The Role of Information Quality and Efficacy Beliefs in Predicting Chinese People's Information Seeking about Air Pollution Risk

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ABSTRACT

Information seeking is suggested as an important precursor of self-protective behavior. Therefore, ways of enhancing information seeking are expected to help individuals' precautionary action under conditions of risk. Builds upon previous efforts, a social-cognitive model of risk information seeking is constructed, presenting a new approach to meet the aforementioned expectation. Data were collected from a sample of Mainland Chinese people (N=1032). Results of path analysis demonstrated satisfactory model fit. Explanations on how the cognitive process resulted in information seeking may create a better understanding of individual behavior. Findings provide practical implications for communicating risks and for helping the public to make better decisions.

Keywords

Risk information seeking, information quality, self-efficacy, outcome expectation, air pollution risk.

INTRODUCTION

Risk in the Modern Society

Risk basically means the potential of damage or loss caused by an activity (Brauch et al., 2011). It is defined as a scientific and political concept especially concerning health and environmental issues (Brauch et al., 2011; Cox, 2013). Risk event usually draws particular attention of policy makers because of its uncertain consequences for society and its significance in justifying specific policy goals. For instance, in emergency response, it is critical to induce the public's behavioral change that may prevent or alleviate a threat (Witte, Meyer, & Martell, 2001), otherwise when risk turns to a real crisis, it might be more time and effort consuming to lessen the negative outcomes (Coombs, 2012). Therefore, it is of paramount importance to get prepared at early stages of the development of a hazardous event.

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To Improve Public Response

The modern world confronts the limitation of its ability to manage the outcomes of rapid development (Beck, 1992). As many risks and crises go interorganizational, no one can escape from the impact (Beck, Deng, & Shen, 2014). It indicates that to be prepared becomes not only the task for decision makers but also the responsibility of each part in a social system, either individuals or groups.

Regardless of different types of threat, emergency response and management has always included a significant public-targeted communication in the form of warnings, background information, and mitigation suggestion, among others (Reynolds & Seeger, 2005). Such process is closely associated with professional threat sensing and assessment. However, lessons are learnt from many failures of risk communication practice that centered merely on the relay of scientific facts but neglected the exchange of opinions between the communicator and the public (Anderson, 1997; Covello & Sandman, 2001).

In order to more effectively facilitate decision-making, risk communication has gradually evolved by expanding its role to strategically present and interpret risks that can improve interactions among interested parties (Sheppard, Janoske, & Liu, 2012). Facing grander challenges in the modern risk society, besides meeting the public's needs to be informed, communication should also value the partnership of the public.

People have the ability of active learning from experience and cognitive reasoning that guide behaviors (Bandura, 1986). From this point of view, the present study concentrates on individuals' risk information seeking, a significant forerunner of self-protective behavior (Kellens, Zaalberg, & Maeyer, 2012; Kievik & Gutteling, 2011; Mileti & Darlington, 1997; Paton & Johnston, 2001), attempting to discover ways that help motivate effective precautionary actions of the public. Many empirical studies have supported the positive effects of information seeking on actual prevention behaviors regarding health and environmental risks (Moldovan-Johnson, Martinez, Lewis, Freres, & Hornik, 2014).

Drawing insights from these early endeavors, we intend to explore how individuals' risk information seeking is influenced. Although being studied in various disciplines, information seeking is commonly described as a purposive process of knowledge acquisition (Johnson & Johnson, 1997). In other words, people engage in such process with the purpose of changing their state of knowledge (Marchionini, 1997). Therefore, we focus on the mechanism of such cognitive operation to better understand and effectively get the public motivated. Answer to the aforementioned question is particularly expected to shed light on communication practice, such as strategies for explaining risks, design of message contents, and selection of communication channels.

