Crisis communication: The role of message type and information processing during a nuclear waste accident

Master's Thesis

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Abstract

Communicating during a crisis can be life-saving for people, which highlights the importance of optimizing crisis communication wherever possible. This research focused on the effect of narrative versus statistical messages on behavioral intentions and whether it is mediated by the heuristic information processing system during a crisis situation. Therefore, an online experiment was developed, whereby participants were confronted with a fictitious crisis scenario about a nuclear waste accident. Then, they received either a statistical or a first-person narrative message about recommendations for preventing radioactive contamination. Afterwards, risk and crisis perception, perceived threat, perceived efficacy, and behavioral intention were measured via a questionnaire. It was expected that a narrative message would result in higher values for these dependent variables than a statistical message. Additionally, information processing was measured (systematic vs. heuristic). A mediating role of heuristic processing on the dependent variables was anticipated while reading a narrative message. In contrast to the expectations, the findings of this study show that crisis perception, perceived efficacy, and behavioral intention were higher after reading a statistical message. Still, this study supports the hypothesis that the statistical message was processed systematically and the narrative message heuristically. However, no mediation effect was found. A possible explanation for this might be a lack of persuasion, e.g. due to identification problems or source credibility. Strengths of this study are the manipulation and a new created scale for measuring the dependent variables during a nuclear (waste) accident. The realism of the crisis scenario and the generalizability of the findings represent limitations of this study. For future research, it is recommended to build a more reliable crisis scenario, by using e.g. Virtual Reality (VR) and to include more variables to the scale, such as source credibility.

Keywords: crisis communication, statistical message, narrative message, information processing, risk, crisis, nuclear waste

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Next to tremendous accidents in nuclear reactors, such as in Chernobyl in 1986 or in Fukushima in 2011, nuclear waste also poses a high risk for radioactive accidents. Nuclear waste has to be stored in a special way, as it is still radioactive and, depending on the material, needs a long time to fall apart (Rehren, 2018). Nuclear waste disposal sites can be found in many areas around the world, often far away from a reactor. In the past, there have already been some accidents, since the waste was not stored correctly. For instance, radioactive substances ended up in rivers because the waste was stored in a nearby lake, and due to heavy rainfalls, the lake was flooded, such as in Italy or France ("Radioaktiver Abfall", 2020). Also, accidents can happen at rightful disposal sites, as they are not yet the final solution for storing the nuclear waste forever. Therefore, nuclear waste poses a huge threat to the people, now and also in the future.

When a concerning amount of radioactive substances is set free, it can be seen as a crisis situation. A crisis in general is a situation in which people experience danger and/or instability, and where they face a short time to make a profound decision (Prideaux, Laws, & Faulkner, 2003). A crisis situation requires that the government communicates adequately with the public. Hence, as the government and health organizations prescribe specific behavior, in this case, to hinder the contamination of more and more people, it is important that the public will not be panic fueled. Several authors describe that the government usually focuses on giving statistical facts, concerning the crisis itself, possible consequences, and the course of action (Bakker, Kerstholt, van Bommel, & Giebels, 2019). During a nuclear (waste) accident, the local government can give updates about the situation and can prescribe rules to follow for preventing radioactive contamination. Another source of information the people can turn to is how other people survived the crisis and listen to, or read, narratives of those people (Bakker et al., 2019). With regard to a nuclear accident, these can be stories and testimonials from people who already experienced such a situation. Both statistical and narrative messages can have influential effects on people, by triggering or guiding certain (protective) behavior from the public during the crisis.

This research will focus on the effect of narrative versus statistical messages on behavioral intentions and how it is mediated by the heuristic information processing system. Communicating during a crisis can be life saving for a lot of people, which highlights the importance of optimizing crisis communication wherever possible. Although both statistical and narrative messages showed promising results in changing the behavior of the recipient, it

has not yet been found which of the message types is most effective, especially in regard to a crisis situation. Hence, the underlying mechanisms of the influence of the message types, such as information processing, still need to be discovered and researched further.

Crisis communication

Crisis communication needs to be differentiated from other forms of communication, such as risk communication. Unlike risk communication, crisis communication happens while the crisis has already started. Its goal is to inform people how they can handle the crisis instead of how to prepare for it (Bakker, Kerstholt, & Giebels, 2018). The best interest of the government during a crisis is to inform the public thoroughly and timely with sufficient information to deal with the crisis. Hence, the main goal of crisis communication is to enable the public to make decisions based on accurate information (Holmes, Henrich, Hancock, & Lestou, 2009). This has the ultimate goal that the harm induced by the crisis gets reduced as much as possible (Seeger, 2006). Several models were developed to explain when and how people engage in protective action, such as the Extended Parallel Process Model (EPPM; Witte, 1992). As the EPPM reflects important insights into the cognitions of people during a crisis, it will be used for this study.

EPPM. As crisis communication aims to elicit certain behaviors from the public, it is of importance to look at how and why people adopt protective behavior. Generally said, people are inclined to engage in protective action when they perceive a threat, and the protective action is expected to diminish negative consequences (Floyd, Prentice-Dunn, & Rogers, 2000). According to the EPPM, people process fear appeal messages in a dual or parallel process. A fear appeal message serves as a base whether people appraise a threat or not. One process is the fear control and the other one the danger control. People engage in danger control when fear appeal and efficacy beliefs are high. During danger control, the threat is dealt with and one concerns oneself with possible solutions. Thus, the intention to adopt protective behavior is high. When engaging in fear control, the threat is perceived as high, but efficacy beliefs are low. Hence, the person uses maladaptive coping mechanisms, such as denial or avoidance and no protective behavior is used (Gore & Bracken, 2005). In the following, the process leading to the two outcomes will be discussed further.

Firstly, based on the fear appeal message, people evaluate the perceived threat, as well as their perceived efficacy. The perception of threat is based on susceptibility and severity, more specifically whether one is in danger to the risk and whether it is serious or not. If the risk or crisis is not perceived as threatening, no response and hence, no behavior is activated. As a result, it is important that the message has a high fear appraisal for people to engage in

protective behavior. If the risk is perceived as threatening, one evaluates one's perceived efficacy, consisting of self- and response-efficacy (Witte & Allen, 2000). Self-efficacy can be explained as the personal belief that one can execute a certain task successfully (Bandura, 1997). Response efficacy is defined as the belief that the recommended behavior will lead to protection and safety against the posed crisis (Witte & Allen, 2000). Both factors are important to address during crisis communication, as they have been found to determine whether people will engage in the recommended behavior or not (Witte & Allen, 2000).

It is important to note that if the fear appeal message leads to a very high risk perception it can result in a no behavioral response, as the fear then can be perceived as greater than the perceived efficacy (Maibach & Parrott, 1995; Tannenbaum et al., 2015). Thus, crisis communication messages should entail a clear, easy to understand, and easy to accomplish recommended behavior. As a result, people will be more inclined to engage in protective and recommended behavior (Gore & Bracken, 2005; Witte & Allen, 2000). Hence, in line with the outlined research, it is expected that people will be more convinced of the crisis communication message when the information is presented truthfully, up-to-date, and easy to understand.

Narrative vs. statistical information

Next to the information that should be delivered, one has to consider how one wants to present the message. In health communication, there are two prominent ways to do this, namely statistically and narratively. Statistical framing represents the information in a factual manner, with percentages and numbers (de Wit, Das, & Vet, 2008). In contrast, narrative framing includes the information in a more emotionally and experiencing way, such as a first-person narrative of someone who already experienced the same situation one now has to face (de Wit et al., 2008). To explore the effects of both message types more in depth, results of meta-analyses and single studies will be discussed in the following sections. As literature on this topic in the crisis domain is scarce, the effects will be firstly reviewed for the health domain. Then, some information of this topic in the crisis domain will be elaborated on. This literature review will be based on the EPPM, especially on the factors perceived threat (susceptibility and severity), perceived efficacy (self-efficacy and response-efficacy) and the intention to engage in a certain behavior. Additionally, focus will be placed on the effects on risk perception, which can be explained as subjective beliefs about a potential harm or loss. The beliefs are based on the perceived severity and characteristics of the risk (Darker, 2013).

In the past, meta-analysis research in the health domain was quite discordant regarding which message type is more effective in persuading people. A meta-analysis by

Zebregs, van den Putte, Neijens, and de Graaf (2015) showed that in the reviewed literature, the persuasiveness of message type was dependent on the outcome variable. They found that attitude and beliefs are more influenced by statistical information, whereas intention is mostly influenced by narrative information. Nonetheless, Braddock and Dillard (2016) found in their meta-analysis that narratives also have significant persuasive effects on beliefs, attitudes, and behaviors and not only on intentions. Thus, the full potential of narrative persuasion is not yet clear.

Similarly, single studies represent this discordance of when and why a certain message type is more persuasive than the other one in the health domain. The study of de Wit et al. (2008), for example, found a more influential effect of a narrative message compared to a statistical message on the motivation to engage in self-protective behavior, such as vaccination for the Hepatitis B virus. Risk perception was also higher in the narrative evidence compared to the statistical evidence condition. Nonetheless, they found no difference on perceived severity. Both message types did not differ between the information included in the message, they only differed in how the message was delivered (narrative vs. statistical). Also, Prati, Pietrantoni, and Zani (2012) found a significant positive effect of narratives on perceived threat (susceptibility and severity) and perceived efficacy (self- and response efficacy). The messages used in their study also included the same information and were just presented differently.

