

INTEGRATING SOCIAL MEDIA IN CRISIS RESPONSE: LEARNING FROM A REALISTIC CRISIS EXERCISE

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ABSTRACT

Social media has become an increasingly important factor in crisis response; from improved situational awareness to facilitating communications. It also enables affected communities to express their needs and others to respond to it. Social media also poses challenges for responders; the spread of rumors, finding relevant information or providing timely responses, for example. To aid responding professionals in leveraging this potential and minimize risks, a better understanding of the use and interactions through social media is needed.

While previous research focused on individual aspects, such as creating situational awareness, we use a more holistic approach. Using a broad demographic range of 'twitter-volunteers', each provided with individual profiles based on real-life cases, we added a comprehensive, realistic component to a crisis exercise. In this paper we present the outline, its design considerations and the initial results, in particular on the achieved realism and added value for responders.

Key words: Social media, exercise design, community interaction, crisis communication

ABSTRAKT

Sociálne médiá sa stali čoraz dôležitejším faktorom pri riešení kríz; zlepšilo sa povedomie o situácii na uľahčenie komunikácie. To tiež umožňuje dotknutým obciam vyjadriť svoje potreby a následne na ne reagovať. Sociálne médiá tiež predstavujú výzvy pre zásahové jednotky; šírenie fám, vyhľadávanie relevantných informácií alebo poskytovanie včasných odpovedí, napr. Ak chcete pomôcť reagovať profesionálom na využitie tohto potenciálu a minimalizovať riziká, je potrebné lepšie pochopiť použitie a interakcie prostredníctvom sociálnych médií.

Kým predchádzajúci výskum zameraný na jednotlivé aspekty, ako je napríklad vytváranie povedomia o situácii, používame viac holistický prístup. Použitie demografických rad "Twitter dobrovoľníkov", z ktorých každý dostane individuálne profily založené na prípade, v reálnom živote, sme pridali komplexné, realistické

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komponenty do krízového cvičenia. V tomto článku sme predstavili obrys, jeho návrh úvahy a prvé výsledky, najmä pokiaľ ide o realizáciu a pridanú hodnotu pre zásahové jednotky.

Kľúčové slová: Socialne média , návrh cvičenia , interakcie obce , krízová komunikácia

1 INTRODUCTION

During crises and disasters, response organizations are in need of accurate, actual and sufficient information in order to improve the effectiveness of response operations. Social media have become a valuable source for such information and have already been playing an important role during crises and disasters over the past years. For example, pictures and other media shared on social media have been combined with remote sensing data in response to Hurricane Sandy in New York City, providing a more comprehensive picture of the actual situation (Oxendine, Schnebele, Cervone and Waters, 2014). In addition to gathering data to improve situational awareness for responding professionals, citizens also use social media services themselves to interact, share and gather information (Sutton, Palen and Shklovski, 2008). While the public is already embracing the presence of social media during crises and disasters, response organizations still face challenges integrating these services and leveraging their potential (Hughes, St Denis, Palen and Anderson, 2014).

Organizations do recognize the potential and efforts are being made by professionals and scholars to further determine the opportunities as well as the risks associated with the use of social media in crisis response. For example, a disaster simulation exercise was organized by the Arizona State University in 2011. Victims used social media and SMS to ask for assistance. In turn, the first responders used several systems to find these requests and act on them (Abbasi, Kumar, Andrade Filho and Liu, 2012). Another game was played at ISCRAM 2012 to introduce participants to information management during disasters. Participants acting as authorities were required to manage information flows and ensure response operations to assist victims during a disaster simulation (Meesters and van de Walle, 2013).

1.1 RESEARCH OBJECTIVE

While such exercises are being designed and conducted to help better understand the role of social media in crisis response, their scope is often limited to a specific aspect. Depending on the scope, the social media input is controlled or preexisting data is used, such as in the exercises of Meesters et al. In other exercises the scope is limited and does not include integration in field operations, as in the example of Abbasi et al. The usage of a realistic human factor in combination with real response organizations during exercises is limited. Social media, however, are not only part of complex (crisis) environments with multiple actors and stakeholders but even enable (new) interactions between them (Palen, 2008). In order to identify and comprehend risks and opportunities in such a complex system we employ a holistic approach (Oliver-Smith, 1996). We aim to provide a comprehensive, realistic exercise environment, using experienced victim simulants and unregulated Twitter use. In this environment, participating response organizations can truly experience public behavior via social media during disasters and interact with the public as in reality.