Air Pollution Risk in China

Perceptions of risk from air pollution in China have become a major preoccupation among the public, putting a lot of pressure on governments at various levels. In 2014, Premier Li Keqiang said in a widely publicized speech that, "the first thing many people do in the morning is check the readings for PM2.5 pollution" (Li, 2014). Other public opinion surveys also show an upsurge of concern with air pollution and other environmental hazards in China. Chinese people have paid much more attention than before on information associated with air pollution. For instance, only a few years ago, most people in China had no idea about PM2.5, but now, this indicator is widely recognized. At least, people know roughly what it means and understand that on scales from "safe" to "extremely hazardous". Recently, a number of cities have provided more information on PM2.5 and air conditions as a result of public pressure. These reflect the actual developments in China on communicating air pollution risk and on government responses. By analyzing the air pollution case, this study hopes to help future research on how communication will change people's knowledge and perception of air pollution.

LITERATURE REVIEW

Overview of Conceptual Frameworks for Predicting Risk Information Seeking

Risk Information Seeking and Processing Model (RISP)

The risk information seeking and processing model was articulated by Griffin et al. (1999) to predict individuals' seeking and processing of health risk information. This model was built upon the adaptation and synthesis of the heuristic systematic model (Chaiken, Liberman, & Eagly, 1989) and the theory of planned behavior (Ajzen, 1991). Founders of RISP strived to construct an audience-based model that could be related to the development and maintenance of preventive health behaviors.

Focusing on individual characteristics, RISP proposed a list of seven factors having potential impact on information seeking. Results of model testing showed that level of information sufficiency, which closely associated with knowledge, had strong direct impact on information seeking and processing.

Framework of Risk Information Seeking (FRIS)

By drawing further on the concepts of RISP, Huurne (2008) proposed the framework of risk information seeking. Following findings of RISP related to the significant role of information sufficiency and self-reported knowledge, FRIS set information need as a key predictor of risk information seeking and avoiding. Besides, it put emphases on psychological factors and invited risk perception, perceived self-efficacy and trust to model construction. FRIS is a more individual-focused framework compared with its precedent.

Results of path analysis suggested a notable finding that information need, affected by perceived self-efficacy and social influence, was a direct cognitive driver and the most powerful motivator of risk information seeking. This implies that a persuasive way to enhance self-efficacy in getting useful information for prevention will increase information seeking though the stimulation of people's need to enrich risk related knowledge.

Planned Risk Information Seeking Model (PRISM)

Based on the theory of planned behavior and RISP, Kahlor (2007, 2010) brought several concepts from previous models together and posit the planned risk information seeking model for predicting health risk information seeking. PRISM was first introduced as an augmented version of RISP (Kahlor, 2007), which treats risk information seeking as a deliberate (planned) behavior. PRISM also concentrates on individual level variables in order to find factors that may have impact on seeking behavior across contexts (Kahlor, 2010; Moldovan-Johnson et al., 2014).

The resulting model indicated that risk perception, affective response, perceived knowledge level were significant predictors of the intention of health risk information seeking. The results accounted for 59% of the variance in the behavioral variable, showing a better performance than RISP (Kahlor, 2010). However, different from the prior efforts, PRISM didn't demonstrate significant influence of information need on information seeking. This implies that, compared with information need, how much knowledge people think they have is more likely to trigger information seeking.

Early efforts on the development of risk information seeking models have enriched our knowledge about determinants of information seeking. Particularly, the individual level determinants come to the fore. Table 1 illustrates a list of major findings of these models.

