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Abstract

Communication is a crucial aspect of nuclear emergency preparedness. Making the public knowledgeable about the correct mitigation actions and allowing them to accept the required course of action can reduce the health effects of radiological risks on the public during an emergency situation. This study aims to extend existing knowledge of nuclear pre-crisis communication and the impact of the communicator's credibility. A comparison was made between the effectiveness of industry, authorities and scientists in providing information to the public. The stimulus was the varying professional label linked to the communicators in a TV-news item embedded in a large scale face-to-face survey administered at the respondents' homes (N=1031). The sample was representative for the Belgian population regarding province, gender, age, level of urbanization and professionally active status. The results demonstrate the importance of pre-crisis communication. A statistically significant difference in reception and acceptance was found between respondents in the experimental conditions and the control group, which had not been exposed to the communicated message. However, differences in credibility of the communicator as was revealed in the labels, did not influence the processing of nuclear preparedness information. Although communicators were not considered equally credible, they were equally effective in communicating mitigation actions.

Keywords: nuclear emergency preparedness; communicator credibility; risk communication; information processing; mitigation actions

Introduction

The Fukushima accident in 2011 highlighted the need to further improve the manner in which information on mitigation actions is communicated to the public (Ng & Lean, 2012). Although this information was in fact provided in the first days after the accident by the Japanese emergency management, many residents in the affected areas were unaware of the nuclear accident. They did not receive the evacuation orders or were simply unable to understand the messages that they received (NAIIC, 2012). The accident revealed that communication is crucial not only *during* an emergency but also *before* an emergency, in the preparedness phase. Nevertheless, research on preparedness communication remains underdeveloped (Coombs, 2010).

One aspect of improving preparedness involves communicating which mitigation actions should be followed in case of an emergency. One possible mitigation action is sheltering. In case of sheltering the following response is advised to the public: (1) quickly enter a building; (2) close the windows and remain inside until the alarm is lifted; (3) do not use any ventilation (in the car and at home); (4) leave the children at school; (5) do not use the telephone; (6) follow the information provided by the mass media. In the risk literature there has been substantial attention for the role of credibility in risk communication in general, with particular focus on the role of credibility on the risk acceptability and risk perception (e. g. Breakwell, 2009). Related to flood risk Terpstra (2004) showed that the perceived credibility of the flood mitigation actions reduced the perceived likelihood of flood risk, which in turn reduced flood preparedness intentions. In our study focus is on the role of communicator who appear in the media as information sources, and how his/her perceived credibility affects the processing of preparedness information. In other words: is compliance with nuclear preparedness communication by the lay public dependent on the information source delivering the information? To the best of our knowledge no previous study has answered this

question. However, research showed that credibility of warning messages was the most important determinant for the decision to seek shelter during a cyclone (Paul, 2012). In addition Frewer et al. (1996) found that the communicator has a strong effect on how credible information is perceived. Therefore, a better understanding of the role of communicators in nuclear preparedness communication is needed.

Risk communicators often rely on mass media to reach the general public. Although recent research has shown that social media play an important role in crisis communication, traditional media remain the dominant channels for information dissemination (Turcanu & Perko, 2014; Vyncke et al., 2016). Moreover, exposure to media information has a positive effect on awareness and consequently on the manner in which information is processed (Chew, Palmer & Kim, 1995). The way in which information is processed is influenced by several persuasive factors among others source credibility (Perlof, 2010). If credible sources are used, the public will be motivated to engage in more elaborate information processing and the information is more likely to be accepted (Pornpitakpan, 2004). The importance of the credibility concept has also been recognised by risk communication scholars (Renn & Levine, 1991; McComas and Trumbo, 2001). They have distinguished different components of credibility in the context of risk, such as trustworthiness and expertise (Peters, Covello and McCallum, 1997; Trumbo and McComas, 2003). The effect of credibility is particularly relevant in the context of risk where communicators are known to have very different levels of credibility (Frewer et al. 1996). By referring to the organisations people work for and their position within these organisations the media can establish source credibility (Chryssochoidis, Strada, & Krystallis, 2009; O'Keefe, 2002). For this reason a good understanding of the impact of this credibility cue is desirable.

Although some recent studies on source credibility have explored the influence of affiliation in television (e.g. Lefevere, De Swert, & Walgrave, 2012), most research so far has focused on newspapers rather than the TV. However, research based on TV source labelling conducted by Lefevere et al. (2012) has shown that popular sources have a stronger effect than elite sources on how the public thinks about an issue. Other studies focused on different types of labels (e.g. labelling news as "Vide News Release") and how these affected perceptions of news credibility. Generally, studies in political communication indicate that labels often remain unnoticed or do not affect the credibility assessment (Tewksbury, Jensen and Coe, 2011). However, to understand the effect of source labels the context should be considered.

