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Ehnis, Christian and Bunker, Deborah, "The Impact of Disaster Typology on Social Media Use by Emergency Services Agencies: The Case of the Boston Marathon Bombing" (2013). *ACIS 2013 Proceedings*. 96.

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The Impact of Disaster Typology on Social Media Use by Emergency Services Agencies: The Case of the Boston Marathon Bombing

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Abstract

In disaster management, emergency services agencies such as police and state emergency services, are growingly using social media microblogging services as an additional channel to distribute information to the general public. How these emergency services agencies are using these social media channels is still insufficiently understood. This paper introduces Actor-Network-Theory as a means to understand the emergency services agency social media utilisation. Using the case of the Boston Marathon 2013 Bombing, we apply genre analysis in interpreting the Boston Police Department's social media communication to understand whether the disaster typology or the social media channel characteristics have an influence on the microblogging utilisation of the emergency services agency. The findings imply that both the social media channel characteristics and the specific characteristics of a disaster influence how a social media channel is utilised.

Keywords

Social Media, Disaster Management, Microblogging, Actor-Network-Theory

INTRODUCTION

Social media services have grown in importance for disaster management in the recent years. These kind of services, especially Facebook and Twitter, are increasingly being adopted by emergency service agencies to communicate with and influence, the general public before, during and after a crisis or disaster (Bruns et al. 2012; Crump 2011; Ehnis and Bunker 2012; Heverin and Zach 2010; Procter et al. 2013; Sutton et al. 2012). Therefore, some social media services can now also be seen as special types of Community Warning and Emergency Incident Response Systems (Bunker and Smith 2009).

Ehnis and Bunker (2012) examined how the Queensland Police Service used Facebook to communicate with the general public during the Queensland Floods of 2011. A dataset of Facebook notes broadcasted by the Queensland Police Service in January 2011, was analysed using genre analysis (Firth and Lawrence 2003). The resulting top-level genres imply that the Queensland Police Service used social media for five purposes during the disaster event. They broadcasted information; issued warnings; fought rumours; encouraged specific behaviour and appealed for information from the general public (Ehnis and Bunker 2012).

These results have led us to ask whether a disaster typology influences the way an emergency services agency uses social media channels. Furthermore, we question whether there are indications that the emergency services agency's social media microblogging channels, such as Facebook and Twitter, are used for different purposes during a disaster. To investigate these questions, we seek to understand emergency services agency social media usage as an Actor-Network (Callon 1991; Latour 2005; Law 1992). In such an Actor-Network, different actors have mutual influence. This analysis seeks to highlight whether the channel and the disaster typology may impact the emergency services agency social media behaviour.

This study uses genre analysis to investigate the public social media communication of the Boston Police Department during the Boston Marathon Bombing of 2013. This event has a markedly different structure than that of the Queensland flood event of 2011.

This paper is structured as follows. First, we give a rough overview of how social media is used in disaster management by emergency service agencies. Second, we introduce the notion of an Actor-Network as a means to understand social media in disaster management and how different disaster types potentially can influence social

media communication. Third, we introduce the case of the Boston Marathon Bombing as a specific instance of a disaster. Fourth, we describe the dataset and analysis methods, followed by the results of the analysis of this disaster. After a short discussion, we conclude this paper with recommendations for further research.

EMERGENCY SERVICES AGENCY SOCIAL MEDIA USAGE IN DISASTER MANAGEMENT

Nowadays, various emergency services agencies show interest in social media services for disaster management purposes and most agencies have already established their own social media presence (Su et al. 2013). In disaster management, emergency service agencies utilise social media services as an additional official communication channel to engage with the general public, but often the adoption is slow and the agencies use social media on an ad-hoc basis (Su et al. 2013; Sutton et al. 2012).

The research around emergency services agency social media usage is emergent. Some research focuses on the whole unfolding crisis communication network structures and how emergency services agencies are embedded into these communication streams. (Bruns et al. 2012; Sutton et al. 2013; Sutton et al. 2012). This research indicates that official emergency services agency social media broadcasts belong to the most shared messages in a disaster context, and that trustworthy information is actively sought by the ‘listening community’.

Further research focuses on why and for what reasons social media users are using social media during crises and disasters (Fraustino et al. 2012) and highlights the potential of emergency services agencies’ social media communication. Su et al. (2013) analysed by survey, what knowledge about social media exists in emergency services agencies and how these agencies are using social media.

Other studies have analysed the social media behaviour of emergency services agencies (Crump 2011) during crisis and disaster events (Heverin and Zach 2010; Procter et al. 2013). These studies show emergency services agencies use social media as a broadcast instrument, but not (yet) as a tool to engage with the general public on a two-way communication basis. Most research to date has focused on one specific social media communication channel and has analysed a single disaster event in isolation.