| Reference	Model	Topic	Major Determinants	Notable Outcome Investigated
Griffin et al. (1999)	RISP	Health risk	1. Sociocultural background 2. Informational subjective norms 3. Hazard characteristics 4. Affective response 5. Information sufficiency 6. Information gathering capacity 7. Relevant channel beliefs	Information sufficiency, which closely associated with knowledge, had strong direct impact on information seeking and processing.
Huurne (2008)	FRIS	Industrial risk	1. Risk perception 2. Perceived self-efficacy 3. Social involvement 4. Affective response 5. Subjective norms 6. Information need	Information need, affected by perceived self-efficacy and social influence, was a direct cognitive drive and the most powerful motivator of risk information seeking.
Kahlor (2007)	Augmented RISP	Global warming	1. Attitudes 2. Risk perception 3. Informational subjective norms 4. Perceived behavioral control	Results suggested the promise of applying the augmented RISP model to environmental risk information seeking.
Kahlor (2010)	PRISM	Health risk	1. Risk perception 2. Affective response 3. Perceived knowledge 4. Information need	Risk perception, affective response, perceived knowledge level were significant predictors of the intention of health risk information seeking.

Table 1. Popular Models for Predicting Risk Information Seeking

A New Approach: The Social-Cognitive Model of Risk Information Seeking

Theoretical Basis: Two Theories of Human Behavior

As we reviewed before, previous models are based especially on an adaptation of the theory of planned behavior (TPB) (Ajzen, 1991), which describes a structure of cognitive causal dynamics that drives human behavior (see Figure 1). The basic rule of TPB is that, the stronger the intention to engage in a behavior, the more likely should be its performance (Ajzen, 1991). Three inter-correlated factors including subjective norms, perceived behavioral control and attitude toward the behavior are assumed as predictors of behavioral intent. Here, we provide a general introduction of the three variables (Ajzen, 1985): 1) subjective norms refer to people's judgment on whether others think he or she should perform the behavior; 2) perceived behavioral control refers to people's belief of the ease of performing a behavior; 3) attitude toward the behavior refers to the extent to which people have a favorable or unfavorable outcome evaluation of a behavior.

TPB has been repeatedly used across a wide range of human actions, especially in health and risk related issues (Griffin et al., 1999). And, owing to the salient role of perceived behavioral control and attitudes, TPB is known as a "belief-evaluation compound" structure to predict preventive behaviors such as risk information seeking (Griffin et al., 1999). However, although TPB is a valuable vehicle for exploring ways to motivate behavior, its validity and utility are still in question. First, most of the empirical studies that support TPB have conducted cross-sectional design and used data collected from university students (McEachana, Conner, Taylor, & Lawton, 2011). When applying the theory to longitudinal examinations, or to samples of other populations, the predicted effect is not satisfactory. In addition, there is still no experimental test that confirms the theory's assumptions (Sniehotta, Presseau, & Araújo-Soares, 2014). Furthermore, the theory has an exclusive focus on rational reasoning but excludes influence from emotional factors (Conner, Godin, Sheeran, & Germain, 2013), which may be incompatible with risk contexts where feelings and intuitive judgments have considerable impact on behavior (Slovic, Finucane, Peters, & MacGregor, 2010).
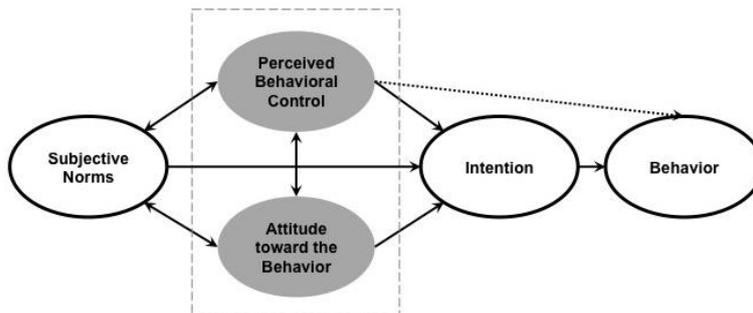
Figure 1. Summary of Causal Relationships Described in Theory of Planned Behavior (TPB)

Concerning the limitations of TPB, we are making an effort to explore a new approach to predicting behavior. Unlike previous models that have formed extended versions of TPB, our model draws insights from the social cognitive theory (SCT). In fact, according to Ajzen (1991), much of the knowledge about the two central variables in TPB (see Figure 1, *perceived behavioral control* and *attitude toward the behavior*) comes from efficacy beliefs (*perceived self-efficacy* and *outcome expectation* regarding a behavior), key concepts in social cognitive theory. Therefore, we are not going to create another derivative of the TPB model. Instead, we are back to its source of inspiration, trying to map the cognitive route through a more comprehensive understanding of human behavior.