This study examines the effect of communicator credibility indicated by labels mentioning the professional affiliation of actors in televised news on nuclear emergency preparedness. Communicators in the survey experiment were labelled as representatives of the nuclear industry, as authorities or as scientists. To our knowledge this is the first study on the labelling of nuclear emergency communicators in television news. This is surprising as nuclear preparedness communication is a critical case to test the effect of source labels, as four reasons make it a most-likely effect scenario. Firstly, communicators on nuclear emergencies are associated with vastly different levels of credibility. Nuclear industry, for instance, tends to be perceived as an information source with rather low credibility, whereas independent experts are regarded as much more credible and trustworthy (Perko, Turcanu, & Carlé, 2012). Hence, clear differences in the effectiveness of

these communicators can be expected. Secondly, since nuclear pre-crisis communication usually takes place in a low information-context, where the health risks are nevertheless high, people might be more attentive to the message than in other “bread-and-butter” contexts. In addition, research has shown that the Belgian public is sceptical about nuclear emergency mitigation actions. In 2008, 31.2% of the Belgian respondents would either take the iodine tablets at the wrong moment, doubt when to take them or not take them at all. Only 40% of the respondents agreed with the statement that iodine tablets can reduce the negative health consequences of a nuclear accident (Perko et al. 2010). Such limited knowledge and public disagreement on the usefulness of mitigation actions makes credibility a crucial heuristic to process preparedness communication. Thirdly, source labels are constantly used on television news. Past research has shown that familiarity increases the effectiveness of the labels (Bar, 2004). In our experiment source labels appeared at the centre of the screen to increase visible, making an effect on information processing most likely (Breuer and Rumpf, 2012; Goldstein, 2002). Finally, the integration of the factorial experiment in a survey might have increased people’s attention for the stimulus. After all, in a real life context there will generally be more distractors than in a controlled survey environment. Consequently, this study contributes to the literature by testing source labelling in an untested context (nuclear emergency communication) using a critical case to test such an effect.

This paper also makes a methodological contribution, as the experiment is conducting using a superior design. Most studies on source credibility are conducted in an experimental setting. For this study the experiment was integrated in a large survey (N=1031). Information processing is operationalised using two measures, namely reception and acceptance (Zaller, 1992). Previous research by Perko et al. (2014) has shown that these are two distinctive components in public information processing that should be assessed separately.

Theoretical background

Communicating preparedness

Preparedness is one of the four stages in the emergency management cycle (Petak, 1985). Communication during the preparedness stage *‘is designed to address the public’s awareness and knowledge gaps(...), to elicit desired preparedness behaviour(...), to ensure adequate understanding, and to educate about what actions to take(...)’* (Sheppard, Janoske, & Liu, 2012, p. 11). This can reduce the public's vulnerability and mitigate harmful effects (Coombs, 2010), by changing the beliefs which determine behaviour (Fishbein & Ajzen, 1975). Previous research has shown that providing preparedness information is only effective if the information is actionable and dense, meaning that it must come from multiple sources and is broadcasted across multiple channels (Wood et al., 2012).

The mass media plays a crucial role in providing the public with pre-crisis information. Even today traditional media are the most important source of information for most citizens (Vyncke et al., 2016; DeYoung et al., 2015). However, social media (e.g. twitter) and online media platforms (e.g. online newspaper) have become increasingly important (Meraz, 2008). Research has shown that media outlets affect each other’s coverage of issues (Vliegenthart & Walgrave, 2008). For long traditional media was perceived as the dominant intermedia agenda-setter, however, recent research has

shown that this is a bi-directional process (Wallsten, 2007). Traditional media increasingly use social media as sources in their reporting (Messner & Distaso, 2008). However, in order to maximize the impact political actors still seek access to the media (Tresch & Fischer, 2014). As Lichtenberg and MacLean (1991, p. 158) put it, *'expert and industry representatives can talk as long as and as well as they like, but to a great extent the messages from them that reach the public are mediated by newspapers, television, radio and news magazines'*. This illustrates the mutual dependence between media and communicators who serve as information sources. According to Gans (2004) the relationship between journalists and their sources is "like a dance". However, not all partners are equally appreciated as a dance partner; some communicators are more present in the news than others. The authorities, the nuclear industry and opinion makers often appear in nuclear emergency communication (Imtihani & Mariko, 2013; Prezelj, Perko, Turcanu, Cantone, & Geenen, 2012). According to Gans (2004) differences in presence in the media of information sources are a consequence of their suitability. One of the factors that determine suitability is trustworthiness of the communicator. Trustworthiness is one of the dimensions of credibility (O'Keefe, 2002).

