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Enhancing Self-Protective Behavior: Efficacy Beliefs and Peer Feedback in Risk Communication

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In times of a high-impact safety incident citizens may have a variety of sources available to help them cope with the situation. This research focuses on the interplay of efficacy information in risk communication messages and peer feedback, such as responses on social network sites (SNSs) in the context of a high-impact risk on the intention to engage in self-protective behavior. The study pitted high and low efficacy information messages against supporting and opposing peer feedback ($N = 242$). Results show a significant interaction effect between efficacy information in a news article and peer feedback from SNS messages on both the intention to engage in self-protective behavior and levels of involvement. Participants who received the article with more efficacy information and also received supportive peer feedback via SNS messages were more likely to express higher levels of involvement and greater intentions to engage in protective behavior. When confronted with a low efficacious news article, the effect of peer feedback on these two variables was significantly stronger. Finally, implications for theory and government risk communication are discussed.

KEY WORDS: Efficacy beliefs; peer feedback; risk appraisal; risk communication; social media

1. INTRODUCTION

In times of a high-impact safety incident, the Dutch National Crisis Centre (N.C.C.) facilitates a website and a news channel to inform citizens in the afflicted areas about the risk, and to stimulate risk mitigation or self-protective action suitable in the particular situation. With recent incidents, however, it became clear that citizens also obtain information from other sources, such as social network sites (SNSs), to stay informed about the risk.[1] On these sites, involved citizens exchange experiences and give feedback and advice. Such social information can, for instance, be incident-related (e.g., "who did it," "is it dangerous?," etc.) or it can be advice on how to protect oneself. In addition, it may support the information provided by official channels, or it may be in sharp contrast to it. Current research indicates that authorities may increase citizens' likelihood of displaying self-protective behavior if risk information conveys a clear and concise action perspective, with added information about self-efficacy and response efficacy (efficacy beliefs).[2] It is unclear, however, how effectiveness of such information is impacted by the feedback and opinions of peers that is available in abundance on the Internet, especially through SNSs. In this study, an experimental design will be used to uncover the interplay between official risk messages against risk information via SNSs and their effects on citizens' intention to take self-protective measures.

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1.1. Efficacy Beliefs in Risk Communication

One way of protecting citizens and reducing the risks citizens face is through risk communication in

which relevant precautionary measures are communicated (this is sometimes called crisis communication as well). In high-impact incidents involving, for instance, the release of hazardous chemicals or contaminated smoke, the government may advise citizens in the surrounding area to stay inside and shut down the in-house ventilation as a precautionary measure. This advice is called the action perspective. Because not every citizen may know which measures to take, risk communication in the "hot phase" should provide the public with information on how to cope with the threats it faces; motivating citizens to engage in self-protective behaviors in fact reduces the risk they face. Presumably, risk information in the context of an acute high-impact incident, e.g., involving the release of hazardous chemicals or contaminated smoke, increases risk perception, and as such has a similar impact as a fear appeal. Indeed, an official inquiry by an independent organization into a recent high-impact incident in the Netherlands led to the conclusion that citizens actually experienced severe risks to their health, and that governmental organizations failed to adequately address citizens' concerns in their communication.[3]

Recent theories in the area of fear appeal suggest that efficacy beliefs can be applied to design an effective risk communication message.[2,4,5] Efficacy beliefs comprise attributed self-efficacy ("I think I can cope with the threat myself") and attributed response-efficacy ("the action perspective to deal with the threat is successful in removing the threat") related to a specific action perspective. These factors have been studied extensively in different risk domains (health promotion, safety risk reduction).[5–7]

According to the Extended Parallel Process Model (EPPM),[4] fear appeals lead to two appraisals, with three potential outcomes. First, people will appraise the threat level, and with a threat appraised as serious, will be more motivated to assess the efficacy of an action perspective ("what can I do to successfully cope with the threat?"). If the threat is evaluated as irrelevant or as insignificant, then the motivation to take further action is reduced to zero (potential outcome 1). If the threat is appraised as serious and relevant, then people will be motivated to take additional action to reduce the level of fear that is invoked by the threat or the risk message.[5] However, only experiencing a risk as threatening or likely to occur is not enough to engage in self-protectiveness.[6] The appraisal of the effectiveness of the action perspective (that is, the self-efficacy and the response-efficacy attributed to the action perspective) is decisive for the direction of additional actions. If the appraisal of effectiveness is positive (potential outcome 2), this will result in danger control, i.e., the activities will take the form of taking self-protective measures or seeking additional information.[2,4,8] If the appraisal is negative or if serious doubts about the effectiveness of the action perspective exist (potential outcome 3), then EPPM assumes that the fear will be controlled psychologically by means of denial ("it will not happen"), defensive avoidance ("I'm not going to spend any time on this"), or reactance ("it is just another government scheme").[5] This means that, to enhance self-protectiveness through governmental risk communication, citizens must (1) be risk aware, (2) perceive the risk at hand as severe and feel vulnerable, and (3) must perceive themselves as able to perform the advised behaviors, and perceive that behavior as effective to cope with the threat.[4,9]

