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Analyzing emotions on Twitter during the 2014 Purdue University shooting crisis

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For the degree of   Master of Science

Is approved by the final examining committee:

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ANALYZING EMOTIONS ON TWITTER DURING THE 2014 PURDUE

UNIVERSITY SHOOTING CRISIS

A Thesis

Submitted to the Faculty

of

Purdue University

by

Elaheh Molla Allameh

In Partial Fulfillment of the

Requirements for the Degree

of

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To my grandfather, who always wholeheartedly encouraged me to pursue my education. I

lost him while I was miles away from him fulfilling his dream.

To my parents, who values my success over their own happiness. Without their sacrifice

and their patience this achievement was not possible.

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ABSTRACT

MollaAllameh, Elaheh, M.S., Purdue University, May 2015. Analyzing Emotions on Twitter During the 2014 Purdue University Shooting Crisis. Major Professor: Mihaela Vorvoreanu.

Social media has recently attracted much attention as an emergency management tool. Providing public emotional support is one of the aspects of emergency management where social media can be extremely useful. However, before we can effectively use social media for this purpose, we need to fully understand the dynamics of emotions on social media platforms. This study contributes to this understanding.

In this thesis I look into the emotional expressions on Twitter following the 2014 Purdue shooting incident. I analyze how different types of users emotionally reacted to the incident during the critical one and a half hours following the shooting. Various types of emotions and their trends over this time period are described and analyzed. Moreover, I give some suggestions for providing effective emotional support using social media in times of crisis.

CHAPTER 1. INTRODUCTION

This chapter explains about the significance, scope, limitation, assumptions, and delimitation of this study. Additionally, this chapter introduces the research question and the statement of purpose for this research.

1.1 Statement of Purpose

On January 21st 2014 Purdue community experienced a tragic shooting incident in which one student lost his life. Considering the recent high rate of such incidents in academic and educational centers (Shultz, Cohen, Muschert, & De Apodaca, 2013), prior preparation for proper reaction to such events is of crucial importance. This study contributes to such preparation by studying use of social media in the case of recent Purdue University shooting incident as a promising technology in emergency management.

In order to react properly to emergency situations, those who are on site of emergency and those who are in charge of managing the situation need to be able to easily communicate and exchange information. This communication and exchange, is not limited only to facts, but also encompasses the emotions. The emotional exchange is important to manage the stressful conditions associated with an emergency.

Effective emergency communications need a medium which secures fast and widespread connections and real time exchange of information. Here social media seems to be a promising option due to its ability to connect a wide social network to

each other and facilitate their fast communications (Yin, Lampert, Cameron, Robinson, & Power, 2012). In this regard, studying dynamics of social media use in cases of emergency is of practical importance in emergency management.

In this study I present a case study on the use of Twitter in a recent shooting emergency. I compare and contrast how three types of micro-bloggers i.e. individuals, news channels and Purdue officials used this platform to express and react to emotions. Emotions associated with uncertainty inherent to an emergency situation will be the focus of my study.

1.2   Research Question

How did different categories of Twitter users express and react to the emotions under the uncertainty associated with the critical period of the recent Purdue shooting incident?

1.3   Scope

This study is focused on only one case of emergency: the 2014 Purdue shooting incident. Although this study is limited to only one case, its conclusions can be generalized to other similar cases based on principle of proximal similarity (Patton, 2002). The scope of this study is also limited to only one social media platform: Twitter. There are many different social media platforms each with its own specifications. It has been shown that users social behavior differs across these platforms (Lenhart, Purcell, Smith, & Zickuhr, 2010). Hence results based on analysis of Twitter, which is associated with heavy news-sharing (Kwak, Lee, Park, & Moon, 2010) may not reflect the activity patterns on other social media platforms.

Another factor limiting the scope of this study is the analysis methods used. There are many qualitative and quantitative approaches for analysis of online social activity and each answers certain types of questions. The same case can be analyzed with approaches other than those the researcher picked to shed light on other perspectives of the case.

Finally, our study is limited to the critical stage of the emergency under study, defined as the timespan between the beginning of the incident and the all-clear email by Purdue police (Heverin & Zach, 2012). It has been shown that users activity patterns changes as the emergency exits the critical stage (Heverin & Zach, 2012). Therefore, the patterns the researcher observes in this study can only be associated with the critical stage of this emergency and not the subsequent phases.

1.4   Significance

Social media is a very young phenomenon. It has emerged and evolved almost entirely during the past decade. However, its dramatic growth in number of users and its rapid diffusion into many aspects of everyday routine, has made it an important component of modern communication. These social platforms have their own rules and dynamics and much of our classic sociological understandings may not translate well into their virtual social world. Hence, new studies focused on social media are necessary to shed light on their various aspects.

Studying social media is also of pragmatic significance in addition to its contribution to the theoretical knowledge. Such studies show capacities of these virtual societies and teach us how to actualize those capacities to solve problems in the real world. An important example of such capacities is the use of social media in emergency management. Many studies have shown that social online platforms can be

effective tools in emergency management (Merchant, Elmer, & Lurie, 2011).

However, in order to fully and efficiently use social media in emergency

management, dynamics of social interactions and exchange of information on these

platforms in times of crisis should be understood well. This study tries to contribute to

this understanding by studying a particular case of emergency. A sound understanding

of emergency-related conversations on social media platforms is a necessary in order

to effectively employ social media as an emergency management tool.

<div align="center">1.5 <u>Definition</u></div>

Crisis Informatics – "examines the technical, social and information aspects of

disasters and crises." (Palen, 2008, p.76)

Disaster management – "a distinct process, typically involving government agencies

and territorial authorities and most often related to national or community

disasters." (Jaques, 2007)

Emergency event – "Any event requiring increased coordination or response beyond

the routine in order to save lives, protect property, protect the public health

and safety, or lessen or avert the threat of a disaster." (Blanchard, 2008, p.340)

Emotion – "an awareness of four elements that we usually experience at the same

time: (a) appraisals of a situation, (b) changes is bodily sensations, (c) the free

or inhibited display of expressive gestures, and (d) a cultural label applied to

specific constellation of the first three element." (Kemper, Association, &

others, 1990, p.118)

Hashtag – "On one hand, a hashtag serves as a bookmark of content, which links

tweets with similar topics; on the other hand, a hashtag serves as the symbol of

a community membership, which bridges a virtual community of users."

(Yang, Sun, Zhang, & Mei, 2012)

Microblogging – "provides individuals with a method for sending real-time, short

messages that can be "followed" by anyone if the individual senders' profiles

are public." (Heverin & Zach, 2012)

Perception: "complex process by which people select, organize, and interpret sensory

stimulation into a meaningful and coherent picture of the world" (Page,

Freberg, & Saling, 2013; Severin & Tankard, 2010)

Sense-Making – "is a theory developed by Dervin (1983) that focuses on information

seeking and use in constructing one's world." (Heverin & Zach, 2012)

Situation Awareness – "the perception of elements in the environment within a

volume of time and space, the comprehension of their meaning, and the

projection of their status in the near future" (Yin et al., 2012) or "all

knowledge that is accessible and can be integrated into a coherent picture,

when required, to assess and cope with a situation." (Vieweg, Hughes,

Starbird, & Palen, 2010)

Social Media – "a group of internet-based applications that build on the ideological

and technological foundations of Web 2.0, and that allow the creation and

exchange of user- generated content." (Kaplan & Haenlein, 2010, p.61)

Social Networking Site (SNS) – "web-based services that allow individuals to (1)

construct a public or semi-public profile within a bounded system, (2)

articulate a list of other users with whom they share a connection, and (3) view

and traverse their list of connections and those made by others within the

system." (Boyd, D., & Ellison, 2007, p.211)

Tweet – "is like a blog post, meant for consumption by many people all at once. It,

too, is published on the Web—in this case, via a free service from a Silicon

Valley startup called Twitter. But Twitter limits such messages to 140

characters, which is why they are also called "micro-blogs." (Hawn, 2009)

Twitter - "created in 2006, is the most popular microblogging tool, with over 200-

million registered users who generate 155-million messages per day."

(Heverin & Zach, 2012)

1.6   Assumptions

The assumptions for this project include:

- The sample of tweets gathered is representative of all Twitter activity related
  to this incident.

- Twitter users express their true emotions in their tweets.

- Hashtag #purdueshooting is the best hashtag to gather tweets related to the
  emergency under study.

1.7   Limitations

The limitations for this project include:

- The only hashtag used in this study is #purdueshooting which is the most
  popular hashtag on the day of shooting.

- Radian 6 does not give the researcher the complete list of tweets with
  #purdueshooting and it does not provide access to full Twitter Firehouse.

- Some tweets are gathered manually using Twitter search, because Radian6 does not provide the researcher the comprehensive list of all the tweets with the proper hashtag.

1.8 Delimitations

The delimitations for this project include:

- This thesis is focused only on one specific case of an emergency event.

- Analysis of social media activity was limited to only one social media platform i.e. Twitter.

- This thesis does not include analysis of other important means of communication such as emails, TV news etc.

1.9 Summary

In the previous section I proposed the research question and argued for its significance. Also I provided a sketch overview of my research and defined the pertinent key terms accordingly. Finally I pointed out main limitations of this study. In the next section, I review the relevant literature and put my work in the context of the previous scholarship.

CHAPTER 2. LITERATURE REVIEW

2.1   General Overview

One important aspect of proper reaction to crises is establishing effective communications. Effective communications are necessary to provide the victims, the emergency responders, and the general public with the necessary information and the emotional support. These communication aspects of crisis management are subjects discussed under crisis communication, crises informatics and risk communication. The first section of this literature review gives an overview of these fields after briefly defining the concept of crisis in general.

The second part of the literature review, focuses on the special role that social media can play in crisis communication. During crises, when conventional means of communication may be impaired, social media offer a promising alternative. Social media can be used to deal with information dearth and hence, contribute to the sense-making process. Also they provide a platform for emotional exchange and therefore contribute to stress management.

The third part of the literature review shows why Twitter is a good social media platform for emergency management in general and my study in particular. And finally, I review other studies on social media activities during shooting emergencies and show how my work can fill an important gap in the literature

2.2   Crisis and Its Stages

According to Hermann (1963), a crisis is defined as any threatening and unexpected event that occurs in a specific time period during which reactions to that event take place (Hermann, 1963). Public shooting incidents are incidents of crisis by this definition. An important stage of any crisis is the critical stage which is the period during which the crisis unfolds after the initial triggering event (Srivastava, 1987). It ends when the immediate danger is removed. My study is focused on this important stage. Quarantelli (1998), focusing on our actions and reactions rather than the crisis itself, describes four stages for a crisis. These stages are: 1) Mitigation: continuing effort to reduce the effects of crises; 2) Preparedness: designing plans to lessen the impact of crises 3) Response: actions to reduce casualties; 4) Recovery: actions to normalize the situation. By this categorization, my study looks at the stages 3 and 4.

2.3   Crisis Communication

Social media are outstanding candidates for effective crisis communications due to their unprecedentedly vast spatiotemporal scope. During a crisis, when time and space have limited other means of communication, social media can shape and organize crisis communications. Social media can overcome the challenges that probably cripple the traditional means of communication in times of crisis. Haiti earthquake is an example where social media was massively used for crisis communication (Holmes, 2011).

Additionally, social media can be useful in public official crisis communications. By expansion of communication technologies, crises nowadays affect people globally. Many people faraway from a crisis watch as a disaster unfolds. This large crowd of observers puts a huge burden on emergency management

authorities and consequently, official communications throughout the crises has gained a particular importance (Malone & Coombs, 2009). Social media can be a good medium through which officials can reach out to all stakeholders and communicate with a very large audience.

In order to effectively implement the power of social media during a crisis, it is necessary to plan carefully and prepare the necessary grounds before a crisis happens (Holmes, 2011). Strategies to implement social media should expand various aspects of crisis communication since these tools may be used for various purposes according to the crisis stage. They may be used to inform people and coordinate actions and they can also be used in public relation post-crisis communications as discussed above (Holmes, 2011). Like any other tool, social media have many disadvantages if not implemented properly.

Laad and Lewis (2012, p.4) list the potential issues with social media as: "lack of confidentiality, circulation of non-verified information, number of channels, poor crafting of messages, and so on." Mixing of reliable and unreliable information on social media is a specifically important issue with these platforms especially considering Freberg's study (2012) which shows lack of high sensitivity to the reliability of information especially among the younger users of social media. In order to effectively handle these issues and use social media correctly, we need to understand the dynamics of social media during crises. Crisis informatics, discussed in the next section, provides us with this necessary understanding.

2.4   Crisis Informatics

Crisis informatics is an area of study that investigates the links and interactions between people, organizations, information, and technology in crisis

situations(Hagar, 2006). Crisis informatics also looks into behavioral and social aspects of information and communication technologies (ICT) as used during disasters (Hagar, 2013). Crisis informatics has a broad scope which encompasses information and technology related activities of both individuals and organizations during disasters (Palen et al., 2010). For example, in crisis informatics we may discuss how people deal with their uncertainty by getting help from ICT in a crisis (Anderson & Schram, 2011). Also we may look at how officials and the public channels and organizations have used ICT to manage the disaster.

Recently, social networking sites (SNS) such as Twitter have heavily influenced the field of crisis informatics. These sites provide a communication platform with very high speed of information diffusion (Hagar, 2013). SNSs also show new patterns of communication and information gathering during emergency. Another feature of these platforms, which makes them important, is their high popularity especially during crises. Based on a survey by the American Red Cross, social media have turned into one of the major information sources Americans turn into during ongoing disasters. In addition to seeking information, Social media are also used to ask for help and announce one's well-being after emergencies (Wendling, Radisch, & Jacobzone, 2013). All these features render SNSs extremely suitable choices for crisis communications. One specific aspect of crisis communication, which can heavily benefit from SNSs, is risk communication. Risk communication is discussed in the next section.