Next to this, there are also studies which support the combination of narrative and statistical messages or which did not find any differences at all. A study by Nan, Dahlstrom, Richards, and Rangarajan (2015) showed that the messages elicited more risk perception when they were combined. When the message contains both statistical and narrative elements, people are more inclined to obtain an HPV vaccine as they perceive the risk as the highest (Nan et al., 2015). Additionally, as stated in Dillard and Hisler (2015), a study by Lemal and Van den Bulck (2010) demonstrated no significant difference of the persuasive effect of the two messages to adopt the recommended behavior. In their study, both message types (narrative and statistic) included the same information. They differentiated the message type and not the information presented.

Although there is some discord about this topic in the health domain, research about the effect of both message types in the crisis domain is scarce. Hence, it is important to investigate the effects more closely within a crisis situation. For instance, Bakker et al. (2019) conducted a study on how decision making during a crisis is influenced by the two message types. They used a virtual environment where people experienced a crisis situation, namely a

car crash. The researchers put the manipulation before the crisis happened (statistical vs. narrative message about a car accident) and then presented the crisis information during the crisis in an objective manner, by stating what happened and what the person should do. Accordingly, they found different results for a different point in time during the crisis. People were more influenced to engage in protective behavior by a narrative message before they received the crisis information, during a very uncertain time. In contrast, after receiving the crisis message, the behavioral influence was not significantly different between the two conditions (Bakker et al., 2019). Thus, the effectiveness of narrative versus statistical message depended on the conditions and no clear consensus is found regarding whether crisis communication benefits from using either a narrative or a statistical framing.

Narratives have shown to be influential to a certain degree in the health domain, on factors such as motivation to engage in protective behavior, risk perception, efficacy beliefs, severity, or the intention to engage in a certain behavior. Thus, one should not rule out the effectiveness of narratives in crisis communication. In line with that, Wachinger, Renn, Begg, and Kuhlicke (2013) suggest that people perceive a risk as more severe when they heard experiences of others about that risk. Hence, one can expect that a narrative influences the behavioral intention of a person during a crisis more effectively than statistical information. Several authors suggest the importance to look at the underlying factors which make the effect of narratives possible (Bakker et al., 2019; Braddock & Dillard, 2016; Winterbottom, Bekker, Conner, & Mooney, 2008; Zebregs et al., 2015). By researching this further, one can find out more about when and through which conditions narrative messages have a deeper impact on people.

Mechanisms explaining the persuasiveness of narratives

Narratives seem to play an important role during crises, as they offer an informative source about what one can expect, what one can do to decrease the inflicting harm, and what has been successful in reducing earlier crises (Seeger & Sellnow, 2016, as cited in Bakker et al., 2019). Studies from other domains showed a significant effect of using narratives to influence peoples' behavior. Nonetheless, there is no consensus on when and how the narrative message is most effective. Therefore, several researchers have focused on the underlying factors of the persuasive effects of narrative messages (Bakker et al., 2019; Braddock & Dillard, 2016; Zebregs et al., 2015). There already exist various models that try to explain the persuasive effect of narratives, such as the Extended Elaboration Likelihood Model (EELM; Slater & Rouner, 2002), or the transportation-imagery model (Green & Brock, 2000).

EELM. The Extended ELM builds on the Elaboration Likelihood Model (ELM; by Petty & Cacioppo in 1986) and focuses more deeply on the processing of narratives (Slater & Rouner, 2002). In the Extended ELM, the identification of the receiver with the character and the "engagement with the story line" (Slater & Rouner, 2002, p. 177) are connected to the persuasiveness of a narrative. Slater and Rouner (2002) explained that identification might induce a perception of similarities with the character's life, which evokes the experience of emotions while processing the narrative. Several studies from the entertainment-education domain indicate that identification with the character is indeed a predictor to perceive oneself as more vulnerable to a risk after reading a narrative. For example, Moyer-Gusé and Nabi (2010) investigated narrative messages in the context of unplanned teen pregnancies. Their study showed that women, who were exposed to a narrative, feel more vulnerable to unplanned pregnancy when they could identify with the characters in the narrative message. Similarly, Chen and Lin (2014) tested the persuasiveness of narratives on prosocial behavior, such as nature conservation. Their results also showed a higher persuasion when the participant identified him-/herself with the character in the shown movie.

Transportation-imagery model. The transportation-imagery model was established by Green and Brock (2000). They describe that people are persuaded by a narrative because they get transported into the world of the narrative. This has two possible implications. Firstly, while being transported into the story, people may adopt the world view of the story and, as a consequence, distance themselves from real-world facts. Secondly, in line with the Extended ELM, the authors propose that while being transported into the story, the receiver takes the perspective of the characters and is able to see the world through their eyes and understands their emotions. Hence, the receiver may experience it as a real-life scenario and gets to know the reasons why the character acts in a certain way. As demonstrated by the authors, people exposed to a narrative indeed altered their beliefs into those from the story and people who were transported highly into the scenario also rated the characters more positively (Green & Brock, 2000).

Mediating factors: Information processing

Winterbottom et al. (2008) propose that it is important to examine mediating factors that enhance the persuasiveness of narratives. Several studies already investigated mediating factors on narratives, such as cultural archetypes (Hong, 2018), or vividness (Janssen, van Osch, de Vries, & Lechner, 2013). Another possible mediation concerns the way how information is processed. In psychology, a lot of models for information processing are referred to as dual-processing models. Those models differentiate between two cognitive

processes for information processing. One process is often referred to as being automatic, intuitive, and heuristic. The other one represents a more rational, effortful, and analytical processing (Evans, 2008). For risk psychology, a lot of research used the heuristic-systematic model (HSM) of information processing (Eagly & Chaiken, 1993). Since risk is an essential part in the crisis domain as well, the use of HSM seems appropriate for crisis communication.

The HSM is part of the risk information seeking and processing model (RISP, by Griffin, Dunwoody, & Neuwirth, 1999), which deals with when and how people seek risk information and process this. According to the RISP model, those processes are influenced by the individual's subjective assessment of how much he/she knows and how much he/she needs to know about a risk to deal with it adequately (Griffin, Neuwirth, Giese, & Dunwoody, 2002). Moreover, other factors such as level of worry about the risk or channel beliefs, influence the way how information is sought and processed by the individual (Griffin et al., 2002).

Similar to other dual-processing models, the HSM entails a heuristic and a systematic process to alter information. While the heuristic process system works with little cognitive effort, by using the systematic system of processing one carefully evaluates and analyzes the message, whereby a lot of cognitive effort is demanded (Griffin et al., 2002). Thus, whereas systematic processing demands thorough assessment, heuristic processing is based on using simple cues, such as the source of information, to form a decision. Both systems can be used independently or simultaneously when information is processed (Trumbo, 2002).

In the risk domain, previous research found that risk perception is executed by the intuitive, heuristic process (Etchegary & Perrier, 2007). Due to the simple and fast processing of risk perceptions in the heuristic system, some authors call it "risk as feelings" (Loewenstein, Weber, Hsee, & Welch, 2001, p.270). Accordingly, people conclude whether the risk is bad or good very fast, as they do not engage in rational thinking about the risk. Nonetheless, studies by Trumbo (2002), and Trumbo and McComas (2003) found that heuristic processing decreases risk perception, whereas systematic processing increases it. Since these studies were on the topic of risk communication, consequences for crisis communication should be anticipated cautiously. Hence, the relationship between information processing and risk perception, especially in crisis communication, needs to be researched further to create more knowledge. Also, the effect of information processing and behavior intention is not yet clear. For example, a study by Zhu, Wei, and Zhao (2016) failed to find a positive connection between systematic processing and behavioral intention. Also, no support

for a positive connection between heuristic processing and behavioral intention can be found in the literature.

Further, the literature lacks information about the connection of the HSM and factors such as perceived threat or perceived efficacy. As both factors are important for behavioral intentions in models such as the EPPM, it is crucial to find results about the relationship of information processing towards these factors. Literature on risk communication in general supports the effectiveness of systematic processing, as people invest more time and cognitive resources to process the given information (Etchegary & Perrier, 2007). This can in turn lead to long-time changes in their behavior. Nonetheless, a crisis situation often asks for timely and fast decisions, as certain behaviors are often needed to be executed immediately to protect oneself. As they do not have the time to deliberate their decisions, one can anticipate that people use a heuristic processing style in a crisis situation. Hence, using simple rules and minimum cognitive effort to form quick judgments in such situations can be more advantageous than using effortful strategies. Further research in this domain is needed to find out more about the relationship between information processing and factors such as perceived threat and perceived efficacy, as well as risk and crisis perception and behavioral intentions.

