

Dialogical Emergency Management and Strategic Awareness in Emergency Communication

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ABSTRACT

This paper introduces two concepts—*dialogical emergency management* and *strategic awareness*—as means to use and understand the content of social media for the purpose of emergency communication. Dialogical emergency management denotes that the emergency management organizations follow what people publish in various social media on emergencies and ongoing emergency response, and then adjust their information strategies in a way that matches the expectations and needs for emergency information of the public. The concept of strategic awareness suggests that it is essential to have an understanding of the receiver (public) of emergency information but also to have an understanding of the receivers' idea about the emergency and emergency response. Hence, the notion of strategic awareness incorporates structured awareness of how people interpret, value, and reacts on communication based on what they think about the sender's (emergency management organization's) actual intentions and motives.

Keywords

Communication, Dialogue, Emergency Management, Screening, Social Media, Strategic Awareness

INTRODUCTION

Mobile phones with visual and audio capabilities are standard today, and as such mobile devices have become commonplace for many European citizens it has become easy to record and disseminate information among individuals and communities. This possibility combined with social media such as the Internet based communities (discussion forums, Facebook®, Twitter®, YouTube®, MSN®, etc.) and the mobile equivalents (keteké® and GIGO) makes it easy for individuals to disseminate information in open media spaces as well as in more restricted social networks. It is expected that such social media spaces will be more prominent in the future.

Information trajectories are changing drastically with the advent of new technology. When mobile phones became popular, common emergency call-centres often became overwhelmed with phone calls since many observers could reach the emergency call-centres directly through their mobile phones (Artman, 1999). *The time of the feedback loop for emergency communication is therefore becoming severely forced, and it might very well be the case that the public receives information about emergencies through social medias before the emergency management organizations have had the possibility to act and present official information about the specific emergencies.* Today, the mobile phones are not constrained to making calls, but might also be a tool to take snapshots and record videos and then publish them at various places within minutes. One might even imagine that there may be conflicting information depending on both the nature of the conflict and the intentions and/or perspectives of the observers. Such discrepancies are of utmost importance for the emergency management organizations to be aware of. This paper addresses this issue and presents a new perspective on how to deal with future emergency communication. Before presenting the concept of dialogical emergency management we give a brief review of how people react and act in crises.

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The public's reactions and actions in crises

A limited research body exists on public reactions to alerts and warnings. Nevertheless, there are several specific examples that describe particular reactions in recent emergencies and disasters. There are for instance studies suggesting that repeated warnings in areas frequented by hurricanes have a high level of public complacency, demanding further development of emergency communication strategies from the emergency management organizations (Andersson, 2006; Kapucu, 2008; Wang and Kapucu, 2008). Related research has been done in fields related to human behaviour in emergency situations such as agent-based simulations of emergency settings (Pan, Han, Law, 2005; Klüpfel, 2005), and design of user-friendly notification messages (Malizia, Onorati, Bellucci, Diaz, Aedo, 2009; McCrickard, Czerwinski, Bartram, 2003).

Aguirre (1991) points to a number of factors that are important to consider when trying to understand public reactions to warnings and alerts such as distance to immediate warning systems (alarms), social network access and access to various other media platforms, cultural belonging and language skills. The physical distance to the actual situation (in this case an emergency) is also pointed out as an important factor that influences if a person decides to take action or not when being notified of an emergency. However, it is less likely that distance is also an aspect when it comes to all forms of value-loaded communication. A brief glance at forums shows that in many cases people from different parts of the world tend to take part in communication regarding subjects that they think are important regardless of their geographical location (for example the demonstrations in Bangkok and Gothenburg).

Drabek (1999, 2001) points out that individual characteristics and social context are important in relation to warning responses. Drabek also states that if emergency management organizations issue an order for a mandatory evacuation, people are more likely to believe the warning and respond to it. The geographical and physical setting is also important; the more vulnerable setting people live in, the more likely they are to believe and respond to warning messages. Another conclusion by Drabek is that the longer the public perceives the duration of an emergency or disaster event, the more likely it is that the public believes and responds to warning messages.

