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The Key Role of Experiential Uncertainty when Dealing with Risks: Its Relationships with Demand for Regulation and Institutional Trust

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The results of a survey and an experiment show that experiential uncertainty—people's experience of uncertainty in risk contexts—plays a moderating role in individuals' risk-related demand for government regulation and trust in risk-managing government institutions. First, descriptions of risks were presented to respondents in a survey ($N = 1{,}017$) and their reactions to questions about experiential uncertainty, risk perception, and demand for government regulation were measured, as well as levels of risk-specific knowledge. When experiential uncertainty was high, risk perceptions had a positive relationship with demand for government regulation of risk; no such relationship showed under low experiential uncertainty. Conversely, when people experience little experiential uncertainty, having more knowledge about the risk topic involved was associated with a weaker demand for government regulation of risk. For people experiencing uncertainty, this relationship between knowledge and demand for regulation did not emerge. Second, in an experiment ($N = 120$), experiential uncertainty and openness in risk communication were manipulated to investigate effects on trust. In the uncertainty condition, the results showed that open versus nonopen government communication about Q-fever—a zoonosis—led to higher levels of trust in the government agency, but not in in the control condition. Altogether, this research suggests that only when people experience relatively little uncertainty about the risk, knowledge provision may preclude them from demanding government action. Also, only when persons experience uncertainty are stronger risk perceptions associated with a demand for government regulation, and they are affected by openness of risk communication in forming institutional trust.

KEY WORDS: Experiential uncertainty; risk communication; risk governance; risk perception; trust

1. INTRODUCTION

In the past few decades, research pertaining to various aspects of risk (e.g., technical risk assessment, sociology of risk, psychometric approaches toward risk) within a variety of domains—health, food, natural hazards, crime, and terrorism, as well as more systemic risks—has grown exponentially. Although no consensus exists about how risk should be defined,[1,2] most scholars would agree that risks deal with phenomena in which the possible occurrence of negative events is not entirely probable. Thus, the concept of uncertainty is entangled with the concept of risk.[3]

In most risk research, the notion of uncertainty is approached from a technical or statistical angle in order to assess the nature and magnitude of the risk. However, the potentially important role

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that uncertainty plays on an *experiential* level when individuals deal with risk has received surprisingly little attention. Yet, it has been firmly established that dealing with uncertainly may have profound effects on psychological appraisal and human decision making—most notably by the work of Tversky and Kahneman.[4] This is especially important because people may experience uncertainty in risk contexts, while at the same time they must rely on institutions to govern those risks.

Indeed, the relationship between citizens and governing institutions is typically asymmetrical.[5] Policymakers differ importantly from the public because they may or may not be directly affected by particular risks, whereas individual citizens usually are (such as when an infrastructure project is planned in their area). Also, power asymmetries are an inherent feature when authorities versus citizens deal with risks. Traditionally, risk communication may perhaps have been a one-way process from governing bodies to a passive public, but citizens are increasingly involved in this, and risk governance is much more subject to accountability procedures.[6] We therefore set out to investigate two characteristics that are important proxies for the relationship between citizens and risk authorities: the public's demand for risk regulation and people's trust in government bodies that manage risks. In this article, we test our expectation that experiential uncertainty plays a moderating role in individuals' risk mitigation preferences and experienced level of trust. We start off by introducing the concept of experiential uncertainty, after which we elaborate our expectations on how this phenomenon connects with the public's demand for risk regulation and shapes trust in government bodies that manage risks.

1.1. Psychology of Uncertainty

People like to feel certain. That is, when experiencing feelings of uncertainty, individuals engage in coping mechanisms that aim to restore their being certain.[7] This is not to say that people never seek or engage in situations that are uncertain or have uncertain outcomes. For example, some people enjoy skydiving or other extreme activities, but by and large these undertakings are still highly controlled. The pursuit of experiencing an accurate understanding of how the world operates is a fundamental human feature,[8] and people are typically strongly motivated to return to a level of certainty that they find acceptable.[9] The most direct way to manage such uncertainty is to engage in tendencies and behaviors that directly target and neutralize the source of uncertainty. For example, feeling uncertain about traffic hazards may cause people to engage in more careful driving, to avoid risky traffic situations, or to demand stricter policing.

In risk research, perceptions of uncertainty have received ample research attention. A study by Siegrist and Cvetkovich[10] showed that people's reported level of understanding about hazardous activities and technologies predicted the relation between risk perceptions and trust. When people judged themselves to have little knowledge there was a negative correlation between risk ratings and trust, whereas no association emerged for people who reported high levels of knowledge. Other relevant research examples are decision making under varying levels of statistical uncertainty,[11,12] the importance of the belief that consequences of hazards are known to science as a risk factor in the psychometric paradigm,[13] and how people interpret diagrams and graphs.[14,15]

In this article, we posit that people are subject to experiences of uncertainty when they find themselves in a risk context. We coin this as *experiential uncertainty*, and we argue that this type of uncertainty can be distinguished from other types of uncertainty—typically operating on a more cognitive level—that traditionally have received attention in risk research. This conceptualization is analogous to what Powell and colleagues call perceived uncertainty and is based on people's self-reports of experiencing uncertainty and puts emphasis on the *amount* of experienced uncertainty rather than the specific *content* of uncertainty.[16] An analogous division has been described by Slovic and Peters[17] in which they distinguish between risk as analysis versus risk as feelings.[18] The latter refer to our instinctive and intuitive reactions to danger. We posit that people's appraisal of uncertainty about risks can take place on an analytical level, and on a more experiential level. Individuals' feelings of uncertainty may inform them in shaping their risk-related reactions. Experiential uncertainty is considered to be a hot-cognition mechanism, and it involves more intuitive than reasoned reactions through a process of arousal.[19–21] This parallels the phenomena of the affect heuristic in which affect is used to inform persons in their risk evaluations (for example, feeling good can lead to the automatic inference that the risk is small and the benefits are large)[22] and of the anticipatory felt emotions that can influence risk decisions.[23] Similarily,

experiential uncertainty can inform people that the risk needs to be monitored and can steer their risk reactions.

