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Social Media for Supporting Emergent Groups in Crisis Management

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Abstract. The great importance of Social Media for our today's life causes an increasing use of internet-based platforms in crisis situations. Our work intends to show how so-called Emergent Groups, which arise as a result of crises, consist of private citizens and are not yet institutionalized organizations, can be supported by Social Media. At first, our litera-ture review's objective is to define the term 'Emergent Group' and to outline their usage of Social Media as well as software-based requirements and suitable concepts to sup-port such groups. A following quantitative and qualitative empirical analysis of a tornado crisis in the USA enables a closer look at especially virtual working Emergent Groups. Building on our literature review and empirical analysis, we discuss implications, derive further requirements and present a concept for the design of appropriate Social Soft-ware. We finally conclude by giving some potential re-search issues.

Introduction

Crises, whose magnitude can be so large that public authorities and rescue forces are overwhelmed, occur regularly. The Japanese earthquake and tsunami 2011 is a striking example for that. Particularly in these situations, it is important that the people affected have the ability to help themselves. The many capabilities to interact which are provided by Web 2.0's Social Media, can stimulate collaborative crisis management by citizens. "*Emergent groups can be thought of as private citizens who work together in pursuit of collective goals relevant to*

actual or potential disasters but whose organization has not yet become institution-alized" (Stallings & Quarantelli 1985). The fourfold typology of the Disaster Research Center (Figure 1) indicates that these groups emerge in order to manage new tasks with the aid of new structures. They have the ability to start from scratch and define its tasks in accordance with the interests of the group members.

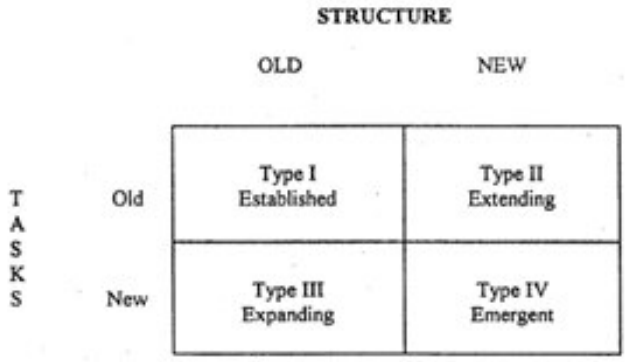

Figure 1: DRC Typology (Quarantelli 1995)

Emergent Groups - which correspond to the term 'Self-Help Communities' (Figure 2) - represent communication relationships between private citizens who are not part of the official crisis management's organizations.

Figure 2: Communication Matrix for Social Software in Crisis Management (Reuter et al. 2011)

Use of Social Media by Emergent Groups

Nowadays, Social Media is widely used by private citizens collaboratively coping with a crisis. As it is common to distinguish between real and virtual communities, a distinction between real and virtual Emergent Groups seems reasonable. Virtual Emergent Groups originate in the Internet and mainly carry out

their activities online, whereas real Emergent Groups use the Internet as a potential supportive resource among many others. The following literature review illustrates how Social Software is used by both real and virtual Emergent Groups. The studies are categorized in four chosen types of Social Software which are frequently mentioned in research papers.

Microblogging is a widespread, internet-based interaction tool. The most popular Microblogging-Platform is Twitter. Because of its simplicity, its prevalence and the option of mobile use, Twitter is a relevant Social Software in crises (Reuter et al. 2011). Studies show that Microblogging is used for collecting and distributing information, communicating, answering help requests (Starbird & Palen 2011), serving as resource for situation updates (Vieweg et al. 2010), coordinating actions, exchanging opinions and emotionally coping with a crisis (Qu et al. 2011).

Social Networks are a more complex form of internet platforms. They enable its users to connect with each other and provide a great variety of interaction tools. The most popular Social Network is Facebook with over 800 million users worldwide. Social Networks are intensively used to create collective intelligence, serve as information source and contain quality control mechanisms (Vieweg et al. 2008).

Wikis are an additional alternative for supporting people affected by a crisis (White et al. 2008a). They are especially useful when creating collective intelligence but have deficits in the aspects of communication and, as a consequence, of coordination. 'Scipionus' is an example for a crisis-related wiki. It deploys a visual interface which allows its users to publish and edit information on the Google Map Interface (Palen et al. 2007)

Crisis-related internet platforms, which are specifically customized for crisis management, can be seen as a fourth type of relevant Social Software. 'Sahana' is an example for such a platform which has already been used in several crises. It addresses "the common coordination problems during a disaster from finding missing people, managing aid, managing volunteers, tracking relocation sites, etc. between government groups, the civil society (NGOs), and the victims themselves" (Van de Walle & Turoff 2008).

