levels of the social system,
especially in the age of new media that enlarges communication networks as well as escalates the involvement of the public. For this reason, more comprehensive and powerful frameworks are required, which can embrace rather than just accommodate the updates in the media environment. Modeling from a social-cognitive perspective could be an extra possibility to aid human-centric risk communication by integrating psychological or cognitive, behavioral, and contextual factors that determine human functioning. Although it is not easy to utilize the social cognitive theory entirely since it is broad reaching and consists of difficult to define variables, several key concepts in SCT such as self-efficacy and outcome expectation could be applied as latent variables to examine causality. In future research, more empirical evidence is needed to support the explanatory power of the model proposed in this manuscript. Also, this theoretical structure may provide implications for risk communication practice, for instance, tactics to convey risk information through altering signals fixed in messages.

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