People's experience of uncertainty can arise from different sources. People may be confronted with a specific situation that they appraise as uncertain (being exposed or pointed to a particular risk), events may trigger individuals to experience uncertainty (such as when reminded about a particular episode in the past in which they experienced uncertainty), or some persons might be relatively prone to experiencing feelings of uncertainty (e.g., when they have a low or unstable level of self-esteem or a high uncertainty orientation).[24] Although causes for being uncertain may vary from being temporal and event-specific to being chronic and trait-like, the general need to be certain is a powerful driving force that enables certainty compensation between different levels and domains.[25] Thus feeling uncertain may lead to compensatory tendencies that do not directly target the cause of uncertainty[8,26]—a process called fluid compensation. For example, research has shown that uncertain individuals attach more value to fair procedures than individuals who are not uncertain,[27] even when the source of uncertainty is independent of the source of fairness in the situation. In doing so, they try to reduce levels of uncertainty in other domains. So under conditions of uncertainty, people are inclined to activate mechanisms that alleviate the experience of uncertainty. In the current investigation, we study this phenomenon in a risk setting. Specifically, we argue and show that, in a context of risk, experiential uncertainty will moderate people's behavioral intentions and appraisal of trust. In the following sections, we articulate our predictions relating to people's demand for risk regulation and their trust in risk-governing authorities.

1.2. Demand for Risk Regulation

In modern societies, risks are increasingly expected to be managed, controlled, and mitigated.[28] Thus, establishing legal frameworks as well as the risk regulatory work of government agencies play an important role because the public must rely on those to keep risks at acceptable levels within a wide variety of domains, such as food risks, zoonoses, and technological risks. Therefore, demand by the public for stricter regulation of a particular risk is a common way for the public to respond to risks with which they are confronted.[29–32]

Following this observation, it may be expected that risk perceptions, the appraisal of how risky a person judges a particular risk phenomenon, generally have a positive relationship with a demand for regulation. Indeed, research has documented the link between risk perception and higher levels of regulatory preferences.[33,34] Yet the association between risk perception on the one hand and risk acceptance or mitigation preferences on the other is not clear-cut and may become weaker or insignificant depending on contextual factors such as when risk activities were undertaken voluntarily,[35] or when people associated desirable benefits with a particular risk.[36] Interestingly, one study found that the perceived *severity* of consequences was associated with demand for risk mitigation, but not the *probability* of the risk *per se*.[37] Finally, when individuals don't know how to cope with a risk or when mitigation measures have already been installed, risk perceptions may not be associated with mitigation preferences.[38,39] These studies suggests that personal relevance of a risk—judging consequences to be severe, risk measures have not yet been adopted, no perceived benefits—could be a factor that moderates the link between risk perception and demand for regulation. In the present research, we posit that a positive relationship between risk perceptions and demand for regulation is more likely to emerge when people experience uncertainty about the risk in question than when they do not. In that case, feeling uncertain about the risk will activate tendencies targeted at the reduction of the source of uncertainty.[9] In contrast, when people are not uncertain, we do not expect that risk perceptions will be related to demanding stricter regulation. For example, someone may perceive inoculations as bearing risks but at the same time may not experience uncertainty about the risk of receiving a vaccination. In that case, increasing risk perceptions are not associated with increases in demands for regulation.

Hypothesis 1. Risk perceptions are positively associated with a demand for regulation, but only when experiential uncertainty is relatively high.

Another central question in risk research is how the understanding of a particular risk domain is related to acceptance of the risk. Besides risk perceptions, the literature puts forward knowledge about risks. The assumption in what is known as the *knowledge deficit model* is that a lack of knowledge and understanding about certain risks produces a low level of acceptance.[40] Although the overly simplistic view of the knowledge deficit model has received criticism,[41] behavioral theories do indicate that knowledge plays a role in behavior, but mainly

because the level of knowledge about a particular behavior influences attitudes. For instance, data from public opinion research suggest that accurate knowledge of biotechnology is positively related to perceived benefits.[42] Hence, both theory and empirical studies suggest that knowledge might play a role in shaping attitudes,[43] but little is known about the conditions under which this occurs. We propose that experiential uncertainty may play an important role in undermining a possible negative relationship between risk-specific knowledge and demand for regulation. In particular, people will be guided by their experiential state of feeling uncertain about the risk rather than by an analytical processing of risk information.[44–46] This means that the effectiveness of informing people will be impotent and diminished by visceral processes.[47] Activation of the experiential system makes people prone to processing information heuristically rather than by using logical inferential rules.[48] Consequently, possessing knowledge about a risk topic is not likely to reduce a demand for regulation. In contrast, uncertainty reduction tendencies[9] play less of a role when people do not feel uncertain about risks and then being better informed may actually reduce people's demand for regulation.

Hypothesis 2. Risk-specific knowledge is negatively associated with a demand for regulation, but only when experiential uncertainty is relatively low.

1.3. Institutional Trust

Another key construct in risk research entails trust in institutions. Especially when it comes to risk phenomena with complex characteristics in which the general public are not trained and about which they do not possess in-depth knowledge, individuals must rely on institutions to manage those risks, and, consequently, trust reflects the perceived capabilities and motivations of risk managers.[49] Indeed, individuals must typically rely on their trust in risk regulators to compensate for their lack of knowledge.[50] For instance, research on gene technology has demonstrated that trust in institutions is an important predictor of risk acceptance.[51] In the current study, we therefore take an institutional perspective on trust, which we conceptualize as the willingness to be vulnerable to a trust party—the risk-managing institution.[52]