<p style="text-align:center">2.5   Risk Communication</p>

Risk has been defined as hazard plus outrage. Wherefore, risk communication has also two aspects. First, it is about how to persuade the public to notice and react

properly to a danger (hazard). Second, it is about how to control the emotional panic response from people (outrage). Outrage is more related to the public and hazard to officials (Sandman, 1993). Lachlan and Spence (2007) have tried to suggest practical ways to quantify outrage and hazard in crises.

Social media can be effective tools in both aspects of risk communication. Social media can help officials and organizations to coordinate a public reaction, and hence manage a hazard. Also social media could be a means to help people feel comfortable and less anxious in emergency situations, and therefore control outrage. The power of social media in many aspects of crisis communication including risk communication has been shown by many cases of various types of crisis. Some of such cases are presented in the next section.

2.6 Social Media in Emergency Management

Social media potential as an emergency management tool has recently gained significant attention. Baron and Philbin (2009) believe that incorporation of monitoring and active engagement with relevant social media activities is an inevitable component of modern crisis communication planning. Wigley and Fontenot (2010) also emphasize on the importance of this crucial component.

There are many studies showing that social media can be effective tools in different cases of emergency management (Merchant et al., 2011). For example, many studies show significance and effectiveness of Facebook and Twitter as communication media during the Haiti earthquake (Dabner, 2012; Muralidharan, Rasmussen, Patterson, & Shin, 2011; Smith, 2010; Starbird & Palen, 2011; Vieweg et al., 2010; Yates & Paquette, 2011; Yin et al., 2012). The south East Queensland Floods in 2011 was another crisis during which social media had been effectively

implemented(Bruns, Burgess, Crawford, & Shaw, 2012). Bruns et al. (2012) show

how Queensland Police used Twitter to provide timely information to victims and

other information seekers. The effectiveness of Twitter for emergency

communications is also shown in the Christchurch earthquake in 2011 (Bruns &

Burgess, 2012).

Although social media are gradually adopted by more and more emergency

management officials, they are not always implemented effectively. An analysis of

the use of Twitter by police departments in a number of U.S. cities provides some

examples of ineffective social media communication. The study shows that the city

police departments primarily use Twitter for crime or incident related information

sharing rather than communicating directly with the public (Heverin & Zach, 2010a).

Page et al. (2013) suggest some strategies for an effective emergency

communication on social media. They emphasize that poor communication results in

feelings of helplessness, uncertainty and insecurity in crisis victims. In fact, an

important aspect of any crisis communication plan for crisis management is dealing

with uncertainty. This important aspect is the subject of the next section.

2.7   Sense-making & Dealing with Uncertainty During Emergency

Inability to access relevant and accurate information elevates and exacerbates

the natural stress associated with emergency cases (Sutton, Palen, & Shklovski,

2008). Consequently, in response to lack of information, people engage in information

seeking activities. The officials would be the first source of information. However, if

the public is not satisfied with the official information they will turn into unofficial

channels to compensate for that (Fessenden-Raden, Fitchen, & Heath, 1987). Social

media provides an excellent platform for such extra information-seeking activities (Sutton et al., 2008).

As an example, Sutton et al. (2008) show how social media was used as a "back channel" source of information during the 2007 Southern California wildfires when people faced "information dearth". As another examples, Heverin and Zach (2012) show information-related activities such as information seeking, sharing and negotiating were highly prevalent in tweets related to three cases of campus shooting. One of the reasons behind these social media activities was coping with stress resulted from lack of information. Seeking and sharing information to fill in the gaps helped social media users to cope with stress during these crises (Heverin & Zach, 2012). In fact, prominence of information sharing in crisis-related social media activities is a pattern. Another example is dominance of information-sharing tweets in Heverin and Zach (2010a) study of Seattle-Tacoma shooting in 2009, is an example.

In some instances, these information-related activities take more complicated forms. Shkolovski et al. (2008) show that the formation of communities on social media in response to the 2007 Southern California wildfires helped their members cope with the crisis in many ways including facilitation of information dissemination. Starbird and Palen (2011) also report the self-organization of Twitter users after the Haiti earthquake in 2010. Online self-organization during crises has been associated with development of roles and norms to guide sharing of sensitive information sharing (Vieweg, Palen, Liu, Hughes, & Sutton, 2008). Vieweg et al. (2008) describe the collective action to gather and share information in the case of social media activities related to the 2007 Virginia Tech shooting. They show that contrary to the classic and prevalent view of public reactions in crisis, the public behavior in this case was based on emerging social roles and norms, which assured information accuracy. Unsatisfied

with scarcity of formal information on list of victims, social media users tried to solve this problem collaboratively. This online collective problem solving activity leads to very accurate information about names of the victims before any official announcement (Vieweg et al., 2008).

Such information-related activities can be better understood in light of Dervin's sense-making theory (Dervin, 1999). This theory describes an individual as constantly facing cognitive gaps that he tries to fill. Because one does not have a comprehensive view of reality, she reaches out to other people to make sense of the situation (Dervin, 1999). In fact, crisis puts a severe demand on sense-making. During crises, cognitive gaps are even more prevalent and important. The norms of one's life have shattered and she has to remodel her understanding of her surroundings. There are many gaps to be filled and many questions are there to be answered till the world makes sense again for the individual involved in crisis. In such cases, because one does not have all the necessary information, extra information seeking activities become inevitable. This is why sense-making during times of crises relies heavily on interpersonal interactions. This phenomenon has been observed in Heverin and Zach (2012) study of three cases of campus shootings. They conclude that microblogging can contribute significantly to collective sense-making during crises.

Interestingly, sometimes the information-related activities on social media becomes so strong that it changes the direction of the stream of information, i.e. news channels and officials use social media generated information. Wigley and Fontenot (2010) analyzed sources of news related to Virginia Tech shooting. They showed that public media used online citizen generated news in their coverage of the incident. This practice was more common during the first stage of the crises compared to subsequent stages. The amount news media used the user generated content varied

between the different categories of the news media: online and cable news channels were more likely to share citizen generated news compared to newspapers. In another study, Wigley and Fontenot (2011) show the same adoption of citizen generated information by news reporters during Giffords shootings in Tucson.

In line of the above discussions, one special role suggested for social media in emergency management is raising "situation awareness"(Vieweg et al., 2010; Yin et al., 2012). Situation awareness has been formally defined as "the perception of elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future" (Yin et al., 2012, p. 52) or "all knowledge that is accessible and can be integrated into a coherent picture, when required, to assess and cope with a situation" (Vieweg et al., 2010, p.1079). In simpler terms, it means what one should know to understand and interpret his or her current situation correctly and decide wisely how to react. Such awareness is essential and necessary for both the victims of a crisis and those who are in charge of crisis management in order to react properly to the situation. However, there is not much information yet available on how such awareness can be established in emergency conditions when many means of communication may have lost their functionality. Here social media can come to play as an alternative means of communication (Yin et al., 2012). Using social media, people who are at the scene can report real-time information, which provides the officials and the news channels with a real time picture of the situation (Yin et al., 2012). On the other hand, officials can reach individuals using social media and coordinate proper collective reactions.

As the above discussions imply, social media information-related activities during crisis have been extensively studied. However, emotional exchange on social media has not been studied to the same level. Although some of the studies have

mentioned the emotional stress as the underlying reason for information-related activities, emotional aspects have not been their focus. The next section shows this gap specifically in the case of social media analysis in shooting incidents. I show that although emotional expressions were detected in previous works on shooting-related social media activities, they are not analyzed and studied deeply enough.

2.8   Social Media Analysis in Shooting Incidents

Heverin and Zach (2012) have studied trends in Twitter activities during three cases of campus shooting: the John Hopkin's University hospital case in September 2006, the Middle Tennessee State University case in February 2011 and the University of Texas Austin case in September 2010. Their main underlying question was how social media contribute to collective sense-making in shooting crises. They used thematic analysis, complex time series analysis and discourse analysis to address this question. Using these methods, they were able to describe complicated behavioral patterns on social media. Following their line, I want to use thematic analysis and complex time series analysis to answer a different question in similar context.

The Heverin and Zach (2012) study show that early responses to these emergencies were mostly information-sharing. Facing information dearth, people turned to social media to seek, share and negotiate information. As the crises evolved from the critical stage to the recovery stage, opinion sharing activities increased. Emotional expressions were also prominent among messages. Authors believe that such posts do not contribute to collective sense-making an only help their senders cope with the situation. Since collective sense-making is the main focus of their study, they do not analyze emotional tweets much further.

Another study by Heverin and Zach (2010a) on Twitter activity related to the

shooting of four police officers in the Seattle-Tacoma, Washington in 2009 also

reports emotion as one of the emerging themes. Similar to their other study, this one is

also mainly concerned with the information-related activities and suggests that

Twitter was used as a means to organize and disseminate related information.

My study uses almost the same methods used in the previous studies of the

social media during shooting incidents. However, I use these methods to study

another aspect of social media activity i.e. the emotional expression and exchange.

The next section of the literature review justifies some aspects of my method,

such as choosing Twitter as the social media platform for this study.

2.9   Twitter Activities & Real World Incidents

Among all candidate social media platforms, Twitter seems like a very

promising option for the purpose of this research. It has a very large user population

(more than 645,750,000) ("statisticsbrain,") and its users use it quite often as a news

platform. Significance of news on Twitter shows the association of its content with

events of the real world. Such character is necessary for any platform that is intended

to be used in emergency management.

It has been shown that news comprises a significant portion of tweets (Kwak

et al., 2010) and Twitter has been extensively studied as a news medium (Blasingame,

2011; Carafano, 2009; Kwak et al., 2010; Morozov, 2009; Phuvipadawat & Murata,

2010). In particular, Twitter has been successfully used as a platform to exchange

news and arrange collective actions in situations where regular news channels were

not readily accessible due to natural disaster, political crisis, etc. (Burns & Eltham,

2009; Carafano, 2009; Morozov, 2009; Muralidharan et al., 2011; Yates & Paquette,

2011). For example, Hughes and Palen (2009) analyze Twitter usage during two emergency and two national security incidents and show information dissemination features that support information broadcasting on this platform. Also Heverin and Zach (2010a) showed Twitter activity related to the shooting of four police officers in the Seattle-Tacoma, Washington in 2009 was mainly for information and news sharing purposes.

Prevalence of news on Twitter indirectly implies the relation between the Twitter communications and the real incidents which is an undoubtable necessary feature if Twitter is to be used for emergency management. However, there is even more direct evidence for such relation. Frequency of relevant tweeting activity has been used in order to monitor correlations between real world incidents and virtual communications on Twitter (Achrekar, Gandhe, Lazarus, Yu, & Liu, 2013; Baucom, Sanjari, Liu, & Chen, 2013; Crooks, Croitoru, Stefanidis, & Radzikowski, 2013; Lee, Agrawal, & Choudhary, 2013; Morozov, 2009; Singh, Gao, & Jain, 2010). A good correlation has been observed between what happens in the real world and what gets posted on Twitter, even for apparently unrelated phenomena such as severity of flu spread (Achrekar et al., 2013; Lee et al., 2013; Singh, Gao, & Jain, 2010). In case of an earthquake that occurred on the East Coast of the US, Twitter communication reflected reality so accurately that some have suggested considering it as an alternative "geological sensor"(Crooks et al., 2013). This real-world-Twitter correlation underscores the potential of Twitter as a tool for raising situation awareness and emotional management in emergencies where real-time interactions are crucial. To rely on Twitter as tool for these tasks, one needs to understand how Twitter posts reflect and relate to the emergency and how quickly the related news gets propagated on this network. The content and frequency of tweets relevant to

particular incidents have been used to analyze reflection of those incidents among the Twitter society(Baucom et al., 2013; Bukhari, Wojtalewicz, Vorvoreanu, & Dietz, 2012; Singh et al., 2010). This study presents this reflection for the case of the Purdue 2014 shooting incident. However, contrary to most of the previous studies my focus is not the information shared on Twitter, but the emotions expressed. Therefore this study is based on this assumption that in addition to news and information, emotions are also exchanged on Twitter. The next section provides support for this assumption.

2.10 Emotion Expression on Twitter

Information dearth and uncertainty have been associated with increased stress. As a natural response, people increase their information-related activities including information-seeking, sharing and negotiating on social media (Sutton et al., 2008). But increase in information-related activities is not the only emotional expression of social media users. Some studies have identified a variety of emotion expression on social media platforms (Quercia, Capra, & Crowcroft, 2012; Roberts, Roach, Johnson, Guthrie, & Harabagiu, 2012).

Emotions expressed in tweets have been categorized as being "negative" or "positive" (Quercia et al., 2012). Quercia et al. (2012) show that positive and negative emotional expressions of Twitter users are highly correlated with other users to whom they are connected. This may indicate propagation of emotions on Twitter.

In a finer-grained approach, Roberts et al. (2012) annotates tweets with seven emotional tags: anger, disgust, fear, joy, love, sadness, and surprise. These emotions are the Ekman's six basic emotions plus love. This categorization of emotions is a finer-grained version of the categorization as being positive and negative. Authors have three coarse-grained categories: positive, negative and unexpected. Anger,

disgust and sadness are considered as purely negative, joy and love as purely positive and surprise as purely unexpected. Fear is classified as both unexpected and negative. Utz et al. (2013) show the expression of one specific emotion, anger, on Twitter during one case of emergency (Fukushima nuclear disasters).