1.2 APPROACH

To determine if a realistic environment is provided, we determine what social media use would occurs during disasters. We identify general types of behavior among three groups of social media users during disasters, depending on their level of affectivness. Next, several case studies are be used to determine typical use of social media for each group. While specific behavior dependens on local crisis characteristics (such as the connectivity or the type of crisis), we can identify the typical use of social media, especially when we focus on a specific type of crisis (Goolsby, 2010).

For the different types of behavior we created profiles and instructions that were provided to online simulation participants. Prior to the exercise, a survey was conducted in order to determine the best fitting profile for each participant. During the exercise participants were free to engage on social media, both with professionals as well as each other. Following the exercise another survey was conducted, in addition to the data collected directly from Twitter and debriefings. Using this data, the social media behavior during the exercise can be described and compared to the behavior from the case-studies. Finally we present some initial results regarding the use, risk and opportunities observed in the exercise.

2 LITERATURE BACKGROUND

Several groups of social media users can be distinguished on a scale ranging from directly involved to uninvolved during disasters (Acar and Muraki, 2011). Firstly, directly affected victims are those experiencing the direct effects of a crisis and are often the first individuals involved. Secondly, while the situation unfolds, indirectly affected citizens experience the (secondary) effects of a crisis event. For example, transportation challenges or disruptions in their daily routines. Lastly there is the general public, not physically affected by the disaster but engaged at a personal level, for example by gathering news. While the behavior itself cannot be strictly classified in these categories, each group has distinct motivations to provide or gather different information during disasters. Next, social media behavior of these groups will be derived from several case studies including Hurricanes Sandy, Gustav, Ike, the Japanese earthquake in 2011 and the 2007 Southern California Wildfires.

2.1 DIRECTLY AFFECTED

During Hurricane Sandy in 2012, directly affected citizens made use of Twitter in order to request assistance. When the 911 system overloaded during the peak of the storm, citizens started posting Tweets asking for assistance (Hughes, St Denis, Palen and Anderson, 2014). Similar behavior has been observed during the Japanese earthquake and tsunami in 2011 (Lindsay, 2011). An important observation is that during the disasters, just a small percentage of all these Tweets were replies to other users. Also, during both events about 50% of the Tweets contained URLs linking to further information or visual data (Hughes, St Denis, Palen and Anderson, 2014; Linsday, 2011). The aforementioned indicates that users, in addition to asking for assistance, mainly used Twitter to send information (Hughes and Palen, 2009). Consequently, this group provides the first and most actual information due to their immediate involvement. In short, *directly affected citizens* send requests for assistance to response organizations and provide onsite information for situational awareness (acting as a sensor).

2.2 INDIRECTLY AFFECTED

The indirectly affected citizens not only distribute information, but they also monitor social media to gather information and increase their situational awareness (Reuter, Heger and Pipek, 2013). Indirectly affected citizens also use social media for informational purposes by accessing forums, photo sharing services, and by contacting family (Sutton, Palen and Shklovski, 2008). Research conducted following the Southern California Wildfires also found that many respondents have shared the information they found relevant with others, thus not only using social media for improving their own situational awareness (Haataja, Hyvärinen and Laajalahti, 2014). Summarizing, *indirectly affected* citizens distribute important, actionable information to help others and monitor social media to increase situational awareness regarding their own situation.