Requirements and Concepts for Software-based Support

The ways of using Social Media mentioned above provide insights into the areas of requirements for software which is able to support Emergent Groups.

The usage of wikis shows the need of citizens to collect, find and distribute *information* during a crisis. At this, meta-information such as context, validity, source, credibility, and timeliness (Palen et al. 2010) as well as the existence of a given structure to manage information is essential for reducing information overload. Palen et al. (2010) present an 'Information Integration Landscape', whose core task is to collect information from the Internet, to add meta-data and to structure and visualize information in order to make it accessible. Starbird and Stamberger (2010) propose the use of a particular hashtag-syntax for tweets during crises. A standardized hashtag-syntax would be machine-readable and could help to collect more relevant information.

Social Software is not only used as information- but also as *communication*-platform via public forums or peer-to-peer-communication. Communication is vital for generating information, emotionally coping with a crisis and coordinating activities. In this area, capturing the group's will out of various topics and opinions is a big challenge, which especially becomes necessary when it comes to decision-making. White et al (2008b) suggest a 'Dynamic Delphi' system which enables its users to develop, discuss and vote on ideas in an iterative process.

Activities of *coordination*, which can be observed on Twitter or Facebook, exhibit a third area of requirements. Be-cause of the strong need for coordination in the case of collaborative self-help activities and its high complexity, this area seems to offer major support potentials. Jaeger et al. (2007) have developed a so-called 'Community Response Grid' which facilitates resident-to-resident assistance. Bui and Tan (2011) present a template-driven processing embedded in a workflow system.

Stress and time pressure due to the crisis situation and its usage by amateurs make an *intuitive design* of a Social Software essential. An iterative design process including potential users is to be recommended. Newlon et al. (2009) have developed an interface-prototype on which all relevant areas are visible at a glance.

Virtual Emergent Groups are especially involved in the area of information in which collective intelligence is created. Real Emergent groups particularly require the area of coordination.

Case Study: Use of Twitter during the Tornado Crisis in the USA on April 27./28., 2011

Twitter is applicable for studying virtual Emergent Groups because it is intensively used during crises and the communication of its users takes place publicly. Starbird et al. (2010) present four different types of information: generative, synthetic, derivative and innovative. So-called 'retweets', which are re-published tweets written by another user, match the derivative information. They can be seen as a recommendation system for information and authors (Starbird et al. 2010). The following empirical analysis aims to focus on the functioning of - especially virtual - Emergent Groups which use Twitter as a working platform.

On Wednesday, April 27, 2011, and on the following day, 211 tornados were registered in the USA. High damages on people (more than 340 died) and material damages on houses, streets and cars were reported. The data collected dates from Thursday when several tornados, tornado warn-ings and tornado watches were active and relief forces searched for dead people and survivors in many cities. In this time, the existence of Emergent Groups is very likely. The data was collected with the aid of 'The Archivist' which uses the Twitter Search API. Our search keyword was "tornado". 79,318 tweets were accumulated which were published between 12:17 (EDT, 2011/04/28) and 03:16 am (EDT, 2011/04/29) and written by 59,282 different users. Information about the user name, the publishing date, the recipient, and the tweet type is available.

Preliminary Results

The following analysis part intends to categorize users, who are actively involved in crisis-related self-help activities on twitter, into different user-types in order to figure out which kind of users a Social Software for Emergent Groups has to support. The relevant criteria are the behavior of the users and the content of their tweets. Because we wanted to ex-amine the most active users on twitter, we analyzed and allocated those 'twitterers' who published most tweets (41 users, 1982 tweets, 2.50% of all collected tweets) and were retweetet the most (51 users, 7742 retweets, 22.32% of all retweets).

The analysis provides four types of users which are given following names: the reporter, the retweeter, the repeater and the helper. As the categories are not disjoint and users can belong to more than one of them, the sum of their percentage is over 100%.

Type name	Characteristic	Task	%
The reporter	Is often retweeted	Generates information	68
The retweeter	Publishes many tweets	Distributes information	16
The repeater	Publishes many tweets	Spreads a message	19
The helper	Is often retweeted and publishes many tweets	Involved in help activities	28

Table 1: Types of twitterers

The *reporter* makes sure that information enters the twitter-space and provides generative, synthetic and innovative information. They often correspond to organized news channels, which per definition cannot be part of an Emer-gent Group and can rather be seen as intermediaries be-tween such groups and the official crisis management. Eyewitnesses, who report about the crisis on the Internet and are an important component of an Emergent Group, as well belong to the category of reporters.

Many users concentrate on retweeting information, which was brought in by the reporters, and are called *retweeters*. They produce derivative information. Their task is to distribute the most important information (e.g. emergency appeals, warnings, news, photos) inside the twitter-space.