ACTOR-NETWORK-THEORY AS A MEANS OF UNDERSTANDING AND INTERPRETING THE USE OF SOCIAL MEDIA IN DISASTERS

In a disaster management context, Actor-Network Theory (ANT) is a perspective on the social media usage of emergency services agencies, the listening community, the disaster event, as well as the existing social media information systems. An approach to identify and understand these complex interdependencies is through the lens of Actor-Network-Theory (Callon 1991, Latour 2005, Law 1992).

A key element of Actor-Network-Theory is that there is no distinction in the view of a human and non-human actor (Cresswell 2009). Human actors are, in a disaster management context, the listening community and the emergency service agency members. Non-human actors are different social media services and other technologies as well as the disaster event itself. The non-distinction between technology actors and possible human users help to show changes in usage practices differently. Users adjust their usage practices when they use a technology, but it is also possible that users are adjusting the technology to their requirements. This may change the user and the thinking about the technology and may lead to unpredicted usage purposes and practices (Riemer and Johnston 2012). With Actor-Network-Theory (ANT) the adjustment could be technology through human actors can help explain these interdependencies between these two actors. But not only

An Actor-Network is mainly an observation of the moment and needs to be maintained through ongoing interaction between the different actors. The network is, therefore, never static and has to be built up through the interactions of the different actors which can change through time and can be caused by the addition or discontinuation of different actors (Law 1992). Such a change in the disaster management context is illustrated in Figure 1.

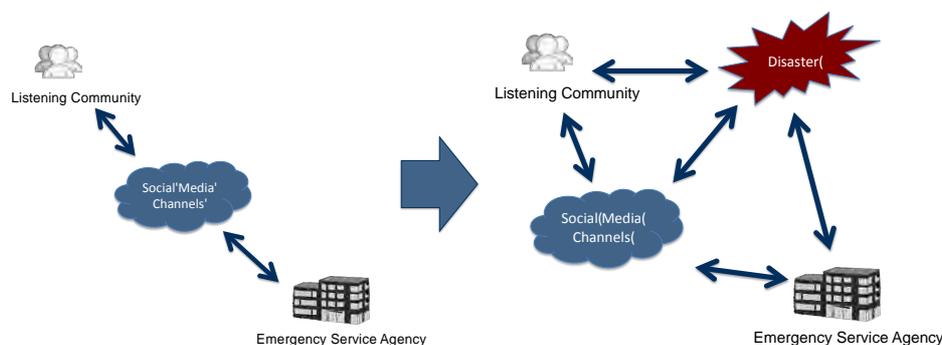


Fig. 3 Change of possible Actor-Networks – Entry of new Actor

Figure 3 shows a possible Actor-Network before and during a disaster. The disaster has effects on all existing actors and changes the field of attention in the network. It is highly possible that the technology is, therefore, used and seen differently, which then also affects of the usage and the actors after the disaster.

The disaster has an affect on all existing actors and changes the “field of attention” in the network. It is likely that different disaster characteristics, such as those described in the next section of the paper, have influence on and may dictate how a social media channel can be used. It is possible that the technology is, therefore, used and seen differently which then also affects the actors and the usage of the social media channels after the disaster event.

POTENTIAL INFLUENCE OF DISASTER TYPES ON SOCIAL MEDIA COMMUNICATION

Each disaster has different characteristics such as: medium and agency of carriage; elapsed time to full effect; lead time; amplitude etc. Table 1. shows specific emergency incident types, which can cause a disaster event, with their typical characteristics. These characteristics have an enormous influence on the management of the disaster. To illustrate this claim we use Powell and Raynor’s (1952) disaster stage taxonomy which splits a disaster in seven stages: warning; threat; impact; inventory; rescue; remedy; recovery. Some types of incidents, like bushfires and floods, generally have a long lead time, which can be used to warn and prepare the response agencies and the general public both physically and emotionally. In other events, like a tsunami, the warning and threat stage is much shorter. Other events like terror attacks may not have a noticeable warning or threat stage and can start directly with the impact of the event. The other event stages may depend on the disaster’s characteristics as well.

The different disaster characteristics require a different reaction from emergency services agencies’ Community Warning and Emergency Incident Response Systems (Bunker 2010). Since the specific characteristics of the disaster change the Actor-Network, it is possible that these characteristics also have an effect on the emergency services agencies’ social media usage.