Credibility

Credibility is an influential factor in persuasion (Perloff, 2010). In risk communication, too, it is considered a fundamental persuasive attribute (Reynolds & Seeger, 2005, pp. 48-49). Credibility can be defined in different ways: as a characteristic of the communicator (Kelman, 1961; Lee, 1986) or as *'a judgement made by a perceiver concerning the believability of a source'* (O'Keefe, 2002, p. 181). In this study the latter viewpoint is adopted.

Perceived credibility is influenced by different factors. A primary factor that was already mentioned is trustworthiness, which is an assessment of whether a communicator is to be trusted (O'Keefe, 2002). Other factors influencing credibility are expertise (Hovland, Janis, & Kelley, 1953; Sternthal, Phillips, & Dhokalia, 1978) and goodwill (McCroskey & Teven, 1999). Expertise (or competence) refers to whether or not a source knows the truth, while goodwill is the extent to which the communicator seems to genuinely care. Work by Peters et al. (1997) has shown that these factors also determine credibility in the area of risk communication. In the context of risk communication perceptions of credibility are activated by different triggers, among which institutional characteristics (Chrysoschoidis et al., 2009) and professional affiliation (O'Keefe, 2002). As this information is often mentioned in the media to convey the credibility of the source, it is interesting to find out more about the credibility ratings of different professional affiliations.

Credibility of nuclear actors

Different actors communicate about nuclear emergencies in television news. However, there are differences between the actors in how often they appear in the news. Research by Perko, Turcanu and Carlé (2012) showed that after the Krško nuclear accident (2008) the nuclear authorities, the nuclear operator and opinion makers such as scientists were among the most often quoted communicators in reporting about the accident. More recently Prezelj et al. (2016) found that industry; government and authorities were among the most quoted communicators after Fukushima, both in Japan and abroad. Interestingly, both studies noted that non-governmental organizations were not regularly quoted in media.

Nuclear emergency communicators are not all perceived equally credible. After the Chernobyl incident, the public became sceptical about nuclear related information communicated by the industry and the authorities (Carlé, Turcanu, Van Aeken, & Harderman, 2007, Eurobarometer, 2007). The nuclear industry is typically considered the least credible source of information (Peters, 1992; Coulson, 2002). While industry is considered competent, it is not seen as trustworthy (McCallum, Sharon, & Covello, 1991). Scientists, on the other hand, have been considered to be credible sources of information (Haynes, Barclay, and Pidgeon, 2008). In 2007 the Belgian authorities were rather well trusted to operate a nuclear power plant safely (Eurobarometer, 2007). Based on these insights the assumption is made that authorities will be less credible than scientists but more credible than the nuclear industry. Such differences in the credibility of information sources have also been found in the context of other risks, such as earthquakes. Tekeli-Yesil et al. (2010) found that industry is perceived to be less credible than scientists as communicators of mitigation actions after earthquakes.

The effect of credibility and information processing

There is an effect of source credibility on information processing (Pornpitakpan, 2004). According to Petty & Cacioppo (1986) credibility can influence the processing of information in two ways. It can either serve as an argument when scrutinizing the information or, the opposite, as a heuristic that allows low-effort information processing. How it will be used depends on the motivation and the ability of the receiver. A stronger motivation and higher ability will lead to more systematic information processing. Peters et al. (1997) confirmed that credibility influences also the processing of environmental risk information. In their study, they revealed a positive correlation between the amount of information received and the credibility of the source of risk related information. Credibility can be understood as a determinant of attention in the risk context, as more credible sources motivate the receiver to pay attention to the information provided (Clark, Wegener, Habashi, & Evans, 2012; Renn, 2008). Contrary, correlation between credibility and the recall of factual information was not confirmed in study of Hovland & Weiss (1951).

Credibility also influences acceptance of information (Renn, 2008). Lirtzman and Avichai (1986) found that the believability of safety hazard information is dependent on the source of information. Furthermore Perko et al. (2014) confirmed that the amount of information related to nuclear emergency received (reception) is influenced by specific knowledge, and that agreement with the mitigation actions communicated (acceptance) is influenced by predispositions such as credibility. This finding supports the concept of Receive-Accept-Sample model of Zaller (1992) initially developed in the context of political communication. In addition, Arora and Arora (2006) confirmed that credibility has a positive effect on intention and attitude towards healthy eating as a preventive measure against cancer (i.e. acceptance). This is in line with the study of McGuire (1985), according to whom credibility has an effect on the processing of persuasive communication but not on learning. The question remains whether an effect of credibility should also be expected in the preparedness stage for nuclear emergencies.