SCT is well known as a theory of behavior change, concentrating on the acquisition of knowledge and behavior patterns (Denler, Wolters, & Benzon, 2014). The major assumption of SCT concerns the reciprocal relationships among the environmental, personal, and behavioral factors that acts upon behavior change (Bandura, 1986). In other words, the sets of contextual, cognitive, and behavioral factors are influencing each other, and people's behavior is the product of the continuous interactions between them. SCT claims that people can control and regulate their behavior in a goal-directed way. Through observation, people evaluate their ability and sketch their own outcomes regarding a behavior. The stronger people's belief in their ability to execute a behavior, the more likely should be its performance (Bandura, 1997). At the same time, if the outcome expected were valued, the frequency of behavior would increase; when unfavorable outcomes are expected people will reduce the frequency of behavior (Bandura, 1997).

SCT is a far-reaching theory that has been broadly applied to diverse areas of human functioning (Denler et al., 2014). Particularly, the concepts of self-efficacy and outcome expectation have been extensively adapted to research on predicting behavior. Risk and crisis related studies have paid more attention to the role of the two factors and confirmed their significant impact on precautionary behavior (Bubeck, Botzen, & Aerts, 2012; Kievik & Gutteling, 2011; Prati, Pietrantoni, & Zani, 2011; Verroen, Gutteling, & Vries, 2013). Therefore, we invite self-efficacy and outcome expectation as central predictors of risk information seeking.

The Proposed Model

The hypothesized model is presented in Figure 2. We attempt to investigate how the public's risk information seeking is shaped within their exposure to the information environment. The basic assumption is that perceived self-efficacy and outcome expectation regarding risk information seeking closely associate with and will considerably cause information seeking. Information quality, risk perception, and knowledge are set as potential contributors to the two correlated variables. This assumption is based on the explanation of sources of efficacy beliefs (Bandura, 1997). Specifically, individual's efficacy beliefs mainly come from mastery experience, observational learning, social persuasion, and psychological state. Accordingly, high quality information people think they get and high level of knowledge people think they have may enhance their sense of mastery, providing the most authentic evidence to assure them that they will succeed in future information seeking. High level of risk perception is likely to play the role of fear appeal, changing people's psychological states and persuading them to instill more beliefs to boost precautionary behavior. Our model doesn't include observation and social persuasion variables, because we intend to focus on individual-level factors in order to develop an approach that can be applied to different contexts.

We pay particular attention to the role of information quality and knowledge. This is based on Beck's (1992) assertion concerning risk society that risks are socially effective only within knowledge (Adam, Beck, & Loon, 2000; Beck, 1992). How the concept of risk is defined and how the characteristics of risk are identified are deeply rooted in how people know about the threats (Böhme, 1997; Böhme & Stehr, 1986; Stehr, 1994). Therefore, the risk society is also seen as a "knowledge society" (Beck, 1992), in which we should consider the