This notion was tested by Kievik and Gutteling.[2] In their study on the risk of flooding, risk perception and efficacy beliefs proved to be strong predictors of participants' intentions to take self-protective actions. In this study, high- and low-risk communication messages were developed that also influenced people's efficacy beliefs. After being exposed to the manipulation, participants were asked whether they would take precautionary measures to protect themselves against the risk of flooding. Results showed that participants who were exposed to the high-risk–high-efficacy manipulation were significantly more willing to engage in self-protective actions than participants in any of the other conditions. Furthermore, not only were they more inclined to seek additional information about the risk, they were also more likely to actually click on the URL of a specific website related to flood risks. In the high-risk–high-efficacy beliefs condition, 96% of the study participants chose this URL, as opposed to 54% in the low-risk–low-efficacy beliefs condition.

Within a risk situation, participants may show high levels of risk appraisal.[10] Therefore, the communication message provided should aim at enhancing the efficacy beliefs of the residents. By giving clear and distinct prospects for action, and by providing clear guidelines on how these actions can be undertaken, participants might be more willing to follow these recommendations.

1.2. Peer Feedback in Risk Communication

With ongoing developments in the information and communication technology, SNSs have gained importance as a news source for large groups of the public.[11] The use of SNSs as an information source apparently has several advantages for members of the public. First, SNSs are an easy accessible way to stay informed.[1,12,13] Second, SNSs allow citizens to obtain the feedback and opinions of other users,[14] who are independent of organizations involved in the crisis, are presumed to be judged as peers and more similar to the average citizen, and, hence may have more impact than the involved but distant official organizations. Finally, the information is often distributed very quickly, allowing almost real-time information provision about (changes in) the current situation.[1]

Such quick responses from peers with eyes-on-the-ground may be judged as very valid to those members of the public who need to make a decision on whether and how to engage in self-protective actions.[16] Moreover, some media (e.g., Twitter) allow users to obtain information about the actual spatial distance between information source and one's own location, thereby enabling better assessment of information relevance.[13]

The question related to the use of SNS as a source of risk information is what impact they may have on the likelihood of the public to engage in self-protective actions. Recent research regarding two high-impact incidents in 2009, the Red River floods and the Oklahoma grassfires, indicates that citizens perceived the messages and feedback from other Twitter users as reliable and usable.[13] Consequently, peer feedback and the information from significant others via such media may be highly important in people's decision-making processes in this context.[17–20] On SNSs, people can learn how others deal with a particular risk situation, thus in fact receiving clear guidelines on how to act. When confronted with supporting or opposing outcomes of actions taken by others, the intention to engage in these particular tasks may increase or decrease.[4,18,21]

Peer feedback may not always lead to adaptive behavior, but also to maladaptive behavior. When confronted with negative or opposing peer feedback, one is more likely to engage in maladaptive behavior than without that social feedback.[17] Such feedback and opinions of peers have been found to play an important role in the display of negative behavior by citizens in various domains, such as criminal behavior,[17] and health-related behaviors as alcohol consumption,[22] eating and body image,[23] and abstinence from condom use.[24] Unaware of any empirical support for this assumption from the domain of physical safety, we assume that the type of peer feedback is important in a risk situation involving physical safety issues as well. Exposure to peer opinions that oppose the self-protective behavior advised by authorities may cause people to become confused and/or reduce the likelihood to engage in that behavior. However, it is to be expected that the effect of such peer opinions will be less if official risk information is able to increase recipients' efficacy beliefs.

1.3. This Study

A field experiment was conducted to test the effect of risk communication aiming to increase efficacy beliefs and peer feedback. Participants were exposed to a scenario of a realistic high-impact safety incident; afterwards, they first read an official risk communication message either aiming to increase efficacy beliefs or not (analogous to Kievik and Gutteling[2]), and supporting versus opposing peer reactions to the incident on a SNS. Finally, participants' intention to engage in self-protective behavior and involvement were measured.

Based on the results found in Kievik and Gutteling,[2] we expect that participants will be more inclined to follow official risk communication with regard to self-protective behavior when this enhances efficacy beliefs:

> H1: Risk communication containing efficacy information will result in a higher intention to engage in self-protective behavior than risk communication that does not contain efficacy information.