For this study, I follow the lines of the previous literature on emotional analysis of tweets. I will first try to annotate tweets according to the above-mentioned categories to understand the type of emotions shared about the Purdue 2014 shooting. However, other emotional categories will be considered in case the above categorization cannot fully describe the emotional expressions of this special case.

2.11 Conclusion

An extensive body of evidence supports social media as candidates for emergency communications and risk management. In order to devise an effective emergency communication plan based on social media, first we need to understand various aspects of emergency-related communications on these platforms. One aspect of such communications i.e. the information-related activities has been extensively studied. However, the types and dynamics of emergency-related emotional exchange on these platforms is not yet elucidated. This study intends to offer some insight on this aspect of social media communications. Understanding the emergency-related emotional exchanges on social media help officials to implement these platforms to control hazard and outrage associated with emergency situations.

CHAPTER 3. METHODOLOGY

This chapter includes an overview and illustration of the method section of this study. It covers the research framework, sampling, data collection, data analysis, validity, and researcher credibility.

3.1   Research Framework

In this study I aim to understand what types of messages (emotional, information-related or action-related) were posted by users on the day of Purdue University shooting in order to detect emotional expressions and assess their share of all relevant tweets. Additionally, I want to find if there is any correlation between the type and content of the posts and the source of the messages (i.e. individuals), Purdue officials and news channels. Moreover, I want to find out how news channels and Purdue officials responded to emotional expressions on Twitter during the critical period of the 2014 Purdue shooting incident. Finally, I annotate the emotion-related tweets with various tags showing the nature of the emotions expressed (e.g. sadness, anger etc.).

Considering the complicated linguistic aspect of this research, I mainly use qualitative methods. However, I also benefit from quantitative techniques such as complex time series analysis (Heverin & Zach, 2012) to show variations in emerging themes over time as the emergency evolves through its critical period.

3.2   Sampling & Data Collection

This study is focused on the Twitter activities during the critical period of the Purdue shooting incident on Tuesday January 21st 2014. The researcher follows Heverin and Zach's (2012) method for identification of the critical period: the time span between the advent of an emergency until the official all-clear message. Hence, the study covers the tweets from the first one on 12:19 pm until the Purdue police email about lifting the shelter in place at 1:46 pm on the day of shooting.

Tweets with the hashtag #purdueshooting were collected using Radian6, a social media analytics tool for gathering and analyzing particular social media messages. The Radian6 is the best social media analytics tool that we have access to. However, it should be noted that its search is not comprehensive and only gives a sample of all the tweets. The sample generated by Radian6 consisted of 1731 tweets for that time period. Due to importance of local news channels and Purdue official tweets in this study, I then completed the Radian6 output by adding tweets from @LifeAtPurdue (the official Twitter account of Purdue University) and @PurdueExponent (the official Twitter account of Purdue University newspaper) Twitter accounts manually via Twitter search. It should be noted that since tweets by @LifeAtPurdue and @PurdueExponent did not have hashtag #purdueshooting, they were not captured by Radian6. This second search lead to finding 20 new tweets and the total number of tweets in the final dataset added up to 1751.

Although @PurdueExponent is not officially affiliated with Purdue administration, it was considered as an official account due to the general conception among students who consider it as the University official newspaper. This fact is manifested in the number of retweets this account receives compared to other local news channels.

3.3   Data Analysis

I first analyze tweets thematically in order to identify the tweets related to information or emotion. The emotion related tweets are the main focus of this study and will be further categorized into different subtypes of emotion. However, the information related tweets are also important for our study since they can indicate the state of uncertainty, which elevates the stressful emotions in emergency situations.

3.3.1   Thematic Analysis

I use thematic analysis to identify the type of Twitter conversations. I follow Boyatzis's three-step of thematic analysis: 1) Design and sampling, 2) Identification of themes and coding and 3) validation based on codes (Boyatzis, 1998). Emerging themes show the nature of the microblogging communications. Then we categorize tweets by their sender and analyze differences in the emerging themes within each category. This analysis shows us how each class of senders has used Twitter.

In order to thematically analyze the tweets, they have to be classified in three rounds. In the first round, general themes in tweets need to be identified. In the second round each tweet should be classified in one of these thematic classes in a mutually inclusive way (i.e. each tweet can be assigned to more than one category). In the third round the classification needs to be done one more time to ensure each tweet associates to the correct theme. Table 3.1 shows the emerged themes and some of the codes associated with each of them.

Table 3.1 Themes and their associated codes

Themes	Codes
Giving Information	Reported shooting, Still being told to stay, Links, Suspect in custody, Lockdown, Live streaming, Electrical Engineering building, See pics
Requesting Information	Update us, Say where you are, Tweet me, Tell me, Keep us posted, What did you see/hear, Any updates?
Demanding Action	Avoid area, Stay safe, Remain sheltered, Stay in place, Make sure, Stay inside, #prayforpurdue, Pray, RT, Purdue cancel classes, Spread this
Expressing Opinion	Gotta respect, No guns, In my opinion, Stop shooting, I cannot believe, Jail, I disagree, Social media, Doing a great job
Spam	Go to, New followers
Joy	Glad, Safe, Happy, Make me feel good, Great
Sadness	So sad, Breaking my heart, Sad day, #sadtruth, smh, My God, Almost cried
Love	Love
Surprise	This can't be real, No,Can't believe, My God, Bloody hell, Crazy to think, Why, Really?!, Never thought, My god
Fear	stay safe, Bloody hell, Scariest thing, Nervous, Worried, Unsafe, Scared, Terrifying, This can't be real
Anger	Idiots, "No, you don't go shooting", Get your facts straight, Do you have any common sense, What's wrong
Hatred	Fuck rots
Disgust	Dumb stuff, Really?!,Dumbass
Pray	Pray, Hope, Praying, #Prayforpurdue, #pray4purdue, Prayers ,Lord, Thoughts
Respect	Gotta respect, Thankfull, Fantastic job, Makes me feel good

3.3.2   Classification of Senders

I want to investigate the difference in engagement in emotional exchange among various types of senders. I categorize the sender for each tweet into one of the classes: individual, news channel, official and others. For each tweet, I look up the sender's name and if needed, sender's profile on Twitter and categorized the sender as an individual, news channel or Purdue official. Those senders who are news reporters in their professional life, but are posting on their personal Twitter account are

considered in the news channel category. Some usernames may not be present on Twitter anymore and their profile may not be accessible. In this case I assign them the fourth category of senders, which is others.

3.3.3   Complex Time-Series Analysis & Quantitative Data

It has been shown that the proportion of various themes in emergency-related tweets varies over time as the crisis unfolds (Heverin & Zach, 2012). I want to investigate this phenomenon in the case of Purdue 2014 shooting, with special focus on proportion of emotion-related tweets. For this investigation, I create a graph of the frequency and proportion of various tweets over time.

All graphs and quantitative data will be generated by Microsoft Excel. For example, time elapsed between subsequent tweets is computed by converting the difference of posting times as reported by Radian6 into seconds using Excel formulas.

3.4   Validity

The main body of the sample tweets is gathered automatically using Radian6. The rest of the tweets, although added manually, were selected using a clear and mechanical process. Therefore, validity issues associated with a selecting a sample biased towards theories (Maxwell, 2005) do not affect this study.

However, the bias resulted from the researcher's perspective cannot be fully eliminated from a thematic analysis such as this study. In order to reduce the effect of researcher's perspectives on the thematic analysis, I try to perform my thematic classification as objective as possible. I emphasize on looking for keywords and obvious clues rather than my general subjective impressions.

3.5   Researcher Credibility

Here I describe my relevant personal experiences and reflections since they may affect the results of this study.

My original interest in the use of social media in crises and emergencies has its roots in my experiences during the Iranian post-election unrest in 2009. Heavy involvement of Facebook in those movements as a backchannel communication medium showed me the potential of social media to be effective and influential in times of turmoil. Later on, perusing my interest in social media use in social movements, I studied Twitter-related activities during SOPA/PIPA 2011 online movement.

Being personally affected by the recent Purdue shooting incident, I am highly motivated to study how social media tools can be effectively used in this type of emergencies. However, this personal experience may affect my analysis and reduce the accuracy and subjectivity of the study. Inevitably, I have certain personal feelings about this incident and I may unintentionally impose those feelings on the analysis of tweets. I have to be aware to always maintain the objectivity of the analysis and separate it from my personal emotions.

In this study I had to read tweets, understand and categorize them. This needs a good familiarity with Twitter communications, and I have this qualification for the following reasons. First and foremost, I have been a Twitter user for more than two years and thus, have both tweeted myself and read many tweets by others. Second, I have had a few advanced level courses with heavy social media immersion such as Social Internet (TECH 637).

3.6   <u>Summary</u>

Four main analyses will be performed on automatically and manually gathered sample

of tweets. First, tweets will be thematically analyzed to identify emotion and

information-related posts. Second, the tweets will also be categorized according to

their senders. Third, the emotion related posts will be classified into different types of

emotions. Finally, the frequency of major themes and fine emotional categories will

be graphed over time. The discussion of these results in light of theoretical arguments

will shed light on emotional expression and exchange of different types of Twitter

users during the critical period of Purdue 2014 shooting.

CHAPTER 4. RESULTS

In this chapter I present the results of the analysis of 1751 related tweets during critical period of 2014 Purdue shooting incident. This set of tweets was initially gathered by Radian6 social media analytics tool and then supplemented by an additional manual search on Twitter search engine.

The results are organized in the following order. First, I classify who has posted the tweets and show the proportions of tweets by individual, news channels and Purdue officials. This classification helps me relate the content of the tweets and their trends to the nature of their senders. Then I describe the proportions of retweets and original tweets in order to identify the main sources that initiate communications and generate original content and those who merely propagate second-hand content. The thematic analysis of the tweets comes next. This analysis describes the general themes of tweets and shows the significance of tweets with emotional expressions. Also by looking into information-related themes in tweets, I can see the emotions related to the state of uncertainty and lack of situational awareness. Finally, the details of emotional expressions are presented. I classify emotions and describe the tweets within each class. I also look into the trends of these tweets and try to explain the patterns observed.

All these pieces together draw a picture of emotional expression during the critical period of 2014 Purdue shooting incident. Such a picture teaches us invaluable lessons for the emergency management using social media.

4.1   Classification of Senders

I categorized the senders into three classes as described in the Methods section: Purdue Officials, News Channels and Individuals. Eight senders (8 tweets) could not be categorized in either of these classes or their accounts were not accessible on Twitter at the time of this study. These tweets were excluded from the categorization by sender.

Figure 4.1 shows the proportions of each of these categories. Individuals' posts comprise the majority of tweets (92.2%). The tweets by news channels are the next most frequent (6.4%). It should be noted that professional reporters posting as individuals were accounted as news channels. Purdue Official posts are only a very small proportion of all tweets (1.4%). Tweets from this category were from 6 different sources: LifeAtPurdue, PurdueExponent, PurdueSports, GradPurdue, GoldandBlackcom, and PurdueLanguages. In total there are 24 tweets from all of these 6 accounts.

Significantly high proportion of individual tweets can be an instance of citizen journalism and may be motivated by sense of duty and personal connection of individuals to Purdue community. These underlying motivations can be subject for a separate study.

All Tweets

■ Individuals
■ Purdue Officials
■ News Channels

1.40% (24)

6.40% (112)

92.20% (1607)
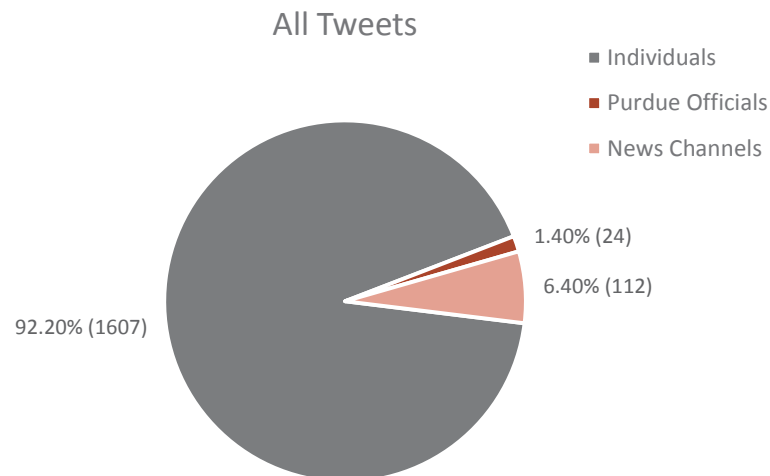
Figure 4.1 Categorization of senders (Number of tweets shown in parentheses)

Although the news channels have posted more frequently, Purdue officials were

quicker to post about the incident. The first official post happens at time zero while it

takes news channels nearly 30 minutes to post anything about the incident.

Individuals were also quick to respond and posted in 5 minutes from the incident. The

latency observed for news channels may be attributed to the time they have spent to

verify the news. This observation may indicate the faster pace of news on Twitter

compared to regular news channels. However, it should be noted that any claim based

on this observations needs further verification because I used two different methods to

compile news channel and official tweets. While the news channel tweets were

gathered only by Radian6, official tweets were compiled both by Radian6 and manual

search over Twitter search engine. Therefore, official tweets were more likely to be

identified and some early news channel tweets may have been missed from the study.