production of knowledge that gives birth to risks, and the conflicts of different types of knowledge that shape risks (Strydom, 2002). Among numerous communication channels, media plays an outstanding role in producing, spreading and interpreting knowledge (Kasperson et al., 1988; Kitzinger, 1999; Stern & Fineberg, 1996). Given this, the risk society is also seen as a "communication society" (Delanty, 1999). Media becomes a major source of risk related knowledge for the public (Dahlstrom, Dudo, & Brossard, 2012; Miles & Morse, 2007; Wahlberg & Sjöberg, 2000). Good quality information may contribute to the knowledge acquisition. Both knowledge and information may help people to form the image of risks and facilitate information seeking.
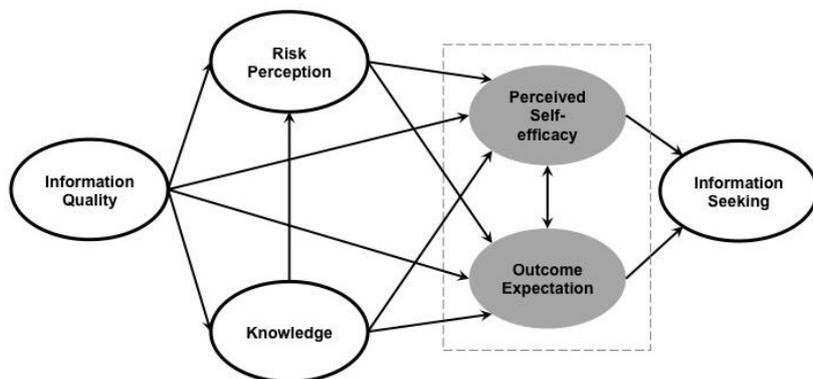

Figure 2. The Proposed Social-Cognitive Model of Risk Information Seeking

METHOD

Data were collected as a part of public opinion survey during September 2013 on Chinese people's environmental risk perception and media use. Participants were recruited from a research institute's panel containing people in six areas of Mainland China (East China, Northeast China, North China, South Central China, Northwest China, and the South West China). An invitation email with URL link of the web-based questionnaire was sent to 12026 Chinese people. A total of 1032 valid samples were collected, among which there are 511 male and 521 female with an average age of 33.8 years old. Although the response rate (8.58%) is unsatisfactory, a low response rate does not necessarily lead to a biased estimation (Krosnick, 1999). It is acceptable if the demographic characteristics of the respondents were balanced according to the population under study (Valenzuela, Park, & Kee, 2009). Comparing with statistics of Central Intelligence Agency (2013), our data reflected an acceptable balance concerning sex ratio (1.06 male/female) and median age (36.7) of the Chinese population. Items that measure the variables in this research were presented in Table 2. All the items were rated on a 7-point scale (1=*not at all*, and 7=*extremely*).

We conducted the structural equation modeling (SEM) to test the model fit. AMOS 21.0 was used to perform SEM and estimate the parameters. X^2 is reported as an index of model adequacy, where a nonsignificant value suggests good fit. However, X^2 is usually significant when testing a large size of samples (Bollen, 1989). Therefore, X^2/df is reported, where a value less than 5 suggests good fit (Kline, 2011). In addition, the goodness of fit index (GFI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA) are reported, which indicate how well the hypothesized model explains the data. Values of GFI and CFI range from 0.00 to 1.00, where 0.90 and the above present good fit. Value of RMSEA less than 0.08 demonstrates reasonable error of approximation.

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Variable	Item	M	SD
Risk Perception	*Perceived Risky (R)*: How risky do you consider air pollution to be to Chinese people and China's society?	5.46	1.24
	Perceived Dread (D): How afraid do you feel when you think of air pollution?	4.90	1.44
	Perceived Catastrophe (C): How harmful do you think air pollution will be to the future development of China's society and to the next generation of Chinese people?	5.66	1.14
	Worry (W): How worried are you about air pollution at this point of your life?	5.41	1.32
Information Quality (IQ)	*IQ1:* Information from media is easily *accessible*.	5.00	1.29
	IQ2: Information from media is *credible*.	4.91	1.24
	IQ3: Information from media is *understandable*.	4.97	1.19
	IQ4: Information from media is *sufficient*.	4.87	1.31
	IQ5: Information from media is *comprehensive*.	4.75	1.32
Knowledge	How much knowledge do you think you have about air pollution?	4.83	1.23
Perceived Self-efficacy (SE)	*SE1*: I have confidence in my ability to understand relevant information.	4.98	1.20
	SE2: I have confidence in my ability to search for relevant information.	5.03	1.14
	SE3: I have confidence in my ability to evaluate the credibility of relevant information.	4.93	1.17
Outcome Expectation (OE)	*OE1*: I believe that, by information seeking, my knowledge will be increased.	5.24	1.03
	OE2: I believe that information seeking will make me alert to the risk.	5.18	1.02
	OE3: I believe that information seeking will help me to be well prepared for the impact from the risks.	5.17	1.02
Information Seeking (IS)	*IS1*: I have intentions to search relevant information.	5.10	1.13
	IS2: I often attend to relevant information.	5.08	1.15
	IS3: I often search for relevant information.	4.96	1.21