Connection to message type. A connection between narratives and heuristic information processing has been hypothesized (Dunlop, Wakefield, & Kashima, 2010). Also, based on the theoretical framework above, one can anticipate a connection. Stored information from a narrative message tend to come to mind the easiest (Zillmann, 2006). Since heuristic information processing for making a judgement is based on simple rules stored in memory, one can anticipate that the narrative information is processed heuristically. Moreover, heuristic processing is anticipated to be responsive to peripheral cues of a message, such as length, source, or evoked emotions (Etchegary & Perrier, 2007). According to Bilandzic and Busselle (2013), this is in line with the persuasiveness of narratives, based on the transportation-imaginary model. When people are more transported into the story, they are persuaded to a higher degree to engage in certain behavior. Hence, while being transported into the narrative, the peripheral cues activate the heuristic system and the information is processed accordingly. Also, since the persuasiveness of a narrative depends on identification with the character, the peripheral cue of the message source links the narrative to heuristic processing (see EELM).

Nonetheless, no clear consensus was found in earlier studies whether a narrative is processed in a heuristic manner. Although studies by Kopfman, Smith, Ah Yun, and Hodges (1998) and Dillard and Hisler (2015) supported this connection, research by Nazione (2016)

resulted in contrasting outcomes. Kopfman et al. (1998) explained that narratives elicited more affective responses, which can be connected to heuristic cues. Moreover, Dillard and Hisler (2015) found a mediating effect of experiential processing on the persuasiveness of narratives. In their study, participant's experiential information processing was experimentally activated before reading a narrative. As a result, risk perception was higher in this condition than in the statistical condition. As experiential processing also represents the intuitive information processing system, one can anticipate the same for the heuristic processing system. In turn, participants in the study of Nazione (2016) reported significantly more systematic thoughts than heuristic ones after reading a narrative. Hence, no clear statement regarding the connection of narratives and heuristic processing can be made. Still, there is a tendency towards heuristic processing.

However, those researches were executed only in the health risk domain. Research on this topic in the crisis domain is yet to be conducted more often. For example, a study by Bakker et al. (2018) in the crisis domain suggests that narrative persuasion might be mediated by heuristic processing instead of affective responses. Thus, more research on whether narrative messages and heuristic processing are connected and whether this is also the case in the crisis domain is needed.

Hypotheses

This study aims to investigate the relationship between narrative messages and behavioral intention, and whether this is mediated by the heuristic information processing system. Based on the outlined theoretical framework, the following hypotheses were developed. Figure 1 presents a model of all hypotheses.

Narrative vs. statistical information. In contrast to the findings of Zebregs et al. (2015), several studies showed a tendency towards the persuasiveness of narrative information (de Wit et al., 2008; Prati et al., 2012; Wachinger et al., 2013). Moreover, narratives seem to lead to higher perceptions of risk, compared to statistical information (Winterbottom et al., 2008). Hence, the following is expected: When confronted with a narrative message, risk and crisis perception are higher, compared to when confronted with a statistical message (H1).

Based on the EPPM, effectiveness of narratives on perceived threat (susceptibility and severity) and perceived efficacy (self- and response-efficacy) will be examined. Although Zebregs et al. (2015) supported that statistical messages are more influential on beliefs and attitudes, Braddock and Dillard (2016) found this effect for narrative messages. Moreover, Prati et al. (2012) found a significant effect of narratives on perceived threat (susceptibility

and severity) and perceived efficacy (self- and response efficacy). Thus, it is predicted that, when confronted with a narrative message, perceived threat and perceived efficacy are significantly higher, compared to when confronted with a statistical message (H2).

Since a high level of risk and crisis perception, as well as of perceived threat and efficacy is needed for an individual to engage in protective behavior (Witte & Allen, 2000), it is crucial to reach this through the crisis communication message (if the individual not yet perceives the risk as high). Thus, it is anticipated that, the more perceived risk, perceived crisis, perceived self-efficacy and perceived response efficacy, the more someone intents to engage in protective action (behavioral intention). Hence, it is expected that behavioral intention is higher after reading a narrative message than after reading a statistical message (H3).

Moreover, a research question regarding the perception of the study (scenario and article) was established. Since a narrative message works with emotions, the question arises whether this has an influence on the perception of the scenario, for example, whether it might be perceived as more or less realistic. Thus, the following research question is posed: Is there an influence of message type on the perception of the study, such as on the scenario and message? (RQ)

Information processing. Based on the outlined mechanisms which underlie the persuasion of narratives, one can expect that memory and identification are important factors. The study by Bakker et al. (2019) demonstrated that affect is not the underlying factor that enhances narrative persuasion and suggested that heuristic processing might be responsible. Moreover, they indicated that narratives may be more persuasive as they come to mind easily. Hence, this would be in line with the heuristic information processing system, as it is responsive to peripheral message cues, such as message source. Additionally, Winterbottom et al. (2008) found some evidence in their literature review that narratives are processed heuristically. Furthermore, Kopfman et al. (1998) provide an indication that statistical messages are processed systematically. Due to this, it is predicted that narratives will be processed by the heuristic processing system (Hypothesis 4a), whereas statistical information will be processed via the systematic processing system (Hypothesis 4b).

Mediation. The literature on the effect of information processing on risk and crisis perception and behavioral intention does not show a clear consensus. For the relationship between heuristic processing, perceived threat and perceived efficacy, support is also missing in the literature. However, some studies support the positive relationship between heuristic information processing and the five variables. Due to this, it is expected that the relationship

of narratives and risk perception, crisis perception, perceived threat, and perceived efficacy gets positively influenced by heuristic information processing (Hypothesis 5a). Following, heuristic processing is also expected to mediate the relationship of narratives on behavioral intention (Hypothesis 5b).

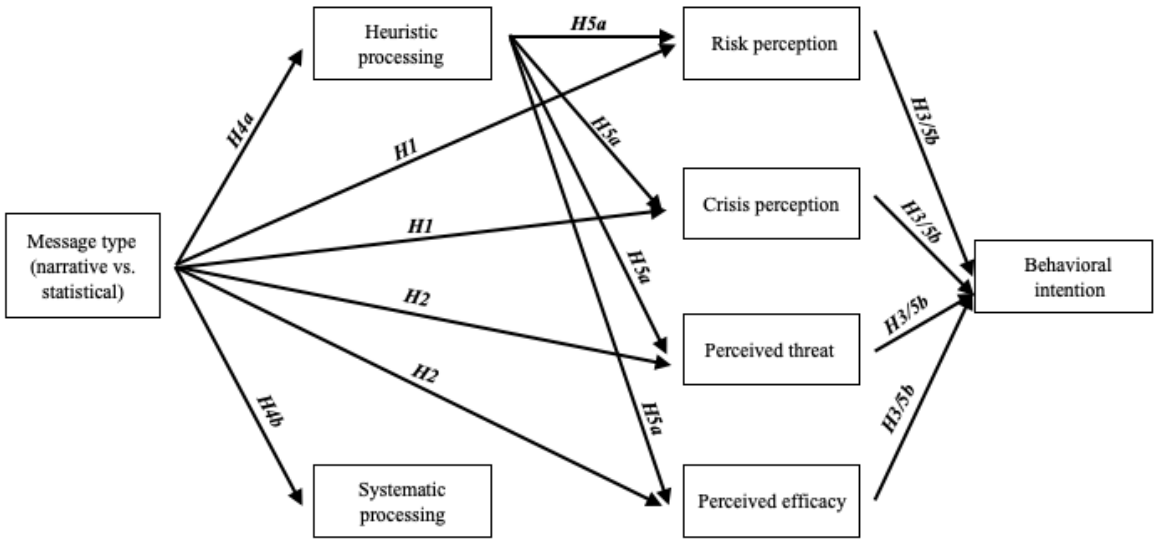

Figure 1. *Hypothesized relationships of variables based on the theoretical framework.*

The current study

The aim of this study is to give a better insight into how narrative and statistical message influence the perception of a crisis and perceived threat, perceived efficacy and behavioral intention. This study contributes to the existing literature by examining the relationship between narratives and behavioral intention in more depth, by measuring whether this relationship is mediated by the heuristic information processing system.

To explore the effects of heuristic information processing more deeply, participants were confronted with a fictional scenario, where they faced an exposure to radiation, due to an accident at a near nuclear waste disposal site. During this crisis, the participants received a message, which contained behavioral suggestions for protection and risk-reducing outcomes. The message was either framed in a narrative or statistical way, whereby a first-person narrative was used. Afterwards, people received a questionnaire where risk and crisis perception, severity and susceptibility, self- and response- efficacy, and behavioral intention were measured. Additionally, the way how the message was processed was measured.

Methods

Participants

This online experiment was completed by N=111 participants (64 females, 45 males, and 2 anonyms). The mean age was 25 with a range from 18 to 58. Their nationalities were German (88%) and others (12%). 58% of the participants hold a high school diploma, 28% a bachelor's degree, 7% a master's degree, 6% did not state an education level, and 1% hold a PhD or higher. Participants were randomly allocated to either the statistical-message condition (n= 58) or to the narrative-message condition (n= 53). The study was advertised via social media (e.g. Facebook, Instagram, or WhatsApp) and participants were recruited through SONA systems, an online platform for undergraduate Psychology Students of the University of Twente. Requirement for participation was a certain degree of English skills. Participants not agreeing to the consent after debriefing were excluded from further analysis (N=8), resulting in a total amount of 103 further used data files.