In risk governance, risk communication plays a central role alongside, for example, the more practical task of risk management.[53] It has been widely established that contemporary risk communication is not simply about "telling people the numbers," but rather involves a more participatory process of co-creation of risk messages.[54] Therefore, it may be expected that individuals are sensitive to the way risk communication is constructed. In this context, a relatively important predictor of trust is whether communication with the public is perceived to be open or not.[55,56] Based on the fairness heuristic theory, empirical evidence demonstrates that peoples' perception of whether they are approached fairly plays a pivotal role in how they evaluate organizations.[57] On the other hand, it is argued that being completely transparent by providing relatively open risk communication messages may disturb people, or confuse them.[12,58] For example, an investigation showed that, rather than receiving detailed risk information, participants preferred simply to know whether a situation was safe or unsafe.[59] We therefore do not expect a simple positive one-on-one relationship between openness in risk communication and trust,[60] but rather argue that this relationship is moderated by experiential uncertainty. Some early evidence has already shown that trust may be particularly affected when people are uncertain about a particular risk.[61] In this research, we expect that when people deal with experiential uncertainty in a risk context, they become more attentive to the openness of risk communication messages. Under such conditions, openness in risk communication will lead to relatively greater differences in trust judgments.[57,62]

Hypothesis 3. Openness in risk communication has a stronger effect on trust in risk-governing institutions under conditions of experiential uncertainty than in situations in which uncertainty is not salient

1.4. Overview of Studies

In this investigation, it is proposed that the experiential appraisal of experiential uncertainty plays an important role in individuals' perception, coping, and acts relating to risks. The aim of this research is therefore to investigate the role of experiential uncertainty within a risk context in relation to demanding government regulation, and to appraise trust in risk-managing institutions. In Study 1, we conducted a survey among members of the general public to examine the relationship between experiential uncertainty and risk perception (Hypothesis 1) and demand for regulation, and between experiential uncertainty and risk-specific knowledge (Hypothesis 2) and demand for regulation.

Furthermore, the appraisal of hazards is not only about perceptions and understanding of risk, but also about how institutions deal with them.[63] In Study 2, we operationalized experiential uncertainty by manipulating uncertainty rather than measuring it.[64] Thus within Study 2 we conducted an experiment in which we tested our expectation that experiential uncertainty and openness in risk communication by a public health agency have a joint effect on people's trust in risk-governing institutions (Hypothesis 3).

2. STUDY 1

2.1. Method

2.1.1. Participants and Procedure

The relationship between experiential uncertainty, risk perception, risk-specific knowledge, and demand for regulation was investigated in a cross-sectional study conducted among a convenience sample of members of the general public in the Netherlands. The respondents participated in the study by filling out a structured paper-and-pencil questionnaire. Approximately 50, well-instructed university students who were taking a course on risk communication collected the data at a variety of locations (e.g., train, shopping center, street, university) in order to obtain a diverse sample in return for partial course fulfillment. Altogether, a total of 1,017 completed questionnaires were collected and all participants provided informed consent.

Respondents were introduced to a description of 10 specific hazard topics from different risk domains (food hazard: antibiotics in meat, vitamin supplements, aspartame; food infections: salmonella, ESBL bacteria in meat, EHEC bacteria; medical risk: newly developed vaccine against H1N1 virus; novel foods: insects as food; other: radiation from cell phones, consumer fireworks). In total, these different risks were briefly described (10 different questionnaires were developed and each respondent completed one). In the descriptions, the background of the risk and the group that is exposed to it were briefly mentioned.

2.1.2. Measures

2.1.2.1. Experiential uncertainty. This was measured with a single item:[16] "I feel uncertain about [risk topic]" (1 = *not at all*, 7 = *very much so*).

2.1.2.2. Risk perception. Two seven-point scale semantic differential items measured risk perception:[65] "I find [risk topic] 1 = *extremely unsafe*, 7 = *extremely safe*" and "I find [risk topic] 1 = *extremely harmless*, 7 = *extremely risky*." The response to the first item was reversed, and the two items were combined to form a reliable scale (α = 0.83).

2.1.2.3. Risk-specific knowledge. This was assessed with true/false statements relating to the technical concepts of the selected hazards, or to relevant general background knowledge. Undergraduate students from a variety of majors (animal science, biology, consumer studies, food technology, life science communication, nutrition and health) developed for each of the 10 risk descriptions six true/false statements—participants could also tick a "don't know" box. The development of most of these items was derived from earlier course work or a literature search. Content validity was established through review of the questions by course instructors. Sample statements (T = true, F = false) for each of the hazards are "antibiotics may kill bacteria, but not viruses" (T: antibiotics in meat), "a high intake of vitamins is not harmful" (F: vitamin supplements), "sugar contains more calories than aspartame" (T: aspartame), "salmonella is a virus" (F: salmonella), "infection can be contracted if chicken meat is not cooked well enough during preparation" (T: ESBL bacteria in meat), "EHEC bacteria are only found on vegetables" (F: EHEC bacteria), "the vaccine is entirely new and not subject to conventional testing procedures" (F: H1N1 vaccine), "all insects can be used as sources of protein" (F: insects as food), "it's possible to sense radiation from cell phones" (F: radiation from cell phones), "in Belgium stronger fireworks are allowed" (T: consumer fireworks). A summative index counting the number of correct answers was computed (theoretical range: 0–6).

2.1.2.4. Demand for regulation. This was measured by a single item:[35] "To what extent do you think that [risk topic] should be regulated by the government?" (1 = *not at all*, 7 = *very much so*).

2.1.2.5. Perceived risk characteristics. Because participants were confronted with the descriptions of 10 different hazards, these may be judged to

Table I. Means, Standard Deviations, and Pearson Correlations Among Variables (Study 1)

		M	*SD*	1	2	3	4	5	6
1	Gender	0.54	0.50						
2	Age	31.48	15.24	–0.04					
3	Education	3.35	0.63	0.00	–0.04				
4	Experiential uncertainty	3.38	1.81	0.13***	0.14***	0.07*			
5	Risk perception	3.92	1.35	0.07*	0.19***	0.01	0.27***		
6	Risk-specific knowledge	3.21	1.51	0.00	–0.04	0.07*	–0.05	0.04	
7	Demand for regulation	5.17	1.55	0.06†	0.03	0.02	0.09**	0.06*	–0.05

Note: †$p < 0.10$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

differ with regard to several risk features. In order to control for some risk characteristics,[13] participants were asked to respond to statements about (1) whether they think exposure to the hazard is *voluntary*, (2) having personal *control* about being exposed to the hazard, (3) whether the hazard is fully *understood by science*, (4) whether the hazard is *invisible*, and (5) whether they think *large groups of people* may be affected by the hazard (1 = *completely not agree*, 7 = *completely agree*).