Secondly, supporting peer feedback that reinforces and is in line with the official communication is expected to result in a higher likelihood that self-protective behavior will be displayed, in contrast to opposing peer feedback that is not in line with the official communication:

> H2: Supporting peer feedback from SNS messages will result in a higher intention to engage in self-protective behavior than opposing peer feedback.

Finally it is important to gain insights into the interaction of both governmental risk communication

[1] See the extensive review of the literature review on trust and risk management.[15]

and peer feedback from SNS messages. Based on the assumption that citizens who are involved in a high-impact incident but who have a high level of self-efficacy belief and a strong belief in the successful outcome of their own actions will be less in need of additional information on how to behave adequately in face of the risk, we expect that the effect of supporting and opposing peer feedback is higher when efficacy beliefs are low, compared to when they are high. Therefore, the third hypothesis is:

> H3: The effect of peer feedback from SNS messages on the intention to engage in self-protective behavior will be less strong when risk communication contains efficacy information compared to when it does not.

2. METHOD

2.1. Design and Procedure

The study is a 2 (Efficacy information: high vs. low) × 2 (Peer feedback: supporting vs. opposing) between-participant experiment. In June 2011, randomly selected citizens living in the east of the Netherlands were invited by e-mail to participate in the study. A total of 242 participants was randomly assigned to the experimental conditions. Participants were told that they would be participating in a study regarding the role of road safety in their hometown. To increase realism, we adopted the procedure used by Kievik and Gutteling.[2] This procedure required them to fill in their postal code; participants were then asked to wait a few seconds to let the computer indicate the amount of risk in their environment. They then received a manipulated "result," a fear appeal: this result stated that their postal code had indicated that in their direct surrounding large amounts of hazardous substances by truck or by rail took place on a daily basis, and described the potential risks (risk perception) associated with it (see Appendix A).

2.2. Manipulation of Efficacy Information and Peer Feedback

After reading this "risk message," participants were asked to read a newspaper article about a large fire at a train station in the area of the Netherlands in which they all lived. The newspaper article contained a picture of a freight train being on fire at a shunting yard in the east of the Netherlands (Appendices B and C). Several of the burning rail cars contained hazardous substances such as ammonia and ethanol. The article was based on an existing risk communication message regarding a similar event, and was rewritten in two versions.

Half of the participants received a high efficacy information message containing information about the fire, with several added aspects to increase the perceived levels of efficacy beliefs, in conformance with Kievik and Gutteling.[2] To manipulate self-efficacy and response efficacy, the article contained the following text: "There are several easy ways to take precautions that will decrease the risks regarding ammonia to a minimum. The following self-protective actions have proven to be very effective," followed by a list of self-protective actions, advising them to stay or go inside and close doors and windows and shut down everything for in-house ventilation, such as extractor hood, exhaust duct, wall, and toilet vents, stay inside a room that can be sealed off, preferably in the middle of the house or building, and, if outside, to walk perpendicular to the wind with a handkerchief covering nose and mouth. The other half of the participants received a message without efficacy information (the low efficacy information condition).

After reading the article, half of the participants received predominantly supporting, reinforcing Twitter messages from peers regarding the self-protective behaviors within the news article (supporting peer feedback condition), whereas the other half received predominantly opposing message (i.e., the opposing peer feedback condition). In the former, 10 Twitter-like messages were shown, all supposedly written by peers, of which eight gave positive, supportive feedback on the given advice from a peer's perspective, and two were neutral; this, we hoped, would increase realism. The tweets were incorporated in the online questionnaire and in each condition all 10 messages were simultaneously shown on screen. For instance, with regard to the first action (closing ventilation) clear guidelines were given on the location and effectiveness of this action: "Closing the doors and ventilation?? Did it, and it was easy!!!" and "Doors were closed already and found the ventilation grids! They are above the windows!!!." In the opposing condition eight Twitter messages reflected reactions from peers who found it hard to deal with the self-protective behaviors or who thought that these behaviors were unnecessary or ineffective: "Yeah right, closing the windows as coping strategy? What about my ventilation system, the grids are impossible to find?!!," "Closing the ventilation grids. . .as if that would make any

difference to ammonia smoke!!," etc. As in the supporting condition, two of the messages were neutral. The SNS messages can be found in Appendices D and E. This manipulation was pretested. Results of the pretest showed that participants in the high efficacy information condition reported higher efficacy beliefs than the low efficacy information condition ($F(1, 29) = 5.27, p = 0.05$).

2.3. Measures

At the start of the experiment, participants were asked to fill in some demographic variables to check for group differences. Variables that were included were gender, age, and highest completed (Dutch) education. Furthermore, participants were asked to which extent they used social media and whether they lived in close proximity to a highway or bus or train station. With regard to the manipulation of risk perception, questions were added about the postal code and perceived threat with regard to the transportation of hazardous substances.