Randomization check. To check whether there were no pre-disposing factors influencing the manipulation, the two conditions were compared on variables that were not affected by the manipulation, such as age, gender, education, and nationality. Therefore, independent sample t-tests and a chi-square test were used. The two conditions did not differ by gender ($t(101)= 0.73$, $p= .39$). Also, the t-test for age distribution between the two conditions did not show any significant differences ($t(101)= 0.14$, $p= .73$). The chi-square test for education distribution also did not show any differences ($X^2(5, N = 103) = 1.51$, $p = .91$), similarly to the nationality distribution ($X^2(6, N = 103) = 5.29$, $p = .51$). Hence, the randomization was successful.

Procedure

Participants enrolled in the study were randomly assigned to one of the two conditions (statistic vs. narrative). Participants were unaware that there was more than one condition. The data collection procedure was the same for all groups. After reading and agreeing to the informed consent (see Appendix A), the participants were exposed to a fictitious crisis scenario, in which they were required to imagine themselves to be in (see Appendix B). They were instructed to take as much time as they needed to understand the scenario correctly. Moreover, they were asked to put themselves into the situation and to experience it as vividly as possible. The participant was asked to imagine that there exists an above-ground nuclear waste disposal site near to their house/apartment/student-room. The disposal site was in a five-kilometer radius away and it stored a highly radioactive material. As there was an

explosion, a concerning amount of beta-radiation was set free. After a pilot-test (*N*= 4), it was made clearer in the scenario that no evacuation was needed, as all pilot-participants were wondering whether staying inside the house would be protecting enough in this situation.

Participants were informed that they looked up for information on what to do now. They were informed that they found a message online, which was displayed on the next page of the online survey. Here, participants randomly received either a statistical message or a narrative message. After reading the message, dependent variables were assessed using a post-questionnaire. As a result of the pilot-test, one question was taken out, as it was not understood correctly. Thus, the questionnaire included 52 questions. The online experiment ended with the debriefing (see Appendix C). All in all, participation in the study took around 10-15 minutes. If eligible, participants received .25 SONA credit for taking part. The Ethical Committee of the University of Twente approved this research (no. 200579).

Manipulation

The message. Participants were randomly assigned to either a statistical message or a first-person narrative condition. The design of the messages is based on previous studies. As done in those studies (de Wit et al., 2008; Dillard & Hisler, 2015; Greene & Brinn, 2003; Mazor et al., 2007; Wojcieszak, Azrout, Boomgaarden, Alencar, & Sheets, 2017), both messages presented the same information, in the same order. The statistical message presented the information using numbers and facts. In contrast, the first-person narrative presented the information in terms of experiences. A person talks about his/her experiences with exposure to radiation, and what he/she did to prevent contamination. As narratives reflect feelings and experiences, one has to ensure that the information stays the same in both messages, so that one can still compare the effect of both messages. Hence, the statistical message also included information about how people tend to feel in such a situation.

Moreover, written text for both messages was chosen, because of the identification aspect. As explained earlier, identification plays a significant role in narratives. Thus, using a video or audio message seemed to be counterproductive for the persuasion of the messages. In contrast to studies from Betsch, Haase, Renkewitz, and Schmid (2015), de Wit et al. (2008), and Wojcieszak et al. (2017), no description of the person of the testimonial (such as name, age, or origin) was given, since this study aimed to reach different persons and not only a specific group. A gender-neutral message was created, even more so than done in the study by Gray and Harrington (2011), who used gender-neutral names. Leaving out these variables ensured that identification was not affected.

To check for possible confounding variables of evidence effectiveness which may account for different findings (see Wojcieszak et al., 2017), the manipulation was carefully constructed to be nearly identical. The length of both messages was identical (298 words) and they presented the identical number of evidence (three in both messages). Both messages addressed the following information: worries in regard to a nuclear waste disposal site, health risk from radiation, and three recommendations. Both messages had the same heading. To further strengthen the similarity, both messages ended with the same sentences: "One can easily and effortlessly reduce one's risk from getting contaminated by radiation if there happens an accident at a nuclear waste disposal site. It shows that just following these simple rules can immediately reduce or eliminate the threat of the crisis" (for both messages, see Appendix D).

Manipulation check. To test whether the manipulation was successful, namely the different framings of both messages, one has to check whether participants perceived one message as a narrative message and the other one as a statistical message. Therefore, two questions were adopted from Wojcieszak et al. (2017). Participants answered on a 7-point Likert scale whether the message focused on a personal story or numbers and statistics (1= *strongly disagree*; 7= *strongly agree*). The findings confirmed the successful message manipulation. Participants in the narrative-message condition reported greater agreement that the information in the article presented a personal story than the those in the statistical-message condition (M= 6.00, SD= 1.33 vs. M= 2.80, SD= 1.53, $F(8.02)$= -11.39, $p< .05$). In contrast, participants in the statistical-message condition reported greater agreement that the information in the article presented numbers and statistics than those in the narrative-message condition (M= 4.83, SD= 1.54 vs. M= 1.94, SD= 1.21, $F(3.25)$= 10.56, $p< .05$).

Dependent measures

For measuring the nine dependent variables, a questionnaire was constructed. In the following, each component of the questionnaire will be described, including reliability and factor analysis procedures (results can be found in Table 1). All items of the nine constructs were subjected to an exploratory factor analysis (EFA) using principal-axis factor extraction (PAF), to examine whether all had the same latent factor in common. For each scale, the value of the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity are given. For a more detailed description, see Appendix E.

Risk and crisis perception. To assess the feelings of the participants regarding the risk more in depth, two questions were adopted and modified from Sobkow, Traczyk, and Zaleskiewicz (2016) and several statements were adopted and modified from Yan et al.

(2019). All in all, 10 items were included for risk perception (Cronbach's alpha= .82), measured on a 7-point Likert scale, ranging from 1= *strongly disagree* to 7= *strongly agree* (see Appendix E). The PAF suggested a 2-component solution. Two items were deleted, resulting to an increase of Cronbach's alpha to .88 (KMO= .85, p<.05).

Additionally, questions for assessing crisis perception were posed. Three items were adopted from Snoeijers and Poels (2018) (Cronbach's alpha= .33) and were answered on a 7-point Likert scale ranging from 1= *strongly disagree* to 7= *strongly agree* (see Appendix E). The PAF resulted in a one-factor solution. After deleting one item, there was an increase of Cronbach's Alpha to .47. The PFA could be carried out with the remaining two items (KMO= .50, p<.05) and it was decided to maintain the scale, but to make every assumption regarding crisis perception with reservation.

EPPM. The Risk Behavior Diagnosis Scale (RBDS) (Witte et al., 1996, as cited in Gore & Bracken, 2005) was used to assess the principles of the EPPM, namely participants' attitude about severity and susceptibility to the risk, as well as about their self- and response-efficacy. The items were adapted to the study's scenario (see Appendix E).

Severity was measured using three items (Cronbach's alpha= .47), measured on a 7-point Likert scale (1= *strongly disagree*; 7= *strongly agree*). The scale was unidimensional when subjected to a PFA. Deleting one item led to an increase of Cronbach's alpha to .59 (KMO = .50, p<.05). Also, for susceptibility, three items were used, with the same 7-point Likert scale as severity (Cronbach's alpha= .90). The PAF suggested a one-component solution (KMO= .75, p<.05).

Self-efficacy was measured using three adapted items (Cronbach's alpha =.54), ranging on the same 7-point Likert scale. The PAF suggested a one-component solution. By deleting one item, Cronbach's Alpha increased to .61. The KMO and Bartlett's Test showed that a PAF with the remaining items is still possible (KMO= .50, p<.05). For response-efficacy, also three items were measured on the same 7-point Likert scale (Cronbach's alpha=80). A PAF suggested a one-component solution (KMO=. 62, p<.05).

Behavioral intention. Questions about intention to engage in the recommended behavior were adopted from Dillard and Hisler (2015) and modified accordingly (see Appendix E). Four questions were posed (Cronbach's alpha= .71), with answer options on a 7-point-Likert scale, ranging from 1= *not at all likely/ interested* to 7= *extremely likely/ interested*. A PAF resulted in a one-component solution (KMO= .61, p<.05).