Table 2. Measurements of Variables

RESULTS

The resulting model is shown in Figure 3. Results of path analysis indicate satisfactory model fit: X^2 (140)=626.574, $p<.001$, X^2/df=4.476<5, GFI=.940, CFI=.971, RMSEA=.058. Perceived self-efficacy (β=.68, $p<.001$) and outcome expectation (β=.22, $p<.001$) considerably increased information seeking (cumulative R^2=.76). Information quality, risk perception, and knowledge were all suggested as significant sources of perceived self-efficacy (information quality: β=.57, $p<.001$; risk perception: β=.14, $p<.001$; knowledge: β=.14, $p<.001$) and outcome expectation (information quality: β=.57, $p<.001$; risk perception: β=.18, $p<.001$; knowledge: β=.11, $p<.001$). Information quality didn't show significant influence on perception of air pollution risk (β=.06, *ns*). The air pollution risk perception was caused by perceived knowledge about the risk (β=.38, $p<.001$) which was greatly increased by information quality (β=.33, $p<.001$).
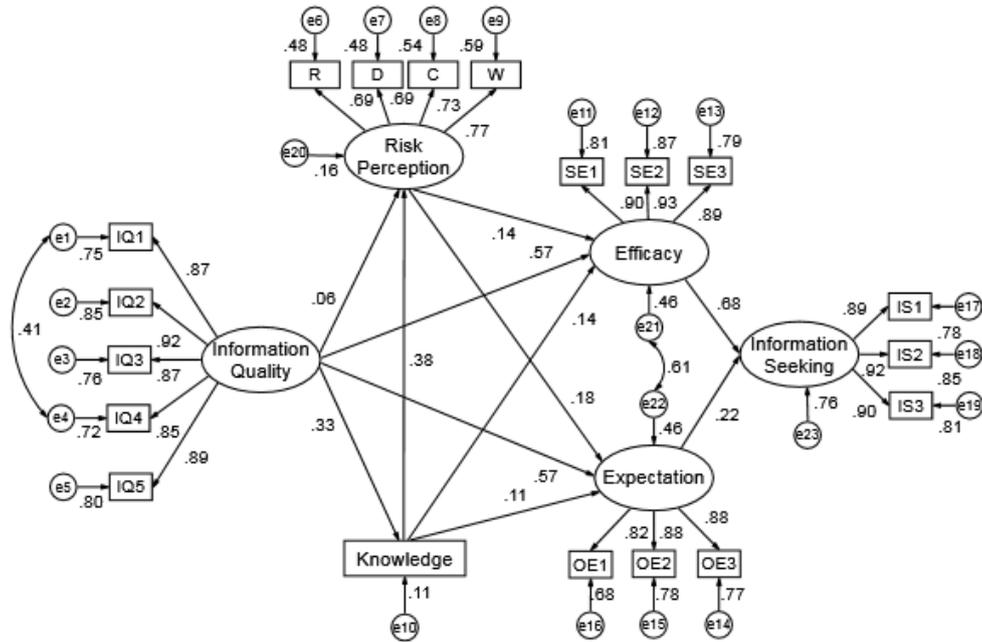
Figure 3. Path Model of the Air Pollution Case