To what extent people trust a certain type of media is also an important factor to consider when planning for emergency communication. Lindell (1987) states that the more channels a warning comes from, the more likely it is that the public will respond to this warning, especially if the public has been informed in advance regarding appropriate ways to respond. During emergencies and disasters, people also actively seek and create information in various social forums on the Internet. Palen, Vieweg, Sutton, Liu, Hughes (2007) as well as Liu, Palen, Sutton, Hughes, Vieweg (2008) have studied how the Internet and mobile phone users create and share information online during different emergencies and disasters. It is quite likely that people tend to listen and believe more in people that they already share a relation with, despite how vague and fragile such a relation is— to the extent that one has only communicated through one's nicknames.

Overall we think there is a great need to understand how people use social media in emergencies and, furthermore, a great need to make use of people's activities on social media spaces. Future emergency management must be better prepared to both understand the driving forces of using social media, as well as the impact of what people do on social media spaces.¹

DIALOGICAL MANAGEMENT AND STRATEGIC AWARENESS

The research on teamwork in emergency management has focused on the dialogical and discursive practices of the decision-makers' way to understand and pin-point the actual situation, sometimes framed within a critical stance towards situation awareness (Artman, 2000; Artman and Waern, 1999; Garbis and Artman, 2004; Heath and Luff, 1992). Lately the concept of sensemaking has been more prominent which focuses on the process of understanding rather than the situation itself (Landgren, 2005; Weick, 1988; Weick, 1993). This research has, however, mainly focused on the practices within the management structures, and less on the dialogical relation of actors outside the management (see for example the game-theoretical analysis by Brynielsson (2006)). The position we take here is focused on how the emergency management organizations can initiate a dialogue with actors (in this case the public) outside the management structure. Instead of taking information from the critical situation as a given input to the management structure we will investigate the possibility to design a system

¹ Research on social media in general is obviously a young research topic. However, some research papers can be found at <http://www.danah.org/TwitterResearch.html>; an interesting example for leisure situations is <http://singaporeseen.stomp.com.sg/singaporeseen/>

which put this relation in a continuous dialogue. By dialogue we do not only refer to the momentous turn-taking between two interlocutors, but also differentiate between monological and dialogical reasoning. Monological reasoning is focused on the sender's production and packaging of a certain message based solely on the sender's own understanding of the situation, while dialogical reasoning also include that the message producer inherently, already in the production of the message, base his/her understanding on the interlocutors understanding of the situation. Hence, dialogical reasoning involves a certain amount of understanding of someone else's understanding. Being aware of this understanding is what we take the term strategic awareness to mean. By being aware of the strategic aspects of a situation one may use this knowledge to (deliberately) improve message production by taking the receiver into account in a structured manner. Also, strategic awareness makes it possible to concretize and investigate the strategic constituents of a situation in order to apply the appropriate measures for maintaining or, potentially, improving the knowledge. As indicated, it is important to distinguish strategic awareness, which is a *knowledge state* parallel to that of situation awareness, from the act of dialogical reasoning, which is an *activity* that can benefit from being strategically aware. By this perspective the emergency management structure is less viewed as a control structure and more as a structure of investigation. The former has often focused on how to control a situation (a fire, an evacuation, an incident, etc.) The latter is more focused on investigating to understand how the clusters of people reason and understand the situations' consequences, which is what we intend to capture with the concept of dialogical emergency management.

New forms of communication systems provide improved possibilities for both the public and the emergency management organizations to gather and make use of each other's information and, moreover, to communicate at a much faster pace than before (Weick, 1993). For emergency management organizations it is therefore vital that they are not merely reacting, but also act proactively in the communication—in control terms this has often been discussed in terms of feedback and feedforward respectively (Brehmer, 1991). In order to act proactively towards the understanding and reasoning of the public, a notion of how different clusters of people position themselves and what they base their opinions and understanding on is needed. This means to understand how the clusters of people trust and believe in the emergency management organizations. This phenomenon of trust and belief is captured by the concept of strategic awareness as outlined by, e.g., Brynielsson, Horndahl, Kaati, Mårtensson and Svenson (2009).