Figure 4.2 shows the cumulative frequency of tweets over time by any of the

above-mentioned senders. Despite the significant difference between the total number

of tweets posted by each category of senders, the cumulative frequency of tweets

follow a somehow similar pattern in all of the three categories. They show an initial

lag time (until around 30 minutes), and then a rapid increase in tweeting activity. The

initial lag time may be due to limited public awareness about the incident shortly after

it took place. Moreover, the main hashtags which make the related communications

detectable take time to form and gain popularity.
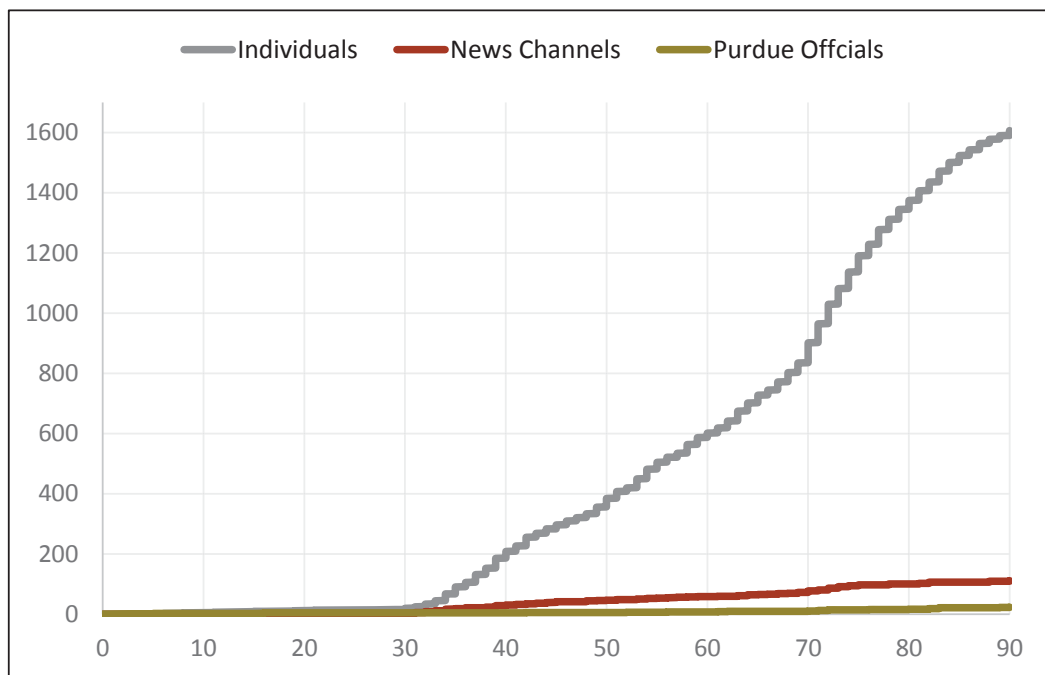
Figure 4.2 Cumulative frequency of tweets over time, categorized by sender

4.2   Retweets and Original Tweets

Figure 4.3 A shows the proportion of retweets and original Tweets. Overall,

the majority of tweets are retweets and not original tweets. This shows that most of

the tweets have not generated new information, but rather participated in information

propagation. Figures 4.3 B, C, and D show the same proportions, but within the

All Tweets

A

Individuals

B

34.30%

65.70%

32.80%

67.20%

News Channels

C

Purdue Officials

D

48.20%

51.80%

20.80%

79.20%

■ Original Tweet
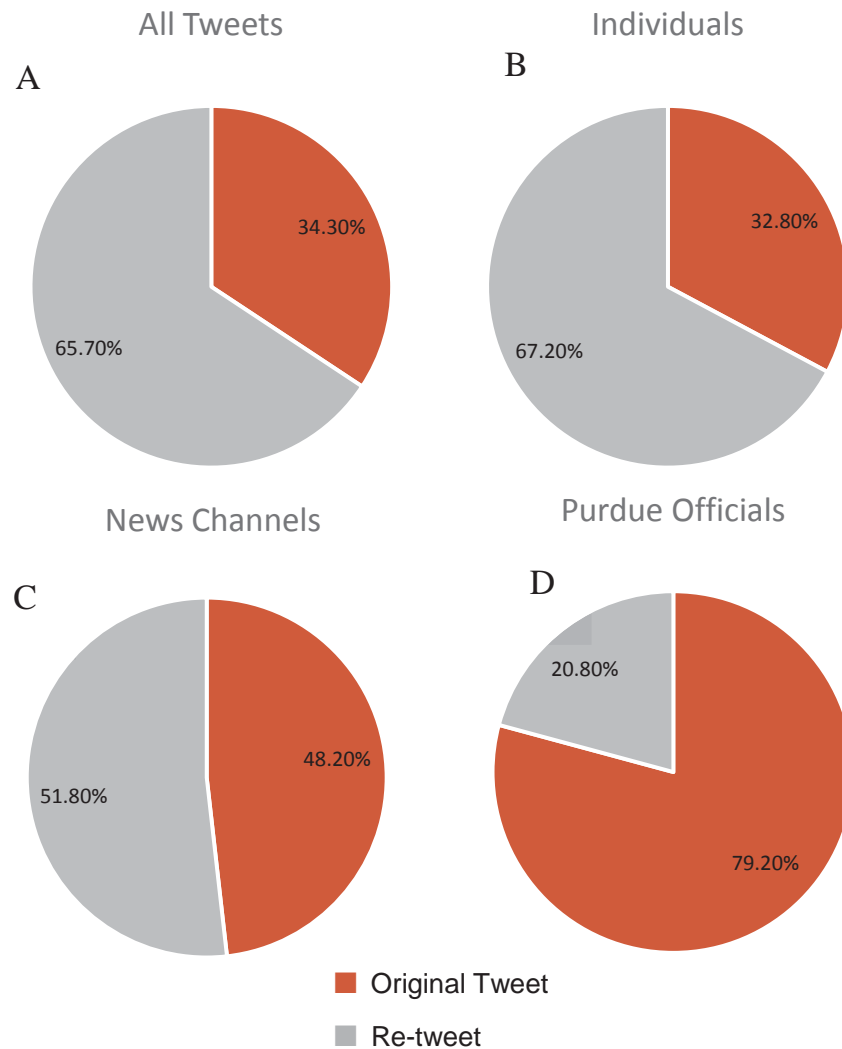
■ Re-tweet

Figure 4.3 Proportion of retweets and original tweets in A) all tweets, B) tweets by individuals, C) tweets by news channels and D) tweets by Purdue officials

tweets sent by individuals, news channels and Purdue officials. We see that the

proportion of retweets is significantly lower in tweets by Purdue officials or news

channels compared to tweets by individuals. While only 33% of the individual tweets

are original, 48% of news channel tweets and almost 80% of Purdue official tweets

are original. This shows the share of news channels and Purdue official accounts in

generating original information relative to the total number of their posts is much

higher compared to individuals. However, the much larger pool of individual posts

compensate for their lower originality ratio and still, the majority of the original tweets are posted by individuals. It should be mentioned that except LifeAtPurdue and PurdueExponent, all the other four Purdue official accounts did not have any original tweets. They just retweeted tweets from other accounts.

4.3   Themes of the Tweets

In this section I present the results of the thematic analysis of the tweets. First, I present the themes emerged one by one. Then, I analyze the cumulative frequency of these themes over time.

4.3.1   Overall Thematic Analysis

Figure 4.4 A shows the themes emerged in the thematic analysis of the tweets in general. The results of the thematic analysis of tweets sent by individuals, news channels and Purdue officials are shown in Figure 4.4 B, C and D. The details for each of these themes is discussed in this section. The themes are listed in order of their frequency. It should be noted that the thematic analysis has been mutually inclusive and therefore, more than one theme may be assigned to a single tweet.

After describing each theme separately, I discuss the frequency

4.3.1.1   Giving information

In line with previous literature (Kwak et al., 2010), the majority of tweets are disseminating news (Giving Information). The news were generally announcing that a shooting has happened and gave some more details.

Giving information was specifically significant among Purdue official tweets. Except two of them, all tweets from Purdue officials were giving information. Purdue official tweets gave information on where the shooting took place, campus safety precautions and links to pages with more information, for example: "Shooting reported on campus. Bldg Electrical Engineering; Avoid area; Shelter in place. Check http://www.purdue.edu for updates".

Not surprisingly, fiving information is also prevalent in tweets by news channels. They not only reported official information, but also reported on the personal experiences of individuals directly involved in the situation: "Talking to a #Purdue student right now on #WTHR. Heard police yelling "get down" outside classroom. #Purdueshooting".

Individuals also gave information in their tweets. One special piece of information specific to individual senders was informing others of one's own safety: "good thing I wasn't going to my class in EE today anyways .... •À_ #purdueshooting".

4.3.1.2 Expressing Emotion

Expressing emotions was second most frequent theme and they comprise a significant portion of tweets. This is an important observation for this study. The high frequency of emotional tweets indicates their importance and justifies studies such as the present one.

Although expressing emotions was so prevalent among all tweets, Purdue officials posted zero tweets with emotional content. This may be a weak point and

hence, an opportunity for future improvement of their emergency communication practices. This issue will be discussed more in the discussion section.

Emotional expressions by news channels were usually reports on emotional state of individuals affected by the incident. For example: "Purdue student at Engineering Building tells WTHR "Police yelled 'Get down! Get down!'... Scariest thing in my life." #Purdueshooting #wthr". The news reporters also prayed for safety of those involved in the incident.

Individuals were the source for the majority of emotional tweets. These emotional expressions will be discussed in detail later in this study.

4.3.1.3   Demanding action

The high frequency of tweets that demand action can be due to the fact that the emergency is in its critical phase and people need to react to the situation. The majority of such tweets demanded staying safe and some included more details on what to do for those on campus.

In addition to giving information, Purdue officials also used Twitter to demand action and coordinate collective responses: "REMINDER: Everyone on campus should remain sheltered in place until further notice. #PurdueShooting", News channels came to the aid of Purdue officials for these coordinations by spreading their action demands: "#Purdue: Everyone advised to stay in place. #Purdueshooting". Individuals also got engaged in retweeting official and news channel action orders. Individuals demanded other actions as well. For example, they asked everyone to stay safe, be careful or pray for those engaged in the emergency: "RT @ANONYMOUS Everyone please be safe and say where you are... #purdueshooting".

4.3.1.4   Expressing opinion:

Only individual expressed opinions in their tweets. The main topic of these opinion expressions in gun rights: "This is 1 reason I disagree with the right to carry guns. People abuse that privilege to the jeopardizing safety of others. #PurdueShooting".

Performance of Purdue officials and police, also coverage by news channels are other topics on which people expressed their opinions: "Purdue police & co. are doing a fantastic job in my opinion. That's all I have to say about that #PurdueShooting #PrayForPurdue". Interestingly, social media was also a subject for opinion expression: "GREAT THING about Twitter: Getting more information during an event like #PurdueShooting from sources. BAD THING: Rumors being tweeted."

4.3.1.5   Spam

Spam tweets were trying to gain followers by abusing hashtags related to the Purdue shooting. Such tweets were only posted by individual senders. These tweets caused negative reactions and disapproval among Twitter users as will be discussed more later: "It's beyond sad that so many spammers are posting to the #PurdueShooting hashtag. Disgusting.".

4.3.1.6   Requesting information:

Although requesting information was the least frequent theme, all types of senders had tweets requesting information. Purdue Officials had two tweets requesting information: "If you have any new information on the shooting on the

Figure 4.4 Themes and their frequencies observed in A) all tweets, B) tweets by individuals, C) tweets by news channels and D) tweets by Purdue officials

Purdue campus, please reply back to us @PurdueExponent." and "Purdue students in

EE 069 during the shooting, we want to hear from you. Call us at 765-743-1111."

This is an example of the role social media can play in raising situational awareness.

Officials can use social media to gain first-hand, real-time information from those on

site of the emergency. This first-hand information helps the emergency-management

team to understand the situation better and handle it more effectively.

There is only one tweet from a news channel reporter which requests

information: "Anyone at #purdue tweet me and tell me what the latest is on the

#purdueshooting so I #RT". News channels could potentially get first hand news by

requesting information from those individuals at the sight of the emergency.

Individuals requested information mainly from Purdue officials: "Hey, Purdue,

update us a little more. One shooter, two shooters, caught, at large? Victims? We kind

of need to know this. #PurdueShooting". These kind of requests is a sign of lack of

situational awareness and will be discussed later.