Conveying credibility in television news: the use of labels in television news

Credibility can only have an effect when the credibility cue – for instance professional affiliation- is noticed by the receiver. One way to convey such cues to the public in TV news is by using labels. TV viewers are familiar with labels as they are frequently used in television news (Berkowitz, 2009). Familiarity with labels guides the attention of the news consumer (Bar, 2004), which in turn increases the chance that labelling will have an effect. Research has indicated that salience of the label has a positive effect on visual attention (Goldstein, 2002; Breuer & Rumpf, 2012). However, only few studies have explicitly tested the effect of labels in television news. Those studies on labelling that exist indicate that labelling TV-news as censored (Newhagen, 1994), a video news release (VNR) (Tewksbury et al., 2011) or staged (Slattery and Tiedge, 2011) does not have a strong effect on information processing. Newhagen (1994), for example, revealed that the recall of the labels did not influence recall of the communicated information. Also Tewksbury et al. (2011) found that labelling content as a video news release does not affect the evaluation of the communicated information. These results contrast with the finding of Lefevre et al. (2012) that the acceptance of information after exposure depends on type of communicator: popular exemplars (person on the street) or an elite source. In other words their study indicates that credibility does matter. In addition, credibility also depends on the timing of source identification. When the source is identified before exposure to the message then credibility has a stronger effect (O'Keefe, 2002). Combining the theoretical insights related to the effect of credibility on information processing, the following hypothesis is formulated:

Communicator credibility, as communicated in labels mentioning professional affiliation, influences the processing of pre-crisis nuclear communication. The more credible the communicator is, the more information about mitigation actions is received and accepted.

Methodology

To test the effect of credibility on the processing of nuclear pre-crisis communication, an experimental design was applied. The validity of the experimental design was pre-tested (n= 32). The experiment was embedded in a survey administered at the respondents' homes using computer assisted personal interviewing (CAPI) in July and August 2008 (N=1031). The sample is representative for Belgian population for the following variables: province, region, gender, age, level of urbanization, and professionally active status (table 1).

[TABLE 1 about here]

The experiment was conducted in four phases (Figure 1). In the first phase of the experiment general knowledge of communicators and their credibility related to nuclear emergencies was measured (independent variables). Knowledge of communicators was tested with the following question: *'when you think of the domain of nuclear energy do you know the following actor?'*. Knowledge was tested for 13 actors active in the nuclear energy domain. When a respondent answered positively on the knowledge question two additional questions were used to assess communicator credibility. A first credibility question measured trustworthiness, where a second question measured competence of the communicator. Trustworthiness of the communicator was measured with the following question: *'Can you tell us whether you think the following actor would tell the truth in case of a nuclear accident?'*. Competence of the communicator was measured with the following question: *"(...) and whether you evaluate them as technically competent for the*

protection of the population in case of a nuclear accident?". For both questions answers were reported on a Likert scale from 1 (totally disagree) to 5 (totally agree).

In the second phase, respondents were exposed to a simulated television news item (i.e. stimulus), without any introduction. The labels mentioning professional affiliation of the communicators in the TV news clip were presented saliently, using large labels in bright colours (red) presented in the middle of the screen as is common practice in the Belgian news. The TV news item was filmed during the B-Fast (Belgian First Aid and Support Team) radiological emergency exercise.

Participants were randomly assigned to one of the three experimental conditions or to the control group. The control group was not exposed to the TV news item. All participants in the experimental conditions were shown the same video clip, with the information delivered by the same three communicators. Experimental conditions differed only in their labelling of the communicators as representatives of nuclear industry, authorities or scientists (table 2). Initially politicians were included as a fourth experimental condition. However, this condition was excluded because participants in the pre-test did not perceive the communicators to be true politicians. In the labels both name and professional affiliation of the communicator were mentioned.

The communicators appearing in the clip advised five mitigation actions in case of a nuclear emergency: (1) to seek shelter, (2) to keep windows and doors closed, (3) to follow the media for instructions and information, (4) to avoid using the telephone unless it is absolutely necessary, and (5) to not eat or drink until this is allowed again. The TV news item was designed in such a way that it appeared as credible as possible, for example by using a particular layout that resembled real items in regular Belgian television news. Another element that enhanced the realism of the stimulus was the use of multiple information sources, as is generally the case in news reports on nuclear emergencies.