After having read the news article and Twitter messages, participants were presented with a short list of questions, to be answered on five-point-Likert scales, mostly in the form of: 1 (strongly disagree) to 5 (strongly agree).

Based on a previously validated questionnaire,[2] the intention to perform self-protective behavior was measured using a six-item scale. Participants were asked how likely they were to adopt the self-protective behaviors ($\alpha = 0.80$). Specific items focused on following official instructions, close windows, doors, and ventilation grids, seek for additional information, etc. Overall, the mean score for intention to perform self-protective behaviors was $M > 4.4$ for all conditions, indicating a relatively high level of intention to take self-protective measures.

Both self-efficacy and response efficacy items were used to measure *efficacy beliefs*. Self-efficacy was measured using questions as: "When I am outside during a crisis with ammonia, I know how to act" ($\alpha = 0.78$). Levels of *response efficacy* tapped into the perceived effectiveness of the advised (official) governmental self-protective behaviors ($\alpha = 0.74$). A sample response efficacy question is: "I think that complying with the emergency measures reduces my risk of contamination with the released hazardous materials." When items of both self-efficacy and response efficacy were taken together to reflect efficacy beliefs ($r = 0.59$), the overall scale proved to be highly reliable ($\alpha = 0.84$). The averages for efficacy beliefs ranged between $M = 3.17$ and $M = 3.482$, indicating an ambivalence toward the belief in one's coping possibilities and the effectiveness of the provided advice.

To ascertain whether the peer feedback manipulation had been effective, items were added that required participants to evaluate the message position. (Questions measured whether the messages were perceived as positive, reliable, realistic and informative. The positivity question was used to distinguish the supporting [more positive] and opposing [less positive] tweets.) To assess the extent to which participants remembered information from the news article and the SNS messages, a small nine-item information retention test was conducted. On average, participants remembered 80% of the information presented in the news article and SNSs.

An alternative explanation for the effects of peer feedback and efficacy information would be that opposing peer information alarms people, spikes involvement, and causes them to process the risk information more elaborately, thus creating differences between risk information aimed at increasing efficacy beliefs versus not. To rule out this possibility, the experiment was designed so that risk information and the embedded efficacy manipulation were supplied before peer feedback was manipulated, making it highly unlikely that the latter would be able to affect processing of the former. Cognitive elaboration being rather difficult to assess in the current setup, we decided to incorporate a different yet related measure, viz. involvement. Involvement has often been found to be a predictor of elaboration; if indeed cognitive elaboration would be increased as a result of exposure to negative information, we would also expect this to become evident from increased involvement as well.[25–27] Involvement can also be regarded as an indicator of risk appraisal, or the assessment of the individual relevance of a particular risk and as such it is shown to be a predictor of affective reactions toward the risk.[20] In the EPPM the appraised personal risk is labeled vulnerability or susceptibility[5] and considered an antecedent of behavior(al intention). Measurement of *involvement* consisted of four questions requiring participants to rate the extent to which they (a) thought it was important to be informed about transportation of hazardous substances in their neighborhood, (b) were interested in the consequences of accidents involving release of hazardous substances, (c) felt involved with the risks regarding the transportation of hazardous substances, and (d) believed that an accident involving

Table I. Intention to Engage in Self-Protective Behavior as a Function of Efficacy Information and Peer Feedback (Five-Point Scale; Higher Scores Indicate Stronger Intentions)

	Efficacy Information								
	High			Low			Total		
Peer Feedback	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*
Supporting	4.59	0.48	60	4.69	0.35	63	4.64	0.42	123
Opposing	4.66	0.57	62	4.42	0.68	57	4.55	0.64	119
Total	4.63	0.53	122	4.56	0.55	120	4.60	0.54	242

hazardous substances would affect them ($\alpha = 0.87$). The mean score for involvement ranged between $M = 3.50$ and $M = 3.90$, indicating a moderately high level of involvement with the risk.

Participants' perception of risk was measured using 10 severity (e.g., how serious and how risky they thought an accident with transportation of hazardous substances would be) and five vulnerability items (e.g., how likely they thought an accident with transportation of hazardous substances in the Netherlands would be, and how likely they thought it would be that they themselves would be confronted with such an accident); this scale had a high reliability ($\alpha = 0.92$).

2.4. Participants

In total, 242 participants took part in the experiment. Of these participants, 61% was male, and the average age was 54 years ($M = 53.54$, $SD = 13.55$). Furthermore, 52.07% of the participants has completed a higher education and 21.90% a tertiary education. When asked how often they used social media, 45.87% reported never to do so, 31.00% used it sometimes, and 23.14% did so frequently. In addition, 48.76% of the participants reported living close to a highway, and 43.39% living close to a bus or train station. Unfortunately, risk perception scores did not deviate from the scale midpoint, $M = 2.98$, $SD = 0.72$.