DIALOGICAL EMERGENCY MANAGEMENT AND SOCIAL MEDIA

A challenging aspect of emergency communication is the constantly changing (a) information needs of the public, (b) nature and characteristics of the public's communication, as well as (c) the communication abilities of the public. In this sense, emergency communication may differ significantly for each emergency and disaster. An investigation of the role of media, and especially social media, in adjacent emergencies show how people respond to, discuss and perceive ongoing emergencies. Figure 1 presents a general overview of different actors in the society who may act and respond to information in different ways. The first responders will have direct communication with the emergency response staff and will provide them with their professional view of the ongoing emergency. The emergency response staff will in turn direct and give resources to the first responders. Journalists are presenting the ongoing emergency to the general public via different mass media channels (e.g., newspaper, online newspapers, TV and radio). The casual observer owns the means to communicate through more personal media such as phones, social media networks and forums, and might direct their communication to specific individuals, to wider groups as well as to the emergency management organizations. There is also the public who receives information by all forms of media (personalised or mass media) and shapes an understanding of the ongoing emergency—correct or not. In this situation there is no first hand experience by the emergency management organizations, but rather mediated expressions, where the public might have and produce opinions and alternative views to the authorised view of the ongoing emergency. In the middle is the emergency response staff that should both coordinate the first responders and inform the public about issues of key importance. In order to communicate with the public efficiently, the emergency response staff must have an idea of the general opinion, knowledge and understanding of the public. Below we present four different examples of cases and their relation to social media.

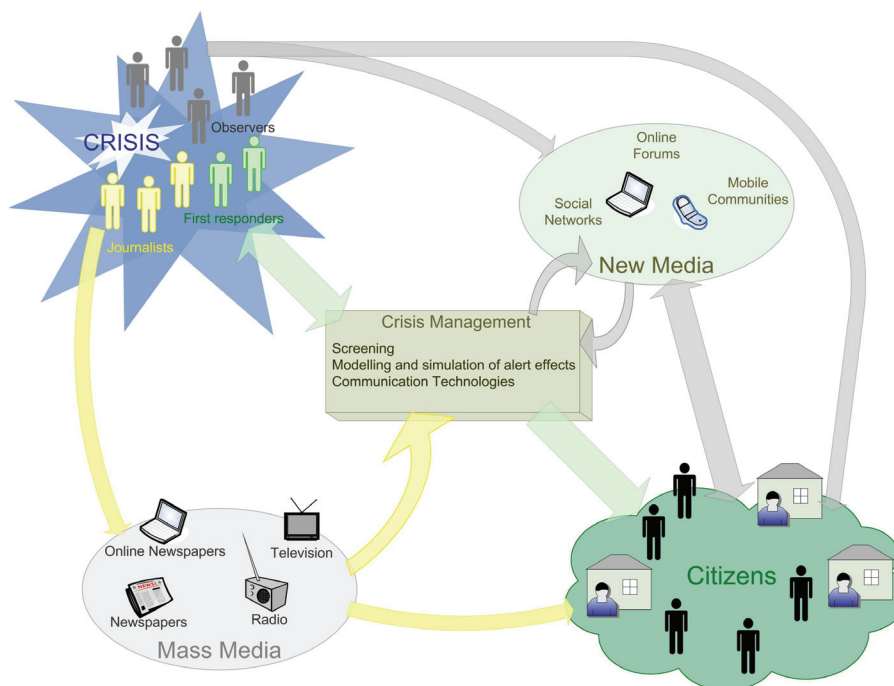


Figure 1. The role of mass and new media in crisis management (courtesy of the A4A consortium).

Example 1: Understanding the whelms of rationalities

Analysis of communication in emergency response units often reveals that people tend to discuss the information that is presented. From a perspective of situation awareness this process can be said to be a process of determining the common elements of the situation. From the visual-perceptual perspective this is appropriate as long as this concerns a physical event. However, when the determining is focused on heterogenic issues without any physical event or object, such as public opinions, the process should be more focused on understanding the variation rather than a single element. To have strategic awareness means to understand other people and be able to take a strategic account of this in the process of negotiating solutions. In such a case it might even be fatal to assume that everything is equal or even that one is merely assuming that other persons' rationality is determined by facts such as actual elements. When it comes to disseminating the public's views on a specific emergency there is nothing to determine once and for all; all there is, is dynamics and variation—people have and will have endless perspectives on any subject.

For example, a major protest march of some kind may face an antagonistic threat. This threat can be specified to some degree based upon former confrontations that may give ideas of the antagonists' rationality and ideas. In terms of situation awareness it is important to know what the antagonists may do and what consequences their actions may have. However, within the situation we also have a more indefinable public who has ideas and opinions which will have consequences for the unfolding of the situation. For emergency management organizations, the situation is that rather than determining *the* rationality, they must understand *the whelms of rationalities* and try to respond in ways which will match those rationalities in a way that takes care of the variation. This is especially important in terms of communicating with the public in a dialogical manner. Dialogue in this sense means that one has an understanding of the interlocutors' understanding of the issue and adapt to this view rather than interpose one's own. In order to obtain such an understanding it is important that the emergency management organizations continuously have a dialogue within the team and expose one's own values and understanding as well as monitor and try to understand views and opinions presented at various social media networks.