4.3.2   Cumulative Frequency of Tweets over Time

Figure 4.5 A, shows the cumulative frequency of tweets with any of the

emerging themes over time. Figures 4.5 B-D show the same data but within tweets

sent by a specific category of senders. The overall trends of different themes is

governed by the trend of the individual tweets due to the overwhelmingly higher

number of individual tweets compared to tweets by news channels and Purdue
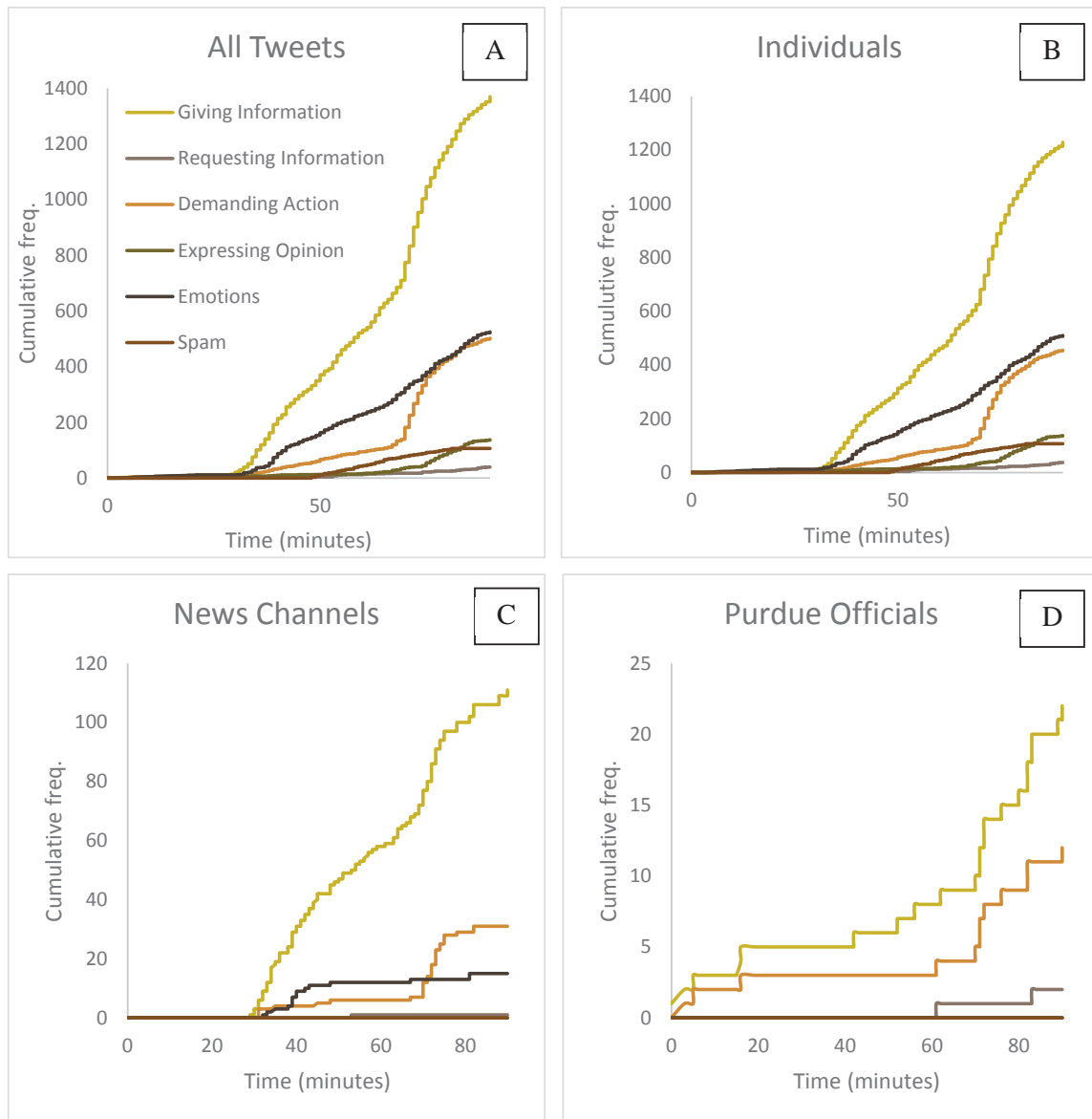
officials.

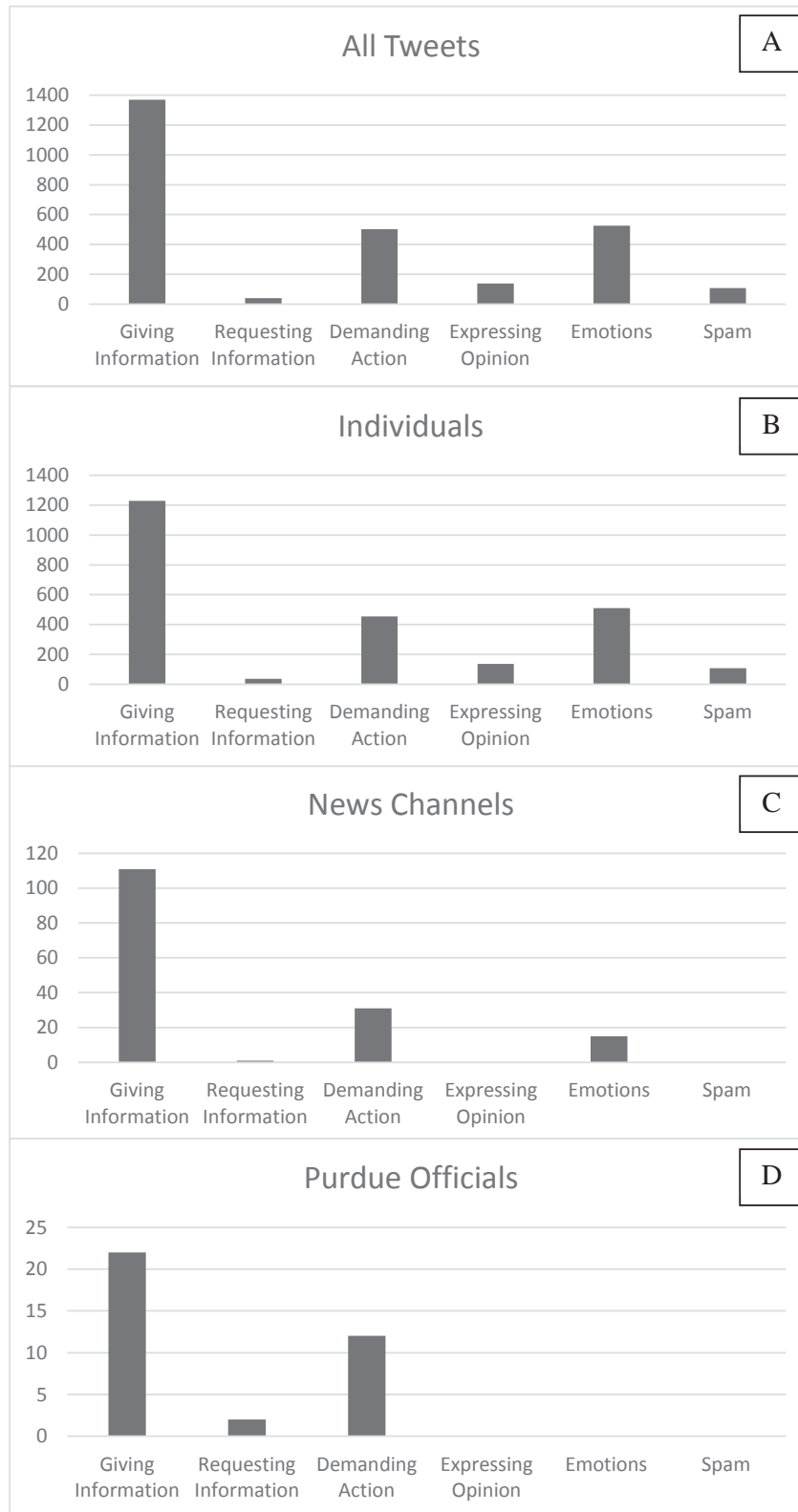Figure 4.5 Frequency of tweets with any of the emerging themes over time in A) all tweets, B) tweets by individuals, C) tweets by news channels and D) tweets by Purdue officials

4.4   Themes of Emotional Tweets

Types of emotion were initially based on literature (section 2.10) (Roberts et al., 2012). However, I observed two additional types, Prayer and Respect not covered by the initial classification of emotions. These two types were added to the analysis. It

should be noted that the emotional categorization of tweets was mutually inclusive. In

other words one single tweet was allowed to manifest multiple emotions. The results

for each of the emotional categories is described in more details in the following
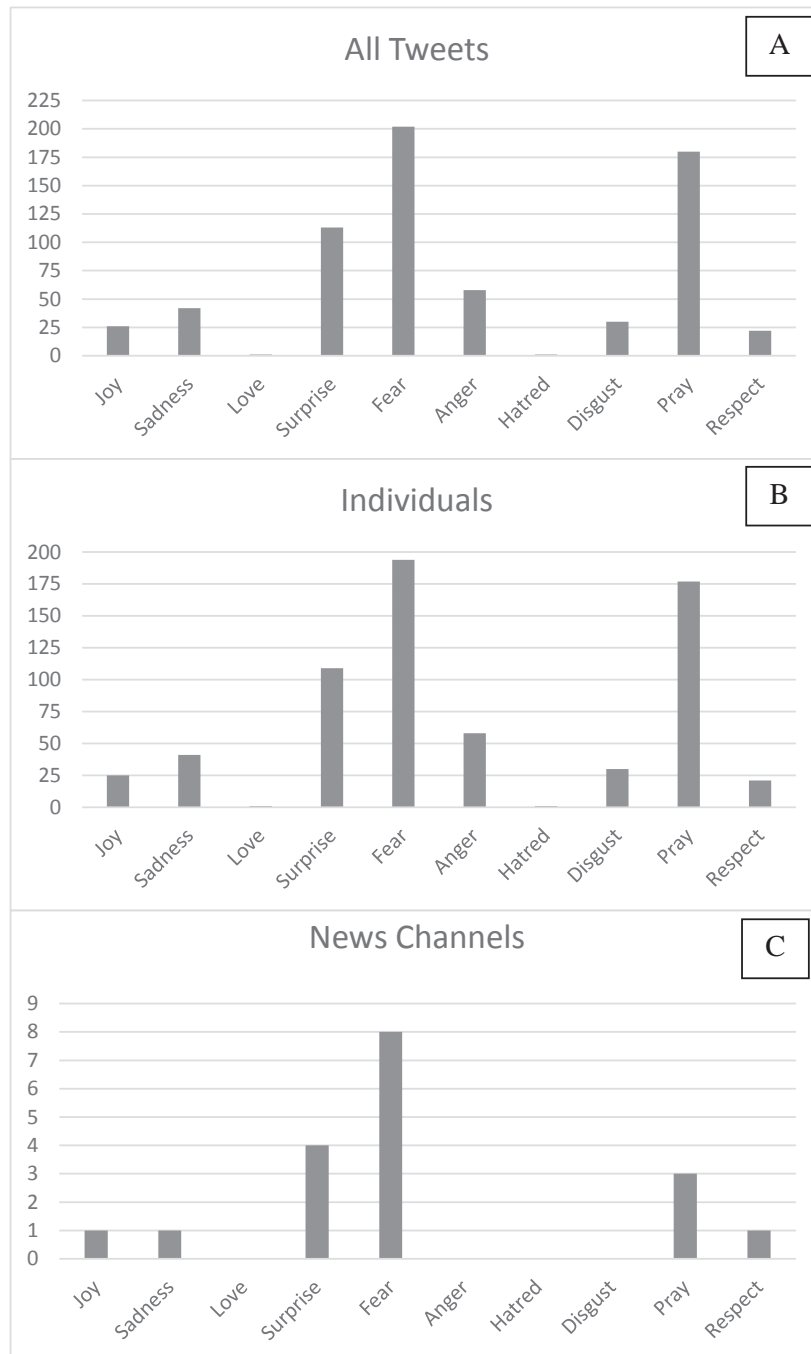
Figure 4.6 Types of emotions observed in in A) all tweets, B)
tweets by individuals and C) tweets by news channels

sections. The emotions are ordered according to their relative frequencies among all tweets. At the end, the trends of tweets with different emotions are described, compared and contrasted.

4.4.1   Types of Emotions

Figure 4.6 shows the types of emotions observed in all tweets, and tweets by individuals and news channels. Officials did not have any tweets with emotional content. Each emotional types are discussed in details in the following subsections.

4.4.1.1   Fear

Fear is the most dominant emotion expressed in tweets. This observation shows the emotional state of the public and stresses the importance of emotional support in times of traumatic emergencies.

Some tweets expressed the sense of fear directly and clearly: "Never been so scared. Praying for everyone to stay safe I cannot believe this is happening #purdueshooting". On the other hand, some tweets show fear with a more indirect language by expressing worries about safety of others: "I'm praying for all of my friends and all of the people at Purdue. Please be safe! #purdueshooting".

Another way of indirect fear expression, especially for news channels, was reporting on other people's emotional states. Considering the fact that news channel tweets usually got retweeted and propagated, these reports were important in forming the emotional atmosphere of the communications. For example, the following tweet reporting an emotional expression by a student, was retweeted 20 times: "Purdue

student at Engineering Building tells WTHR "Police yelled 'Get down! Get down!'...
Scariest thing in my life." #Purdueshooting #wthr". Another example is the following
tweet which reported on the general emotional state of the students and was retweeted
10 times: "Student locked in a room with 25 fellow students on Purdue campus tells
EWN they're all "pretty nervous." #purdueshooting". In total, there are 8 tweets
posted by news channel that expressed fear (Figure 4.6 C)

Thirty eight of the fear tweets, starting from 1:15pm, 38 minutes after the
incident, were referring to a photo of a man in casual outfit holding a rifle on campus:
"No, this can't be real. #PurdueShooting http://t.co/QXEVPOpT3u". 36 of the people
who posted on this photo seem to have taken the man in the photo for the shooter.
Although the photo itself was authentic, the man shown was a police officer, and not
the shooter. Nonetheless, the misinterpretation of the photo caused much fear and
confusion. This is an important observation showing the potential of rumor,
misinformation and false interpretation to instill fear in the general public and affect
them. The emotional consequences of misinformation and false interpretations
highlights the importance of setting a mechanism to provide timely and accurate
information and counter false rumors. Two tweets correctly identifed the man in the
picture as a police officer. However, even those two tweets express fear since they
infer from the photo that the situation on campus is quite critical and dangerous.

4.4.1.2   Pray

Praying or requesting prayers was the second most dominant emotional
expression in all tweets (Figure 4.6 A). It should be noted that tweets which had
hoped safety of others were classified as expressing prayers: "Talking to another

#Purdue student about #PurdueShooting. Says 26 students locked in classroom. "Just hoping that everyone else is safe.""