[TABLE 2 about HERE]

In the third phase of the experiment, the amount of information received and accepted by respondents was measured by two sets of items (i.e. the dependent variables, see appendices 1 and 2). Reception refers to the amount of information one is able to correctly recall after exposure. Recall was measured using 11 items. The first recall item, a multiple choice question, asked the respondent *'who were the people interviewed in the TV news item?'*. Possible answers were *'independent scientists'*, *'representatives from the nuclear industry'*, *'government officials'* and *'don't know/ no answer'*. Based on the other 10 items, an index was constructed, indicating the amount of factual information correctly recalled after exposure.

Acceptance refers to the level of agreement with the mitigation actions communicated in the TV news item. Acceptance was measured with three items, using a Likert scale from 1 (strongly disagree) to 5 (strongly agree). Principal axis factoring was used to test the unidimensionality of the concept (appendix 2). A one-dimensional sum scale was constructed containing the three items, with a Cronbach α of 0.70. Based on this sum scale every respondent was assigned a score between 3 (minimum) and 15 (maximum); a higher score indicating higher levels of acceptance.

[Figure 1 about here]

Results

The first test performed assessed whether respondents perceived communicators to differ in credibility. Differences in credibility are required if we expect that these differences will cause information processing to differ across conditions. Table 3 provides descriptives of credibility measured as trustworthiness and competence of the three conditions. Significant differences were observed for trustworthiness between the experimental conditions. As assumed, the industry received the lowest rating, which means that industrial communicators were considered the least trustworthy. Scientists, on the other hand, received the highest scores; they were perceived as the most trustworthy communicators. Finally, the authorities took the middle position, as less trustworthy than scientists but more so than the industry. Significance of the differences was tested using analysis of variance (ANOVA) with contrast tests. The ANOVA indicates that there are differences between one or more of the trustworthiness ratings, $F(2, 458) = 44.59, p < .05$. Subsequently, two contrasts were tested. The first contrast tests if participants in the condition with industrial communicators perceive the industrial communicators as less trustworthy than the participants in the authorities' condition perceive the authorities to be. This seems to be the case: $t(458) = 6.554, p < .05$. In other words the industry is perceived to be less trustworthy than the authorities. The second contrast tests if participants in the authorities' condition perceive the authorities to be less trustworthy than participants in the scientist condition perceive the scientists to be. Also this contrast is significant: $t(458) = 3.03, p < .05$. Based on these results we conclude that the communicators differ in their level of trustworthiness. Differences between communicators are less pronounced for competence. The F-test of the one-way ANOVA with contrast tests is significant, $F(2, 449) = 9.442; p < .01$. However, only one contrast is significant. Nuclear industry is perceived less competent than the authorities; $t(449) = 3.6, p < .01$. When it comes to competence scientists and authorities are considered equally competent to protect the population after a nuclear accident, $t(449) = -1.4, p = 0.150$.

[TABLE 3 about here]

According to our hypothesis, communicator credibility has a positive effect on the processing of information (reception/acceptance). Recall of the communicators was assessed using a question that asked the participants to indicate the identity of the communicators in the clip as either 'industry', 'authorities' or 'scientists'. Communicators could either be recalled correctly (e.g. exposed to industrial communicators - communicators recalled as industrial), incorrectly (e.g. exposed to industrial communicators - communicators recalled as either authorities or scientists), or not at all ('don't know'). As is shown in Figure 2, correct communicator recall was low in all conditions. For the condition with industrial communicators, correct recall was 51%, while this was 26% and 40.2% in the condition with authorities and scientists, respectively. In all conditions, a large number of respondents incorrectly recalled the communicator. Only a small group of people had no recollection of the communicators shortly after the message.

The best guarantee that differences in information processing between the experimental groups are due to the experimental manipulation is to include in the analysis only those participants that recalled the communicator after exposure. This can be seen as 'a most conservative test' for the effect of credibility, as we know for sure that this group consciously processed the information. Only for this group we can guarantee that the differences found are due to the credibility cue. However,

excluding all the people who did not process the credibility cue might bias our findings. This would be the case when sensitivity for the stimulus is affected by priming of credibility before exposure. Priming can either increase (assimilation priming) or decrease sensitivity for the stimulus (contrast priming) (Herr, Sherman & Fazio, 1983). If sensitivity for the stimulus is affected by priming, then focusing on only those respondents with a correct recall of the communicators would negatively affect the study's validity. An additional robustness test was conducted to evaluate the effect of credibility priming on stimulus sensitivity, operationalized as 'correct recall of the communicator' after the experiment (0/1). Respondents participating in the control group were excluded from this robustness analysis. Priming was operationalized using an index that indicates the number of experimental actors known to the respondent. Each respondent has a score between zero and three. A score of zero indicates that the respondent did not know any of the experimental actors; a score of three indicates that three actors belonging to the different conditions were known. Meaning these respondents knew Electrabel (industrial communicator), FANC (authority) and scientists from the universities. This index captures priming as communicator credibility was only measured when a communicator was known to the respondent. For each known communicator two questions on credibility were asked. A respondent with a score of zero did not know any of the communicators and was therefore not asked any question on communicator credibility. Respondents with a score of three answered six credibility questions for three communicators. Therefore, the risk of priming increases with the number of communicators known to the respondent. The effect of the knowledge of communicators on stimulus sensitivity was tested using a logistic regression. Results show that there was no significant effect of the number of credibility questions on stimulus sensitivity ($\beta=0.062$; $SD=0.11$; $p=0.565$). Answering more credibility questions did not influence sensitivity for the stimulus, nor positively nor negatively. This indicates that our focus on only those respondents with correct recall of the communicators is not biased by priming.