Table 1

Factor Loadings, Communalities and Cronbach's Alpha based on Principal-Axis Factor Analysis with Varimax Rotation of nine scales

Items	Factor loadings		Communality	α
	Factor 1	Factor 2		
Risk perception				.88
I feel anxious when thinking about getting contaminated by radiation.	.85	.25	.76	
I feel anxious when thinking about radiation.	.82	.16	.69	
I feel anxious when thinking about radiation.	.72	.16	.69	
I worry about getting cancer	.77		.59	
I worry about getting contaminated by radiation	.76	.17	.61	
This event evokes fear.	.76	.24	.63	
This event evokes negative feelings.	.52	.34	.38	
I feel anxious when thinking about an accident happening at a nuclear waste disposal site.	.48	.43	.41	
Crisis perception				.47
This event stands out.	.70		.48	
This event causes negative effects.	.37		.14	
				.59
Severity				
Radiation is a severe threat for getting cancer.	.76		.58	
Radiation is a serious threat.	.55		.30	
Susceptibility				.90
I am susceptible for contamination by radiation	.92		.84	
I am at risk for getting contaminated by radiation.	.86		.73	
It is possible that I get contaminated by radiation.	.84		.71	
Self-efficacy				.61
I am able to change my clothes and wash myself if necessary.			.76	
I am able to throw away my self-grown fruits and vegetables.			.47	
Response-efficacy				.80
Changing clothes and washing myself prevents getting contaminated by radiation.			.84	
Staying inside the house prevents getting contaminated by radiation.			.70	
Throwing away self-grown fruits and vegetables prevents getting contaminated by radiation.			.60	

Table 1 (continued)

Items	Factor loadings		Communality	α
	Factor 1	Factor 2		
Behavioral intention				.71
How likely are you to adopt the recommended behavior of changing your clothes and wash yourself if necessary?	.96		.92	
How likely are you to adopt the recommended behavior of staying inside the house?	.58		.34	
How likely are you to adopt the recommended behavior of throwing away your self-grown fruits and vegetables?	.54		.30	
Systematic processing				.74
I thought about what actions I myself might take based on what I read.	.72		.51	
I tried to think about the importance of the information from the article I found online for my daily life.	70		.49	
I have made a strong effort to carefully examine the information presented on the case of radiated contamination.	.64		.41	
In order to be completely informed about the issue of radiated contamination, I feel that the more viewpoints I can get the better off I will be.	.51		.26	
I consider the significance of the information from the article I found online.	.49		.24	
I connect the information from the article I found online to knowledge that I have.	.35		.12	
I compare information from the article I found online to others.	.35		.13	
Heuristic processing				.63
I only spend a short time to think about the information from the article I found online.	.80	-.23	.69	
I skimmed through the article I found online.	.65		.42	
The article I found online lacked useful information on which I could base my decision to engage in protective behavior.	.37	-.21	.19	

Information processing. Participants had to answer questions regarding the two information processing systems. Questions for both systems were adopted from Smerecnik, Mesters, Candel, De Vries, and De Vries (2012) and Trumbo (2002) (see Appendix E). Items for the systematic processing system adopted from Smerecnik et al. (2012) were changed into positive worded items, as they are more easily understood and reduce error making.

Systematic processing was measured by seven items (Cronbach's alpha= .74), measured on a 7-point Likert scale (1= *strongly disagree*; 7= *strongly agree*). The PAF

suggested a one-component solution (KMO= .61, p< .05). Heuristic processing was measured by five items (Cronbach's alpha= .52), also on a 7-point Likert scale (1= *strongly disagree*; 7= *strongly agree*). The PAF suggested a two-component solution. Two items were deleted, resulting in an increase of Cronbach's alpha to .63 (KMO= .59, p<.05). Hence, the items were reduced from five to three items for measuring heuristic processing (Cronbach's alpha= .63).

Other measures

Motivation and imagination. Since this study builds up on a fictitious, imaginary scenario, it is important to assess to what a degree the participants engaged themselves into the story, and whether there are any differences between the message conditions. Therefore, four questions regarding their motivation and perception of the study were asked (see Appendix E). Participants could answer on a 5-point Likert scale, ranging from 1= *none at all* to 7= *a great deal*.

Demographic variables. In the end, participants were asked to report their age and their gender. Moreover, it was asked for their level of education and which nationality the participant had.

Data analysis

Dependent measures. For further analysis based on the EPPM, the components susceptibility and severity are transformed to the variable *perceived threat* (Cronbach's alpha= .80), and the components self- and response-efficacy are transformed into the variable *perceived efficacy* (Cronbach's alpha= .74). The PAF for perceived threat suggested a one-component solution (KMO= .76, p<.05). The PAF for perceived efficacy also suggested a one-component solution (KMO= .65, p<.05). To compare the two message conditions on the dependent measures (risk perception, crisis perception, perceived threat, perceived efficacy, behavior intention, systematic processing, and heuristic processing), seven independent-sample t-tests were executed.

Mediation analysis. To test whether the information processing system had a mediating effect on the dependent measures, multiple regression analyses were conducted. Therefore, perception of the message type was used and not the allocation to the message. After checking for the correlation of the perception of the message type and the dependent variables, it was tested whether information processing correlates with the other five dependent variables.

Lastly, several mediation analyses were executed to test whether information processing system mediates the relationship between the perception of the message type and the five remaining dependent variables (risk perception, crisis perception, perceived threat,

perceived efficacy, and behavior intention). Therefore, PROCESS v3.5 by Andrew F. Heyes was used in the statistical program SPSS.

Results

Motivation and Realism check of scenario and message

In respect to the participant's motivation, the mean score of the motivation to put themselves in the scenario was above the midpoint of the scale (*M*= 3.36, *SD*= 0.91). Moreover, the mean score of how well they were able to imagine the scenario (*M*= 3.77, *SD*= 0.81), and the mean score of the participants' perception of how realistic the scenario (*M*= 3.31, *SD*= 1.00) or the article they found online (*M*= 2.88, *SD*= 1.00*)* was, were all above the midpoint of the scale. These results show that a realistic scenario was successfully constructed. A t-test showed no differences between the message conditions on their motivation (*t*(101)= 0.07, *p*= .07), their imagination (*t*(101)= -0.46, *p*= .65), or their perception of how realistic the scenario (*t*(101)= -0.31, *p*= .09) or the article (*t*(101)= 0.99, *p*= .32) was. So, the message type is not a confounding variable of the perception of the study, which answered the posed research question.

General descriptions of results

Table 2 shows the means, standard deviations and Pearson correlations of the variables. Overall, perception of risk (*M*=5.58, *SD*= 0.98) and crisis (*M*=5.89, *SD*= 0.88) were well above the mid-point of the scale. Both threat (*M*= 5.51, *SD*= 0.92) and efficacy (*M*=5.37, *SD*=0.92), were highly perceived, as the results are also well above the midpoint. Moreover, the participants' intention to engage in the recommended behavior was rather high (*M*=5.93, *SD*=1.12). The perceptions of the message (personal story (*M*=4.38, *SD*=2.15) vs. numbers and statistics (*M*=3.40, *SD*=2.00)) are around the midpoint. Also, the results for the processing systems show an above the mid-point agreement for the statistical message (*M*=5.43, *SD*=0.80) and the narrative message (*M*=3.92, *SD*=1.24).

Table 2

Means, Standard Deviations, and Pearson correlations between Risk Perception (RP), Crisis Perception (CP), Perceived Threat (PT), Perceived Efficacy (PE), Behavioral Intention (BI), Perception of Narrative Message (PNM), Perception of Statistical message (PSM), Heuristic Processing (HP), and Systematic Processing (SP) (n=103)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. RP	5.58	0.98	1.00								
2. CP	5.89	0.88	.29**	1.00							
3. PT	5.51	0.92	.53**	.40**	1.00						
4. PE	5.37	0.92	.19	.26**	.01	1.00					
5. BI	5.93	1.12	.10	.30**	.14	.43**	1.00				
6. PNM	4.38	2.15	.05	−.27**	-.05	-.40**	-.33**	1.00			
7. PSM	3.40	2.00	-.03	.12	-.06	.38**	.17	-.65**	1.00		
8. HP	3.92	1.24	-.26**	-.24*	-.16	-.22*	-.16	.24*	-.09	1.00	
9. SP	5.44	0.80	.14	.27**	.09	.41**	.28**	-.27**	.22*	-.45**	1.00

Note. **Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed).

Hypotheses testing

Comparing means of message conditions on dependent variables. It was hypothesized that reading the narrative message lead to higher results for risk perception, crisis perception, perceived threat, perceived efficacy, and behavioral intention compared to a statistical message (H1-3). Significant differences were found for crisis perception, perceived efficacy, and behavioral intention, but not in the expected direction, as the results for these variables were higher for the statistical message condition than for the narrative message condition (see Table 3). Hence, hypotheses 1, 2, and 3 are rejected.

Also, two independent-sample t-tests were used to test whether participants in the narrative message condition processed the information heuristically (H4a) and participants in the statistical message condition statistically (H4b). Results show that there are significant differences. Participants in the narrative message condition show a higher agreement to heuristic processing than in the statistical message condition. Moreover, participants in the statistical message condition show a higher agreement to systematical processing than the narrative message condition. Hence, hypotheses 4a and 4b were accepted (see Table 3).

Table 3

T-test Results Comparing Message conditions on Risk and Crisis Perception, Perceived Threat, Perceived Efficacy, Behavioral Intention, Systematic Processing, and Heuristic Processing

	Statistical Message		Narrative Message			
Variable	M	SD	M	SD	t-test	p (one-tailed)
Risk perception	5.54	0.99	5.61	0.97	-0.33	.37
Crisis perception	**6.10**	0.75	5.69	0.95	2.42	.01
Perceived Threat	5.49	0 .98	5.53	0.87	-0.23	.41
Perceived Efficacy	**5.77**	0.71	4.96	0 .94	4.94	.00
Behavioral intention	**6.35**	0.79	5.50	1.25	4.08	.00
Systematic processing	**5.68**	0 .67	5.18	0.85	3.34	.00
Heuristic processing	3.71	1.28	**4.14**	1.16	-1.77	.04

Note. All variables were measured on a 7-point Likert scale ranging from *strongly disagree* to *strongly agree*. Behavioral intention was measured on a 7-point Likert scale ranging from *extremely unlikely* to *extremely likely*. Significantly higher results are highlighted in boldface.