Table 1. Emergency Incident Types and Characteristics – reproduced from (Bunker 2010)

	Medium	Agent	Elapsed Time Full Effect	Lead Time Warning	Amplitude	Magnitude	Area	Contm't Potential	Local/Social Impact	Plan Effect
Bomb	Various	Explosive	Short	None	High	Various	Small	Good	Local/social	Poor
Bushfire	Fire	Natural Activities	Various	Long	Various	Various	Various	Medium	Local	Good
Earthquake	Earth	Tectonic Activity	Short	Various	Various	Various	Various	Poor	Local	Medium
Fire,	Fire	Electrical/c hemical	Short	None	Various	Various	Small	Good	Local	Good
Floods,	Water	Natural Activities	Long	Long	Various	Various	Various	Poor	Local	Medium
Hazmat – land	Land	Chemical/ organic/ radiation	Various	None	Various	Various	Small	Good	Local	Good
Hazmat – sea	Water	Chemical/ organic/ radiation	Various	None	Various	Various	Small/ medium	Poor	Local/social	Medium
Structural failure (transport, building etc)	Structure	Various	Short	Various	High	Various	Small	Medium	Local/social	Good
Pandemic	Air/water	Biological	Medium/ Long	Medium	High	Various	Large	Poor	Social	Medium
Severe weather events	Air/water	Natural Activities	Various	Various	High	Various	Various	Poor	Local	Medium
Terrorist Act	Various	Various	Various	None	High	Various	Various	Poor	Local/Social	Medium
Tsunami	Water	Natural Activities	Short	Short	Various	Various	Various	Poor	Local/Social	Medium

THE BOSTON MARATHON BOMBING DISASTER

The Boston Marathon Bombing, a human terror attack carried out through the usage of two improvised explosive devices, has totally different characteristics from a flood event, which was analysed in our previous research. A flood event emerges slowly and there is a long lead-time between the first evidence and the full effects of the event. This time can be used to prepare and warn the general public. In a bomb event, a lead time to the event is not present and the full effects occur immediately. This brings enormous pressure on emergency services agencies and their management of such an event. On one side, they have to respond to the unforeseen event. On the other side, the listening community wants trustworthy firsthand information as quickly as possible so that they can understand what is happening and take appropriate action. There is a high demand for this type of information directly from the agencies, which can be implied through the fast-rising numbers of emergency services agency social media followers in disaster events, as illustrated in Sutton et al. (2013). The listening community consists, in such cases, of people directly or indirectly affected by the event. There are also the usual media agencies and listeners that are not affected by the event but who are very interested in news of the event.

There is a huge balancing act between informing and guiding the listening community, suppressing and correcting inevitable emerging rumours, but not endangering the general public by warning the offenders about details of the ongoing response and investigations. During a natural disaster, such considerations of information disclosure are not as necessary nor as important.

The Boston Marathon Bombing, therefore, was chosen as a case to investigate for this comparison since this event potentially dictates a different social media usage than the previous investigated flood case (Ehnis and Bunker 2012) and highlights different as well as similar usage patterns in emergency service agency social media usage. In Table 2, a rough timeline is given for the event. The timeline was derived from media coverage (Black 2013; Castillo and Botelho 2013; Hanstock 2013) to give an overview of the event and is not intended to be exhaustive.

Table 2. Timeline of the disaster event – derived from (Black 2013; Castillo and Botelho 2013; Hanstock 2013)

Boston Marathon Bombing – Monday – 15.04.2013			
2:49 pm	Two explosions near the finish line, only a few seconds apart.	3:39 pm	Boston Police confirms event on Twitter.
2:50 pm	First tweets from members of the public.	4:02 pm	Boston Police confirms two dead and 12 injured persons.
2:57 pm	Twitter feed of the Boston Globe reports two explosions.	4:12 pm	Boston Police responds to what is assumed to be a third explosion at the JFK Library.
3:14 pm	Video of the explosions is shared online.	5:01 pm	Mobile phone service in downtown Boston turned off.
3:15 pm	Runners, still on the course, are stopped.	8:49 pm	It is announced that the FBI has taken over the investigation.
Tracing main suspects – Thursday to Friday – 18.04.2013 & 19.04.2013			
ca. 5 pm	FBI releases pictures of two suspects.	ca. 6 pm	Lockdown of Boston area slightly lifted.
ca. 11pm	University police officer at MIT shot, police responds to this call.	ca. 7 pm	Resident discovers possible location of suspect.
ca. 1am	Police tracking hijacked car with its in-built GPS. Fire fight with suspects. One suspect shot.	7:30 pm	Police surrounds location of suspect.
ca. 2am	Police urge residents of Watertown to stay inside and turn off mobile phones.	8:43 pm	Suspect taken into custody.
ca. 8am	Suspects identified.	8:45 pm	Police announces over Twitter that suspect is in custody.

ANALYSIS

To identify different usage patterns from an outside perspective, messages broadcasted from the Boston Police Department Twitter and Facebook accounts were collected and analysed. The timeframe of the observation covers the onset of the bombing event until the main suspect was taken into custody.