DISCUSSION

In order to improve the public's response to risks, this study focuses on individuals' risk information seeking, an important indicator of precautionary actions and self-protection, to contribute insights to both research and communication practice regarding how to get the public prepared under risk conditions. Using data collected from a public opinion survey among a Chinese population on air pollution risk in China, this study examined a path model (Figure 2) for predicting risk information seeking. Results of analyses demonstrated good model fit, indicating a significant explanatory power of the proposed model. Figure 4 presents a summary of the causal relationships between variables. Key findings are highlighted as follows:

1) Perceived self-efficacy and outcome expectation have *directly*, *significantly*, and *largely* contributed to information seeking, which is consistent with previous findings;

2) Perceived information quality, perceived knowledge, and air pollution risk perception are all supported as generators of efficacy beliefs, which has expanded previous findings about *indirect predictors* of information seeking;

3) Perceived information quality has greatly caused the increase in perceived knowledge that has significantly raised the level of air pollution risk perception. This reinforces the view that media is *a major source of knowledge* for ordinary people, contributing to the construction of lay understanding of risks.
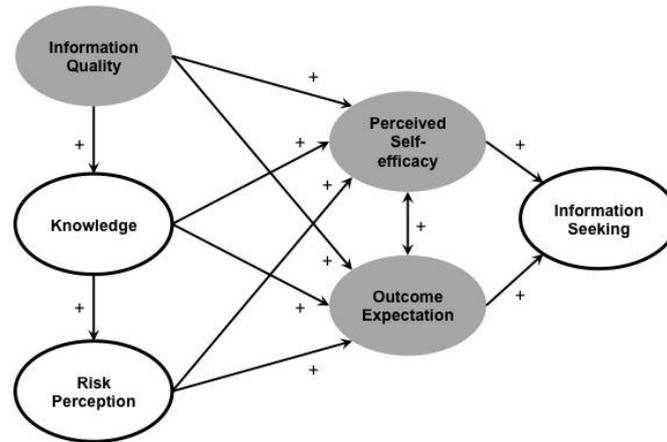
Figure 4. Summary of the Causal Relationships between Variables

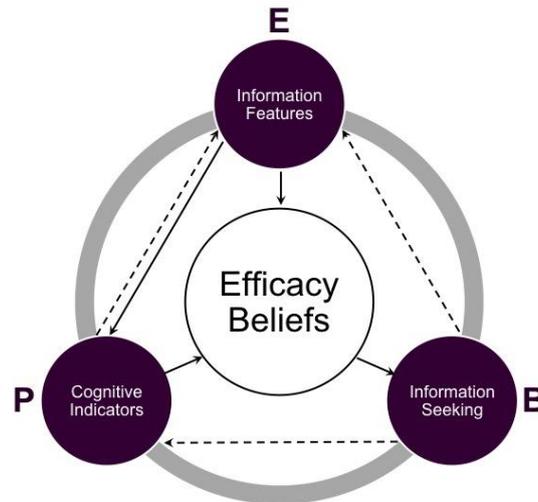## The Cognitive Route to Risk Information Seeking

Drawing insights from the theory of planned behavior (TPB), most of the previous studies on the development of risk information seeking models have focused on individual level factors that determine a person's intentions and actions. The present study is no exception.

Both TPB and SCT believe that cognitive self-regulation plays an important part in shaping behavior patterns. The two theories value not only the power of inner drive but also the role of outside force (i.e., the environment) to explain human behavior. However, TPB is designed for specific contexts by dealing with the nature of behavior-specific factors (Ajzen, 1991). Differently, SCT focuses more on the cognitive mechanisms without limiting the context. It believes that behavior can be motivated by a sense of control and expectation of the outcome regardless of any particular context. Applied to various fields of research, including organizational management (Wood & Bandura, 1989), education (Schunk, 2004), mass communication (Bandura, 2001), and health intervention (Bandura, 1994), this assumption has been widely supported. Our findings also confirmed the salient impact of efficacy beliefs (i.e., perceived self-efficacy and outcome expectation) on risk information seeking.