Mediation. Before executing mediation analyses, it was checked whether the mediation variable (heuristic processing) correlates with the other dependent variables. A Pearson correlation analysis showed that, except for the relationship on perceived threat and behavioral intention, the correlations were significant (see Table 2). Processing the message heuristically reduced risk perception, crisis perception, and perceived efficacy. For testing whether heuristic information processing system mediates the relationship between narrative message and the five remaining dependent variables (H5a and H5b), PROCESS was used in SPSS. Results can be seen in Figure 2. No significant mediation effect could be found (see Table 4).

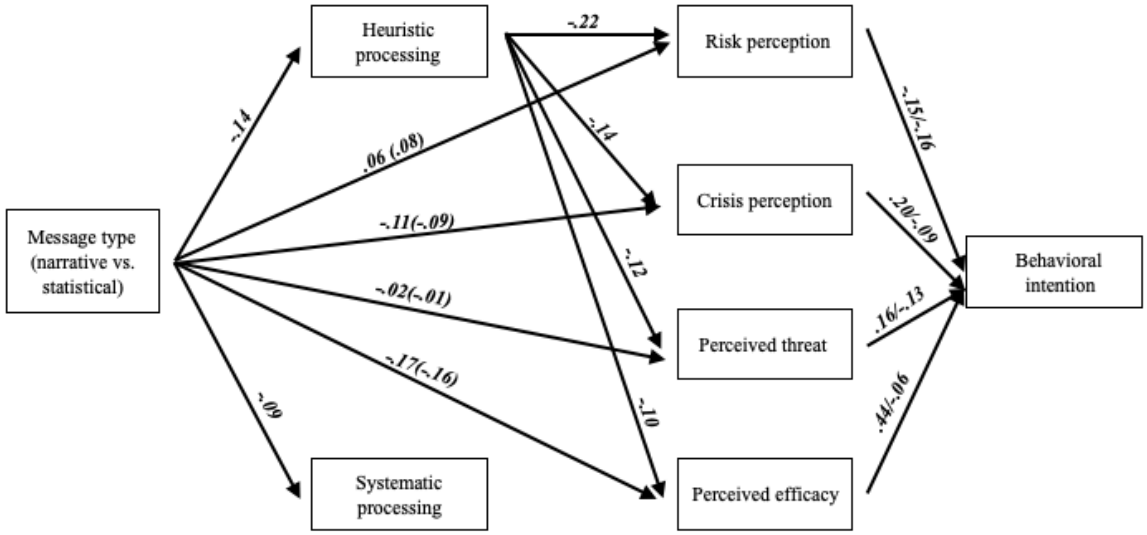

Figure 2. Model with path and mediation estimates. Each pathway includes a coefficient of the direct relationship of two variables. The c-path displays the total effect of narrative message on the dependent variables and the direct effect of narrative message on the dependent variables in parentheses.

Table 4

Bootstrapped indirect effects of mediation model (Perception of Narrative Message as IV)

		Indirect Effect		95 % CI	
Mediator	Dependent Variable	(a x b)	Standard Error	Lower	Upper
HP	Risk Perception	-.03	.02	-.07	.00
HP	Crisis Perception	-.02	.01	-.05	.00
HP	Perceived Threat	-.02	.02	-.05	.01
HP	Perceived Efficacy	-.01	.01	-.04	.02
HP	Behavioral Intention	-.01	.02	-.05	.02

Note. N= 103. IV= Independent variable. HP= Heuristic processing. CI= Confidence interval.

Additional analysis

Although no mediation effect of heuristic information processing could be found, there are still some noteworthy correlations between the information processing systems and the other dependent variables (see Table 2). These correlations are not initially necessary for answering the hypotheses, but they are still interesting to investigate. For instance, systematic processing has a significant positive relationship with crisis perception, perceived efficacy,

behavioral intention ($p<.01$), and the perception of statistical message ($p<.05$). In contrast, a negative correlation with the perception of narrative message was found. These results imply that the more the message was processed systematically, the higher were the perception of the crisis, perceived efficacy, behavioral intention, and the perception of the statistical message. Additionally, the more the message was processed systematically the less the message was perceived as a narrative message ($p<.01$).

With regard to heuristic processing, several negative correlations were found (see Table 2), such as with risk perception ($p<.01$), crisis perception, and perceived efficacy ($p<.05$). Further, a positive correlation was found for the perception of narrative message ($p<.05$). Hence, the more the message was processed heuristically, the lower were the perception of risk and crisis as well as the perceived efficacy. In contrast, the more the message was processed heuristically, the higher was the perception of the message as a narrative message.

Discussion

This study aimed to investigate an underlying factor of the persuasiveness of narrative messages in crisis communication. The effect of message type (narrative vs. statistical) and a possible mediating factor, namely information processing, were examined more closely.

This research displayed some significant results, although mainly in the not-hypothesized direction. It was found that crisis perception, perceived efficacy, and behavioral intention were higher after being exposed to a statistical message than to a narrative message. Thus, none of the hypotheses in regard to the EPPM were supported. Still, the hypothesis regarding message type and information processing were accepted, as the results for heuristic processing were higher after reading a narrative message compared to after reading a statistical message. Additionally, the results for systematic processing were higher after reading a statistical message compare to after reading a narrative message.

The findings of this study are partly in line with previous research. Although several studies indicated that narrative messages indeed are more influential than statistical messages on factors such as risk perception, perceived threat, perceived efficacy, or behavioral intention (de Wit et al., 2008; Prati et al., 2012), there are also studies which suggest the opposite. Zebregs et al. (2015) for example, described that a statistical message is more influential on beliefs and attitudes than narrative messages. Moreover, Greene and Brinn (2003) found that statistical messages were more influential than narrative messages on decreasing tanning bed usage among women. The finding that people in the statistical message condition were more inclined to use the recommended behavior would then be in line with previous research.

Nonetheless, the study by Zebregs et al. (2015) showed that the effect on behavioral intention was stronger for the narrative message condition compared to a statistical message condition. This finding is also supported by other authors, such as de Wit et al. (2008), who found that, after getting confronted with a narrative message, people tend to get a vaccination against HBV more often than after being confronted with a statistical message. Hence, this study's findings contradict previous findings, but also support them.

With regard to the used literature for the hypotheses, it might be interesting to look at their study designs more closely. The literature shows discordance on the effect of narrative versus statistical message, and also this study showed mixed and differing results. A possible explanation for this might be the different study designs and used risks or crises. The literature used for the hypotheses mainly focused on vaccination (de Wit et al., 2008; Nan et al., 2015; Prati et al., 2012). On the contrary, the meta-analysis by Zebregs et al. (2015) focused on different studies, ranging from birth control to global warming. Ropeik (2004) described that different characteristics of a risk result in different perceptions and different degrees of fear. Aspects such as dread, choice, or man-made vs. natural, influence the way the risk is perceived. This might explain the discordance in the literature regarding the effectiveness of the message types, as they investigated different risk topics. In line with that, this study's design also differed from that of the used literature, as this study focused on the risk of nuclear waste. As nuclear waste has the characteristic of a man-made risk, and not that of a natural (such as HPV), according to Ropeik (2004), it can be expected that the risks are perceived differently, resulting in different outcomes. Other risk characteristics might also play a role, such as dread. Although people tend to be more fearful in regard to man-made than natural risks, people are very fearful of cancer (dread, Ropeik, 2004). As radiation can cause cancer, investigating this topic might result in higher risk perceptions than when investigating topics such as a heart disease. Thus, based on risk characteristics, both risks are perceived differently. This also influences the other variables, such as perceived threat and efficacy, as well as behavioral intention. Hence, the used literature for the developed hypotheses might not be suitable for the chosen crisis scenario, which could explain the differing results.

Possible explanations that the results for the statistical message were higher on the dependent variables crisis perception, perceived efficacy, and behavior intention than those for the narrative message were adopted from Lindsey and Ah Yun (2003). They explain that perceived verifiability of evidence and perceived message credibility are influential on the persuasiveness of the message type. Hence, people might expect the statistical message as

more verified, because they think that narrative messages are more easily manipulated (Ah Yun & Massi, 2000). Moreover, Kopfman et al. (1998) showed that statistical messages were perceived as more credible than the narrative messages, which can also mediate the persuasiveness of the message, according to Lindsey and Ah Yun (2003). So, due to the possible verifiability of the statistical message and the possible higher perceived credibility, participants in this condition might expected that the recommended behavior is easy to accomplish and would result in decreasing the consequences of the risk, more than the participants in the narrative message condition did. Nonetheless, Allen et al. (2000) found that both statistical and narrative messages were seen as equally credible in their study.

Still, it can be expected for this study that the verifiability and credibility for the statistical message were higher because both messages included the same recommendations. Also, both conditions received the same crisis scenario, which highlights the assumption that the statistical message influenced how the crisis and its consequences were perceived, due to the way the information about this crisis were presented. Moreover, it was checked for differences between the conditions on factors such as realism of the scenario and the article, their motivation to engage in the study and their imagination of the scenario. No differences were found there. Thus, the message framing might has influenced the way the message was perceived (verifiable and credible) and thus, the perception of the crisis and the recommendation in the statistical message were more convincing. However, these variables were not measured in this study, and hence, one cannot make a clear assumption. Including these factors in future research can give more insights into the mediating factors of statistical persuasion in crisis communication. Moreover, it cannot be explained why the effect was not found for the other dependent variables (risk perception and perceived threat) as well.