In addition bias due to sample selection was checked for by using three different categorizations of the participants. In a first test we included all participants in their respective conditions. Such a test guarantees generalization of the findings to the general population, as there is no discrimination between those with high and low elaboration of the information. In the second test the participants were divided into groups according to their recall of the communicator, which resulted in the creation of four groups: (1) control group; (2) participants who recalled the communicators as industry; (3) participants who recalled the communicators as authorities and (4) participants who recalled the communicators as scientists. The third test compares the different conditions, but only including those respondents who correctly recalled the communicators. In the end the results for the three tests are similar; reception and acceptance follow the same pattern independent of the test group. Hence, it makes sense to focus on those participants who had a correct recall of the communicator as a most conservative test of the effect of communicator trustworthiness.

[FIGURE 2 about HERE]

Differences in reception and acceptance of information across the groups were tested using ANOVA with planned contrasts. A comparison is made between four different groups: the control group and three groups of participants who correctly recalled the communicators as members of the industry, the authorities or scientists. The randomness of the groups is tested for the following variables: specific knowledge; risk perception of a nuclear accident; and attitude towards nuclear energy. These variables have been identified in previous research as important predictors for either

reception or acceptance (Perko et al., 2014). The groups did not significantly differ on these variables: specific knowledge $F(3, 433) = 0.998, p = 0.393$; risk perception $F(3, 426) = 0.536, p = 0.658$ and attitude towards nuclear energy $F(3, 370) = 0.802, p = 0.493$. Thereupon the central hypothesis could be tested: that perceiving a communicator as more credible will lead to more information being received and accepted. Table 4 shows the distribution of reception – index of the amount of correctly recalled information- immediately after exposure, measured. The distribution of recall for the control group proves that the control group was already knowledgeable to an extent about the information presented in the video clip. Without exposure to the video clip, 64% of the participants in the control group had a score between six and eight, indicating a medium level of knowledge. In other words, the general public is partly aware of the necessary actions in case of a nuclear emergency. When studying the distribution of reception within the other conditions, a positive effect of exposure to the video clip can be observed.

Differences in reception between the four groups were tested by means of ANOVA with contrast tests (see table 5). The assumption of homogeneity of variances was not met: Levene's Test $F(3, 563) = 5.4; p = 0.001$. Therefore, the more robust Welsh F-test was used, which indicated a significant main effect ($F(3, 563) = 43.729, p = 0.000$). The results point out differences in the reception of information. In total three contrasts were tested. A first contrast tests the difference between the control group and the individuals in all other experimental conditions. Reception was higher for participants exposed to the video clip than for the control group. Exposure to the video clip had a positive effect: $t(563) = 11.457, p < .05, r = 0.44$. This indicates a significant and substantial effect of exposure on reception. However, there were no differences in reception between the different experimental conditions. The contrast of industry versus authorities and scientists combined is not significant, nor is the contrast between authorities and scientists. Information about nuclear emergencies was recalled to the same extent, regardless of the affiliation of the communicator. In conclusion, reception of nuclear emergency information in a pre-crisis situation is not influenced by communicator credibility operationalized as professional affiliation mentioned in source labels.

[TABLE 4 & 5 about here]

A second dependent variable used to assess the effect of communicator credibility is acceptance. Acceptance was measured as the level of agreement with nuclear mitigation actions. Table 6 provides information about the distribution of acceptance. Differences in acceptance were tested using ANOVA (see table 5). The Levene's test was not significant ($F(3, 505) = 1.87, p = 0.135$), indicating that the assumption of homogeneity of variances was met. A significant main effect was found: $F(3, 505) = 15.9, p = 0.000$. Planned contrasts were used to assess differences between the groups. These contrast tests indicate that the pattern in acceptance is similar to that of reception. Exposure to the video clip had a positive effect on the acceptance of mitigation actions, as participants exposed to the video clip accepted the actions to a greater extent than those in the control group. This can be seen in the significant contrast between the control group and the groups exposed to the video clip: $t(505) = 6.845, p < .05, r = 0.29$. Also for acceptance there is a significant and substantial effect of exposure to the video clip. The effect of exposure on acceptance is nevertheless weaker than the effect of exposure on reception of information. Acceptance did not appear to be affected by the credibility of the communicator, and remained the same for the three types of communicators.