2.3 GENERAL PUBLIC

Besides those directly or indirectly affected, there is a large group of people not personally affected but who are engaged in online conversations regarding the unfolding crisis. These interactions between members of the public generate the majority of data regarding an incident, although the resulting information has a low value for first responders. Nevertheless, the discussion represent in general the sentiment of the public, which is useful for decision makers, politicians and/or government officials (Sutton, Palen and Shklovski, 2008, McCarthy, 2005). For example, communication advisors can anticipate certain questions and provide information. Finally, the general public can serve as mediator, providing information or even aid to those (in)directly affected. In short, the *general public* contributes to the generation of low-value information, represent the sentiment of the general population and can respond to requests for information or even aid.

3 EXERCISE DESIGN

The exercise is part of the post graduate program in disaster management provided by the Campus Vesta school, in the province of Antwerp, Belgium. The program trains executives of different organizations, such as the police or fire department, on managing large-scale incidents. The program consists of different modules, one which is a multi-disciplinary, complex disaster exercise.

3.1 SCENARIO

For the 2014 exercise, an accident between a passenger train and a truck carrying hazardous goods was used as the scenario. It included two (simulated) train stations on either side of the incident and a nearby residential area. As a result of the collision, the truck was leaking gas, with the wind in the direction of the residential area, while other passengers got stuck at the adjacent train stations and were in need of alternate routes and information. To add realism, volunteers (including professional actors) played the role of the passengers on the train. In addition to the rescue services, the exercises also included scenario specific agencies such as the railroad infrastructure and train company. These agencies deployed their webcare teams; a group dedicated to handling information requests and providing individual feedback through the use of web 2.0 technologies (Faase, Helms and Spruit, 2011). While these teams commonly exist in service providers and facilitate the regular CRM operations, they play an increasingly important role in crisis response and management.

3.2 SOCIAL MEDIA INTEGRATION

In addition to the exercise elements mentioned above, we added a dynamic social media component using Twitter. Volunteers were recruited to fulfill the role of a so-called online 'Twitter simulant', via professional and personal networks. Next, an online questionnaire was distributed among those who responded to gather demographic data, including their daily use of Twitter. Obviously participants of the professional responders were excluded from the exercise. Also, the resulting pool of volunteers would need to consist of individuals with mixed ages, familiarity with crisis response, Twitter usage and popularity. The average age of the respondents is 36 years old, with a minimum of 15 and a maximum of 70 years old. Furthermore, the respondents have mixed Twitter experience and usage, ranging from 1 Tweet a week to 300 and from a handful of followers to thousands. This resulted in a pool of 153 participants covering a wide demographic range.

For the exercise several profiles were designed, using three constructs. The location of the victim (1): directly affected victims on the train, indirectly affected citizens on two nearby stations and the residential areas, and the general public. As a second construct we defined different objectives (2). For example, a student trying to get to class, or a citizen wanting information. Finally we included a motivation/role (3), such as a concerned family members, a journalist etc. The combination of these constructs resulted in 48 different profiles which were distributed among the volunteers. Each profile was matched with a volunteer using their demographic data, keeping a balance of 20% directly affected, and 80% indirectly affected in mind.

General instructions regarding Twitter usage during the exercise were provided such as the required use of a hashtag for tracking and data collection purposes. Safety instructions were also included as the messages were posted publicly on Twitter. Volunteers were required, for instance, to clarify that they were participating in an exercise if there was indication of confusion. Participants received several example Tweets based on previous incidents, for their specific profiles to serve as inspiration. Finally a select number (10%, based on the earlier mentioned cases) of profiles received a specific Tweet with factual information to be posted directly. These Tweets contained relevant information for the responders and allowed the researchers to track the penetration of vital information.

Profile Code	Location	Objective	Motivation	Example	Example Tweet 2	Example Tweet
-		-		Tweet 1	_	3
Loc:[CAMP]	[CAMP]	[CLASS]	[TRAIN]	Is a train delay	@vestarail is there	Thanks!
Obj:[LES]	Train	Get to	A train	a good excuse	another way to get to	@vestarail
Mot:[TRAIN]	station	class	passenger	to show late	Vesta Station from	again too late
	"Campus"			for class?	station Campus?	for class!
				#pgrmoefening	#pgrmoefening	#pgrmoefening

Table 1 Example profile constructs

Following the exercise, an online survey was sent to participants, with the goal of evaluating how participants experienced the exercise and how they view the value and use of social media during a crisis. In addition to the survey results, all Tweets regarding the exercise have been extracted from Twitter using the tool DataSift and the predefined hashtag. Finally a semi-structured debriefing was held with the organizations and responders on-site, discussing their experience.