We argue that Chinese people's beliefs in their ability and expectation of the favorable outcome regarding information seeking come from two sources: 1) how they evaluate the information environment; and 2) how they know and perceive the risk. Findings of our study highlight the role of information quality, one aspects of the information environment, suggesting the higher people's evaluation of accessibility, credibility, understandability, sufficiency, and comprehensiveness of information they received, the higher their levels of efficacy belief will be.

Meanwhile, evaluation of information quality can serve as the criteria for people to judge how much they know about the risk. The information environment is also an environment for learning because most people know about modern risks from the media, especially considering the increasingly problematic air pollution issue in China. As China has rapidly industrialized pollution has increased, which has triggered great public concern in living conditions and health. According to a study on the impact of sustained exposure to air pollution on life expectancy (Chen, Ebenstein, Greenstone, & Lie, 2013), air pollution is causing residents of Northern China to have a life expectancy about 5.5 years lower than residents of other regions. Such information, as well as real-time air quality reports in many big cities in China (e.g., Beijing, Shanghai, and Guangzhou), has widely spread through the media and other communication channels. Owing to the significant exposure to related information, high quality information is very likely to create a positive impression on the audience, letting people believe they know much about air pollution. As a consequence, people will perceive air pollution more dangerous because they know it to be dangerous and a most direct threat to their well being at the moment. Then, under the cognitive self-regulation, people can encourage and persuade themselves to instill more beliefs in the learning process to get better informed and prepared for the potential impact.

Future research should consider longitudinal studies of the effects of information seeking to provide a more complete description of the reciprocal interactions between the environmental, personal, and behavioral factors. To be more specific, frequent information seeking may change how people evaluate the information they receive, how much they know and how they feel about the risk; changes in knowledge and perception may also lead to a new evaluation of the information environment (see Figure 5).

Figure 5. From the Social-Cognitive Perspective: The Generation of Information seeking within the Communication of Risk (*E*=environmental factors, *P*=personal factors, *B*=behavioral factors; Solid lines indicate causal relationships confirmed by this study, dash lines indicate potential effects that might happen as the result of longitudinal interactions between *E*, *P*, and *B*.)

Practical Implications

The cognitive route examined in this study supports a new perspective for understanding individual's risk information seeking, contributing several insights to risk communication practice:

1) Risk communication should be *individual-and-decision-focused* for the public's best interest. It needs to facilitate individuals' information seeking, helping them to gain more personal relevant information, get prepared and make sound decisions under risk;

2) Risk communication should be *information-oriented*. Provision of risk information will have diverse effects, especially changing risk perception and affecting a range of individual decisions (Viscusi & Magat, 1987). Risk communication can play the role of hazard education by including more knowledge and background about the risk in message content. Information can also be designed as hazard warnings by using the strategy of fear appeal to increase people's risk perception. In addition, successful cases of precaution may play as incentives letting people more frequently search for such information;

3) The *cognitive linkage* between risk information and precautions should be further investigated by considering the influence of other aspects in the information environment, such as characteristics of different information sources and communication channels. This is expected to contribute to a better media selection because different ways of conveying a risk may lead to different interpretations of the risk.

Limitations

As important as findings and implications, limitations of this study must be acknowledged. First, empirical study analyzing a set of cross-sectional survey data is not strong enough to tell the story about cognitive processing. Results can indicate a possible causal path, but it cannot define the real causation. Experimental tests are needed to add more persuasive evidence to our assumptions. Future research may consider experiments to investigate the effect of deliberately designed information. The second one relates to how participants' knowledge is assessed. Self-reported knowledge is not equal to what people really know about the risk, and it may also be a dimension of risk perception reflecting whether they feel familiar with the risk. Thus, a more precise way measuring people's real level of knowledge should be applied. Longitudinal knowledge examinations are needed to see whether certain information provision strategy can help education and learning.

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