Many tweets express prayers explicitly, for example: "Prayers for students, faculty, staff, and parents! #purdueshooting". Many others used hashtags instead of direct expression. For example: "Stay safe everyone. Never in a million years would I have imagined this happening at #Purdue. #PurdueShooting #PrayForPurdue" and "Just talked to a Logan freshman at Purdue on lockdown in the Lilly biology building this PM during #PurdueShooting. She's ok. #praying". In fact hashtags for prayers are very frequent. For instance only #prayforpurdue was used in 49 tweets: "#prayforpurdue my thoughts and prayers are with all of my Boilers. Stay safe #purdueshooting"

Although prayer is the second most frequent emotion among tweets by individuals (Figure 4.6 B), it holds the third place in tweets by news channels (Figure 4.6 C). News channels had three prayer tweets, one of which is a retweet of a post originally by an individual: "RT"@ANONYMOUS : A reported shooting at Purdue University is breaking my heart. Praying there are no victims. #pray4purdue #purdueshooting"".

4.4.1.3 <u>Surprise</u>

If we focus only on the news channels, Surprise is the second most frequent emotion (Figure 4.6 C). However, the overwhelming number of individual senders dominate the overall tweets and make surprise the third most frequent emotion in general (Figure 4.6 A and B). Being surprised can be related to lack of situational awareness and destruction of routines in one's mind.

There are four tweets by news channels expressing surprise. For example: "Stay safe man...thinking of you all up there #PurdueShooting RT @ANONYMOUS: This is happening all around me in HAMP. Jesus.". One tweet by news channels expressing surprise shows lack of situational awareness clearly: "Students received text messages saying most of campus can return to normal but @LifeAtPurdue says stay sheltered in place. #PurdueShooting". This post was retweeted three times by others.

Individuals had different reasons for being surprised. For instance, some were surprised since they were not expecting such an incident to take place so close to them: "Stay safe everyone. Never in a million years would I have imagined this happening at #Purdue. #PurdueShooting #PrayForPurdue". Some others expressed surprise about the reaction of people to the situation: "Can't believe a professor here even THOUGHT of going out there with some students, hello there's a LOCKDOWN. #Purdueshooting". And some were surprised about the thoughts and intentions of the shooter: "What makes people think they can get away with a school shooting? #purdueshooting".

Many tweets expressing surprise were referring to the misinterpreted photo described above (section 4.4.1.1): "No, this can't be real. #PurdueShooting http://t.co/QXEVPOpT3u". This post was retweeted 38 times and was one of the important tweets in this category.

4.4.1.4   <u>Anger</u>

In general there are over 50 tweets expressing Anger (Figure 4.6 A). It is noteworthy that none of these tweets were posted by news channels. This may be due to the professional sense of news channels for whom only certain emotions are appropriate for expression. Individuals, on the other hand, exercised more freedom in expressing their negative emotions such as anger. Emergence of emotions such as anger, disgust and hatred (discussed below), signals the importance of emotional support and surveillance in times of emergency. An effective emotional surveillance and support program can prevent dire consequences of these negative emotions.

There are several reasons why individuals have expressed anger. In some instances people were angry about a certain professor or reaction of Purdue officials: "RT @ANONYMOUS Purdue cancel classes. Do you have any common sense. We are on the news. #PurdueShooting". Some were angry about propagation of false information: "Please get your facts straight before you post information about the shooting/shooter(s). #PrayForPurdue #PurdueShooting". And others expressed anger about the incident in general: "RT @ANONYMOUS What's up with all these school shootings make u not even wanna send ya kids to a good college & it's the geniuses doing it #purdueshooting".

Angry emoticons and negative words are prevalent in anger tweets: For example: "No. You don't go shooting on campus where my little sister and my friends are >:(#purdueshooting" or: "Another fucking school shooting! #purdueshooting".

4.4.1.5   Sadness

In general, 50 tweets expressed sadness out of which, 49 were posted by

individuals. The one sadness tweet by news channels was a retweet by a news

reporter: "RT@ANONYMOUS: A reported shooting at Purdue University is breaking

my heart. Praying there are no victims. #pray4purdue #purdueshooting".

Sadness was mainly caused by the incident in general and did not have a particular

personal reason. For example: "A reported shooting at Purdue University is breaking

my heart. Praying there are no victims. #pray4purdue #purdueshooting" or "shooting

at purdue....so sad. People are crazy these days. Lord keep your hand on them all.

#Purdueshooting". Some people expressed sadness because of the prevalence of such

tragedies in America: "RT @ANONYMOUS praying for the families of the victims

at Purdue University. Another sad day in America smh. #PurdueShooting".

4.4.1.6   Disgust

There were around 30 tweets expressing disgust and were all tweeted by

individuals. No such emotion was expressed by news channels. The main causes for

disgust were guns used in a wrong way and spammers using #purdueshooting for

gaining followers. For example: "If you are using the #PurdueShooting hashtag to try

and gain followers - You are an asshole. Some of us have loved ones on campus.

#shameful" or "It's beyond sad that so many spammers are posting to the

#PurdueShooting hashtag. Disgusting.". Some others had expressed disgust about the

reaction of news channels to the tragedy: "RT @ANONYMOUS This is seriously

what CNN decides to report on while there's a shooter at #Purdue? #Purdueshooting

http://t.co/DpkABMhwjy".

4.4.1.7 Joy

The main reason for joy among individuals was themselves or their loved ones being safe. People were glad that they or their friends and family were not injured and came out of the tragic incident safe and sound, for example: "glad i am safe in my dorm! so grateful i did not have class in EE today #purdueshooting" or "Thanking the Lord my sister is safe •À_ #purdueshooting".

Proper performance of news channels, social media or police was another reason for joy; for example: "Pictures coming out of the #purdueshooting are incredible. Good social media." and "Great coverage of #purdueshooting by @WTHRcom"

There was only one retweet by news channels expressing joy: "RT@ANONYMOUS: Purdue police got us out of the building quickly and safely. Makes me feel good about the work they do #purdueshooting".

4.4.1.8 Respect

I added this category to the emotional categories obtained from literature to better describe about 20 of the tweets such as "I cannot tweet enough about the respect I have for my prof right now. Keeping calm and Using comic relief #purdueshooting". Except one respect tweet which was posted by a news channel: "RT@ANONYMOUS: Purdue police got us out of the building quickly and safely. Makes me feel good about the work they do #purdueshooting", the rest of such tweets were posted by individuals. Respect was expressed recognizing the reactions of professors, news coverage by WTHR, performance of Purdue police or the Purdue community as a whole: "@WTHRcom doing a REALLY great job reporting

#PurdueShooting. Not spreading rumors & trying to calm students they speak with on air." or: "RT @ANONYMOUS Purdue police & co. are doing a fantastic job in my opinion. That's all I have to say about that #PurdueShooting #PrayForPurdue".

4.4.1.9 Love

There is only only one tweet posted by an individual which falls in this category: "I come back to Kokomo and then I remember why I love west lafayette so much. Which is awkward right now because #purdueshooting"

4.4.1.10 Hatred

There is only one tweet expressing hatred and that was posted by an individual: "Everyone is saying they'd do this and they'd do that. Does that make you any better? Let these fucks rot in jail and hell #PurdueShooting"

4.4.2   Cumulative Frequencies of Emotions over Time

Figure 4.7 A-C shows the cumulative frequency of emotions over time. 30 minutes after the incident, all types of emotions show a surge and fear, the most frequent emotion, is not an exception. The surge in fear tweets could be due to tweet posted on 32 minutes by a news reporter: "Purdue student at Engineering Building tells WTHR "Police yelled 'Get down! Get down!'... Scariest thing in my life." #Purdueshooting #wthr". This tweet was retweeted many times propagating fear expression on Twitter.

The surprise tweets increase rapidly after 38 minutes and that may be caused by a tweet posted exactly at that time: "No, this can't be real. #PurdueShooting

http://t.co/QXEVPOpT3u". As described in section 4.4.1.1, this tweet refered to a man carrying a rifle and many had taken the man in the photo to be the shooter. Many were surprised by seeing the photo and the post was retweeted 38 times.

There is a second increase in surprise tweets around 72 minutes. This second increase was partly a response to Purdue officials who announced back-to-normal operations on campus: @LifeAtPurdue posted on 72 minutes: ""Everyone in Electrical Engineering Building continue to shelter in place. All other areas of campus may resume normal operations." Many were shocked by this announcement and had expressed their surprise in their tweets: "RT @ANONYMOUS Not once have I ever felt unsafe at Purdue until today. Now they are saying to continue normal operations? #getittogether #PurdueShooting". However, there are also other tweets expressing surprise after 72 minutes which are unrelated to the above official announcement: "RT @ANONYMOUS So much speculation spewing on #PurdueShooting based on photos, tweets, etc. w/ zero context/confirmation.".

Anger tweets increase in frequency around 47 minutes. No specific reason was found for this increase and tweets expressed general anger about the fact that a school shooting had happened. Anger tweets show a second increase around 73 minutes which could be partly related to the tweet from @LifeAtPurdue announcing normal operation at 72 minutes. There are also other reasons that people are angry around this time, e.g. CNN coverage: "This is seriously what CNN decides to report on while there's a shooter at #Purdue? #Purdueshooting http://t.co/DpkABMhwjy". This was posted at 74 minutes and was retweeted four times in the next 10 minutes. The link referred to in the tweet was not available to public at the time of this study and hence, I could not find out the exact reason for this anger. Other tweets expected CNN to cover the incident earlier and wider. There is also a third wave of increase in anger

tweets around 83 minutes. The reason again is a tweet from @LifeAtPurdue around

82 minutes saying: "Everyone in EE Bldg continue to shelter in place! All other areas

of campus may resume normal op. Check http://Purdue.edu for updates". People are

angry about the officials trying to make Purdue community resume normal operation.

For example, only one minute after the above tweet by @LifeAtPurdue, some posted:

"Resume normal operations... REALLY? Hell no @LifeAtPurdue #purdueshooting".

and another user tweeted: ""@LifeAtPurdue: Everyone in EE Bldg continue to shelter

in place! All other areas of campus may resume normal op." #nothanks

#purdueshooting".

Sadness shows its first presence at 34 minutes by a tweet posted by an

individual: "A reported shooting at Purdue University is breaking my heart. Praying

there are no victims. #pray4purdue #purdueshooting". The second increase happens at

70 minutes and I could not find a specific reason for that. This increase is concurrent

with an increase in disgust tweets at 68 minutes, that one also with no clear

explanation. Interestingly, respect tweets also show an increase in 68 minutes. This

concurrent increases may have an underlying reason unrelated to the type of

emotions.

Considering all tweets (Figure 4.6 A), until around 78 minutes joy dominates

over sadness. As mentioned above, joy tweets are predominantly due to being safe.

Sadness tweets, however, are mostly related to the incident in general. At the

beginning of the emergency, people are more concerned about their own safety and

safety of others and this may explain many tweets expressing joy. However, as the

immediate threat and emergency passes, people feel safer and start to mourn the

incident. This may be the reason for increase of the sadness tweets over time.

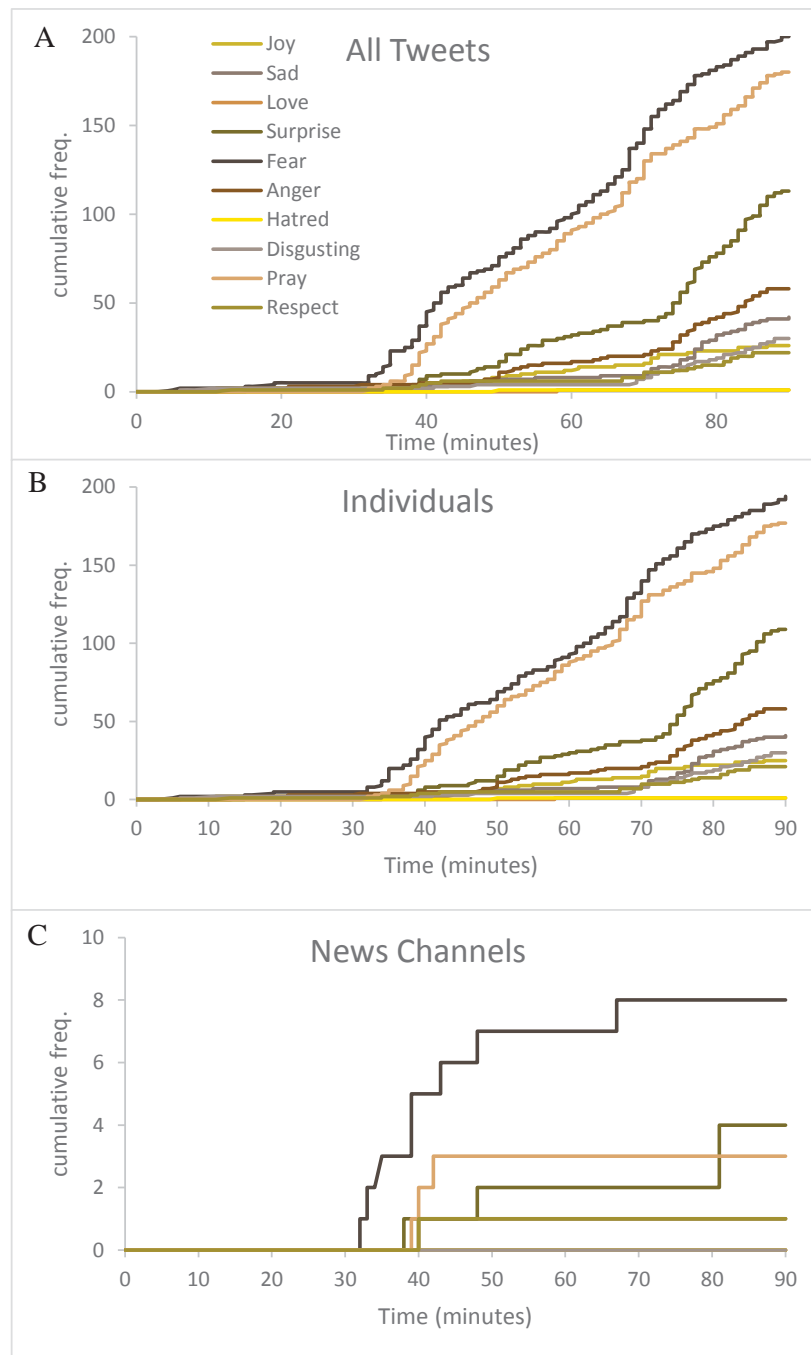Figure 4.7 The cumulative frequency of emotions over time

4.5 <u>Summary</u>

In this chapter I presented the results of my study and discussed them from various perspectives. Theme and their trends over time were the main focus of this chapter. In the following chapter, I answer my research question according to these results and explain the implications of this study for emergency management.