In contemporary emergency management research much of the teamwork is focused on determining the right information. However, when dealing with human values and opinions, there is no exact determining factor. Instead it is important to focus on the great variation and also to cluster such information so that it is pragmatically viable. We think there is a need for some computer support system which can act as a virtual game system and prospect variations of how people reason and what clusters the public consist of.

Example 2: The public as informants

Another view of the public's use of social media is to regard them as informants. As it is quite possible, or even most likely, that a person outside the emergency management structure is the first actor at the scene this person might also be the first one to take a photo, video film or just report some suspicion and publish that on the Internet. In cases where we have large crowds of people witnessing some social action, accident, or even natural phenomena there may exist several reports at different places on the Internet. These reports may inform the emergency management in that they provide unique and timely reports of events. However, in order to make use of diverse reports on the Internet and within social media the emergency management must gather, sort and cluster the information in a way that makes sense both in terms of understanding the nature of the situation, but also in terms of what can be done in terms of alleviating the situation. Of course one must also be certain of any forms of mis- or disinformation that is presented by the public.

For example, a person takes a photograph of a bag on the underground and sends it to Facebook with a small line of text describing it as a possible bomb. Friends of the person following this thread starts to speculate whether there really is a bomb and present the image and speculation in other places. Let's say that it is also confirmed that this bag was in fact a bomb. This in turn leads to more and more people becoming aware of "suspicious objects" such as bags on the underground and elsewhere. As the process develops, an emergency management unit may collect many pictures of "suspicious" events which can create a global coherent picture of an impending crisis.

In this case the emergency unit must be able to gather and sort the information in ways that make them coherent in terms of threat, timeliness, events, people, etc. This helps the emergency management to form strategic awareness.

Example 3: Understanding of the opponent

Emergencies occur in many variations and consist of various amounts of uncertainties stemming from natural phenomena, public opinions, and sometimes willful-thinking opponents. Due to the nature of large-scale emergencies, all of these components must of course be assumed to be present to some small extent. To technically combine these disparate components requires the use of a game-theoretical framework that can cope with the heterogeneity and complexity that can be anticipated in an emergency situation, see for instance Brynielsson (2007). However, from an emergency command and control centre perspective, situations can still be more or less strategic in nature, i.e., some situations stem from natural disasters whilst others are the result of, in the most drastic case, terrorists having a political agenda. To deal with the most drastic terrorist situation, one needs to reason about how the terrorists' reason about how we reason and so forth in order to achieve their goals. To consider the underlying reason for how intelligent individuals interact with one another in this way is something we take the term strategic awareness to incorporate, i.e., awareness of other intelligent actors and how they think and reason about us.

A dominating strategic component includes situations with a willful opponent such as a terrorist, but also other situations where people tend to "think about how I think." When, for instance, sending an alert message, one needs to consider how the receiver interprets and reacts on the message. A reasonable assumption is that receivers of alert messages try to interpret the message to form a hypothesis regarding the bigger picture. Such hypotheses are likely to be shared using social media so that, hence, it makes sense to screen these media to obtain an understanding of the understanding these well-meant "opponents" have.

It should be noted that the difference between "thinking about thinking" and "thinking about thinking about thinking" is huge—both conceptually and technically. In the former case, we can try to model how a message receiver, e.g., a public citizen, thinks about our message and optimize our message production based on this model. In the latter case, we have a circular dependence where the message receiver, e.g., a terrorist, is actively trying to model our model to optimize some kind of desire that the receiver have. Hence, a receiver capable of, and interested in, modelling the sender makes it impossible for the sender to optimize the message production: any such optimization would then be modelled by the receiver who would then outperform the message sender. Technically speaking, this is the difference between a decision-theoretic and a game-theoretic problem, where the former is just a special case of the latter and can be solved by ordinary probabilistic methods whilst the latter often results in a combinatorial explosion and provides controversial solutions in the form of Nash equilibria. For technical details regarding game and decision theory we refer to our own work on creating more realistic game-theoretical tools for opponent modelling (Brynielsson and Arnborg, 2004, 2005, 2006) or the seminal work by Luce and Raiffa (1957) for a non-mathematical treatment of the subject.