In regard to the relationship of the message type and the processing system, the findings of the current study are in line with previous research (Bakker et al., 2019; Kopfman et al., 1998; Winterbottom et al., 2008). This study found that the statistical message is processed more systematically and the narrative message more heuristically. Nonetheless, the anticipated mediation was not found. It might be possible that there was a lack of persuasion of the narrative message, leading to the not expected findings. This can have several reasons. Firstly, it might be the case that the participants could not identify with the story teller as no personal details were published (Slater & Rouner, 2002). Since no identification points were given in this study, it might be that the effect on the dependent variables regarding the EPPM were suppressed (Slater & Rouner, 2002). Thus, publishing more details about the story teller and tailoring the message more to the recipient can make the message more persuasive (see

EELM). Secondly, it was created a rather short message (298 words), which might have reduced the potential to imagine the situation concretely (Green, 2006). This might have inhibited the transportation into the story, decreasing the ability to understand the characters' thoughts and reasons (Green & Brock, 2000). Thirdly, another reason for a lack of persuasion could be the aspect of source credibility. Getting the message from a credible source could increase the persuasiveness of the narrative message on the intention to engage in a certain behavior (Griffin et al., 2002). As no details were given about the source, participants could not know where the information is coming from, just that it is from the internet. Consequently, the message might not be very persuasive, as one does not know whether one can trust the information presented in the source. As this variable was not included in this research, one can only speculate about this aspect. Still, this could be an interesting variable to include in future research.

Strengths

One strength of this study is that it adds to previous literature and supports it on the assumption that narrative messages are processed heuristically and statistical messages systematically. By measuring the information processing systems, this study adds to previous research (e.g. Dillard & Hisler, 2015). In regard to this, it was not only possible to measure the two information processing systems, but the hypothesis dealing with this could also be accepted.

Moreover, the created manipulation was successful. One can say that this study showed that the narrative message was perceived as a personal story by the participants and that the statistical message presented numbers and statistics. Hence, the manipulation in this study succeeded. The results even show a higher agreement for the narrative-message condition, than in the statistical-message condition (M= 6.00 vs. M= 4.83).

Another strength of this study is that the developed scale can be used in future studies. As no fitting questionnaire for this research topic (nuclear waste accident) was found, the researcher developed an own scale by adapting items from other studies. Thus, future studies investigating risk and crisis perceptions in regard to nuclear (waste) accidents can use the developed scale.

Limitations and recommendations for future research

Next to the strengths, this study also has some limitations, e.g. concerning the design of the study. Although the participants indicated that they were motivated to engage in the study (M= 3.36), that they could imagine the scenario well (M= 3.77), and that the scenario and the article were quite realistic (M= 3.31, M= 2.88), the results were just above the

midpoint. So, because people did not see it as highly realistic it might not have had the intended persuasive effect it could have had if the scenario and message were perceived as more realistic. Hence, the question remains whether the results would be different if the study design in regard to the scenario and article was more convincing and realistic. However, it is important to note that when investigating a crisis situation using an experiment, it is hard to make it very realistic, without bringing people in danger or posing psychological threats. For instance, if the crisis situation is too realistic and people get traumatized by seeing an incident or remembering an experienced crisis. Hence, the method and design choices should be made cautiously. As the study of Bakker et al. (2019) showed, and what is supported by several other authors (Gillath, McCall, Shaver, & Blascovich, 2008; Yee, Bailenson, Urbanek, Chang, & Merget, 2007), using a virtual environment for studying behavioral responses in a crisis situation is very useful, as it mirrors nearly the same behavioral response one would make in a real-life situation. Thus, future research should concentrate on implementing VR into their study design when focusing on behavioral and cognitive responses in a crisis situation. Although it was posed in the introduction to not use a video, due to identification problems, the recommendation to use VR refers to the crisis scenario, and not the message.

Another limitation is the generalizability of the findings. Firstly, the generalizability to other catastrophes might be limited. As the crisis in this study reflects a man-made catastrophe, results may differ for natural catastrophes or health related crisis like a pandemic. Ropeik (2004) explained that the risk perception for man-made catastrophes are higher than that of natural catastrophes, as they evoke more fear. Thus, the effectiveness of both message types could also differ during different crisis situations. Hence, the results of this study are not generalizable to other catastrophes as they evoke different feelings. Secondly, generalizing the findings to other populations should be made cautiously. The study sample mainly reflects people from Germany, where there already are some problems with nuclear waste disposal sites. Findings can be generalized to some European countries, or countries which reflect the same history in regard to problems with nuclear waste disposal site. Still, one should not generalize these findings to countries in, e.g. Asia, since they have a different history in regard to nuclear accidents, such as with Fukushima. Although this study's findings give more insight into how message types influence the perception of and behavioral intention during this crisis, more research is needed to investigate behavior during a crisis with other populations and crisis situations.

Implications and conclusion

This study has some implications for theory. In accordance with several authors (Trumbo, 2002; Trumbo & McComas, 2003), it seems as if heuristic processing would decrease aspects in risk and crisis perception, such as perceived efficacy or behavioral intention. On the contrary, in this study, the statistical message possibly was more credible and hence resulted in higher risk and crisis perception than the narrative message as the message was more convincing. Thus, for crisis communication this would indicate that a statistical message is more effective to influence people to adopt recommended behavior. So, what was learnt in this study about the persuasiveness of the two message types can be used to create more effective crisis messages. Nonetheless, not all results are clearly in support of one or the other message type, which undermines the importance of future studies investigating this further. Also, more variables should be included while investigating this topic, such as source credibility. This would help to understand how people process the information given during a crisis situation and which source is best to use. Still, this study represents an effective manipulation and it supports the assumption that a narrative message is processed heuristically. Moreover, this study adds to previous research by showing a negative connection between heuristic processing and risk and crisis perception, and perceived efficacy. This would indicate that processing a message heuristically during a crisis would be counterproductive, as a certain degree of fear must be appealed, in order to engage in protective action (see EPPM). Investigating this further might yield more interesting insights about the relationship of the HSM and the EPPM.

In conclusion, this study contributed to the crisis communication domain by investigating the role of message type and information processing during a crisis situation. It was possible to develop an effective manipulation, and this study supported the assumption in which way the messages were processed. In contrast with the expectations, the findings support the use of a statistical message during a crisis situation, as it had more effects on crisis perception, perceived efficacy and behavioral intention. Also, no mediation effect of heuristic processing was found. One possible explanation could be the lack of persuasion, due to, e.g. identification problems. Future research could use a more realistic scenario, for example through VR, to improve the quality of the study. Further, the research design can be improved by adding more variables to further investigate the function of message types and possible mediating factors in crisis communication.

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Appendix A

Informed consent

Welcome to this study on crisis communication! Please read the information on this page carefully.

Consent to Participate in Research. You are invited to participate in a research study. I am interested in underlying factors of crisis communication, meaning what is most beneficial to communicate recommended behavior during a crisis. The data will be kept anonymous and confidential, what matters is your own personal opinion.

Please fill out this survey without any breaks or distractions.

Duration. The study should last approximately 10-15 minutes.

Risks. There are no or minimal foreseeable physical or emotional risks involved. If you already experienced something with a nuclear accident or feel uncomfortable with this topic you might want to not engage in this study. You will encounter a fictitious scenario about a nuclear accident and thereafter, you are asked to fill out a questionnaire. Once you have filled out the questionnaire the study is completed.

Confidentiality. To ensure confidentiality, your responses will be anonymous (i.e., personal identifying information cannot be matched with your answers) and we only analyze group averages (i.e., individual performances will not be analyzed).

Your rights. Your participation is voluntary. You may choose not to take part in the study or to stop participating at any time, for any reason, without consequences. You have the right to refuse to answer particular questions or perform any task. In addition, your privacy will be maintained in all published and written data resulting from this study. For further information or questions about this study, please contact Dr. Margôt Kuttschreuter at m.w.m.kuttschreuter@utwent.nl or Nele Hingmann at n.m.hingmann@student.utwente.nl

Have you read the above information and agree to participate in this study?

Appendix B

Scenario

Please read the following scenario thoroughly. Take your time to understand everything correctly. Please try your best to put yourself into this situation and try to experience it as real as possible.

Imagine that there exists an above-ground nuclear waste disposal site near your current house/apartment/student-room (see picture). You live in a 5-kilometer radius of the site, which stores a material that is highly radioactive. Suddenly, you hear a loud noise, sounding like an explosion. From the radio, you hear that there happened an accident at the nuclear waste disposal site you live near to, whereby a concerning amount of beta radiation was set free. But, there is no need to evacuate and you hear that more information should follow soon.

Although you have some iodine tablets at home, you do not know how to react properly. Thus, you start looking up more information online. You come across the following message (see next page):

Appendix C

Debriefing

Thank you for participating in this study. You were confronted with a fictitious scenario about a nuclear accident. All information is based on fundamental research and the picture used was obtained from Google. You were allocated to one of two conditions, as this study aims to compare the persuasion of two message types, namely narrative and statistical. If you want to have further information about the study, please contact n.m.hingmann@student.utwente.nl

After you got debriefed, do you still give your informed consent? If not, your data will be deleted immediately.