CHAPTER 5. DISCUSSION

In this section I answer my research question based on the results obtained from this study. I started this research by asking how different categories of Twitter users express and react to the emotions under the uncertainty associated with the critical period of the recent Purdue shooting incident. The results of this study elucidate many aspects of this question. However, before discussing the details it should be mentioned that the results clearly show a considerable portion of tweets do express emotions. High emotional content of Twitter activity suggest that question such as the one asked in this study are both valid and significant. In fact emotional expressions on social media pose many questions to social media studies, with many important theoretical and practical implications.

In the following sections, I explain how various aspects of emotional expressions on Twitter after the shooting incident are manifested in the results of this study.

5.1   Source of Emotional Tweets

There are some aspects of emotional emergency Twitter activity which are peculiar to this type of tweets and are different from the characteristics of non-emotional emergency tweets. One important example is the source of original content on Twitter as explained below.

For non-emotional tweets, for example the information-related ones, individuals tend to retweet rather than post original tweets. In other words, they mostly engage in

content curation rather than content generation. On the other hand, other types of senders, i.e. news channels and officials, tend to post original tweets which are then retweeted by individuals. Nonetheless, it is not the case for emotional tweets and the source of almost the entire emotional expressions are individuals. Consequently, while the information content of Twitter is under the influence of news channels and officials, its emotional atmosphere is determined by individual users.

5.2   Emotional Tweets

The frequency of emotional tweets is determined by two types of factors: the general tweeting frequency and the public's emotional responses to certain events. In general, the tweeting frequency has the following pattern: it has a lag time followed by a sudden increase. Emotional tweets are not an exception and follow the same general pattern. However, certain events in the real world or the virtual world of social media can increase or decrease the frequency of certain emotional expressions.

For example, in our study proper or improper emergency management practices were the reason behind many emotional posts. Sufficient or insufficient news coverage had also the same effects. Interestingly, the initiating event could even be a piece of false information or misinterpretation. For example, I observed that misinterpretation of a photo caused much surprise and fear among Twitter community.

5.3   Emotional Expressions by Purdue Officials

I observed no emotional Twitter activity by Purdue officials. Officials did not post any original tweets with emotional content and did not respond to emotional

posts by news channels and individuals. This shows the room for much investment in developing related emergency management strategies. Some of these strategies are mentioned in the implications section.

5.4 Emotional Expressions by News Channels

News channels had some emotional expressions mostly by retweeting what individuals had expressed. However, the themes of emotions expressed by news channels were different from the emotions expressed by individuals. While hatred, disgust and anger were freely expressed by individuals, new channels avoided expressing these type of emotions. This may be due to the professional standards of news channels. Implications of this professional ethical standard in emergency situations is discussed in the implications section. In addition to the negative emotions mentioned, the other emotions expressed by news channels were almost the same as those expressed by individuals: fear, prayer, surprise, respect, sadness and joy. The reason could be the fact that emotional tweets by news channels reports on individual emotional expressions.

5.5 Emotional Expressions by Individuals

Although Twitter is a social media platform predominantly used for sharing news (Kwak et al., 2010), emotional expressions were prolific in tweets posted by individuals. Various types of emotions, both positive and negative, were expressed as the main or the side message of many tweets. As previously mentioned, this prevalence indicates the importance and relevance of studies on emotional expressions on Twitter.

The two main emotions expressed by individuals were fear and prayer. The emergence of these two emotions is not surprising and they seem to be the natural

emotional responses to such incidents. Many things may cause fear in the public in such a situation. First, the emergency poses an immediate threat to all those who are close enough to be afflicted by the situation. Second, the sense of uncertainty, confusion and lack of situational awareness generates worry and fear. In fact, high frequency of information-related and surprise-expressing tweets observed in this study are signs of lack of situational awareness, which leads to uncertainty and fear.

Many have prayed for the safety of those involved in the incident. The significance of prayers shows that many turned into spirituality for emotional support. This indicates the potential of spiritual activities for emotional support. This potential will be discussed more in the implications section.

Surprise is also highly expressed. As mentioned above, this type of emotion may be related to lack of situational awareness. However, the data reveals additional reasons for this type of emotions. For example, unexpected decisions by Purdue officials or the inadequate coverage by certain news channels were the reason for some of the surprise tweets. Moreover, rumors and false information resulted in much surprise among Twitter users. This was due to the nature of rumors, which generally reported exaggerated misinformation and naturally causing surprise.

Individuals also expressed sadness. The subject of sadness tweets was mostly not personal. The majority of sadness tweets were expressing sorrow about this particular shooting incident, or the prevalence of similar incidents in general. Some other negative emotions expressed were anger, disgust and hatred. However, these emotions were not dominant. As mentioned above, these types of emotions are expressed only by individuals and were totally absent from the news channel tweets. Although the tragic shooting incident itself was the subject of many anger and disgust tweets, some other peripheral reasons had also caused those emotions. For example,

the prevalence of spam tweets trying to misuse #purdueshooting hashtag for getting more followers was considered inappropriate and disgusting by some users.

Contrary to the nature of the tragic emergency under study, there were tweets expressing joy and love! These tweets were mostly personal and were expressing the personal safety and wellbeing of individuals. Joy and love expressions are very rare and it is not surprising considering the tragic nature of the incident.

Another positive emotion expressed was respect. The majority of respectful tweets were commending the good performance of those engaged in managing the stressful situation, e.g. professors, police officers and news channels. This type of emotion can provide the emergency management team with feedbacks from those affected by the emergency and hence, is of practical importance. The practical implications of emotional expressions are discussed in the next section.

5.6   Implications

In this section I list some of the observations described in the previous section and discuss their implications for emergency management. The special focus of this analysis would be on the ways the results of this study can provide insight for providing emotional support in times of crisis using social media as an emergency management tool.

5.6.1   The emergency management team can assess the emotional state of the public using social media analysis

The emotional content on Twitter is predominantly generated by individuals, and not by officials and news channels. This observation indicates the capacity of social media analysis for understanding the emotional state of the public. Such

analyses are especially important for emergency cases such as terrorist attacks that are highly associated with negative emotional activities. The assessment of the public's emotional state allows officials to provide the necessary emotional support and prevent dire consequences of extreme negative emotions. In the case of this study, the dominant emotional expressions were fear and prayers. It may not be the case for all emergencies. Other dangerous negative emotions such as anger, hatred and disgust may arise. Monitoring these negative emotions and providing the necessary emotional support to sooth those, may prevent their dire potential consequences.

5.6.2 The insight from social media analysis can help officials to choose the most effective form of emotional support

Understanding the emotional state of the public may provide the necessary insight for setting up the offline emotional support programs. For example, the prevalence of prayer, such as the case in this study, may indicate the potential of the religious communities and university clubs to provide effective and substantial emotional support and help the public in dealing with the situation. Also, worries and fear resulted from information scarcity can be addressed by providing accurate, timely and enough information. The next part discusses this type of emotional support in more detail.

5.6.3 Officials can provide emotional support indirectly by non-emotional activities

Emotional support can also happen in an indirect way by alleviating lack of situational awareness. The feelings of confusion, lack of knowledge and surprise can be addressed by timely, frequent and relevant information provided by official

accounts. Providing the public with enough information helps the public develop a sense of situational awareness and reduce fear and surprise consequently.

Timely, accurate and frequent updates are also extremely important for dealing with misinformation. This study shows that misinformation and misinterpretation may lead to unnecessary fear among people. Providing information by officials will help the public to understand the situation better and therefore, feel safer and calmer.

In this regard, one positive aspect of official Twitter activities in this study was their fast reaction and early post. According to my data, officials were the first to post about the incident on Twitter. Their post was about ten minutes before the official alert email sent to Purdue email system on 12:27pm. Quick and frequent official tweets can alleviate the information dearth and prevent propagation of false information.

5.6.4   Social media emotional analysis can provide officials with a feedback system

The results show that many times emotional expressions happen in response to certain emergency management decision or news coverage. Such emotional expressions may provide a gauge for public approval and a feedback system for officials and news channels. This feedback would be specifically important in emergency management decisions that are directly related to the public. One such example is when emergency management officials want to return the community to normal operation conditions. The management team may be able to assess the objective and technical aspects of the situation easily. But the community should also be emotionally ready for going back to normal operations. This aspect may not be easily assessable by traditional means, but social media may open an option for such analysis. The results of this study show that ignoring this important aspect caused

much negative feedback from community on the official's decision to return campus to normal operation. This feedback is not necessarily negative. In the case of my study, the effective performance of those engaged in emergency management was commended by Twitter community in form of respectful expressions. Lack of respectful expressions may be an indirect sign of ineffective emergency management.

5.6.5   Officials should engage in emotional communications on social media

Despite the promising potential of social media for public emergency emotional support, the official accounts studied here showed zero emotional activity and absolutely failed to engage in Twitter emotional exchange. However, this study showed that the trends for various emotions among the public showed ebbs and flows in response to different factors, and official tweets providing emotional support could be one of those factors. Effective official emotional support can increase the positive emotions and control the negative ones.

The extent to which officials should engage in emotional communications is a critical question in a social media emergency management protocol. Too much emotional expressions may jeopardize official accounts position as a source of getting emergency information and coordinating collective action. One suggestion may be setting different official channels for information/action related announcements and emotional support. Officials may set up different accounts on a single social media platform or may use different platforms each for a special type of communication with the public. Using different social media platforms may be a better option since it has been shown that people use various social media for different types of online social interaction (I. A. Bukhari, 2014).

Officials can also benefit from some special dynamics of social media in order to effectively provide the public with emotional support. For example, Official accounts are usually scarce on Twitter compared to individual accounts. However it does not mean that the voice of those few accounts would be heard in the crowded emergency conversations on social media. Individuals usually propagate and retweet what others have sent rather than generate original content. An official account can benefit from this propagation and spread its message widely over social media. Officials should also use the proper hashtags to target their tweets to its appropriate stream of communication. In order to do so, they should identify or generate hashtags quickly and effectively. Generating a proper hashtag allows officials to guide the online communication stream to their benefit.

Officials should choose the nature of the emotional message they send to the public intelligently. While positive emotions are favorable in general, negative emotions have their own benefits and utilities. For example, it has been shown that certain levels of fear can help officials convince the public to take emergency actions more seriously and commit to collective reaction orders(K. Lachlan & R. Spence, 2014).

5.6.6   Officials accounts should remain active and establish their position in non-emergency times

Officials have only a few accounts and the total number of official posts comprises only a very small proportion of all tweets. The voice of official accounts thus cannot be heard unless their message is retweeted by many other users. This propagation will take place only if official accounts establish a sufficient number of followers. In order to gain followers, these accounts should remain active in non-emergency times and have a meaningful presence on Twitter. Proper activities in non-

emergency times not only leads to a good number of followers, but also builds the

relation of these accounts with the public and establishes their authoritativeness and

reliability.

5.6.7   Officials and News Channels Should Avoid Expressing Certain Negative

Emotions

The results show that although news channels engaged in the emotional

expression, they avoided expressing certain negative emotions such as hatred and

disgust. This is an appropriate practice and may help preventing the negative

consequences of such emotions. New channel and official tweets get retweeted widely

and are influential on the general discourse on Twitter. Therefore these sources should

be extremely careful of what they share and how it may affect the public in an

emergency situation. Such awareness is specifically important in emergencies such as

terrorist attacks where emotions such as hatred may have dire consequences.

5.6.8   Thematic analysis can be used to asses the emotions on Twitter in times of

emergency

The method used in my study provides a successful example of applying

thematic analysis on emotions. Similar analysis can be done in real-time while an

emergency evolves to continuously evaluate the emotional state of the public. This

real-time insight provides an invaluable piece of information, which will be

significantly helpful for making effective emergency management decisions.

5.7   Conclusion

This study looked at the emotional expressions on Twitter, following the 2014

Purdue shooting incident. 1751 tweets were thematically analyzed, looking for

various types of emotional expression. I found that the emotional expressions were in fact a significant part of Twitter communications. I showed the types of Twitter users who expressed or did not express emotions. The specifications and details of emotions expressed by each of these different types of users were then described. Finally, I discussed the implications of the results for effective emotional support in emergencies.

5.8   Future research

In order to effectively use the capacity of social media for emotional support, we need to develop a better understanding of emotional expressions on social media. The emotional content of various social media platforms should be analyzed, compared and contrasted. Such studies help us identify the best platform for providing emotional support.

Also differences in emotional expressions between emergencies of different types, e.g. man-made vs. natural, should be studied. Various emotional patterns may be observed for different kinds of crises. These patterns may also vary according the geographic and cultural context of these crises.

We should understand to what extent these online emotional expressions correlate with real emotions of the public. After all, active online users are only a small sample of the general community. This small sample has certain age, education and economic distribution which may differ from the public in general. Besides, the online community lives in a virtual world and certain online events may affect its emotional state. For example, rumors or misinformation spread on Twitter may heavily affect the emotional state of its users. Hence, the representativeness of online communities should be carefully assessed before generalizing their emotions.