2.1.2.6. Demographics. Gender (0 = *male*, 1 = *female*), age, and highest finished level of education (1 = *no education/primary school*, 2 = *lower vocational training*, 3 = *intermediate vocational training*, 4 = *higher vocational training*) were measured as control variables.

2.2. Results

2.2.1. Descriptive Statistics

Of the 1,017 respondents, 461 were male and 552 were female (four respondents did not reveal their gender). Participants' ages ranged from 18 to 82 years[1] ($M_{age} = 31.48$; $SD_{age} = 15.24$; six respondents did not report their age). Of the participants, 0.8% had no education/primary school, 6.0% lower vocational training, 49.8% intermediate vocational training, and 42.8% higher vocational training (seven respondents did not report their education).

Means, standard deviations, and zero-order Pearson correlations between the variables are presented in Table I. Women reported higher levels of experiential uncertainty and risk perceptions, and age and level of education were positively correlated with experiential uncertainty. Furthermore, age was also positively correlated with risk perception, and level of education had a small but sigificant ($r = 0.07$) correlation with risk-specific knowledge. Experiential uncertainty also had small correlations with risk perception ($r = 0.27$) and demand for regulation ($r = 0.09$). With respect to the risk-specific knowledge index, participants scored just above the scale midpoint ($M = 3.21$).

[1]Sixteen participants were under the age of 18. As we were interested in the risk-related perceptions and attitudes of an adult sample, these responses were left out of the analysis.

Table II. Results of Regression Analyses of Risk Perception and Experiential Uncertainty on Demand for Regulation (Study 1)

Step and Variables	1	2	3
1. Voluntary	–0.12***	–0.10**	–0.10**
Invisible	0.09**	0.09**	0.09**
2. Risk perception		0.03	–0.12*
Experiential uncertainty		0.08*	–0.19*
3. Risk perception∗ experiential uncertainty			0.36**
ΔR^2	0.02***	0.01*	0.01**
Corrected R^2	0.02***	0.02***	0.03***

Note: Standardized regression coefficients are being reported.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

2.2.2. Test of Hypotheses

In order to test our expectations regarding the precise pattern of demand for regulation, two hierarchical regression analyses were performed. For Hypothesis 1, after controlling for the perceived risk characteristics in Step 1 and the main effects of both experiential uncertainty and risk perception in Step 2, the interaction term of experiential uncertainty and risk perception was added in Step 3. The predictor variables were centered before calculating the cross-product term and regression statistics.[66] The results of this regression analysis are presented in Table II. Only the perceived risk characteristics

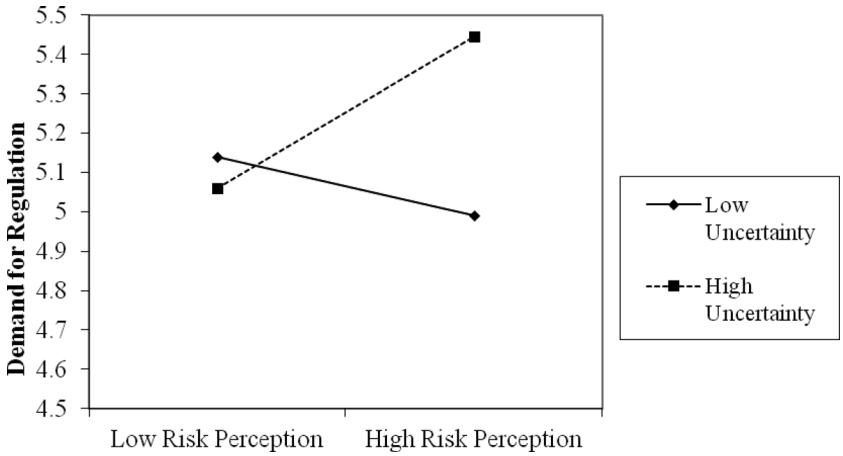

Fig. 1. The interactive effect of risk perception and experiential uncertainty on demand for regulation (Study 1).

from Step 1 that significantly predicted the outcome variable were retained in the final model. Of these, voluntary had a negative association ($b = -0.09$, $t = -3.68$, $p < 0.001$), and invisible ($b = 0.08$, $t = 2.77$, $p < 0.01$) had a positive association with demand for regulation. In Step 2, the analysis did not yield a significant association between risk perception and demand for regulation, $b = 0.03$, $t = 0.78$, *ns*, while experiential uncertainty was positively associated with demand for regulation, $b = 0.07$, $t = 2.46$, $p = 0.01$. Furthermore, in Step 3 experiential uncertainty and risk perception interacted in their effects on demand for regulation $b = 0.06$, $t = 3.11$, $p < 0.01$. Inclusion of this interaction effect resulted in a significantly improved model fit between Steps 2 and 3 of the regression model, $F = 7.80$, $p < 0.001$. To interpret this interaction effect,[2] the total regression equation was rearranged into simple regressions of demand for regulation on risk perception, given conditional values of experiential uncertainty (mean –1 *SD*, mean + 1 *SD*; cf. Ref. 66). As shown in Fig. 1, in the case of high experiential uncertainty, risk perception had a positive relationship with demand for regulation ($b = 0.14$, $t = 2.73$, $p < 0.01$). However, when experiential uncertainty was low, relatively low levels of demand for regulation were observed regardless of the strength of an individual's risk perception ($b = -0.06$, $t = 1.19$, $p = 0.24$). These findings signify that relatively high levels of experiential uncertainty are required to establish a positive association between risk perception and demand for regulation.