In sum, based on our tests we can conclude that the information conveyed by a more credible communicator, as implied in a televised professional source label, is received and accepted to the same extent than if the information conveyed by a less trustworthy communicator.

[Table 6 about here]

Discussion

Communication is a crucial aspect of nuclear emergency preparedness. In this article we tested the effect of communicator credibility on the reception and acceptance of advised mitigation actions (e.g. sheltering). Credibility was communicated as professional affiliation mentioned in source labels appearing in a televised news item. The effect of labels in the context of risk communication was determined, as an effect of source credibility is most likely in this context. Results show that – although the different communicators were not considered equally credible – they are all equally effective in communicating mitigation actions. Neither the reception nor the acceptance of the mitigation actions is affected by the professional affiliation of the communicators mentioned in labels on the screen. Communication invariably has a positive effect on preparing people for a nuclear emergency. People who watched the video clip had better knowledge on how to react in case of a nuclear emergency and accepted the nuclear mitigation actions to a greater extent than people in the control group.

First we tested whether nuclear communicators were perceived equally credible. Results show that the nuclear industry is considered the least trustworthy communicator in case of a nuclear emergency. The Belgian authorities are considered more trustworthy than the industry but still less so than scientists, who are the most trustworthy actor in case of a nuclear emergency. Differences in competence between the communicators were less clear, as authorities and scientists are perceived equally competent. However, also for competence differences in information processing can be expected, as industry is perceived significantly less competent than the authorities and scientists. Because of these differences, it is interesting to investigate how these differences have an impact on reception and acceptance of the communicated information. Previous research on persuasive communication (Perlof, 2010) and risk communication (Reynolds & Seeger, 2005) corroborates the importance of credibility in this respect, and more recent studies have revealed the role of credibility in the preparedness stage (Arora & Arora, 2006). Although some studies (for example Tewksbury, Jensen, & Coe, 2011) found that labels have no strong effects on credibility assessment, the reverse can be assumed for labels that communicate professional affiliation of communicators. Not only are people sceptical towards information about nuclear accidents, they are also familiar with these labels (Bar, 2004). With the labels saliently presented they provide a useful heuristic tool to process nuclear information (Petty & Cacioppo, 1986).

A positive effect of exposure on information processing was found, but an effect of credibility on information processing was not. Participants who watched the TV news item were able to recall significantly more information correctly than the control group. However, these differences were not outspoken because participants in a control group were already quite knowledgeable. In addition to the positive effect on recall of information, exposure to the TV news item also has a positive impact on the acceptance of the information. This clearly illustrates the benefit of communicating about

nuclear mitigation actions in the preparedness stage. Whether this will also lead to a correct response in case of an accident remains unsure. According to the theory of planned behaviour (Ajzen, 1991) this should be the case, as intention can be considered a good proxy for actual behaviour. However, more research is needed to validate the intention (preparedness) - behaviour (crisis) relationship.

Nuclear pre-crisis information processing is not affected by the source labels mentioning professional affiliation (disproving our hypothesis). It seems irrelevant whether mitigation actions are communicated by the nuclear industry, authorities or scientists. Any differences in credibility these communicators may have, do not affect the processing of nuclear pre-crisis information. We thus find no support for the conclusion of Haynes, Barclay, and Pidgeon (2008) that it is scientists who should communicate about risk. Our findings also refute the positive effect of credibility that has been described in literature (Pornpitakpan, 2004). In nuclear pre-crisis communication source credibility does not seem to influence information processing. Our results align with the conclusion of previous research on labels; labelling content does not always elicit strong effects (Newhagen, 1994; Slattery & Tiedge, 1992; Tewksbury et al., 2011). Our results regarding the limited recall of the labels, agrees with results in previous studies (Tewksbury et al., 2011). The differences in recall across the conditions require more attention in the future. Similarly no effect has been found from source labelling. However, our finding contributes to the literature as we tested the effect in a most likely effect situation focusing on information processing as reception and acceptance of information rather than on credibility assessment, while using another type of label. The difference in label might also explain why we did not find the same effect as Lefevere et al. (2012), who did not only manipulate the label but also clothing and language to test the different effects of public and elite sources on how people think about an issue. In this study a more restricted operationalisation of credibility is used, that allows us to single out the effect of source labels. Even when fundamental information is used about the source (professional affiliation), in a context in which credibility is assumed to be important to assess the quality of risk information, no effect of source labels was found. The stability of the results indicate that trustworthiness has no effect on processing of nuclear emergency preparedness information, neither for people who had a high elaboration nor for people with low elaboration of the information.