Dataset & Analysis Techniques

For the data analysis, two datasets were collected. The first dataset consists of Twitter messages broadcasted by the account “@Boston_Police”. The second dataset consists of Facebook wall posts disseminated through the account “BostonPoliceDepartment”. The datasets were prepared in a semi-automated manner for analysis. The observed period was five days. The datasets started at the 15th of April 2013, the day of the Boston Marathon Bombing, and ended after the 19th of April, the day the main suspect was taken into custody. In total, the datasets consisted of 223 threads. The general statistics of the datasets are shown in Table 3.

Table 3. General dataset statistics

	Threads Twitter	Retweets	Threads Facebook	Shares	Comments	Likes
Total:	153	517312	70	81808	20428	457711
Minimum:	11 at 17 th	15407 at 17 th	3 at 17 th	1007 at 17 th	185 at 17 th	5009 at 17 th
Maximum:	57 at 19 th	425323 at 19 th	32 at 19 th	59839 at 19 th	5009 at 19 th	393307 at 19 th
Genre appearances:	Twitter 231	Facebook 113	Genres per thread:	Twitter 1.5 average	Facebook 1.6 average	

In order to make a valid comparison to the reference study (Ehnis and Bunker 2012), genre analysis was used to understand from the data how an emergency services agency, the Boston Police Department in this case, used Social Media during a disaster. Each message posted on the social media streams of the agency was seen as a communication thread. These threads were, based on content and purpose, classified into different sub-genres.

These individual genres are in this case defined as “*categories of information objects, based on conventions of form, purpose and content*” (Westman and Freund 2010). Since some threads could serve more than one purpose, it was possible that one thread had multiple genre affiliations. In a further step, the sub-genres were clustered into top-level genres. The top-level genres were then mapped against the timeline of the disaster event.

Genre Compositions

During the genre analysis, 6 top-level genre sets could be identified, which were built up from 16 individual sub-genres. The genres emerged out of the data, but there was also an attempt to align the genre description with the descriptions from Ehnis and Bunker (2012). Table 4 shows the top-level genres with a brief description. The genres are similar to the top-level genres of the previous study, except for “Emotional Sense-making” which did not appear as a distinct genre in that study. Table 5 shows the individual sub-genres. Most of the single sub-genres are different to the sub-genres of the previous study which we attribute to being caused by the other characteristics of that disaster type.

Table 4. Top-level Genre overview

Top-Level Genre Name	Proportional Distribution Twitter	Proportional Distribution Facebook	Description
Broadcast Information	48%	23%	The target is to inform the community about the occurrences.
Broadcast Warning	9%	12%	Intention to warn the community about different threats. In this case only general warnings (has no further sub-genre).
Encourage Behaviour	25%	21%	Purpose is to urge the community to show a specific behaviour.
Appeal for Information	10%	23%	Intention of these messages is to get information from the community (has no further sub-genre).
Fighting Rumours	4%	0%	These threads have the intention to clarify false or misleading information circulating throughout the community or traditional media coverage (has no further sub-genre).
Emotional Sense-making	4%	21%	With these messages it seems the event is emotionally processed and an attempt is made to make sense of it.

Table 5. Sub-Genre overview

Top-Level Genre	Sub-Genre	Distribution Twitter	Distribution Facebook	Description
Broadcast Information	Incident Information	38%	23%	Information about specific incident events.
	Information about Wounded and Casualties	4%	0%	Information about wounded and casualties or information where further information could be found.
	Information about investigation	9%	50%	Information about the actual process of the investigation about the disaster event.
	Road Information	15%	8%	Information about blocked roads, further traffic expectations and blocked public transportation.
	General Information	15%	15%	General information about the event, or normal police work.
	Sharing Department Information	14%	4%	Information, which comes originally from another communication channel of the emergency agency, like a blog or different microblogging channel.
	Sharing other Agency Information	5%	0%	Information, which was broadcasted by another agency and shared on the social media channel.
Encourage Behaviour	Navigate Behaviour	60%	65%	Messages with the intention to influence parts of the community to show a specific behaviour. For example, to not leave the house
	Media Navigation	40%	35%	Messages with the intention to navigate the media or make reporters show a specific behaviour and not interfere with the police operations.
Emotional Sense-Making	Expression of Sympathies	89%	79%	Threads, which were opened to show sympathies to families who lost somebody through the event. As well as showing sympathies to the wounded. Further messages which are intended to emotionally process

			the event.
Social Praise	11%	21%	Messages, which highlight positive behaviour of individuals or groups.