4 **RESULTS**

The exit-survey returned 70 responses, whereof 59 fulfilled the role of an online Twitter simulant. Eight respondents were part of the social media team of the involved agencies. In total, 2086 Tweets posted by 193 users were extracted from Twitter.

4.1 TWITTER PARTICIPANT-SURVEY

Over half the participants indicated themselves that their general Twitter behavior during the exercise was not or only slightly different than their normal usage pattern. The majority (54%) also indicated that their behavior during the exercise does not significantly differ from their potential behavior during a real crisis. Although this is based on a hypothetical question and highly speculative answers, it should be noted that –in the scenario- most participants were not directly affected, just like they likely would not be in reality. Also, the vast majority of respondents experienced the exercise and scenario as realistic. On a 5-point scale ranging from 'Very unrealistic' to 'Very realistic', the respondents answered with a mean of 4.19. Interestingly, more than half the participants indicated that participating in the exercise helped them to better understand the value and use of social media in crisis situations. Over 90% indicated willingness to participate again in an exercise.

4.2 TWEETS

About 105 of the collected Tweets are Retweets and 882 Tweets replies to other users. Furthermore, about 1321 user mentions occur throughout the Tweets. Tweets categorized as "Mention" contain one or several usernames in the content of the Tweet, with the exception of Tweets starting with a username (these are replies). All

remaining Tweets are free of user mentions and only contain information followed by a hashtag. These have been categorized as "Tweet". The presence of a URL, either to documents or pictures has been observed in 309 Tweets. The recorded Tweets were analyzed using NodeXL (Hansen, Shneiderman and Smith, 2010) to examine the interactions within and between the various groups.

5 DISCUSSION

The analysis of the post-exercise survey data indicates that the interactions and behavior felt realistic to the respondents. With the majority of the respondents being the online Twitter simulants, these results indicate that even without the onsite experience, volunteers felt engaged. The high number of reply Tweets and interactions also demonstrates a high level of interaction between users. These communications were mainly between users belonging to one of three simulant groups in the form of discussions, or between victims and response organizations in order to ask for assistance or provide information. Furthermore, the large number of mentions illustrates that users have mentioned other users in certain Tweets in order to inform them about the content. This was mainly done to distribute information to a targeted audience. The presence of URLs in Tweets displays how Twitter has been used to share pictures by "first responding" victims and to refer to additional information by other users (such as websites or excel sheets for data collection). In short, the various types of behavior found in case studies, depending on the level of involvement, can be identified in our exercise as well.

5.1 REALISTIC SOCIAL MEDIA USE

As also observed in the case studies, exercise participants in the role of directly affected victims requested for assistance via Twitter. Specifically, the *directly affected* (on-site) simulations, acted as "first responders" by immediately sharing pictures of the situation and wounded individuals on the train and asking for immediate assistance. The *indirectly affected citizens* showed a strong focus on improving their situational awareness and determining their options. Those who were stuck on train stations asked for alternatives, while nearby residents expressed concern about their own safety and the planned neighborhood party. The *general public* also contributed to information distribution and generation during the exercise. They were engaged in conversations, shared information with various degrees of accuracy or were critical to the governments and responders.

Additionally, our data show that some users established themselves as "hub" and became very active during the situation, thus fulfilling the role of an information broker. For example, one user posted many reply and mention Tweets which indicates active communication with others. Across the exercise we saw users not only providing information to each other, but also establishing collaborations. For instance, citizens organized themselves together in order to create maps and victim lists or to create carpool lists. These interactions demonstrate a great potential of social media to empower citizens during times of crisis, especially those indirectly affected and (understandable) not a direct priority for responders. Twitter simulants indicated that they valued these initiatives during the exercise.