Another hierarchical regression analysis was conducted to test Hypothesis 2. After controlling for the perceived risk characteristics in Step 1, in the second step main effects of both experiential uncertainty and risk-specific knowledge and in the third step the cross-product term of experiential uncertainty and risk-specific knowledge were added. The results of this regression analysis are presented in Table III. Only the perceived risk characteristics from Step 1 that significantly predicted the outcome variable were retained in the final model. Of these, voluntary had a negative association ($b = -0.09$,

Table III. Results of Regression Analyses of Risk-Specific Knowledge and Experiential Uncertainty on Demand for Regulation (Study 1)

Step and Variables	1	2	3
1. Voluntary	-0.11^{***}	-0.10^{**}	-0.10^{**}
Invisible	0.09^{**}	0.09^{**}	0.09^{**}
2. Risk-specific knowledge		–0.04	-0.18^{**}
Experiential uncertainty		0.07^{*}	–0.10
3. Risk-specific knowledge * experiential uncertainty			0.23^{*}
ΔR^2	0.02^{***}	0.01^{*}	0.01^{**}
Corrected R^2	0.02^{***}	0.02^{***}	0.03^{***}

Note: Standardized regression coefficients are being reported.
$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

[2]Following a reviewer's suggestion, we also constructed a measure of cognitive uncertainty by computing a summative index that counted the number of "don't know" answers to the knowledge questions (theoretical range: 0–6). In the two separate regression models that tested Hypotheses 1 and 2, this index was included as an additional step. The results showed that—like its experiential counterpart—cognitive uncertainty had a positive association with demand for regulation, but that the interaction terms in the final regression step remained significant and resulted in a significantly improved model fit. This indicates that the moderating role of experiential uncertainty is significant over and above the influence of cognitive uncertainty.

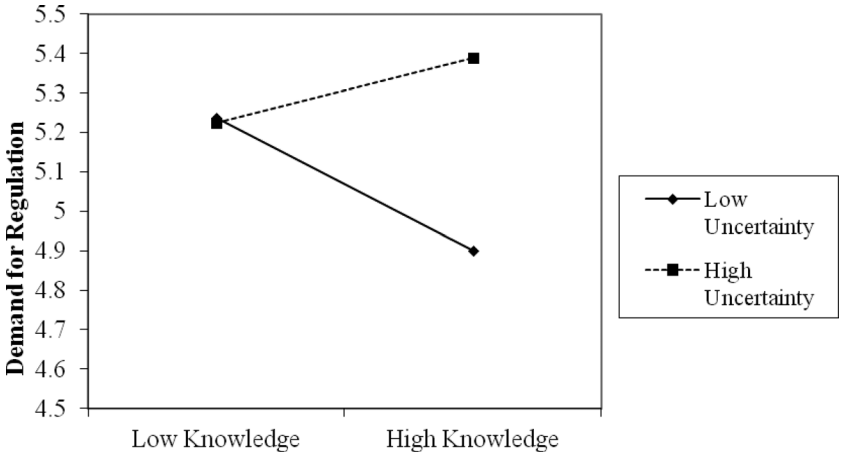

Fig. 2. The interactive effect of risk-specific knowledge level and experiential uncertainty on demand for regulation (Study 1).

$t = -3.56$, $p < 0.001$), and invisible ($b = 0.09$, $t = 2.98$, $p < 0.01$) had a positive association with demand for regulation. In Step 2, the analysis did not yield a significant association between risk-specific knowledge and demand for regulation, $b = -0.04$, $t = -1.13$, *ns*, while experiential uncertainty was positively associated with demand for regulation, $b = 0.06$, $t = 2.34$, $p = 0.02$. As expected, in Step 3 experiential uncertainty and risk-specific knowledge interacted in their effects on demand for regulation, $b = 0.05$, $t = 2.55$, $p = 0.01$. Inclusion of this interaction effect resulted in a significantly improved model fit between Steps 2 and 3 of the regression model, $F = 6.98$, $p < 0.001$. Again, to interpret this interaction effect, the total regression equation was rearranged into simple regressions of demand for regulation on risk-specific knowledge, given conditional values of experiential uncertainty (mean –1 *SD*, mean + 1 *SD*). As shown in Fig. 2, in the case of high experiential uncertainty, relatively high levels of demand for regulation were observed, regardless of the level of knowledge ($b = 0.06$, $t = 1.14$, $p = 0.25$). However, when experiential uncertainty was low, risk-specific knowledge had a negative relationship with demand for regulation ($b = -0.11$, $t = -2.56$, $p = 0.01$). These findings signify that more risk-specific knowledge about risks is only effective in reducing demand for regulation when experiential uncertainty is relatively low.

2.3. Discussion

The results of Study 1 corroborate our expectation that the experience of uncertainty can moderate people's reactions in a risk-related context. Specifically, the results showed that only for participants with relatively high levels of experiential uncertainty did risk perceptions have a positive relationship with demand for government regulation of risk. This relationship did not emerge for persons who experienced relatively little experiential uncertainty. In contrast, when people experienced little experiential uncertainty, an increasing amount of knowledge about the risk topic involved was associated with a weaker demand for government regulation of risk. When experiential uncertainty was relatively high, this relationship between risk-specific knowledge and demand for regulation was not found.

In Study 2, we aimed to extend these results by focusing on another aspect of the relationship between citizens and risk-governing institutions: by measuring the extent to which participants experience trust in the government as a risk communication party. It has often been observed that trust plays a pivotal role in risk communication because it has the property to substitute knowledge, for example, when a person is deciding whether or not to accept a certain risk situation.[41]

To further improve upon the generalizability of our findings and to avoid mono-operation bias, Study 2 differed from Study 1 with regard to how experiential uncertainty was operationalized, and we used an experimental design in order to be able to draw causal conclusions about the relationship between experiential uncertainty and trust in risk-managing government institutions in the context of one particular risk. While in Study 1 we asked respondents to respond to a relatively broad question about respondents' feelings of uncertainty in relation to a particular risk, in Study 2 we adopted a conventional procedure used in the uncertainty management literature that allowed us to manipulate experiential uncertainty.[67] In the experiment,

participants were asked to read a risk communication message ostensibly issued by the National Institute for Public Health and the Environment (RIVM). RIVM is the Dutch national government agency responsible for managing public health issues, and its tasks include risk communication about epidemics like Q-fever. The context of this communication was the epidemic of Q-fever,[68] a zoonosis caused by infected cattle that hit the Netherlands between 2008 and 2012, resulting in thousands of infections and at least dozens of deaths in humans.[69,70] The epidemic was widely covered in the media and caused a lot of unrest in Dutch society. Moreover, Q-fever is caused by a virus that has airborne properties, and outbreaks are more likely to occur with growing intensification of goat and sheep farms.[71]