The absence of an effect might be the result of the type of message conveyed, which is factual by nature. Authors such as McGuire (1985) have indicated that the effect of credibility is stronger for persuasive communication than for factual information; it can be that the factual nature of the information reduced the effect of credibility. There might also be an effect due to the fact that some of the information is logical (e.g. stay inside), in the sense that there is no discrepancy with already existing knowledge or behavioural intentions. Research on message discrepancy has shown that the positive effect of credibility is stronger when the information discrepancy is higher (Pornpitakpan, 2004). Next to the content related arguments there is another possible explanation for the absence of an effect: the intention underlying the communication. By communicating before an actual accident (in the preparedness phase) communicators demonstrate goodwill by being concerned for the public's wellbeing. Goodwill is the third dimension of credibility (Gass & Seiter, 2007; McCroskey & Teven, 1999). Research showed that perceived caring positively affected cognitive learning in the class room (Teven and McCroskey, 1997) and on patient satisfaction and compliance (Kim et al., 2004). In the risk literature care is considered as a dimension of trust (Renn & Levine, 1991;

Poortinga & Pidgeon, 2003); motives attributed to an information source determined the trust in the context of risk (Eiser et al., 2015). Therefore if we would have measured goodwill in our study together with the other dimensions of credibility, which were measured before exposure, a strong correlation between goodwill and trustworthiness would have been found. However, it could be that the combination of demonstrating goodwill by communicating and the provision of factual information overruled the traditional effect of credibility. This indicates that people might update their trust in an actor when new information is available or that trust is context dependent. In both cases, this would affect their information processing. These arguments should be taken into account when making a general claim about the use of source labels in television news. Further research is required.

Future research should also address limitations of this study. Firstly, upcoming studies could include actors not included in our design. One such actor is NGO's (e.g. Greenpeace), who play an active role in environmental risk communication (Bakir, 2005). However, there is reason to believe that including such additional condition with NGO actors would not have affected the main conclusion of this study. In 2008, the Belgian public perceived credibility of NGO's to lie in-between that of industry and scientists (Perko et al., 2010). In addition, future studies should study credibility in the context of social and digital media outlets. Social media nowadays play an important role in emergency management (Ng & Lean, 2012), and with it new questions on credibility arise (Westerman et al., 2015).

Conclusions

This research contributes to the literature by studying the role of source labelling on television in the context of a nuclear emergency preparedness. Previous studies have not looked at the effect of labelling in this context; however, this particular context provides a critical test for the effect of TV source labelling. Different characteristics, inherent to both the topic and the design, stimulate an effect of source labels on communication effectiveness. Results show that the importance of credibility should not be overestimated in pre-crisis communication. Communicating nuclear emergency mitigation actions has a positive effect on nuclear emergency preparedness, regardless of who delivers the information. Participants exposed to the video clip knew more about the nuclear mitigation actions and they accepted the instructions to a greater extent, than those not exposed to the communication. Pre-crisis communication generally increases the public's preparedness, indicating the importance of an active communication role for nuclear actors in the preparedness stage, regardless of their perceived credibility. With this conclusion derived from a most-likely effect scenario, the non-effect of source labelling is a significant finding. If no effect is found here, it will probably not be found elsewhere. There is also a methodological reason why attention should be paid to this non-effect. Where most studies on this topic use an experimental design with convenience sample, this study used a representative sample. Therefore, the conclusion of this study has strong external validity.

From a practical point of view this study has an important implication for those actors responsible for nuclear emergency preparedness. Since it does not matter who communicates, the best course of action is for all nuclear actors to work together in achieving better preparedness of the population for possible nuclear emergencies. Low levels of perceived credibility are no excuse to forsake this societal requirement. Although the industry, the authorities and scientists are not considered equally credible, they are equally effective in communicating mitigation actions and morally responsible to

communicate about radiological risks. For instance communication about pre-distribution of potassium iodine tablets in the vicinity of nuclear installations, a protective action applied in 14 European countries (Jourdain, 2010), would be more successful if also industry and independent scientists would be actively involved. In other words, what matters is not who communicates mitigation actions in the preparedness stage, but rather that these actions are communicated.

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Appendix: Construction of variables

1. Reception

[Table 7 about here]

2. Acceptance

[Table 8 about here]