Communication Patterns

The communication patterns identified in this study came out of the analysis of the data; they are descriptive and are intended to be value free. It is not the intention of the researchers to evaluate the operations of the Boston Police Department or other involved agencies. Rather, it is to reflect usage characteristics of social media actors during an event. The data in the dataset can be divided into three main phases. The first phase is the day of the Boston Marathon Bombing. According to the collected data, this phase is characterized through the active response to mostly the physical effects of the two bombs. The second phase lasted from the 16th of April to 18th of April and is characterized through information about the investigation as well as an emotional sense-making to process the event. The third phase starts at the night of the 18th to the 19th and ends the following night. The suspects were located in this last phase. One suspect was shot and the other suspect was taken into custody after a longer intensive search.

The first phase is shown in Figure 2. The bombs went off about 2:50 pm local time. The first public Tweets could be identified a few seconds to minutes afterwards. The first response from the Boston Police Force Twitter account was broadcasted at 3:39 pm. At this day “@CherylFiandaca” posted most of the Tweets on the official police account apparently directly from the scene of the disaster. This behaviour appeared to be that of a trusted digital volunteer (Denis et al. 2012) but she was, in fact, a public information officer.

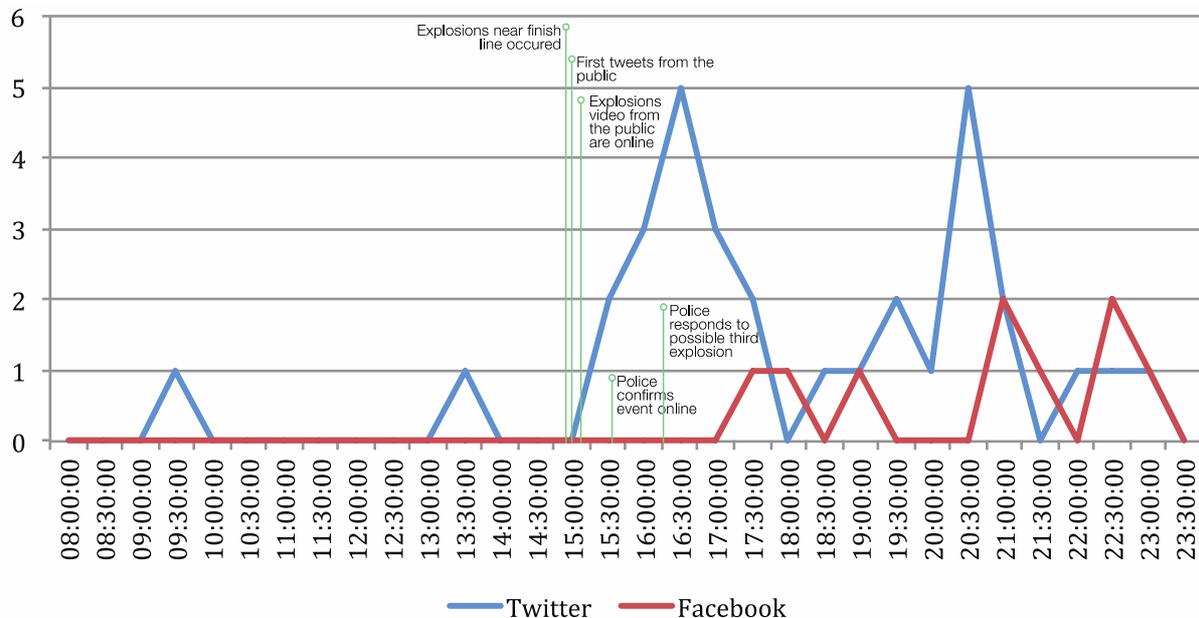


Figure 2: Number of Threads on 15th of April 2013

As shown in Figure 4, most of the Twitter messages in the first phase were broadcasted information about the event and they tried to encourage a specific behaviour from the general public and the media. The Facebook site was unattended most of the day and the first messages were posted at 5:41 pm. It appeared that the Facebook page was administered somewhere in the Boston police station away from the Command and Control Centre. As shown in Figure 5, this social media channel was also used mostly to broadcast information and encourage a specific behaviour, but later that day, the focus shifted more in the direction of honouring the casualties and wounded and to start to process the event on an emotional basis (both outwardly and inwardly). Both accounts were rarely used to counter the rumours, which were disseminated not only through social media, but also through classical media coverage.

The second phase shows different usage patterns on the Facebook and Twitter communications channels. Twitter was mostly used to broadcast information to keep the listening community informed about the ongoing investigation and to influence the behaviour of some of the general public, but more importantly, of the media. Facebook, on the other hand, was mostly used to process the event on an emotional level.