3. STUDY 2

3.1. Method

3.1.1. Participants and Design

One hundred and twenty students from the Netherlands (52 men and 68 women) with an average age of 21.17 years took part in the experiment. Participants were randomly assigned to one of the conditions of the 2 (uncertainty salience: uncertainty vs. control) $\times$ 2 (openness in communication: low vs. high) factorial design. The design was balanced, with 30 participants in each of the experimental conditions.

3.1.2. Procedure

Participants were invited to take part in a study on communication about Q-fever. They were handed a paper-and-pencil questionnaire and, after a brief explanation of RIVM's tasks and duties, they were asked to read one of the two drafted versions of a risk information box, ostensibly from RIVM about Q-fever.

The information in the two versions (openness in risk communication low vs. high) was based on the developmental stages in risk communication introduced by Fischhoff.[54] According to this idea, risk communication has evolved from just telling the public the risk-related facts and figures to treating the public as a genuine risk communication partner. The latter is characterized as not only informing people, but also contextualizing the information and being open to their input. Thus rather than simply sending information, it captures a two-way communication process and is considered to be a more open way of risk communication. The two conditions differed on some specific points that reflected our operationalization of open and nonopen communication. In the open risk communication condition, the information box started off by mentioning that one of the tasks of RIVM is to inform the general public as much as possible. Then, information was provided about the location of infected farms (by showing a map), and details were disclosed about the number of infections by providing a table with the prevalence and mortality rate associated with Q-fever in the past six years. This information was contextualized by explaining what these figures mean for public health, and a comparison between Q-fever and influenza was made in order to reassure people. A number of measures taken by the government to mitigate Q-fever were mentioned, as well as some safety guidelines that the public should take into account. It was stated explicitly that the concerns and wishes of the public were considered, contact information was provided, and the public were explicitly invited to contact RIVM if they so wished. In the nonopen risk communication condition, the risk communication contained these elements to a lesser extent, or not at all. Specifically, the epidemiology of Q-fever was discussed in much less detail, and it was stated that the prevalence of the disease had recently reduced considerably. It was also mentioned that, because of privacy issues, no information could be provided about the location of infected farms and that provision of such information would not be beneficial to the general public. This was followed by the mentioning of a number of measures taken by the government to mitigate Q-fever. The information box ended by stating that additional information would be disseminated to the general public if RIVM judged it to be important, but that at present it was not deemed necessary to establish an information platform that people could contact.

After the participants had read the risk information box, uncertainty salience was manipulated. In line with previous uncertainty management studies,[67] participants were informed that "recent research suggests that feelings and thoughts about uncertainty (in the control condition: 'watching television') are helpful in understanding someone. Please find below two questions about your thoughts and feelings. We would like you to write down your first reaction to these questions. It is important not to think too long about your response, as the questions really concern your experiential and genuine

reaction." Participants in the uncertainty condition were asked to respond to two open-ended questions concerning their thoughts and feelings about their being uncertain. Participants were asked to write down their responses to the requests: (1) "Please briefly describe the emotions that the thought of your being uncertain arouses in you," and (2) "Please write down, as specifically as you can, what you think physically will happen to you as you feel uncertain." Participants in the control condition were asked two questions that were similar in format and that did not remind participants about their uncertainties.[27,72] These participants were asked to write down their responses to the requests: (1) "Please briefly describe the emotions that the thought of you watching television arouses in you," and (2) "Please write down, as specifically as you can, what you think physically will happen to you as you watch television."

After this, all participants completed the Positive and Negative Affect Schedule (PANAS),[73] on which they reported on 20 items how they felt at the time. Following previous uncertainty salience experiments,[27] the PANAS was included as a filler task and to determine whether the salience manipulation engendered positive and negative affect. Then, participants were asked to respond to questions about their level of experienced trust in RIVM, which comprised our dependent variable. Finally, in order to check whether the openness in risk communication manipulation was successful, participants were asked to report the extent to which they judged that the information from RIVM was open. After this, the participants were thanked for their participation and debriefed about the research.

3.1.3. Measures

3.1.3.1. Manipulation checks. In order to check whether openness in risk communication manipulation was successful, respondents were asked to what extent they thought that the information about Q-fever was presented in an open manner. Participants were asked to respond to seven questions (1 = *not at all*, 7 = *completely*) about the risk communication. An example of a question was: "to what extent do you feel that you have been informed enough by the information given by RIVM?," which was followed by five questions about the perception of open, full, frank, extensive, and egalitarian communication. Finally, people were asked whether they thought that their worries and needs were addressed in the risk communication from RIVM. These seven items were collapsed into a highly reliable scale ($\alpha = 0.92$).

Furthermore, following previous uncertainty management research,[27] both authors independently coded whether the responses that participants gave during the induction of uncertainty salience showed that they had been thinking about their being uncertain.

3.1.3.2. PANAS. The PANAS consists of two 10-item subsets[73] of statements relating to the affect experienced at the time (1 = *not at all*, 7 = *completely*), one measuring positive affect (PA) and one measuring negative affect (NA), and both subsets were averaged to form reliable scales ($\alpha = 0.83$ and $\alpha = 0.77$, respectively).

3.1.3.3. Trust. The dependent variable trust was based on Mayer and Davis's[74] measure. It measures three aspects of trust in an institution, tailored to the RIVM context. Participants responded to statements by indicating the extent to which they agreed with 11 trust-related statements (1 = *completely disagree*, 7 = *completely agree*). Three items measured ability-based trust (sample: "RIVM has a lot of knowledge about the work that needs to be done"), four items measured benevolence-based trust (sample: "RIVM will go out of its way to help me"), and four items measured integrity-based trust (sample: "RIVM tries hard to be fair in dealings with others"). The 11 items loaded on a single factor and were combined into a reliable scale of trust ($\alpha = 0.90$).