Example 4: Communicating to specific clusters of actors

Given that social media is a significant channel for people in general it should also be a significant channel for the emergency management structure. However, social media is a very stratified media where certain people cluster themselves in groups by less obvious reasons. Also, one person might be in several different groups at the same time. Given our view of dialogical emergency management, and that communication is fundamentally a reciprocal relationship between sender and receiver the emergency management at any point have a view of the public. By becoming aware of different clusters of actors in society, with different values, information, agendas, etc., the emergency management may be able to tailor messages to specific clusters of actors and by that may be better suited to come into a dialogue with the clusters of actors. Dialogue might in this case both mean an actual conversation where information and values are exchanged and mended, or as in presenting information to specific actors that actually resonance with their understanding. However, it is important that the actors within the emergency management are able to coordinate their own views and understandings of the situation in relation to the public's values and opinions.

Let's say that there has been a major riot in connection to a demonstration. Different actors are now discussing the situation and are blaming different groups to be the cause of the riot. As things unfold, some actors seem to be planning a get-together to settle things once and for all, i.e., another riot is becoming manifest. Now a proactive emergency management may try to communicate with the different groups in ways that resonance their reasoning without, of course, taking sides.

In this case it is of utmost importance to have and present an understanding, a strategic awareness, of each group and their values in order to design a message that will make the groups less antagonistic to each other, without taking part in the actual discussion.

SCREENING SOCIAL MEDIA: DIALOGICAL EMERGENCY MANAGEMENT IN EFFECT

In the following we sketch a concept focusing on how to screen social media networks in order to follow communication and make use of the obtained information content. The concept is focused on gathering, sorting and filtering information from social media and then presenting the information in terms of specified rules. Methodology for sentiment analysis are at the heart of the envisioned screening concept, i.e., algorithms based on natural language processing, computational linguistics and text mining, in order to determine the emotional impacts that particular messages invoke.

Screening activities of social media on the Internet and mobile sites need to tackle problems regarding large data volumes, heterogeneity, real-time processing, conflicting information, semantics, etc. Advances need to be targeted in helping users:

- to sort and filter reports at monitoring level,
- to decide on emergency communication strategies using a computer support tool.

Below we present some aspects which are vital for realizing a tool that makes dialogical management possible.

Real-time and anytime

The screening activities ought to be developed along the lines of so-called anytime algorithms, i.e., the view that we should produce better and better results while at the same time being able to always provide the current best estimate of the final answer/view. Examples of real-time manual search engines are Scoopler² and OneRiot³, which constantly index live updates from social networking services such as the Twitter®, Flickr®, Digg® and Delicious®. The screening activities extend real-time searches by introducing semantic meaning between, e.g., actors, events, and places. The result of the automatic screening activities ought to be a semantically meaningful network that can be used for further analysis in the form of visualisation, what-if-simulations of communication plans, etc. By forming networks of people, organisations, places and events that are of specific interest, conceptual images that facilitate understanding can be created. Correlation of observed data about individuals, things, places, memberships and so forth could be used to both detect the current/future state of public media awareness, and to discover networks through the observation of hidden relations and co-occurrences. Such

² See <http://www.scoopler.com/about/>

³ See <http://www.oneriot.com/company/about>

contextual analysis combined with semantic linkage will be a major challenge both in terms of being visually usable and in terms of creating algorithms for relevant analysis (Brynielsson et al., 2009).

Contextual sensitivity

As a basis for the screening activities, the situational context must be understood in terms of the underlying emergency situation. A way to establish such understanding is by creating and analyzing a model comprising the relevant entities, e.g., actors, events and places, and their common relations. Using such a model, entities are described using a set of attributes such as name and length, and relations using their semantic meaning. For example, two persons can be linked together using the semantic relation “father of.” Hence, relations should not be thought of merely as “web links” but rather in terms of relations that have a semantic meaning. That is, technical solutions must not be restricted to ordinary web pages, although web pages still serve as a natural food-for-thought since they contain a wide variety of information in the form of links, text, sound, graphics, etc. Taking this view, relations between entities can be obtained in various ways. For instance, explicit links between persons can be found in social networks and implicit relations can be inferred by analyzing and trying to automatically understand text content by using text mining techniques.