3. RESULTS

3.1. Background and Manipulation Checks

No differences were found between the groups in gender distribution (χ^2 (3) = 4.79, n.s.), age (F (3,241) = 0.44, n.s.), education (F (3, 238) = 0.60, n.s.), social media usage (χ^2 (12) = 13.3, n.s.) = 0.53, n.s.), closeness to a highway (χ^2 (3) = 3.87, n.s.), closeness to a bus or train station (χ^2 (3) = 1.95, n.s.), or risk perception (F (3, 238) = 1.62, n.s.).

To test whether the efficacy belief manipulation was successful, the overall efficacy belief scale was subjected to an analysis of variance; the results showed efficacy beliefs to be slightly higher in the high efficacy information condition compared to the low efficacy belief condition ($M = 3.44$, $SD = 0.65$ vs. $M = 3.22$, $SD = 0.73$; F (1, 238) = 6.03, $p = 0.015$). Results also showed a main effect of the peer feedback manipulation on levels of perceived positivity (F (1,241) = 34.40, $p < 0.01$); in the opposing condition reported positivity was lower than in the supporting condition ($M = 2.38$, $SD = 0.76$ vs. $M = 2.98$, $SD = 0.82$).

3.2. Effects of Peer Feedback and Efficacy Information on Intention

An ANOVA was used in which efficacy information and peer feedback were inserted as independent variables, and the intention to engage in self-protective behavior as dependent variable; means and standard deviations are displayed in Table I.

Contrary to expectations, no significant main effect of efficacy information on the intention to engage in self-protective behavior was found (F (1,238) = 1.18, n.s.). Similarly, peer feedback could not be shown to affect intentions (F (1,238) = 2.2, n.s.).The interaction effect between efficacy beliefs and peer feedback, however, turned out to be significant (F (1,238) = 6.39, $p = 0.01$; $\eta^2 = 0.03$; see Fig. 1).

Subsequent planned comparisons showed that in the high efficacy information condition, participants did not respond to differences in peer feedback on the intention to engage in self-protective behavior ($M_{\text{supporting peer feedback}} = 4.59$, $SD = 0.48$ vs. $M_{\text{opposing peer feedback}} = 4.66$, $SD = 0.57$; $F < 1$). In the low efficacy beliefs condition, however, the difference between the peer feedback conditions on the intention to engage in self-protective behavior was significant ($M_{\text{supporting peer feedback}} = 4.69$, $SD = 0.35$ vs. $M_{\text{opposing peer feedback}} = 4.42$, $SD = 0.68$;

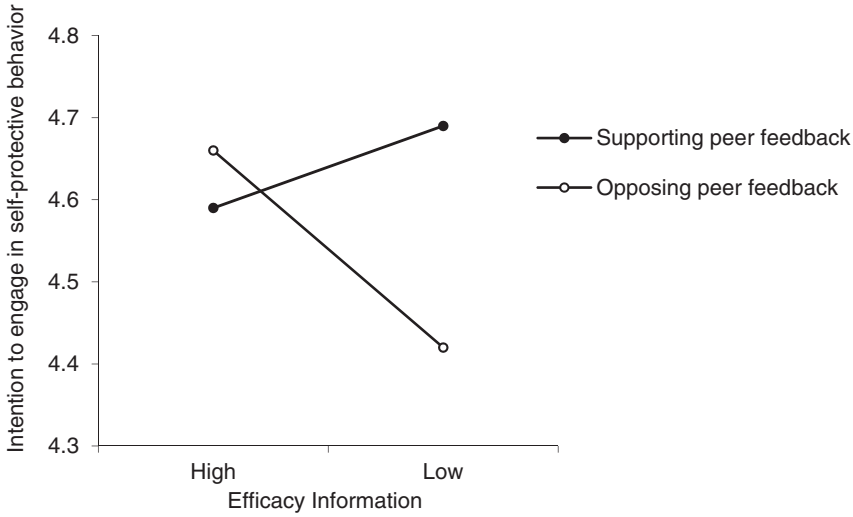

Fig. 1. Interaction effect between efficacy beliefs and peer feedback on the intention to engage in self-protective behavior.