Appendix D

Messages

Message (statistical)

What to do when faced with an incident at a nuclear waste deposit site

When an accident at a disposal site happens and people get contaminated by radiation, health risks can be anticipated. Nearly 30% of asked EU-citizens are scared of a lack, or an accident at the disposal site. As reported by the International Commission on Radiological Protection (ICRP), a 10% risk of cancer for adults arises due to an external whole-body radiation dose of one Sievert (Sv). The risk of dying due to radiation increases to 50% when one is exposed to 4,5 Sv. Even one SV is a rather high dose, which is unlikely to experience if one follows recommended behaviors in emergency situations.

If you are exposed to a radiation cloud, there are some actions you can take in order to protect yourself. The German Federal Ministry published some recommendations for reducing the threat of getting contaminated. Recommendations are (1) to stay inside and keep windows and doors shut, (2) to change contaminated clothes and wash yourself, and (3) to throw away self-grown fruits and vegetables from your garden or balcony afterwards. Staying inside the house and keeping windows and doors shut reduces your risk of exposure to alpha and beta radiation by 100%. When food or vegetables are self-grown in the garden or on a balcony, one should throw them away, as they could be contaminated and affect one negatively afterwards. Taking an iodine tablet is not always necessary, which will be communicated by the disaster control management of one's city. One can easily and effortlessly reduce one's risk from getting contaminated by radiation if there happens an accident at a nuclear waste disposal site. It shows that just following these simple rules can immediately reduce or eliminate the threat of the crisis.

Message (narrative)

What to do when faced with an incident at a nuclear waste deposit site

One day I was going home from meeting a friend, and suddenly I heard a loud explosion. When I arrived at home, I found out that there happened an accident at a nuclear waste disposal site I was living near to. Radiation was exposed and I was worried to get contaminated by radiation. I was scared to get negatively affected and ending up having

cancer due to the radiation. Hence, I directly closed every door and window and stayed inside the house, which made me feel safe. Moreover, I put off my clothes I was wearing, showered and changed into new clothes. I did this because I felt dirty since I was outside when the accident happened and thus, I and my clothes could have also been contaminated. Luckily, I had some iodine tablets at home which I also could take, which made me feel of being more in control of the situation. The disaster control management from my city communicated via radio that people until the age of 45 needed to take the tablets, which I did accordingly. After the radiation cloud was gone I could go outside without being exposed to the threat of getting contaminated, but I was worried that it negatively affected the nature. So, I threw away my fruits and vegetables from my garden since they could also be contaminated and affect me negatively afterwards. Luckily, I did not suffer from any negative consequences after the event.

One can easily and effortlessly reduce one's risk from getting contaminated by radiation if there happens an accident at a nuclear waste disposal site. It shows that just following these simple rules can immediately reduce or eliminate the threat of the crisis.

Appendix E

Detailed description of questionnaire construction

Risk and crisis perception

Issues that are treated in the risk perception scale are: getting contaminated by radiation, suffering from cancer, staying inside the house for a longer time period, throwing away one's self-grown food, and negative consequences for the nature due to the event (see Table E1). These issues are seen as possible consequences due to an accident at a nuclear waste disposal site. As the PAF suggested a two-component solution accounting for 61% of the variance, the results had to be investigated more closely. The item "I worry about the negative consequences for the nature after the event." did not load high on factor 1, but on factor 2. In contrast, the item " I worry about getting cancer did not load high on factor 2, but on factor 1. As factor 1 might present risk perception in regard of oneself and factor 2 in regard to the nature, both can be important factors for the overall construct of risk perception. As defined by WHO (2013), risk perception deals with threats to one's health, but also to the environment. Hence, both factors and scales were used to measure risk perception. After calculating Cronbach's Alpha with and without these items, it was decided to keep them. But, two items were deleted, due to their low communality, resulting in eight remaining items measuring risk perception, namely "I worry that I cannot eat my self-grown fruits and vegetables", and "I felt anxious when thinking about staying inside for a longer time".

The items for crisis perception were adopted from Snoeijers and Poels (2018) (see Table E1). The difference between risk and crisis perception is that in crisis perception the perception regarding the event as such is measured and not in regard to its consequences. Meaning, the questions are based on certain characteristics of a crisis situation, such as uncertainty, quick situation changes, and negative effects due to it (see Snoeijers & Poels, 2018). Thereby, one can see whether the participants perceive this event as a crisis situation or not, next to how much risk they perceive. The PAF showed that the first item "The event is unpredictable" did not load high on the factor (0.3 is seen as a cut-off score, according to Field, 2013, p.692), hence, it was not included in further analysis. This resulted in an increase of Cronbach's Alpha from .33 to .47.

EPPM. The PAF for severity resulted in a one-component solution, accounting for 52% of the variance. The item "Radiation is harmful" did not load high on the factor, and was excluded. Thereby, Cronbach's Alpha increased from .47 to .59. The PAF for susceptibility suggested a one-component solution, accounting for 84% of the variance.

The PAF for self-efficacy suggested a one-component solution, accounting for 56% of the variance. The item "I am able to stay in the house to prevent against radiated contamination." was excluded from the scale due to a low factor loading. This resulted in an increase of Cronbach's Alpha. During the pilot testing, this item was already not seen as relevant from the participants as staying inside the house was not seen as efficient when dealing with radiation. Although there were made changes due to this point, maybe participants still perceived this as not relevant in this case, which could explain the low factor loading. The PAF for response-efficacy, suggested a one-component solution, accounting for 71% of the variance. The KMO and Bartlett's Test supported a PAF with the three items (KMO=. 62, $p<.05$).

Behavior intention

Questions about intention to engage in the recommended behavior were adopted from Dillard and Hisler (2015) and modified accordingly (see Table E1). However, only four of the five questions used by Dillard and Hisler (2015) were adopted, because the behavior is dependent on an event happening. Dillard and Hisler's (2015) question regarding the intention to engage in a recommended behavior in the next time was not adopted. The PAF resulted in a one-component solution accounting for 65% of the variance.

Information processing

The PAF for systematic processing resulted in a one-component solution, accounting for 40% of the variance. For the heuristic processing construct, the analysis suggested a two-component solution, accounting for 62% of the variance. The items "I have been able to make a decision about how concerned I am about radiated contamination without seeking a great deal of additional information, by using my existing knowledge" and "Past experiences with other situations like this have made it easier for me to decide how I feel" were excluded from further analysis after checking Cronbach's Alpha with and without these items. Deleting them increased Cronbach's Alpha. A PAF with the remaining three items was suitable, according to the KMO (.59) and the Bartlett's Test ($p<.05$).

Table E1

Overview of the questionnaire, informing about the construct, the scale it was measured on, and the wording of the used items

Construct	Scale Type	Wording
Risk perception	7-point Likert scale	This event evokes fear. This event evokes negative emotions. I worry about getting contaminated by the exposed radiation. I worry about getting cancer. I worry that I cannot eat my self-grown fruits and vegetables. I worry about the negative consequences for the nature after the event. I feel anxious when thinking about radiation. I feel anxious when thinking about getting contaminated by radiation. I feel anxious when thinking about an accident happening at a nuclear waste disposal site. I feel anxious when thinking about staying inside for a longer time.
Crisis perception	7-point Likert scale	This event is unpredictable. This event causes negative effects. This event stands out. The event changes quickly.
Severity	7-point Likert scale	Radiation is a serious threat. Radiation is harmful. Radiation is a severe threat for getting cancer.
Susceptibility	7-point Likert scale	I am at risk for getting contaminated by radiation. It is possible that I get contaminated by radiation. I am susceptible for contamination by radiation.
Self-efficacy	7-point Likert scale	I am able to stay in the house to prevent against radiated contamination. I am able to change my clothes and wash myself if necessary. I am able to throw away my self-grown fruits and vegetables.
Response-efficacy .	7-point Likert scale	Staying inside the house prevents getting contaminated by radiation. Changing clothes and washing myself prevents getting contaminated by radiation. Throwing away self-grown fruits and vegetables prevents getting contaminated by radiation.
Behavior intentions	7-point Likert scale	How likely are you to adopt the recommended behavior of staying inside the house? How likely are you to adopt the recommended behavior of changing your clothes and wash yourself if necessary? How likely are you to adopt the recommended behavior of throwing away your self-grown fruits and vegetables? How interested are you to look up for more information about nuclear waste and its disposal sites?
Systematic processing	7-point Likert scale	I connect the information from the message to other information I have read or heard.

		I compare information from the message to others. I consider the significance of the information from the message. I tried to think about the importance of the information from the message for my daily life. I thought about what actions I myself might take based on what I read. In order to be completely informed about the issue of radiated contamination, I feel that the more viewpoints I can get the better off I will be. I have made a strong effort to carefully examine the information presented on the case of radiated contamination.
Heuristic processing	7-point Likert scale	I skimmed through the message I found on the internet. I only spend a short time to think about the information from the message. The message lacked useful information on which I could base my decision to engage in protective behavior.. I have been able to make a decision about how concerned I am about radiated contamination without seeking a great deal of additional information, by using my existing knowledge. Past experiences with other situations like this have made it easier for me to decide how I feel.
Manipulation check (scenario)	5-point Likert scale	How motivated were you to imagine yourself in the scenario? How well were you able to imagine the situation? How realistic do you think this scenario is? How realistic do you think the message is?
Demographics		Age Gender Country Affiliation City