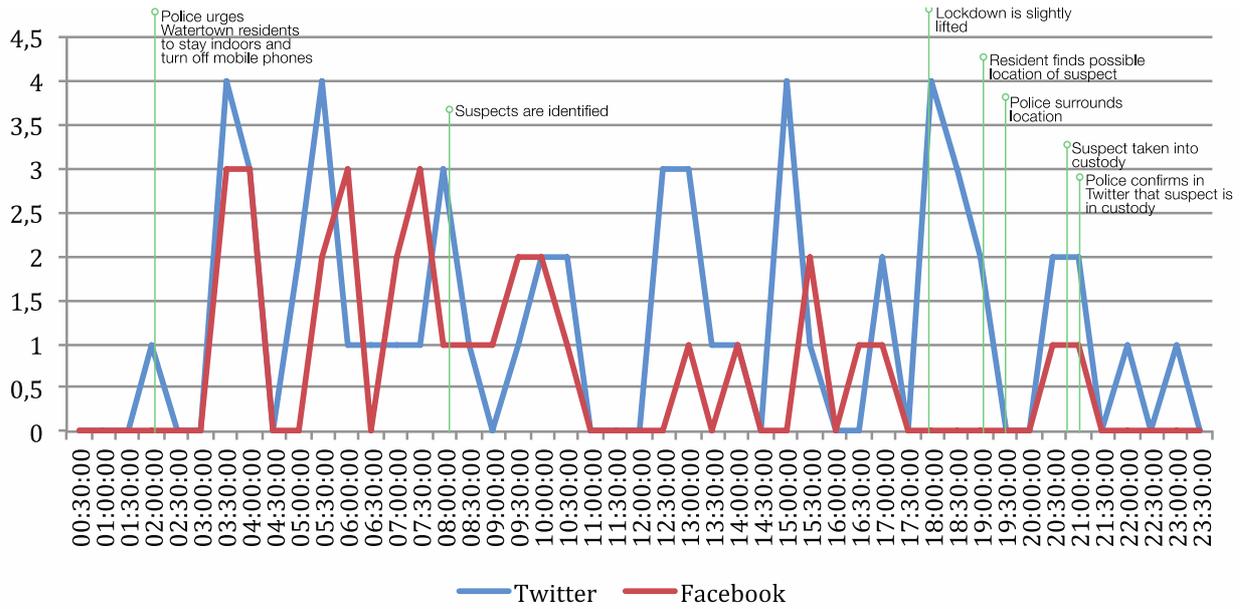


Figure 3: Number of Threads 19th of April 2013

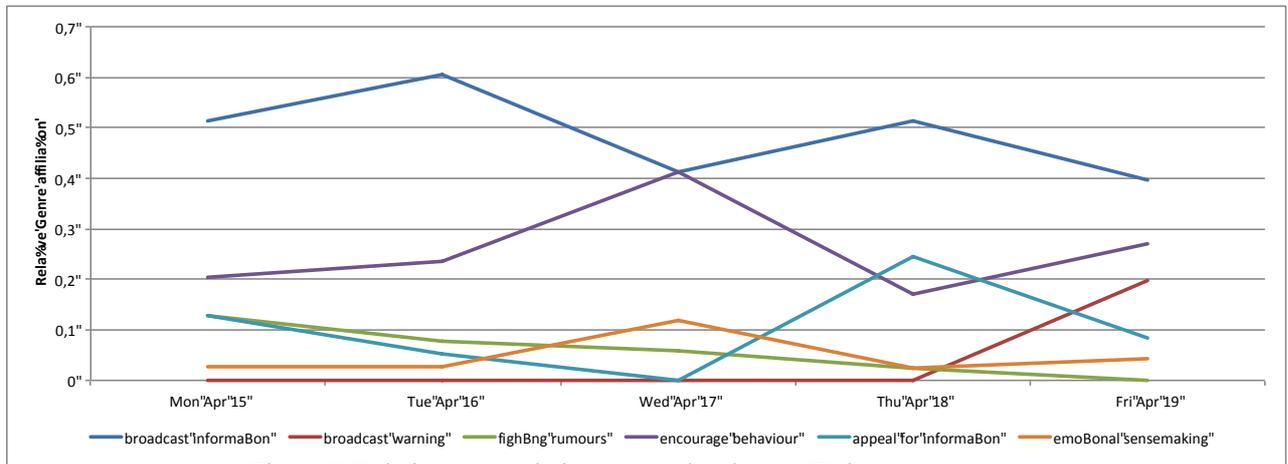


Figure 4: Relative appropriation per top-level genre Twitter Account

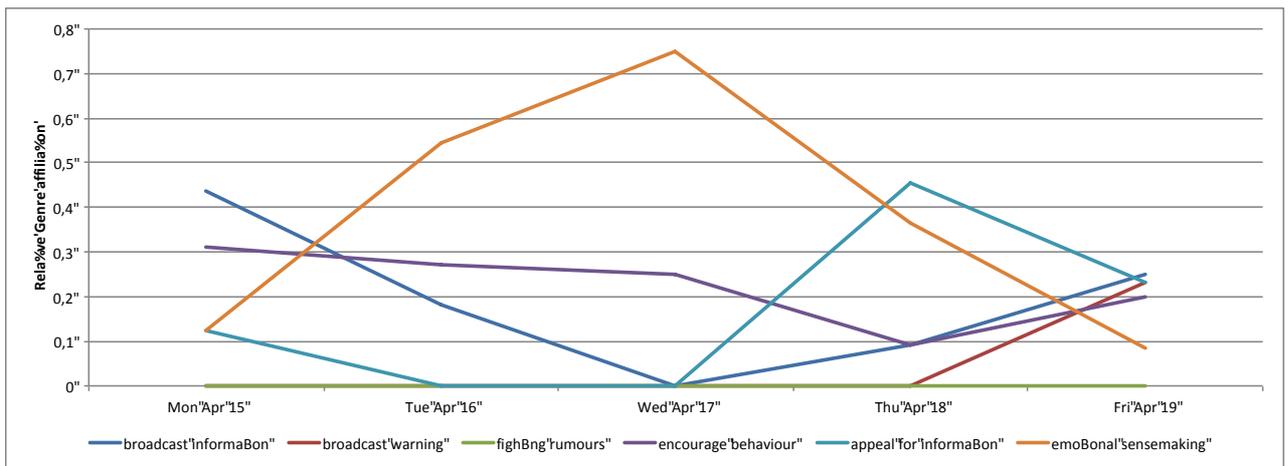


Figure 5: Relative appropriation per top-level genre Facebook Account

In the third phase, the usage patterns start to adjust. It could be anticipated that in this phase, the same team operated the social media channels. The broadcasted threads are shown in Figure 3. On the night of the 18th to the 19th, more information about the suspects was available and the listening community appealed for information. Since the suspects were armed and dangerous, the community was warned and urged to stay inside. The media were directed to certain areas and asked not to endanger police operations. At 4:18 am, it was communicated that

one of the suspects was dead. In the late evening, at 8:45 pm local time, it was announced over Twitter and retweeted over 70,000 times that the remaining suspect was in custody: “*Suspect in custody. Officers sweeping the area. Stand by for further info.*” Minutes after, a more emotional statement was broadcasted over Twitter and Facebook: “*CAPTURED!!! The hunt is over. The search is done. The terror is over. And justice has won. Suspect in custody.*” This message was retweeted more than 140,000 times and received more than 290,000 Likes on Facebook.

DISCUSSION & IMPLICATIONS