5.2 USE BY RESPONSE ORGANIZATIONS

Large amounts of unstructured data (Tweets) are a challenge for response organizations during disasters. However, the importance of the ability to analyze and utilize this data became clear to them as mentioned during the debriefing. Even with the predefined hashtag employed in this exercise to facilitate data collection, it proved challenging to find useful information. Not in the least because it depended on the specific organization what would classify as useful. Officials from the municipality required different information than the responding fire department, for example. The exercise also showed how communication needs have changed with the introduction of social media. The first Tweets and information exchange took place 45 minutes before communication was initiated by the official responders. As a result, some users became the de facto news source, being retweeted and followed more than the 'official' (exercise) accounts. Lastly, users mentioned that they considered Tweets sent by agencies as important but usually arrived too late, decreasing their value.

As a result of the exercise, the organizations recognized the value of organized citizens, most evidently through initiatives such as the carpool system. More generally, the fact that response organizations were able and even needed to make use of a real and dynamic Twitter environment, including their own tools provided them with a comprehensive experience and a way to examine the integration of social media in response operations.

5.3 SAFETY

It is important to note that several precautions have been taken to ensure the safety both on- and offsite. Since the exercise was conducted using the Twitterplatform, including existing and personal Twitter accounts, special measures have been put in place to ensure that no confusion would arise whether or not the incident was real. Every participant placed a Tweet at the start of the exercise indicating that he/ she would be participating in an exercise and the following Tweets were part of it. The official Twitter accounts from various government agencies posted similar messages and indicated a clear hashtag with the word 'exercise' in it. Finally, part of the exercise control team was monitoring the Tweets and interaction in real time in order to respond quickly to any confusion that might arise. While no incidents occurred, the precautions proved necessary as the hashtag became 'trending' (popular) within 15 minutes after the start of the exercise.

6 CONCLUSION

In this paper we presented a new disaster response exercise with the inclusion of a realistic Twitter simulation component, using profiles based on the behaviors of three groups of social media users identified in past cases. The combination of a real and realistic Twitter setting with an on-site disaster exercise provided a comprehensive environment enabling both researchers and professionals to explore the challenges and opportunities when including social media in crisis response.

This paper presents the first step of ongoing analysis of the exercise, including network analysis and comparing timelines. From the collected quantitative and qualitative data, several initial lessons learned have been identified, such as the need for further integration of social media in the operational routines or the opportunities for citizens to provide support to each other directly. Further analyses and potentially similar exercises could aid in identifying more opportunities and ways to improve crisis response using social media.

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REFERENCES

- [1] C.E. Oxendine, E. Schnebele, G. Cervone, N. Waters, Fusing Non-Authoritative Data to Improve Situational Awareness in Emergencies, (2014).
- [2] J. Sutton, L. Palen, I. Shklovski, Backchannels on the front lines: Emergent uses of social media in the 2007 southern California wildfires, in: Proceedings of the 5th International ISCRAM Conference, Washington, DC, 2008, pp. 624-632.
- [3] A.L. Hughes, L.A. St Denis, L. Palen, K.M. Anderson, Online public communications by police & fire services during the 2012 Hurricane Sandy, in: Proceedings of the 32nd annual ACM conference on Human factors in computing systems, ACM, 2014, pp. 1505-1514.
- [4] M.-A. Abbasi, S. Kumar, J.A. Andrade Filho, H. Liu, Lessons learned in using social media for disaster relief-ASU crisis response game, in: Social Computing, Behavioral-Cultural Modeling and Prediction, Springer, 2012, pp. 282-289.
- [5] K. Meesters, B. van de Walle, Disaster in my backyard: a serious game introduction to disaster information management, in: Proceedings of the 10th International ISCRAM Conference–Baden-Baden, Germany. T. Comes, F. Fiedrich, S. Fortier, J. Geldermann and T. Müller, eds, 2013.
- [6] L. Palen, Online social media in crisis events, Educause Quarterly, 31 (2008) 12.
- [7] A. Oliver-Smith, Anthropological research on hazards and disasters, Annual review of anthropology, (1996) 303-328.
- [8] R. Goolsby, Social media as crisis platform: The future of community maps/crisis maps, ACM Transactions on Intelligent Systems and Technology (TIST), 1 (2010)
 7.
- [9] A. Acar, Y. Muraki, Twitter for crisis communication: lessons learned from Japan's tsunami disaster, International Journal of Web Based Communities, 7 (2011) 392-402.
- [10] B.R. Lindsay, Social media and disasters: Current uses, future options, and policy considerations, (2011).