Table II. Involvement Ratings as a Function of Efficacy Information and Peer Feedback (Five-Point Scale; Higher Scores Indicate Higher Involvement)

	Efficacy Information								
	High			Low			Total		
Peer Feedback	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*
Supporting	3.54	0.85	60	3.91	0.78	63	3.73	0.83	123
Opposing	3.69	0.87	62	3.50	0.98	57	3.60	0.92	119
Total	3.62	0.86	122	3.72	0.90	120	3.67	0.88	242

F (1, 238) = 7.99, $p < 0.01$; $\eta^2 = 0.03$). Apparently, the effect of peer feedback on the intention to engage in self-protective behavior is stronger when a message does not allow for the formation of efficacy beliefs compared to when it does.[2]

[2]In addition, we have analzed the relationships between perceptions of efficacy and peer feedback on the one hand and behavioral intentions on the other by inserting efficacy belief and perceived positivity ratings as predictors in a linear regression. The results suggest that both perceived positivity and efficacy belief ratings positively affect behavioral intentions (t (242) = 3.56, $p < .01$ and t (242) = 3.72, $p < .01$, respectively); in support of the ANOVA results, the interaction term was also significant, t (242) = –3.14, $p < .01$. The variance explained by this regression model was 12.4% as opposed to 3.4% for the ANOVA model. Subsequent analyses simultaneously incorporating the manipulated variables and the perception of efficacy, following the procedure for moderated mediation testing suggested by Muller *et al.*[28] (also see Preacher *et al.*[29]), did not yield evidence for any mediational role of efficacy perceptions, as indicated by nonsignificant Sobel test statistics; the resultant model explained 10.42% of the variance.

3.3. Effects of Peer Feedback and Efficacy Information on Involvement

An ANOVA with efficacy information and peer feedback as independent variables, and involvement as dependent variable, means, and standard deviations are displayed in Table II.

The analysis revealed nonsignificant main effects of both the former and the latter (F (1,238) = 0.66, n.s., and F (1,238) = 1.23, n.s., respectively). The interaction of both variables, however, was significant (F (1,238) = 6.28, $p = 0.01$; $\eta^2 = 0.03$ (see Fig. 2). Planned comparisons revealed that in the high efficacy condition, participants did not respond to differences in peer feedback in terms of involvement with the crisis at hand ($M_{\text{supporting peer feedback}} = 4.59$, $SD = 0.45$ vs. $M_{\text{opposing peer feedback}} = 4.66$, $SD = 0.57$; $F < 1$). On the other hand, in the low efficacy beliefs condition, the difference between the peer feedback conditions on involvement was significant ($M_{\text{supporting peer feedback}} = 4.69$, $SD = 0.35$ vs. $M_{\text{opposing peer feedback}} = 4.42$, $SD = 0.68$; F (1, 238) = 6.47, $p = 0.01$; $\eta^2 = 0.03$).

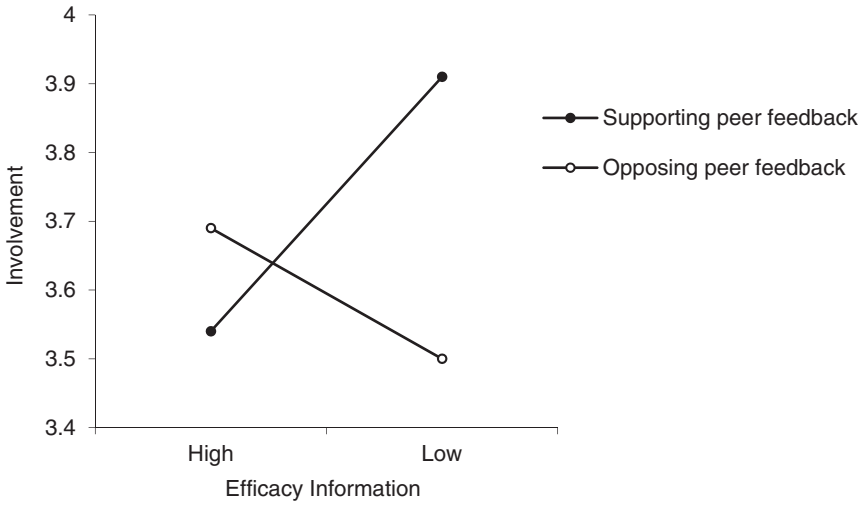

Fig. 2. Interaction effect between efficacy beliefs and peer feedback on involvement.

Based on this interaction effect, when one receives a low efficacious risk communication, the effect of peer feedback on involvement is stronger when efficacy information is low than when it is high. Due to this finding the alternative explanation, that opposing peer information promotes more elaborate processing of the risk information, is highly unlikely. This explanation would imply that exposure to opposing peer feedback results in higher involvement, which is clearly not the case here.

3.4. Conclusions and Discussion

By manipulating levels of perceived efficacy through a newspaper article and by providing peer feedback from SNS messages that reflected positive supporting peer feedback or negative opposing peer feedback, this study tried to gain insights into the formation of intentions to engage in self-protective behavior by citizens when both information sources are simultaneously present. The results provide support for the hypothesis that the effectiveness of peer feedback on SNSs depends on efficacy information: when participants received a high efficacious message, peer feedback from SNS messages proved not to have any effect on the intention to engage in self-protective behavior, as opposed to a low efficacious message. Apparently, low efficacious messages do not meet people's needs when in a situation of crisis, and cause people to turn elsewhere.