Social network analysis

As indicated, the result of the screening activities is a semantically meaningful network that can be used for further analysis in the form of visualization, what-if-simulations of communication plans, and so forth. By forming networks of people, organizations, places and events of specific interest connected with links that indicate connection, we can create conceptual images that facilitate understanding. Furthermore, by studying how the information has moved in the network we can find opportunities to improve emergency communication management. The field of social network analysis (SNA) provides tools and methods for such analysis. SNA is a set of powerful techniques to identify social roles, important groups and hidden organizational structures. Correlation of observed data about individuals, things, places, memberships, etc. may be used to both detect the current state of public media awareness, and to discover deviating cells and networks through the observation of hidden relations and co-occurrences.

Screening activities related to analysis are likely to be human-centric but should be aided by tools handling visualization, document clustering, sentiment analysis based on text content, calculation of various SNA measures such as centrality and community detection, and data mining. To establish and maintain the mentioned social network a number of technical screening activities are to be performed and contrasted relative to the earlier-mentioned model of the situation. Taking the network view, these screening activities involve *analysis* of the current network, informed *expansion* of the network as a consequence of the analysis, and network *reduction* as a means to obtain better focus on the parts of the network that are considered relevant. Expansion activities include the use of search engines, entity extraction, relation extraction, spidering, manual input and restructuring of data. Searching provides documents related to specific entities and results in implicit relations between documents. Entity and relation extraction through automatic analysis of texts result in entities and relations between both the entities and the documents where they have been obtained. Spidering makes it possible to follow paths of interest in an online link structure to obtain new relationships to see, for instance, whether two groups are interconnected. Lastly, the network reduction activities need tools that help the emergency management personnel to determine which parts of the problem that ought to be focused and expanded on further. Typically, the network needs to be cut down to a more manageable network that can be further expanded. One way to do this is to use abstraction techniques to determine equivalent or redundant actors and sub-networks that can be abstracted away without losing information related to the original problem.

In practice the screening of real-time social media will help the emergency management organizations to quickly respond to current public trends and opinions and strategically and promptly respond with relevant messages to the public. As means for understanding the view of other—potentially opposing—actors, the notion of so-called strategic awareness (Brynielsson et al., 2009) can be of help in order to formalize opponent strategy and provide support for strategic decision-making that takes others’ likely intentions into account.

DISCUSSION

Effective emergency communication represents an essential element of emergency response and needs to be continuously adapted to the development of human society. Today, people are constantly connected to diverse communication networks with a global coverage through media such as the Internet or mobile phone networks. Such technologies allow people to exchange and share information with others in their professional and private

lives. Innovation and the development of global communication infrastructures have changed the power structures dramatically with regard to information dissemination. It is no longer the public media alone that can audio/video-broadcast live information from places on the other side of the globe. People can share globally their pictures, videos and impressions of events taking place just minutes ago. Emergency management organizations can provide their services online without having face-to-face interaction with the public. This is in a broad sense the “information society” realized. Our conceptual idea presented in this paper is to make it possible for future emergency communication to develop a more articulated dialogical stance towards the public. The important problem is that large-scale emergencies are of major concern and one needs to not understand the factors of the emergencies, but also understand how the public understands the emergency situations. Our idea is to develop computer support for emergency management organizations, which would help them to understand the public’s interpretations to make it possible to communicate and act in accordance to specific clusters of people and at specific social media forums.

CONCLUSION

In this paper we propose a conceptual and theoretical development aspect of emergency management. We introduce the concept of dialogical emergency management to stress the inherent dual relation between emergency management organizations and the public. This concept is meant to redirect the traditional focus on the processes and work within the control system, to a focus on the relationship with the public. This relation can both be discussed in terms of what emergency management organizations can gain from factual information published in social media and being an important factor when emergency management organizations are communicating with the public. For the communication aspect we also introduce the concept of strategic awareness in order to stress one’s knowledge of what others know in order to establish reciprocal communication. As a technical solution we propose a screening mechanism of social media. By that we will be able to collect and cluster different views that people present and discuss. As has been seen in the reviewed research on public behaviour in crises there is a need for people to be informed in emergencies, as well as a great need to be able to communicate and share information during emergencies (Palen et al., 2007; Liu et al., 2008). The use of social media in these situations will probably be much more prominent in the future and therefore there is a need for computer systems that help to screen the vast and quickly spread information on Internet. The system as such is meant to help the emergency management staff to form a better strategic awareness of the public or specific actors within the public, in order to be better prepared to communicate with the public—that is, realizing a dialogical emergency management.

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