The motivations behind posting emotional tweets are another aspect to be studied. We need to know why users post about their emotions and how the motivations vary across different categories of users. The socio-psychological characteristic of emotional tweets such as sense of duty and social responsibility should also be analyzed. Here, the local users who were immediately affected by the incident may differ from those distant from the incident. Differences between local users and the users in general have been observed in other aspects of Twitter activities in emergency cases (Kogan, Palen, & Anderson, 2015).

Retweeting and information propagation is another import practical aspect, which needs further studies. Highly influential Twitter accounts should be studied as benchmarks in order to find their types and specifications. The insight gained from such studies can then be used to further expand and increase the impact of official accounts.

Emotional studies should be part of development of a comprehensive and effective social media emergency management protocol, which covers all aspects of emergency management. Finding the best strategy to effectively use social media to manage various aspects of emergencies opens an important and interesting area for future studies.

LIST OF REFERENCES

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Achrekar, H., Gandhe, A., Lazarus, R., Yu, S.-H., & Liu, B. (2013). Online Social Networks Flu Trend Tracker: A Novel Sensory Approach to Predict Flu Trends. *Biomedical Engineering Systems and Technologies* (pp. 353–368). Springer.

Anderson, K. M., & Schram, A. (2011). Design and implementation of a data analytics infrastructure in support of crisis informatics research (NIER track). *Proceedings of the 33rd International Conference on Software Engineering* (pp. 844–847).

Baron, G., & Philbin, J. (2009). Social media in crisis communication: Start with a drill. *Public Relations Tactics*, *16*(4), 12.

Baucom, E., Sanjari, A., Liu, X., & Chen, M. (2013). Mirroring the real world in social media: twitter, geolocation, and sentiment analysis. *Proceedings of the 2013 international workshop on Mining unstructured big data using natural language processing* (pp. 61–68).

Blanchard, W. (2008). *Guide to emergency management and related terms, definitions, concepts, acronyms, organizations, programs, guidance* (p. 340). executive orders & legislation. Retrieved from http://training.fema.gov/EMIWeb/edu/docs/terms and definitions/Terms and Definitions.pdf

Blasingame, D. (2011). Twitter first: changing TV news 140 characters at a time. *Proceedings of the 12th international symposium on online journalism*.

Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code development*. Sage.

Boyd, D., & Ellison, N. (2007). Social network sites: definition, History, and scholarship. *Journal of Computer-Mediated Communication*, *13*(1), 210– 230.

Bruns, A., & Burgess, J. E. (2012). Local and global responses to disaster:# eqnz and the Christchurch earthquake. *Disaster and Emergency Management Conference, Conference Proceedings* (Vol. 2012, pp. 86–103).

Bruns, A., Burgess, J. E., Crawford, K., & Shaw, F. (2012). # qldfloods and@ QPSMedia: Crisis communication on Twitter in the 2011 south east Queensland floods.

Bukhari, I. A. (2014). *Perceptions and expectations about the use of social media to raise situational awareness in emergency events*. PURDUE UNIVERSITY.

Bukhari, I., Wojtalewicz, C., Vorvoreanu, M., & Dietz, J. E. (2012). Social media use for large event management: The application of social media analytic tools for the Super Bowl XLVI. *Homeland Security (HST), 2012 IEEE Conference on Technologies for* (pp. 24–29).

Burns, A., & Eltham, B. (2009). Twitter free Iran: An evaluation of Twitter's role in public diplomacy and information operations in Iran's 2009 election crisis.

Carafano, J. J. (2009). All a twitter: How social networking shaped Iran's election protests. *Heritage Foundation Backgrounder*, (2300).

Crooks, A., Croitoru, A., Stefanidis, A., & Radzikowski, J. (2013). # Earthquake: Twitter as a distributed sensor system. *Transactions in GIS*, *17*(1), 124–147.

Dabner, N. (2012). "Breaking Groundin" the use of social media: A case study of a university earthquake response to inform educational design with Facebook. *The Internet and Higher Education*, *15*(1), 69–78.

Dervin, B. (1999). Chaos, order and sense-making: A proposed theory for information design. *Information design*, 35–57.

Fessenden-Raden, J., Fitchen, J. M., & Heath, J. S. (1987). Providing risk information in communities: Factors influencing what is heard and accepted. *Science, Technology, and Human Values*, 94–101.

Freberg, K. (2012). Intention to comply with crisis messages communicated via social media. *Public Relations Review*, *38*(3), 416–421.

Hagar, Chris. (2006). Using research to aid the design of a crisis information management course. *Association of Library & Information Science Educators SIG: Multicultural, Ethnic & Humanistic Concerns (MEH), Information Seeking and Service Delivery for Communities in Disaster/Crisis. San Antonio, TX*.

Hagar, Christine. (2013). Crisis informatics: Perspectives of trust--is social media a mixed blessing? *SLIS Student Research Journal*, *2*(2), 2.

Hawn, C. (2009). Take two aspirin and tweet me in the morning: how Twitter, Facebook, and other social media are reshaping health care. *Health affairs*, *28*(2), 361–368.

Hermann, C. F. (1963). Some consequences of crisis which limit the viability of organizations. *Administrative Science Quarterly*, 61–82.

Heverin, T., & Zach, L. (2010a). Twitter for city police department information sharing. *Proceedings of the American Society for Information Science and Technology*, *47*(1), 1–7.

Heverin, T., & Zach, L. (2010b). *Microblogging for Crisis Communication: Examination of Twitter Use in Response to a 2009 Violent Crisis in the Seattle-Tacoma, Washington, Area*. ISCRAM.

Heverin, T., & Zach, L. (2012). Use of microblogging for collective sense-making during violent crises: A study of three campus shootings. *Journal of the American Society for Information Science and Technology*, *63*(1), 34–47.

Holmes, W. (2011). Crisis Communications and Social Media: Advantages, Disadvantages and Best Practices.

Hughes, A. L., & Palen, L. (2009). Twitter adoption and use in mass convergence and emergency events. *International Journal of Emergency Management*, *6*(3), 248–260.

Jaques, T. (2007). Issue management and crisis management: An integrated, non-linear, relational construct. *Public Relations Review*, *33*(2), 147–157.

Kaplan, A., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of social media. *Business Horizons*, *53*(1), 59–68.

Kemper, T. D., Association, A. P., & others. (1990). *Research agendas in the sociology of emotions*. SUNY Press.

Kogan, M., Palen, L., & Anderson, K. M. (2015). Think Local, Retweet Global Retweeting by the Geographically-Vulnerable during Hurricane Sandy. *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing - CSCW '15* (pp. 981–993). New York, New York, USA: ACM Press. doi:10.1145/2675133.2675218

Kwak, H., Lee, C., Park, H., & Moon, S. (2010). What is Twitter, a social network or a news media? *Proceedings of the 19th international conference on World wide web* (pp. 591–600).

Laad, G., & Lewis, G. (2012). Role of social media in crisis communication. *Unpublished Masters Thesis). Clark University, Massachusetts, USA*.

Lachlan, K. A., & Spence, P. R. (2007). Hazard and outrage: Developing a psychometric instrument in the aftermath of Katrina. *Journal of Applied Communication Research*, *35*(1), 109–123.

Lachlan, K., & R. Spence, P. (2014). Does message placement influence risk perception and affect? *Journal of Communication Management*, *18*(2), 122–130. doi:10.1108/JCOM-12-2012-0097

Lee, K., Agrawal, A., & Choudhary, A. (2013). Real-time disease surveillance using Twitter data: demonstration on flu and cancer. *Proceedings of the 19th ACM SIGKDD international conference on Knowledge discovery and data mining* (pp. 1474–1477).

Lenhart, A., Purcell, K., Smith, A., & Zickuhr, K. (2010). Social Media & Mobile Internet Use among Teens and Young Adults. Millennials. *Pew Internet & American Life Project*.

Malone, P. C., & Coombs, W. T. (2009). Introduction to special issue on crisis communication. *Journal of Public Relations Research*, *21*(2), 121–122.

Maxwell, J. (2005). *Qualitative research design: An interactive approach* (2nd ed.). Thousand Oaks, {CA}: Sage Publication, Inc.

Merchant, R. M., Elmer, S., & Lurie, N. (2011). Integrating social media into emergency-preparedness efforts. *New England Journal of Medicine*, *365*(4), 289–291.

Morozov, E. (2009). Iran: Downside to the" twitter revolution". *Dissent*, *56*(4), 10–14.

Muralidharan, S., Rasmussen, L., Patterson, D., & Shin, J.-H. (2011). Hope for Haiti: An analysis of Facebook and Twitter usage during the earthquake relief efforts. *Public Relations Review*, *37*(2), 175–177.

Page, S., Freberg, K., & Saling, K. (2013). Emerging Media Crisis Value Model: A Comparison of Relevant, Timely Message Strategies for Emergency Events. *Journal of Strategic Security*, *6*(2), 2.

Palen, L. (2008). Online social media in crisis events. *Educause Quarterly*, *31*(3), 12.

Palen, L., Anderson, K. M., Mark, G., Martin, J., Sicker, D., Palmer, M., & Grunwald, D. (2010). A vision for technology-mediated support for public participation & assistance in mass emergencies & disasters. *Proceedings of the 2010 ACM-BCS Visions of Computer Science Conference* (p. 8).

Patton, M. (2002). *Qualitative research & evaluation methods*. ((3, Ed.) (p. 238). Thousand Oaks, CA: Sage Publications.

Phuvipadawat, S., & Murata, T. (2010). Breaking news detection and tracking in twitter. *Web Intelligence and Intelligent Agent Technology (WI-IAT), 2010 IEEE/WIC/ACM International Conference on* (Vol. 3, pp. 120–123).

Quarantelli, E. L. (1998). *What is a disaster?: perspectives on the question*. Psychology Press.

Quercia, D., Capra, L., & Crowcroft, J. (2012). The Social World of Twitter: Topics, Geography, and Emotions. *ICWSM*.

Roberts, K., Roach, M. A., Johnson, J., Guthrie, J., & Harabagiu, S. M. (2012). EmpaTweet: Annotating and Detecting Emotions on Twitter. *LREC* (pp. 3806–3813).

Sandman, P. M. (1993). *Responding to community outrage: Strategies for effective risk communication*. AIHA.

Severin, W. J., & Tankard, J. W. (2010). *Communication theories: Origins, methods, and uses in the mass media*. Longman.

Shklovski, I., Palen, L., & Sutton, J. (2008). Finding community through information and communication technology in disaster response. *Proceedings of the 2008 ACM conference on Computer supported cooperative work* (pp. 127–136).

Shultz, J. M., Cohen, A. M., Muschert, G. W., & De Apodaca, R. F. (2013). Fatal school shootings and the epidemiological context of firearm mortality in the United States. *Disaster Health*, *1*(2), 10–11.

Singh, V. K., Gao, M., & Jain, R. (2010a). Situation detection and control using spatio-temporal analysis of microblogs. *Proceedings of the 19th international conference on World wide web* (pp. 1181–1182).

Singh, V. K., Gao, M., & Jain, R. (2010b). Social pixels: genesis and evaluation. *Proceedings of the international conference on Multimedia* (pp. 481–490).

Smith, B. G. (2010). Socially distributing public relations: Twitter, Haiti, and interactivity in social media. *Public Relations Review*, *36*(4), 329–335.

Srivastava, P. (1987). Bhopal: Anatomy of a crisis. *Ballinger, Cambridge, MA*.

Starbird, K., & Palen, L. (2011). Voluntweeters: Self-organizing by digital volunteers in times of crisis. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 1071–1080).

statisticsbrain. (n.d.). Retrieved July 5, 2014, from http://www.statisticbrain.com/twitter-statistics/

Sutton, J., Palen, L., & Shklovski, I. (2008). Backchannels on the front lines: Emergent uses of social media in the 2007 southern California wildfires. *Proceedings of the 5th International ISCRAM Conference* (pp. 624–632).

Utz, S., Schultz, F., & Glocka, S. (2013). Crisis communication online: How medium, crisis type and emotions affected public reactions in the Fukushima Daiichi nuclear disaster. *Public Relations Review*, *39*(1), 40–46.

Vieweg, S., Hughes, A. L., Starbird, K., & Palen, L. (2010). Microblogging during two natural hazards events: what twitter may contribute to situational awareness. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 1079–1088).

Vieweg, S., Palen, L., Liu, S. B., Hughes, A. L., & Sutton, J. (2008). Collective intelligence in disaster: An examination of the phenomenon in the aftermath of the 2007 Virginia Tech shootings. *Proceedings of the Information Systems for Crisis Response and Management Conference (ISCRAM)*.

Wendling, C., Radisch, J., & Jacobzone, S. (2013). The Use of Social Media in Risk and Crisis Communication.

Wigley, S., & Fontenot, M. (2010). Crisis managers losing control of the message: A pilot study of the Virginia Tech shooting. *Public Relations Review*, *36*(2), 187–189.

Wigley, S., & Fontenot, M. (2011). The Giffords shootings in Tucson: Exploring citizen-generated versus news media content in crisis management. *Public Relations Review*, *37*(4), 337–344.

Yang, L., Sun, T., Zhang, M., & Mei, Q. (2012). We know what@ you# tag: does the dual role affect hashtag adoption? *Proceedings of the 21st international conference on World Wide Web* (pp. 261–270).

Yates, D., & Paquette, S. (2011). Emergency knowledge management and social media technologies: A case study of the 2010 Haitian earthquake. *International Journal of Information Management*, *31*(1), 6–13.

Yin, J., Lampert, A., Cameron, M., Robinson, B., & Power, R. (2012). Using social media to enhance emergency situation awareness. *IEEE Intelligent Systems*, *27*(6), 52–59.