This interpretation is supported to some extent by the effects found on involvement. Although one might argue that opposing peer information causes more elaborate processing of the risk message, in turn resulting in higher effectiveness of the embedded efficacy information, our results provide no support for this alternative explanation. This conclusion, however, is based on our involvement measure rather than on a direct measure of cognitive elaboration; hence, this should be interpreted with considerable care. It should be noted, however, that the experiment was designed so that exposure to peer information took place only after the efficacy manipulation; this setup in itself decreases the likelihood of the alternative explanation.

Some practical and procedural limitations of this study have to be mentioned. In this research no main effect of efficacy beliefs on the intention to engage in self-protective behavior was found. Witte[5] indicates that, to enhance self-protective behavior among participants, high levels of risk perception and efficacy beliefs are desired. Although efficacy beliefs should always reflect some effect on self-protective behavior, this effect is stronger in combination with high levels of risk perception.[2] The average score of 2.5 on risk perception could indicate that participants did not perceive the transportation of hazardous substances as a potential threat to them. Therefore, the chosen risk might not be frightening enough to increase the perceived levels of risk among participants. Therefore, in future research another risk topic or manipulation should be used that might induce higher levels of risk perception in participants. Moreover, to measure the levels of positivity and reassurance in peer feedback only two questions were used. The use of only two items might result in biased conclusions about whether participants felt that the social media messages were either

supporting or opposing. Therefore, using more items seems advisable.

Several factors may influence how citizens behave in a risk situation, specifically whether or not they will engage in self-protective behavior. Efficacy information is instrumental in promoting the intention to adopt self-protective behaviors through efficacy beliefs;[2] in this study, efficacy information was embedded in a newspaper article, but this might not always be the case. Extending on these findings, we would like to argue that those particular media, be it newspapers, online forums, or SNSs, that are most able to increase citizens efficacy beliefs will turn out to be most influential in bringing about self-protective behaviors. We should keep in mind, however, that peer feedback via SNSs or similarly does not necessarily provide information about the best course of action to be taken when crises loom or run wild. Our results have important implications for governmental institutions that desire their well-balanced and well-founded risk information to have the strongest effect, to ensure the safety of all citizens. If misinformation and adverse advice of peers, however well-intended, is to be rendered ineffective, these institutions should make sure that the information that they provide is as clear as crystal on what to do to avert the negative consequences of a disaster.

To accomplish this, risk communication experts should try to enhance levels of efficacy beliefs in their (governmental) communication messages. This will on the one hand result in more self-protectiveness among citizens and on the other hand will temper the effect of peer feedback from the SNS.

APPENDIX A

Based on your postal code, results show that you are at a **high risk** regarding the transportation of hazardous substances.

The transportation of hazardous substances is common. In your area, the transportation takes place both on the roads as per rail, within and outside the build-up area. A lot of these hazardous substances could pose a real threat to your health and safety.

In case of an accident with the transportation of hazardous substances, a large radius around the accident area is involved. Furthermore, the blending of the different hazardous substances could result in a dangerous situation. Every category of substances poses a different threat to the surrounding. For instance ammonia can be categorized under "toxic liquids."

Risks

The transportation of hazardous substances can pose the following risks to the direct surrounding:

(1) A large fire as a result of a inflammable liquid, such as gasoline.
(2) A large burning cloud as a result of LPH.
(3) A toxic cloud, like in the case of a chlorine outbreak.
(4) A evaporating toxic liquid, such as ammonia.
(5) An explosion due to explosives.

APPENDIX B: FREIGHT TRAINS CONTAINING AMMONIA AND ETHANOL ON FIRE

Freight trains containing ammonia on fire. Photo ANP (2011).

At a shunting yard in the east of the Netherlands, three freight trains are on fire. Around midnight, houses within a radius of 2 km to the fire were evacuated as a precautionary measure due to the risk of an explosion and possible release of hazardous substances. Because of the strong wind, surrounding villages are also at risk of being affected by consequences of the fire.

Two of the freight trains contain ammonia and the third contains ethanol. The fire department has been trying to control the fire since last night. At the shunting yard, several other freight trains contain the highly inflammable ethanol. Therefore, these freight trains are kept wet and at a low temperature.