3.2 Results

3.2.1. Manipulation Checks

A 2 (uncertainty salience: control vs. uncertainty) × 2 (openness in communication: low vs. high) analysis of variance (ANOVA) on the perceived openness scale yielded only a main effect of openness in communication, $F(1, 116) = 8.40$, $p < 0.01$. As expected, participants who had read the open version of the Q-fever government information judged the communication to be more open ($M = 4.33$, $SD = 1.08$) than those who had read the nonopen information ($M = 3.71$, $SD = 1.25$). This shows that the openness in communication manipulation was successful in affecting the relative

strength of participants' openness judgments in ways that were intended with this manipulation.

Two judges coded whether the participants' responses during the induction of uncertainty salience showed that they had been thinking about being uncertain.[27] Cohen's κ was run to determine whether there was agreement between the two judges. There was high inter-rater agreement, $\kappa = 0.933$, $p < 0.001$. As expected, the two judges indicated independently of each other that what participants wrote down showed that most participants in the uncertainty condition had been thinking of their being uncertain, whereas those in the control condition had not. This suggests that uncertainty salience was successfully operationalized. One participant explicitly stated that he/she was not uncertain, and two participants did not answer the two uncertainty salience questions; these three cases were removed for the remainder of the analyses.[3]

3.2.2. PANAS Findings

Following previous uncertainty management experiments, the PANAS was administered immediately following the uncertainty salience manipulation, serving primarily as a filler task and to find out whether unintended effects of the salience manipulation on the positive and negative subsets were found. As expected, two 2 × 2 ANOVAs yielded no significant main or interactive effects on either the PA or the NA scale. Overall means of the PA and NA scales were 3.42 ($SD = 1.00$) and 2.27 ($SD = 0.80$), respectively.

3.2.3. Test of Hypothesis

The means and standard deviations of trust are presented in Table IV. A 2 (uncertainty salience: control vs. uncertainty) × 2 (openness in communication: low vs. high) univariate analysis (ANOVA) was performed to test Hypothesis 3. This ANOVA yielded no main effect of uncertainty, $F(1, 113) = 0.11$, *ns*, $\eta_p^2 < 0.01$, nor a main effect of openness in communication, $F(1, 113) = 0.12$, *ns*, $\eta_p^2 < 0.01$. The anticipated interaction effect was significant, $F(1, 113) = 5.98$, $p < 0.02$, $\eta_p^2 = 0.05$. In order to interpret this interaction effect, we performed one-sided contrast analyses. In line with Hypothesis 3, for participants who were instructed to think about uncertainty, the openness in communication procedure had a stronger effect on trust, $t(113) = 1.95$, $p = 0.03$, than for participants within the control condition, $t(113) = 1.51$, *ns*. That is, in the uncertainty condition, more openness in communication resulted in higher ratings of trust. Additionally, two contrasts indicated that within the high openness in communication condition an effect was found of uncertainty salience, $t(113) = 1.99$, $p = 0.02$, whereas within the low openness in communication condition no effect of uncertainty salience was found, $t(113) = 1.48$, *ns*.

Table IV. Means and Standard Deviations of Trust as a Function of Uncertainty Salience and Openness in Communication (Study 2)

Openness in Communication	Uncertainty Salience: Control *M*	Control *SD*	Uncertainty *M*	Uncertainty *SD*
Low	4.53	1.11	4.15	0.86
High	4.15	1.06	4.65	0.75

Note: Means are on seven-point scales, with higher values indicating more positive ratings of the trust variable.

4. GENERAL DISCUSSION

In this article, we have introduced the concept of experiential uncertainty and have argued, based on the outcomes of two studies, that it is crucial in understanding how risk perceptions, risk knowledge, and risk communication relate to the demand for risk regulation and institutional trust. In Study 1, our cross-sectional data showed that risk perception was positively associated with a demand for government regulation, but only under conditions of high experiential uncertainty. When experiential uncertainty was low, having more knowledge about the risk topic was associated with a weaker demand for government regulation of the risk—and this relationship disappeared under high experiential uncertainty. In Study 2, we extended our research to experiential uncertainty that is not related to a specific risk.

[3] We also ran the analyses without omitting these cases; the results were substantially identical, although somewhat weaker. With all cases retained, another series of one-sided contrast analyses was run. For participants who were instructed to think about uncertainty, the openness in communication procedure had a stronger effect on trust, $t(116) = 1.78$, $p = 0.04$, than for participants within the control condition, $t(116) = 1.50$, *ns*. Additionally, two contrasts indicated that, within the high openness in communication condition, an effect was found of uncertainty salience, $t(116) = 1.97$, $p = 0.03$, whereas within the low openness in communication condition no effect of uncertainty salience was found, $t(116) = 1.30$, *ns*.

Specifically, we tested and found that open risk communication led to more trust in risk-managing institutions, but only when experiential uncertainty was high. These results and their implications for theory and practice are discussed below.