During the analysed timeframe, it appeared that the police department changed their communication from responding to an event (15th April), to investigating and processing the event (16th to 18th), to being in control of a major police operation (19th April). All three phases showed different usage patterns on the social media channels, which were influenced by the communication channel and the characteristics of the disaster or crisis event. Actor-Network-Theory helps explain how social media was used during this disaster by the Boston Police Department. To illustrate this notion of an Actor-Network, Figure 6 shows an Actor-Network of the Boston Police Department Social Media usage during the Boston Bombing

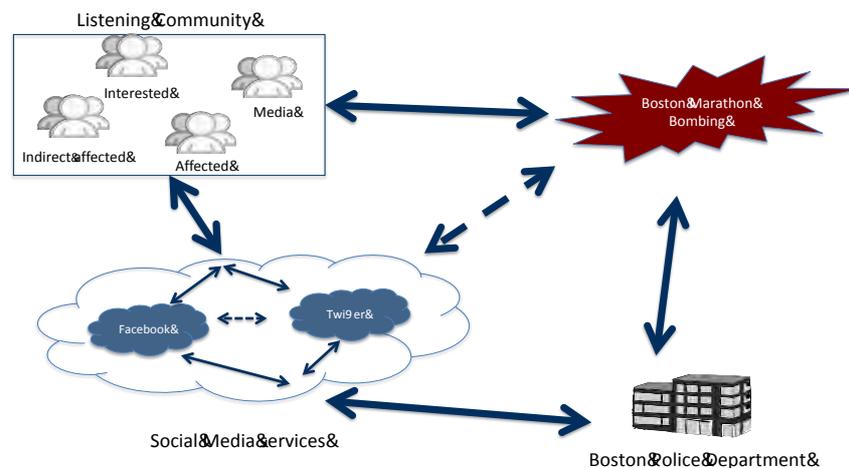


Figure 6: Simplified Actor-Network - Boston Marathon Bombing - Police Social Media Usage

The analysis showed that the listening community targeted by the Boston Police Department consisted of at least four groups: Individuals directly affected by the disaster event; individuals indirectly affected (like family members or friends of directly affected individuals); interested individuals from the general public; and media agencies. Some of the social media messages targeted one of these specific groups. For instance, in the third phase of the event there were attempts to influence the media behaviour by guiding the media agencies to specific areas and asking them not to interfere with the police operation, while affected individuals were asked for information and urged to stay at home.