The *repeater* possesses only one or very few main messages (e.g. charity appeal, political opinion) which he wants to make known to many twitter-users. That's why they repeat the message again and again. A popular method is to write to prominent twitterers who have a high number of followers in order to win the attention. They provide generative as well as synthetic information which they then try to distribute.

The *helper* is the kind of twitterer who is involved in various helping activities and can be especially distinguished by their tweet-content. They make emergency appeals, show ways of donating clothes or participating in search and rescue groups, give advice about correct behavior or emotionally support victims. Participants of real Emergent Groups use twitter to publish their status and belong to the category of helpers, too. Helpers are less fixed on information processing, but are more involved in communicating, connecting with other people and coordinating activities.

The categories presented here show typical and definable ways of using twitter as a social platform in crises. The analysis reveals that every twitterer, who is particularly active within a crisis, can be matched to at least one of the categories mentioned above.

Discussion

The objective of a Social Software for Emergent Groups should be to support the members of both virtual and real Emergent Groups in their common procedures and behaviors. Because such groups have positive effects on crisis management, their existence should be promoted by appropriate software. The connection of virtual groups, which increasingly emerge, and real groups, which work locally, could create synergetic effects. The identification of types of twitterers is mandatory for this effort.

Besides the four areas of requirements (information, communication, coordination, intuition), further areas can be added: In order to generate synergetic effects between virtual and real communities, *internal connections* between these two types have to be considered. The cooperation between Emergent Groups and the official crisis management could be fostered by finding *external points of intersection* between them. *Promoting the existence* of Emergent Groups can be stated as a further area of requirement.

We designed and implemented a first prototype of a social platform for citizens, which helps them to organize them-selves in local crisis situations, and evaluated its usability. Challenges are aspects like improvisational practices (Ley et al. 2012), the different use of terminologies (Reuter et al. 2012) or different approaches of aggregation of information in different scenarios (Christofzik & Reuter 2013). The resulting design concept can be visualized as in following figure:

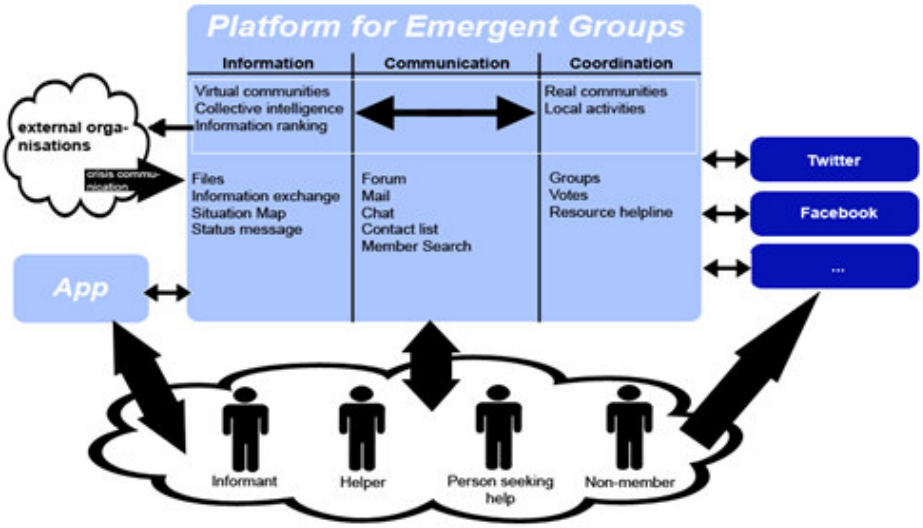

Figure 3: Design concept of a Social platform for supporting Emergent Groups in crisis management

Conclusion

Our work seeks to examine the internet-based functioning of virtual and real Emergent Groups and has stated seven different areas of requirements for its software-based support. We have designed, implemented and evaluated a prototype of a social platform which plans to support both types of such groups as well as to promote their existence.

Our work shows a number of potential research issues in the area of supporting Emergent Groups with the aid of Social Media. Improving the implemented platform in an iterative process including potential users (in particular the types of users we identified) and further studies about real and especially virtual Emergent Groups could improve the knowledge about their functioning and reveal further support potentials. The seven areas of requirements mentioned above (information, communication, coordination, intuition, internal connections, external points of intersection, promoting the existence) offer potentials for deeper research and suitable software concepts. For instance, interfaces between a social platform for Emergent Groups and popular Social Networks (such as Twitter or Facebook) should be found in order to increase the acceptance and usage of the platform by designing it as an integrative component of the common procedures. Increasing the acceptance would automatically shift the focus on an adequate marketing strategy and on promoting the existence of Emergent Groups.

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