- [11] A.L. Hughes, L. Palen, Twitter adoption and use in mass convergence and emergency events, International Journal of Emergency Management, 6 (2009)
- [12] C. Reuter, O. Heger, V. Pipek, Combining real and virtual volunteers through social media, in: Proceedings of the 10th International ISCRAM Conference, Baden-Baden, Germany. Karlsruhe, Germany: KIT, 2013, pp. 780-790.
- [13] M. Haataja, J. Hyvärinen, A. Laajalahti, Citizens' Communication Habits and Use of ICTs During Crises and Emergencies, Human Technology, (2014).
- [14] J.F. McCarthy, Digital backchannels in shared physical spaces: experiences at an academic conference, in: CHI'05 extended abstracts on Human factors in computing systems, ACM, 2005, pp. 1641-1644.
- [15] R. Faase, R. Helms, M. Spruit, Web 2.0 in the CRM domain: defining social CRM, International Journal of Customer Relationship Management, 5 (2011) 1-22.
- [16] D. Hansen, B. Shneiderman, M.A. Smith, Analyzing social media networks with NodeXL: Insights from a connected world, Morgan Kaufmann, 2010.

Článok recenzovali dvaja nezávislí recenzenti.



NEEDS ASSESSMENT AND RECOVERY PLANNING IN DISASTER RECOVERY

A COMPLEX CHALLENGE

COBACCIRE (Community Based Comprehenative Recovery) seeks to ad increasing challenges facing needs assessment and recovery planning today

- A back of coordination and collaboration among organisations; The need for more effective common reliefs assessment; Soliable internation gaos is assessing the scale and elevinity of a clearitie; Delayed utilization of primary information sources is communities for post-impact information colle Lack of community assertings and envolvement; shadoon avainings, needs, searchings or manage

Our primary ambition: Close collaboration gaps between communities that play a role during recover and make it earlier to match needs with capacities.



A COMMUNITY-BASED APPROACH TO **RECOVERY PLANNING**

THE COBACIORE PROJECT

The COBACORE project is leading the development of an innovative approach for community based comprehensive recovery. The COBACORE project is building new tools that supports local communitie in their needs assessments and recovery permong during parts classifier recovery. It inputedures a vision on two relat-generation classifier recovery with be

The COBACCRE platform will provide a quicker and more rebust needs assessment solution, and will offer different interfaces for different statisticides in this complete involvment importantly, distans, private and public organisations will be specifically considered within a commany-based approach.

Citizens and relief ventions will benefit from facilities to share relets and capabilities, and to build local partnerships. Geventmethat bodies and humanitation relatif organisations will have a community-georetaid view of the recovery process and means to collaborate attackgically. Volunteers and online communities will have channels to contribute in a more cohering and validie mannin.

GOBACORE : AN INNOVATIVE PROJECT

MAIN PROJECT FEATURES

- J Development of a comp during disaster recovery. ch to néeds assessment and recovery plan
- COBACORE will take a whole-cycle approach, recognizing that needs assessment is part of a larger cycle (the viewers continuum)
- J COBACORE will enhance, not replace, existing tool and practices tailored tools for different types of com have a role in disaster recovery.
- Délivering a général framéricotic customisable to a rangé of solimarios éxtémové intéraction and évaluation sésators with end-user groups, including professional réliéf organisations, govérnmental bodés and voluntéer groups to érause fil-for-purpose intéráctic.
- J Benefitting from a large-scale field study evaluation sessio on on the Netherland

the COBACORE platform will enable a quicker and more extensive level of needs assertiones than is cur