The public was made aware, through social media channels, that the police were looking for specific information. The police service made sure that information was gathered via traditional channels like the phone or via a specific email address. Even though some specific questions from members of the listening community were answered on social media, in general, it seems that the police avoided engagement with the listening community on a two-way communication basis on social media. Similar patterns can be found in other crisis and disaster contexts such as, Heverin and Zach (2010) or Procter et al. (2013). In direct response to the Boston Marathon Bombing, social media could be seen as a Community Warning System (Bunker and Smith 2009) and a Community Information System, but not as a two-way communication channel.

During the Queensland Floods event of 2011, the Queensland Police Service used hashtags on Twitter, which emerged from the community, to group the information to the existing Twitter flood communication streams (Bruns et al. 2012). Since it is possible to search hashtags and to follow them, this practice can help reach social media users, who are not directly following the police social media accounts. The Boston Police Department used hashtags differently; they used them to give a tweet a specific meaning. An example for this is “#tweetfromthebeat” which indicated that the tweet came from the scene of the event. Maybe a combination of both could help increase the reachable listening community and also give some kind of higher-level information to the broadcasted message.

To compare the communication practices in different disasters, Figure 7 shows the top-level genre allocation of the Boston Police Department Twitter and Facebook account as analysed in this study, and the top-level genre allocation of the Queensland Police Service Facebook account during the Queensland Floods 2011 (Ehnis and

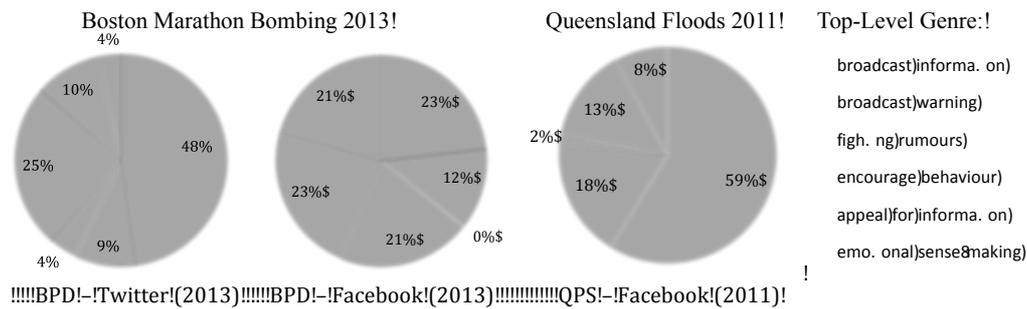


Figure 7: Comparison of top-level genres Boston Police Department and Queensland Police Department

The top-level genre which emerged in this study and was not present in Queensland Flood case is Emotional Sense-Making. It is reflected in the emergency services agency's social media usage that the Boston Marathon Bombing disaster with its structure as an unexpected rapid event with fatalities, disrupted the public as well as the police in a negative way. The Boston Police Department used both social media channels to process the event emotionally outwardly and inwardly. Still, most of this emotional sense making was identified on the Facebook channel, especially in phase two of the event.

Both social media channels were also used for different purposes in other aspects, which can be seen in the allocation of genres in Figure 7. It appears that the internal structure of the social media channel has an influence on the genre allocation during a disaster event. In this disaster event, both social media channels were used independently. Only a few messages were posted on both channels and no relocation from Twitter to Facebook or vice versa was found.

CONCLUSION

In this study, we used genre analysis to analyse the social media behaviour of an emergency services agency using the case of Boston Marathon Bombing disaster. Actor-Network-Theory was introduced to point out the interdependencies in emergency services agencies' social media usage in disaster communication. To highlight the influences of the disaster typology on social media communication, the results of this analysis were compared with the results of Ehnis and Bunker (2012). A further usage pattern, emotional sense-making, was identified which appeared in addition to the known communication patterns: broadcast information; broadcast warnings; encourage behaviour; fighting rumours; appeal for information. Social media was used to process and make sense out of the disaster event.

The data implies that both the disaster typology and the internal structure of the social media channel have an influence on the social media usage. Whereas the disaster typology influences the genre composition, the social media channel influences the allocation of these genres in the emergency service agencies' social media communication practices.

Nevertheless, it is expected that different cultural settings and other factors may make the results problematic to interpret. Furthermore, the study is limited through its "outside perspective" of interpreting the meaning of the data broadcasted through social media channels. To actually understand the implications of different disaster typologies on the social media usage of emergency services agencies, further research must be done. Different disaster typologies and the social media utilisation inside emergency services agencies must also be investigated to better understand this research topic.

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