Soot samples taken from the smoke by the RIVM (Dutch institute for public health and environment) show higher concentrations of ammonia in the direct surroundings of the fire. To protect oneself from the risks regarding the fire, several easy and efficient self-protective behaviors can be used to limit the ammonia risks to a minimum. The following behaviors are proven to be the most effective; (1) Go inside your house and close doors, windows and

everything for ventilation (mostly located above your windows, walls, and toilets); (2) If possible, stay inside a room that can be sealed off, preferably in the middle of the house or building, and (3) if outside, walk perpendicular to the wind with a handkerchief covering nose and mouth to prevent inhalation of ammonia. Based on recent other ammonia related fires, these self-protective behaviors are highly effective and therefore result in a strong decline of the health related risks.

Twitter

To receive further information, you can use the free to use telephone number: 0800–28032011. Furthermore, a special Twitter account can be followed to receive information. Add @ammoniafire to your Twitter account.

APPENDIX C: FREIGHT TRAINS CONTAINING AMMONIA AND ETHANOL ON FIRE

Freight trains containing ammonia on fire. Photo ANP (2011).

At a shunting yard in the east of the Netherlands, three freight trains are on fire. Around midnight, houses within a radius of 2 km to the fire were evacuated as a precautionary measure, due to the risk of an explosion and possible release of hazardous substances. Because of the strong wind, surrounding villages are also at risk of being affected by consequences of the fire.

Two of the freight trains contain ammonia and the third contains ethanol. The fire department has been trying to control the fire since last night. At the shunting yard, several other freight trains contain the highly inflammable ethanol. Therefore, these freight trains are kept wet and at a low temperature

Soot samples taken from the smoke by the RIVM (Dutch institute for public health and environment) show higher concentrations of ammonia in the direct surroundings of the fire. To protect oneself from the risks regarding the fire, some self-protective behaviors can be used to limit the ammonia risks. For instance; Go inside your house and close doors, windows and everything for ventilation, stay inside a room that can be sealed off, preferably in the middle of the house or building and last, if you are outside, walk perpendicular to the wind with a handkerchief covering nose and mouth.

Twitter

To receive further information, you can use the free to use telephone number: 0800–28032011. Furthermore, a special Twitter account can be followed to receive information. Add @ammoniafire to your Twitter account.

APPENDIX D: SOCIAL NETWORK MESSAGES CONTAINING A SUPPORTING OPINION

Monique1242 says: via Iphone

Ventilation shafts are indeed located above the windows! The smoke doesn't bother me anymore! ☺!!

MooiWark says: via Twitter.com

Receive the latest news regarding the fire on Twitter!! #trainfire #ammoniafire

RonalddeB says: via Blackberry

Great news article in the Tubantia!! Helpful and effective suggestions! No more troubles with the smoke and fire!!!

MilouOnline says: via Android

I quickly found information regarding the fire!! Lots of updates @ www.crisis.nl . NICE!!!!

StephanTwitter says: via Android

BOOM LARGE FIREEEEEEE #fun #lol

Martine001 says: via Tweetdeck

My windows and doors are always closed (im always cold!) but I closed my indoor ventilation! Glad it works!! #noworries here!

Johan27 says: via web

RT @ MilouOnline crisis.nl works perfectly. Very helpful and effective ☺ A great help!

LindaBorne says: via Android

Ventilation shafts are closed!!! Those tips are very easy to conduct!! ☺ ☺

Gerard1978 says: via TweetDeck

I'm in the middle of my house (@my office *TIP*) Closed all ventilation and windows. Easy to perform!

WJansen says: via Android

I just walked nearby the #ammoniafire. Used my sleeve to cover my mouth and nose. Its easy! #helpyourfriends!

APPENDIX E: SOCIAL NETWORK MESSAGES CONTAINING AN OPPOSING OPINION

Monique1242 says: via Iphone

Ventilation grids above the windows? And that should protect me against the hazardous substances?! I do not believe it!!

MooiWark says: via Twitter.com

Receive the latest news regarding the fire on Twitter!! #trainfire #ammoniafire

RonalddeB says: via Blackberry

What a stupid news article in the Tubantia! As if these suggestions would be of any help against smoke and fire!!!! ☹☹

MilouOnline says: via Android

I was looking for further information and after a long search I found some… but it wasn't up to date @ www.crisis.nl !! Not very efficient!!

StephanTwitter says: via Android

BOOM LARGE FIREEEEEEE #fun #lol

Martine001 says: via Tweetdeck

Windows and doors were already closed (COLD) and I closed all ventilation grids, but i cant beliefs that is effective!

Johan27 says: via web

RT @ MilouOnline, indeed very ineffective and inefficient !!! Useless!

LindaBorne says: via Android

"Close al ventilation" Yeah Right!! That isn't easy at all!!! ☹☹

Gerard1978 says: via TweetDeck

I'm already in the centre of my house (@my office) and I'm trying to close all ventilation. How does that work?! HELP!!

WJansen says: via Android

I just walked nearby the fire but I didn't have anything with me to cover my mouth! What should I do now?!

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