The present research provides a better understanding of risk acceptance and risk-related attitude formation by shedding light on the moderating role of experiential uncertainty. This observation links up with the broader uncertainty management literature and shows that, under conditions of uncertainty, people are motivated to reduce levels of uncertainty.[9,62] Our results contribute to the risk literature because we found that the experiential appraisal of uncertainty plays a moderating role in risk reactions. That is, the presented results indicate that experiential uncertainty informs people in the process of forming risk reactions. This is akin to the functioning of the experiential system of information processing—in contrast to a more analytic system.[46] Indeed, feelings can be used as valuable sources of information in forming judgments,[75] and perhaps are particularly salient in a context of risk. The question remains as to how these insights into the moderating effects of experiential uncertainty can be utilized to shape better ways of risk communication. For one thing, it might be difficult to tailor risk information to audiences who differ on how prone they are to experience uncertainty, or have different levels of uncertainty tolerance.[24,76]

A promising direction for further research in this area would be to investigate whether experiential uncertainty should be seen as a trait-like reaction that some people are more prone to experience than others. To the best of our knowledge, this is at the moment unknown. One factor that could play a role here is who is affected by the risk.[77] It might be that when people believe that they will be personally affected, this raises their experiential uncertainty. This could, for example, be the case when the level of construal is low, that is, when people perceive a risk to be relevant on a spatial (i.e., in their area), temporal (i.e., within a proximal time frame), social (i.e., it could happen to people like them) or hypothetical dimension (i.e., they believe the risk event is not just some imaginary scenario).[78] If it is indeed the case that certain specific risks lead to more experiential uncertainty, then we suggest, based on the current results, that risk communicators adjust their message. Under such circumstances, knowledge provision will not be effective in raising acceptance of hazards. Instead, people will be more likely to process information heuristically, and risk communicators should try and make use of such heuristics.[22] Secondly, the concept of identity-protective cultural cognition argues that people will process information so as to justify how they want society to be organized. For example, while egalitarians will approve of pro-environmental policies, individualists and hierarchists will oppose them because such policies will hamper their opportunities (for individualists) and status (for hierarchists).[79] It could therefore be expected that when someone's social preferences are challenged by certain risks, this will increase experiential uncertainty.

Our results are furthermore relevant for the debate on the role that possessing risk-related knowledge plays in risk acceptance. The outcomes indicated that only among individuals who did not feel uncertain about risks was there a negative association between knowledge and demand for risk regulation. Interestingly, an earlier study demonstrated that only among individuals who reported relatively low knowledge levels did a negative association between risk perception and trust emerge, and a positive association between benefit perception and trust.[10] Care must be observed in comparing this work with the current study because in our article we have tried to measure objective hazard-related knowledge, while in the work of Siegrist and Cvetkovich a self-report of knowledge was used. However, one could argue that self-reported knowledge is inversely related with experiencing uncertainty about a certain hazard.

A potential limitation of Study 1 is that some concepts were measured in a rather concise way, and this needs to be discussed. Experiential uncertainty was measured simply by asking the extent to which people felt uncertain about a particular hazard. Given our conceptualization, we believe that doing so has its merits. In this article, we did not aim to probe for a cognitive understanding of uncertainty (e.g., "to what extent do you think it's likely that hazard X might come true?" or "to what extent do you think hazard X might have negative consequences?"). Instead, we wanted to test the effects of *experiential* uncertainty. That is, we sought to investigate the associations and consequences of risk-related evaluations when people *feel* uncertain in the context of particular hazards. We feel that, given the idiosyncratic nature of experiential uncertainty, asking a rather inclusive question about a person's experiences of uncertainty is a solid choice, but more research needs to confirm the validity of such a measure.[16] The same applies to our demand for

regulation measure. Depending on the specifics of a particular hazard, many different options can be favored in order to control, mitigate, or regulate it, and these actions could be taken by many different government agencies. Therefore, we have chosen to include a relatively holistic measure of demanding regulation in order to explore the effects on general risk-reducing tendencies.

The results show that the way risk communication is designed (open vs. nonopen) has implications for perceptions of trust toward the source of risk communication.[56] Indeed, research by White and Eiser[49] demonstrated that more transparency about a risk event led to higher trust, and that, in the case of a negative event, a lack of it was particularly detrimental for trust. Second, our results indicated that an effect on trust emerged only under conditions of experiential uncertainty. This parallels recent research by Siegrist and colleagues in which it was demonstrated that procedural fairness had a stronger effect on acceptance when people held a relatively strong moral conviction.[80] Attitude strength, just like experiential uncertainty, apparently makes individuals vigilant and steers risk judgments. Finally, it should be mentioned that creating trust is by no means an end goal of risk communication. Rather, people can use experiences of trust as input for their *subsequent* appraisal of risk communication,[56,60,81] such as the formation of benefit perceptions[82] and acceptance of technologies.[56] Similarily, trust might also act as a contextual factor that influences people's reception of risk communication. Therefore, levels of preexisting trust in risk authorities could influence experiential uncertainty in particular risk contexts and we think this should be further scrutinized.

Another aspect of the experimental procedure in Study 2 warrants attention. Participants were asked to respond to questions after relatively passively reading an information box about Q-fever, and it could therefore be argued that the results might have been stronger if the emotional involvement was deeper.[83] Alongside this, there is also the question of whether similar results could be expected in contexts of different hazards. Q-fever has a number of distinct features that make thorough scrutiny of risk communication about this topic likely. First, the Q-fever epidemic broke out recently within the Dutch context and affected a lot of people—thousands of them were infected and those are just the reported cases. Thus in terms of construal, this hazard is relatively concrete on the temporal, spatial, and hypothetical dimensions, making the psychological distance small.[84] Further, there is strong evidence that Q-fever is connected with intensive farming systems and is, hence, not a natural hazard but linked to human activity. Recent research suggests that people react more vigilantly to hazards that are caused by humans than to hazards that are not.[85] Finally, Q-fever is an involuntary risk because it is an airborne zoonosis, it has a relatively high base rate, and this public health episode had been shown to be socially amplified by the media, making three additional factors that draw attention to risk communication.[86] Altogether, we would expect that a similar pattern of results could be obtained when people are exposed to different types of hazards (such as mobile phone base stations), but that weaker effects may result for hazards with fewer of the high-profile characteristics such as a higher construal level, hazards caused by nature, that are not associated with stigma, that are not likely to be socially amplified, that have a low baseline risk, or that are communicated about by high-trust actors, or when the communication takes place in a high-trust environment.

5. CONCLUSION

Experiential uncertainty plays a moderating role in how individuals cope with risks. When people feel uncertain, higher risk perceptions lead them to express a higher demand for government regulation, and open risk communication leads to more trust in risk-managing institutions. Supposedly, both mechanisms are aimed at reducing experiential uncertainty. Understanding these processes sheds new light on questions surrounding risk acceptance, as well as risk communication.

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